ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
AMENDED FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED ZEN WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE ON A SITE NEAR SARON, WESTERN CAPE

DEA Ref. No: 14/12/16/3/3/2/322

AMENDED FINAL REPORT

June 2015

FINAL SUBMISSION

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PROJECT DETAILS

DEAT Reference No.	:	14/12/16/3/3/2/322
Title	:	Amended Final Environmental Impact Assessment Report: Proposed Zen Wind Energy Facility & Associated Infrastructure on a site near Saron, Western Cape
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Client	:	Zen Wind Farm (Pty) Ltd
Report Status	:	Amended Final Environmental Impact Assessment Report
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When used as a reference this report should be cited as: Savannah Environmental (2015) Amended Final EIA Report: Proposed Zen Wind Energy Facility & Associated Infrastructure on a site near Saron, Western Cape

PURPOSE OF THE AMENDED FINAL EIA REPORT

Zen Wind Farm (Pty) Ltd (formerly Zenaphan Trading Pty Ltd) is proposing to establish a wind energy facility and associated infrastructure on a site located near Saron, within the Drakenstein Local Municipality. The project is referred to as the Zen Wind Energy Facility. An Environmental Impact Assessment is being undertaken for this proposed project. The project has been registered with the Department of Environmental Affairs (DEA) with the reference number: 14/12/16/3/3/2/322.

A draft Environmental Impact Assessment Report was initially released for public review in November 2012 for a 30-day public review period. Following the review of the draft EIA report, the following was undertaken and considered, and so the finalisation of the EIA report was delayed until November 2013. The Final EIA report included:

» The consideration of impacts changes associated with use of wind turbines with a rotor diameter of up to 122m. The turbines considered each have a capacity of approximately 3MW, a hub height of up to 110m, and a rotor diameter of 122m, as the largest potential turbine to be used for this site.
» The avifauna specialist study recommended that a radar survey be undertaken to understand night-time movement of birds across the site. The results of the radar survey were taken into account in the avifauna impact assessment.
» The completion of the bird and bat pre-construction monitoring programmes, and an updated impact assessment based on the results of the bird and bat pre-construction monitoring programme.
» The change in the layout/location of wind turbines to address areas of sensitivity highlighted by the bird and bat monitoring, and consideration of the layout by all relevant specialists. Minor changes to two turbine positions (turbines 33 and 43) were made in order to address areas of sensitivity highlighted by EIA findings, habitats and the bird and bat monitoring.
» Addition of an access road within the site development footprint.

The Final EIA Report for the Zen Wind Energy Facility was available for review by all stakeholders from 14 November 2013 – 14 December 2013, prior to submission of the final report to the National Department of Environmental Affairs. All final comments received from I&APs were incorporated into the Final EIA Report prior to submission to DEA in January 2014.

In April 2014 the DEA rejected the Final EIA report and requested that the Final EIA report be amended to include the following:

a) The findings of an additional bird monitoring study (3 key vantage points, from which all proposed turbine areas were covered, each monitored for a total of 12 hours in all seasons);
b) Amendments to the facility layout plan where required, in line with the recommendations of the additional bird monitoring study;
c) Cumulative Impact Assessment.

A pre-construction bird monitoring programme was conducted across a 27 month period from September 2012 to December 2014, and for a total observation period of > 400 hours. The monitoring followed BirdLife South Africa's guidelines (version 2, Jenkins et al. 2012). The purpose of the bird pre-construction monitoring programmes was to provide baseline data to inform the findings of the avifauna impact assessment and management plan. The bird pre-construction monitoring programme for the Zen Wind Energy Facility has been completed, and the results of the monitoring have been considered in this Amended Final EIA Report.

Changes made in this report have been underlined for ease of reference. The findings, conclusions and recommendations remain consistent with the Final Report submitted in January 2014.

This Amended Final EIA Report will be available for a 30 day public review period from 06 March 2015 –07 April 2015 at the following locations:

» Saron Public Library
» Gouda Public Library
» The report is also available for download from www.savannahSA.com

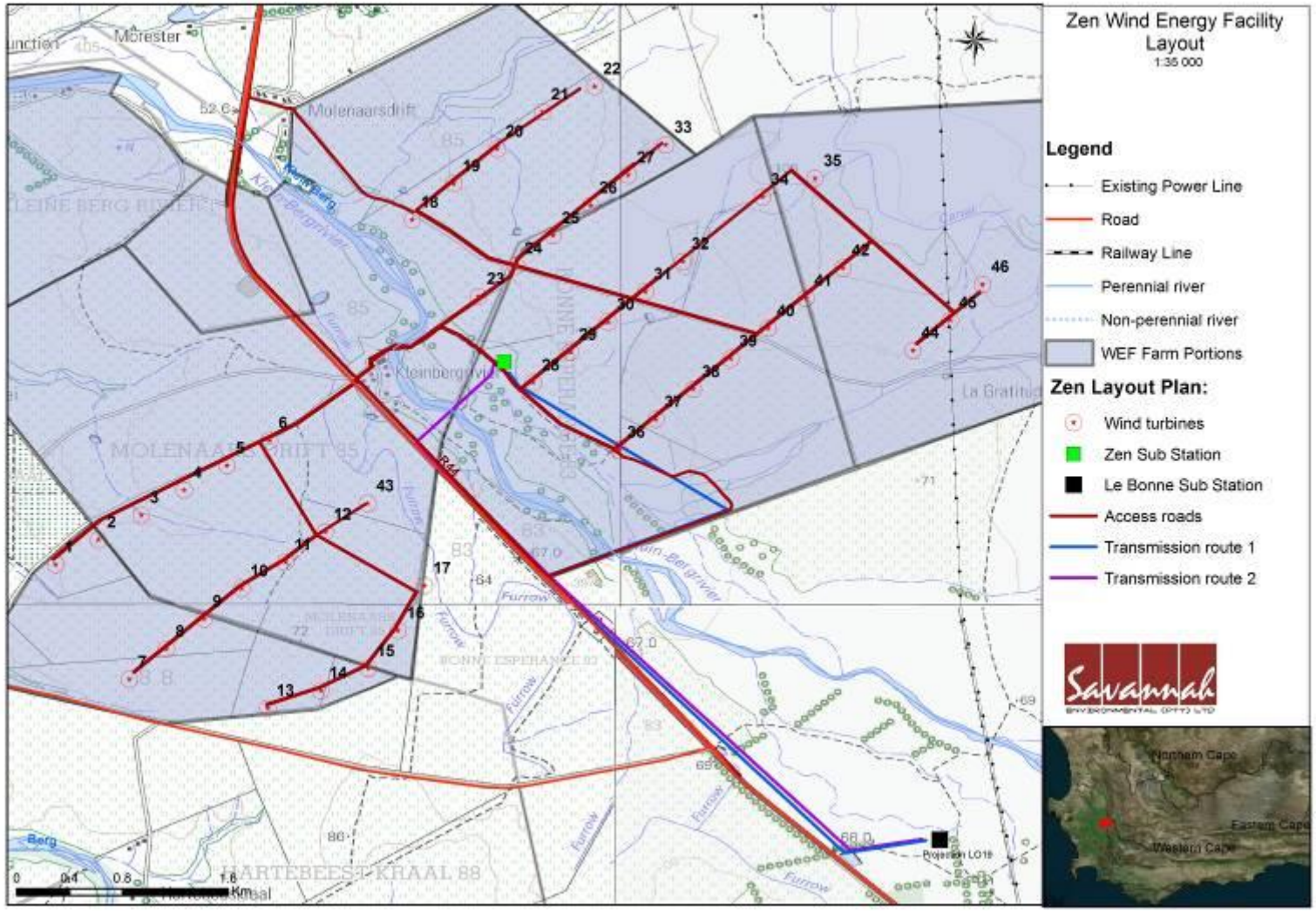

Figure 1: Layout map showing the revised technical design and layout of the Zen Wind Energy Facility

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Zen Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site near Saron located within the Drakenstein Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) lies approximately 6 km south of Saron, in the Western Cape Province. Up to 46 wind turbines are proposed to be constructed over a broader area of approximately ~3 542 ha in extent. The proposed facility would be known as the Zen Wind Energy Facility.

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

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel tower, a hub (up to 110 above ground level, depending on the turbine size decided upon) and three blades.
» Internal access roads (up to 6m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Two power line route alternatives were assessed in the EIA.

The site (~3 542 ha in extent) includes the following farm portions (refer to Figure 1.1):

» Portion 1 of the farm Bonne Esperance 83
» Portion 2 of the farm Bonne Esperance 83
» Portion 9 of the farm No. 88
» Remainder of Portion 4 of the farm Kleinbergrivier No.1
» Remainder of the farm Moolenaars Drift No. 85
» Remainder of Portion 1 of the farm Moolenaars Drift No. 85

Savannah Environmental was contracted by Zen Wind Farm (Pty)

Ltd as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

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 site selection and project alternatives.
» **Chapter 3** describes wind energy as a power generation option.
» **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 scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of environmental impacts associated with the proposed project.
» **Chapter 9** describes the cumulative impacts associated with the proposed project.
» **Chapter 10** presents the conclusions of the impact assessment as well as an impact statement for the proposed project.
» **Chapter 11** 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 and final 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 assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. This layout includes 46 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMPr)** included within **Appendix N**.

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 Zen Wind Energy Facility 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 of the project.

The following infrastructure would be included within an authorisation issued for the project:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity. The capacity of the facility will be up to 140MW.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a tower, a hub (up to 110m above ground level, depending on the turbine size decided upon) and three blades.
» Permanent internal and access roads (up to 6 m in width and including turning circles where required) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised, widened and upgraded where possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Route 2 is nominated as the preferred option from an environmental perspective.

Mitigation of land use loss associated with the construction of the project includes the following:

» The minimisation of loss of productive land: The developer has proposed the installation of at least one additional centre pivot on the site in order to intensify crop production on portions of the site which are unaffected by the facility. The landowner has expressed serious intent to commit lease fees to such intensification activity. The benefits of this off-set would be the minimisation of impacts to loss of agricultural potential as a result of the area impacted by the proposed facility.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to M must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N 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 EMPr 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.

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

» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is 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 to carry out a restricted activity involving a specimen of a listed threatened or protected species. Should TOPS species be identified during the final ecological survey, in terms of the NEM:BA a permit (a TOPS permit) will be required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Nature and Environmental Conservation Ordinance of 1974 and the Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000).

» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.

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

» Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.

» Bird diverters must be utilised on the new power line where required, and specifically where the power line traverses the Klein Berg River.

- Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
- No infrastructure to be placed on current/future irrigated fields.
- Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
- Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
- Quarterly noise measurements are recommended for the first year of operation of the wind energy facility.
- Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

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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	National Department of Environmental Affairs
DMR	Department of Mineral Resources
DOT	Department of Transport
DoE	Department of Energy
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
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

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.

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.

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 Programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going 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).

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. 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. 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

Zen Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site near Saron located within the Drakenstein Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) lies approximately 6 km south of Saron, in the Western Cape Province. Up to 46 wind turbines are proposed to be constructed over a broader area of approximately ~3 542 ha in extent. The proposed facility would be known as the Zen Wind Energy Facility.

The Final EIA Report for the Zen Wind Energy Facility was available for review by all stakeholders from 14 November 2013 – 14 December 2013, prior to submission of the final report to the National Department of Environmental Affairs. In April 2014 the DEA rejected the Final EIA report and requested that the Final EIA report be amended to include the findings of an additional bird monitoring study undertaken at 3 key vantage points (from which all proposed turbine areas were covered), each monitored for a total of 12 hours in all seasons.

The purpose of the bird pre-construction monitoring programmes was to provide baseline data to inform the findings of the avifauna impact assessment and management plan. The bird pre-construction monitoring programme for the Zen Wind Energy Facility has been completed, and the results of the monitoring have been considered in this Final EIA Report[1]. The findings, conclusions and recommendations remain consistent with the Final Report submitted in January 2014.

The nature and extent of the Zen Wind Energy Facility, as well as potential environmental impacts associated with the construction and operation of the facility are assessed in this 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 site selection and project alternatives.
» **Chapter 3** describes wind energy as a power generation option.
» **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

[1] Changes made in this report have been underlined for ease of reference.

» **Chapter 7** describes the scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of environmental impacts associated with the proposed project.
» **Chapter 9** describes the cumulative impacts associated with the project
» **Chapter 10** presents the conclusions of the impact assessment as well as an impact statement for the proposed project.
» **Chapter 11** contains a list references for the EIA report and specialist reports.

1.1. Project description

The site for the proposed Zen Wind Energy Facility falls within the Drakenstein Local Municipality in the Western Cape Province. The broader area (~3 542 ha in extent) includes the following farm portions (refer to Figure 1.1):

» Portion 1 of the farm Bonne Esperance 83
» Portion 2 of the farm Bonne Esperance 83
» Portion 9 of the farm No. 88
» Remainder of Portion 4 of the farm Kleinbergrivier No.1
» Remainder of the farm Moolenaars Drift No. 85
» Remainder of Portion 1 of the farm Moolenaars Drift No. 85

Wind turbines use the energy from the wind to generate electricity. In essence, the blades of the turbine are turned by the wind and the energy captured is converted into electrical energy and supplied to the electricity grid for use in homes and elsewhere.

Zen Wind Farm (Pty) Ltd will be considering various wind turbine technologies in order to maximise the capacity of the site. The turbines being considered will each have a capacity of approximately 3MW. The 3MW turbines will have a maximum hub height of up to 110m, and a maximum rotor diameter of up to 122m. The worst case scenario has been considered in the EIA. The three wind turbine alternatives being considered at this time are as follows:

» Hub height 90m, rotor diameter 110m (base case).
» Hub height 89m, rotor diameter 122m.
» Hub height 100m, rotor diameter 110m.

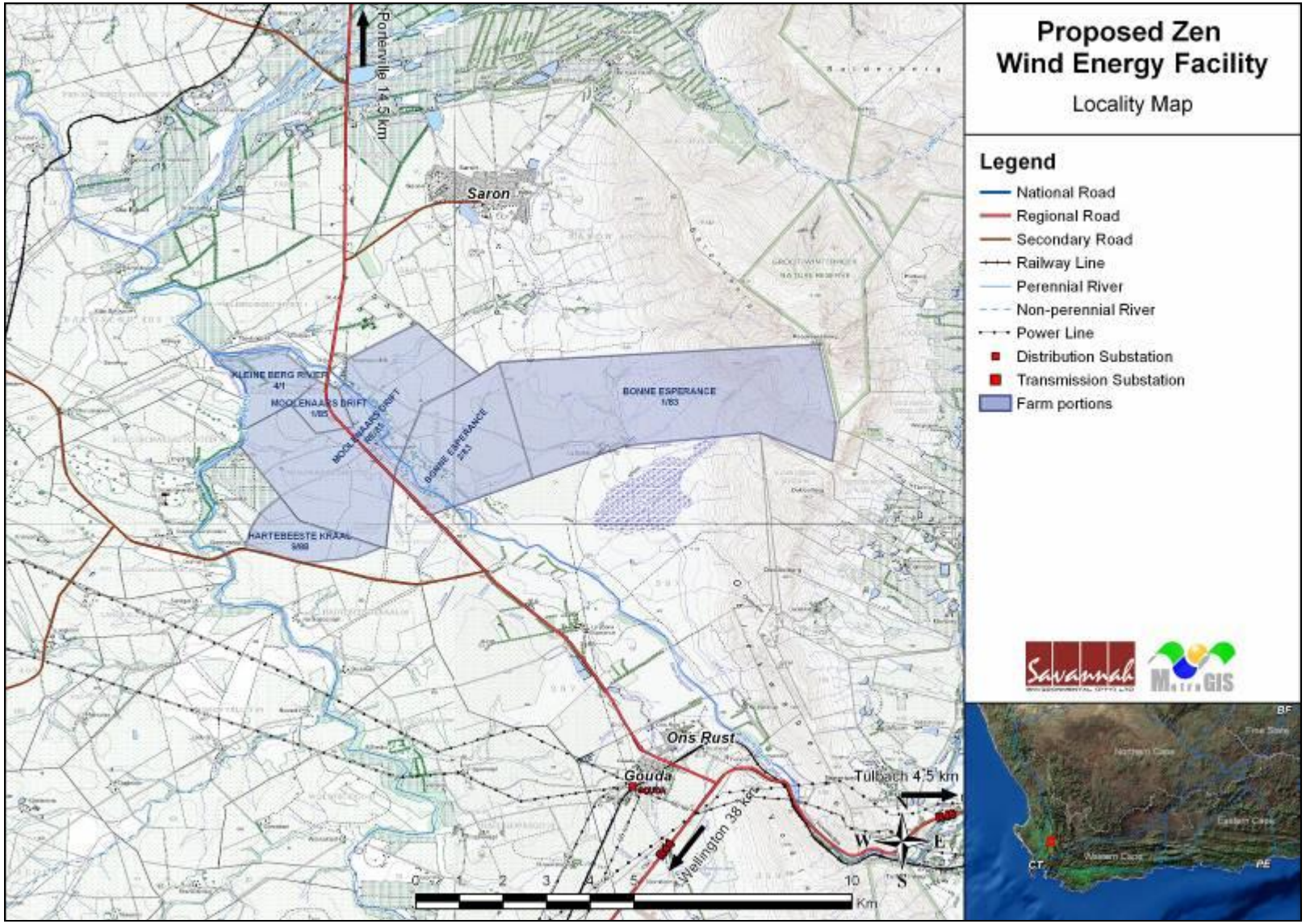

Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Zen Wind Energy Facility, Western Cape Province

In practice, the wind energy facility may be a combination of all three of these turbines. Up to 46 wind turbines are proposed to be constructed on the site. The capacity of the proposed Zen Wind Energy Facility will depend on the most suitable wind turbine (in terms of the turbine capacity) selected by Zen Wind Farm. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 140MW.

Specialist software is available to assist developers in selecting the optimum position for each turbine before the project is constructed. This layout also informed the positioning of other infrastructure such as access roads and substation/s. The positioning or detailed layout of the wind energy facility has been developed based on preliminary wind monitoring results, the findings of the bird and bat monitoring, as well as the findings of the EIA studies, and is shown in Figure 1.2 (minor changes to two turbine positions (turbines 33 and 43) were made in in 2013 order to address areas of sensitivity). Final placement will be informed by the outcomes of the EIA as well as from the results of the on-going on-site wind monitoring. The site is proposed to accommodate up to 46 wind turbines as well as the associated infrastructure which is required for such a facility including, but not limited to:

» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel tower, a hub (up to 110m above ground level, depending on the turbine size decided upon) and three blades.
» Internal/ access roads (up to 6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Two power line route alternatives were assessed in the EIA.

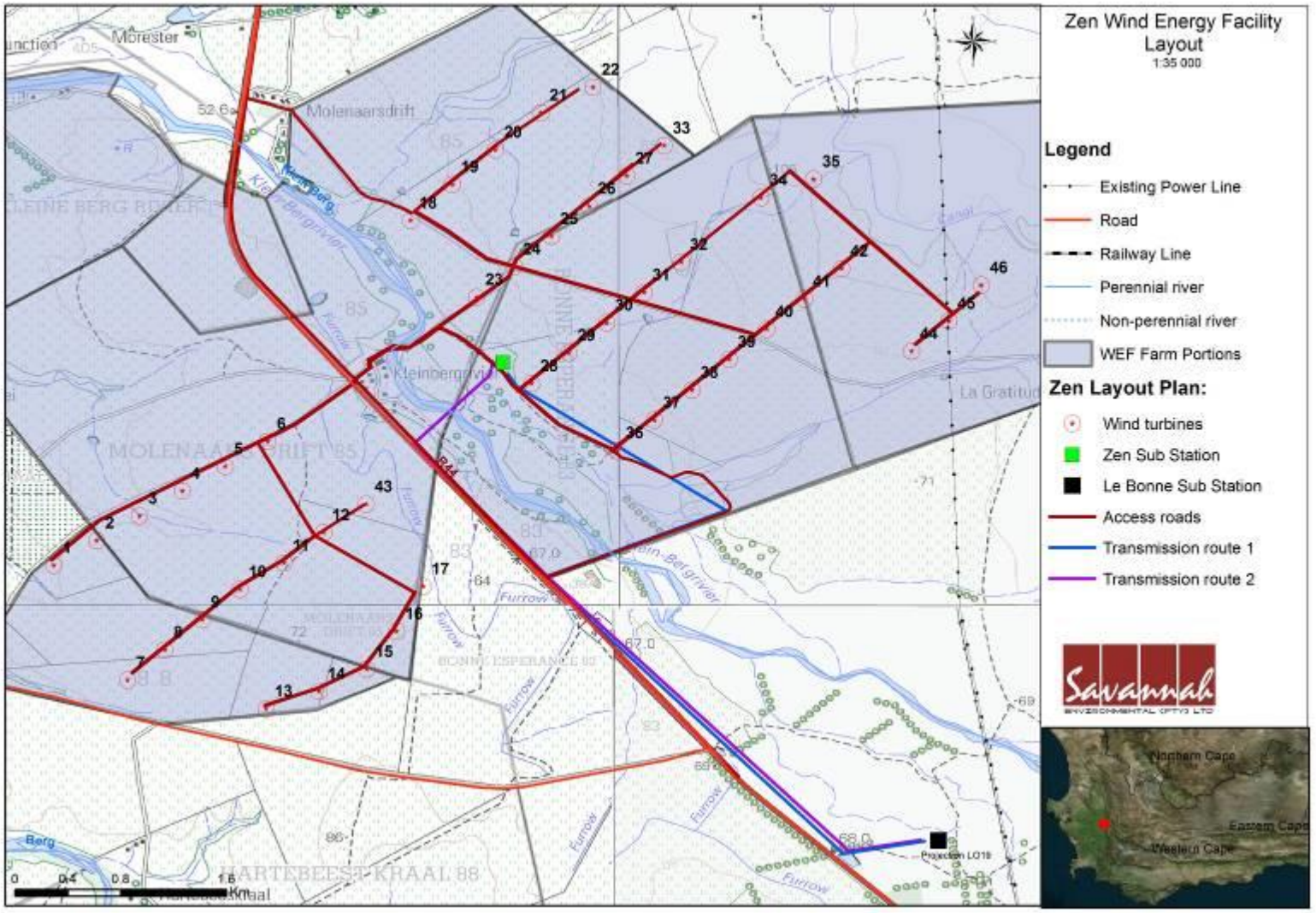

Figure 1.2: Layout map showing the technical design and layout of the Zen Wind Energy Facility, Western Cape Province

1.2. The Need for the Proposed Project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF.

a) Drakenstein Local Municipality Integrated Development Plan (IDP) (2012-2017)

The Drakenstein 2012-2017 IDP is the first of the new, third generation IDP cycle documents, as required in terms of the Municipal Systems Act (2000) for all South African municipalities. The document was adopted by Council in May 2012, and will serve as the basic developmental framework and the basis for annual reviews of municipal performance for the period up to 2017. Reviews will be based on an assessment against defined Key Performance Areas (KPAs). Council developed eight (8) KPAs that will be used to monitor and assess and the performance of the Municipality, using the Service Delivery and Budget Implementation Plan (SDBIP) as a tool.

Of specific relevance to the proposed Zen Wind Energy Facility, the IDP notes that in terms of its Key Priority Area (KPA 2) "Physical Infrastructure and Energy Efficiency in order to ensure efficient infrastructure and energy supply that would contribute to the improvement of quality of life for all citizens within Drakenstein".

b) Cape Winelands District Municipality EMF (Draft, November 2012)

The Cape Winelands District Municipality (CWDM) currently has a draft EMF. The purpose of the CWDM EMF is to integrate biophysical and socio-cultural information for the District's geographically defined area in order to promote more environmentally and socially responsible development. Spatially, the draft EMF indicates that the Zen site falls into a low to moderate environmental risk sensitivity zone (refer to Figure 1.3). A low to moderate environmental risk sensitivity zone is defined in the EMF as an area in which a change in land use will pose limited threat to attaining the desired state of the environmental attribute (CWDM Draft EMF, March 2012). In addition this means that most types of activities / development can be considered in this area. Therefore the Zen project fits into the environmental management planning for development in this area of the CWDM EMF. Site specific sensitivities are explored in further detail in this EIA.

c) Drakenstein Local Municipality Draft Spatial Development Framework

The DLM Amended SDF is currently in a semi-finalised form. The document was approved by Council in November 2010, and is used as the key spatial guidance framework for the municipality. The DLM SDF notes that large sections of the local communities have limited access to economic and income-generating opportunities in both the formal and informal sectors. Minimal opportunities for small-scale farmers and the uneven spread of the benefits of the tourism industry have limited the impact of the agricultural and tourism sectors on the economic disposition of disadvantaged communities.

The SDF further notes that the rural land within the municipality is characterised by low levels of access to social services, health and educational facilities and basic infrastructure. The SDF recognises the need for development within small/ rural areas/ settlements (such as Saron). The SDF mapping identified the "Gouda/ Saron Agricultural Land Use" zone which indicates that the area around Gouda and Saron is best suited for the dry land cultivation of annual crops (i.e. cereals and fodder crops) and extensive grazing. The SDF notes that the key issues in the Gouda farming area are constituted by too small farming units impacting negatively on economic viability, and the limiting effect of the strong South-Easter (which essentially precludes the production of summer annual crops). Therefore the Zen Wind Energy Facility is considered to be compatible with spatial development plans for the area as there is no direct conflict of land use, and the facility utilizes the strong winds characteristic of the area, which are considered a limiting factor to other types of land use.

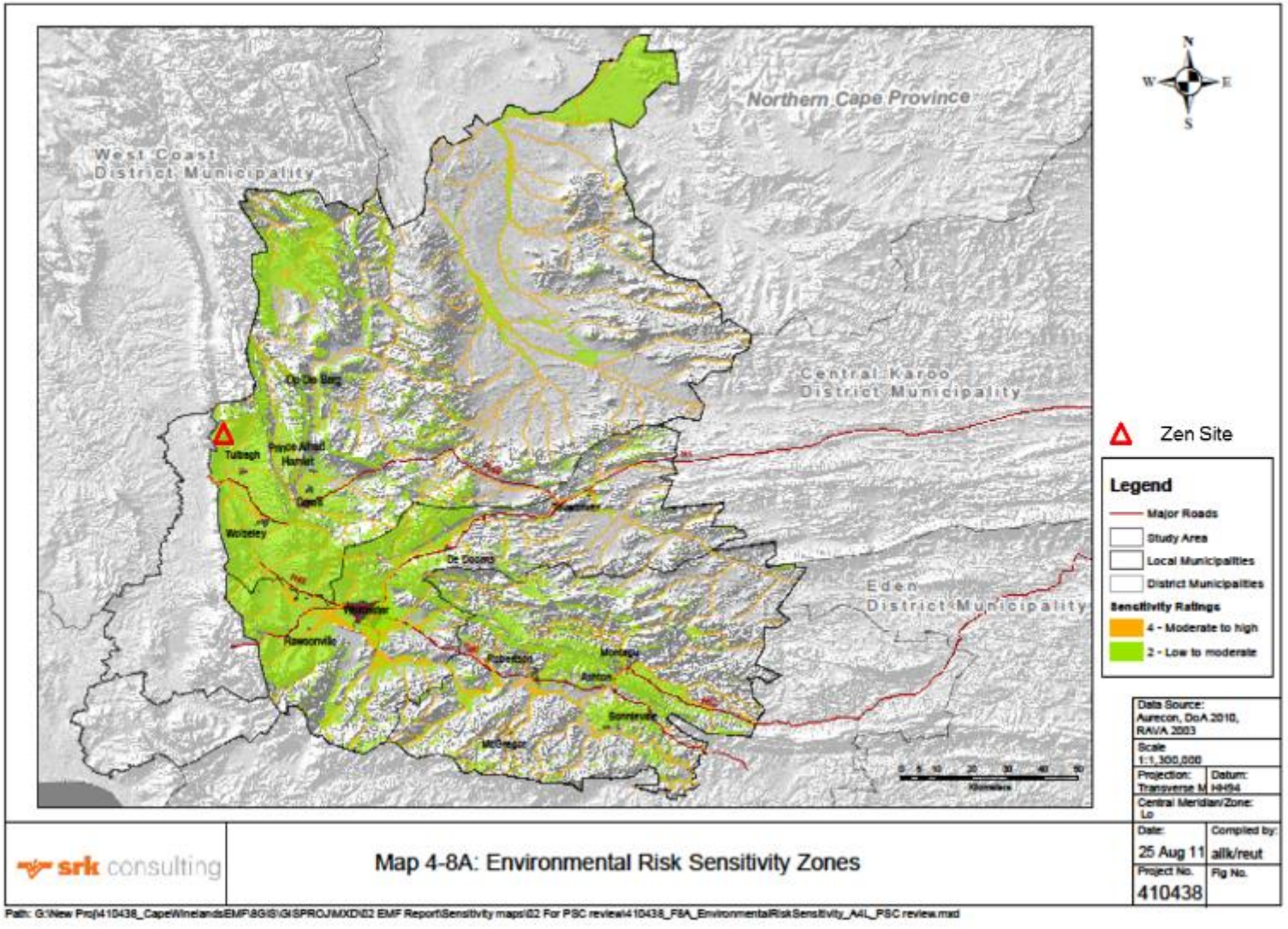

Figure 1.3: Approximate Location of the Zen Site within the Environmental Risk Sensitivity Zones identified in the CWDM Draft EMF (sourced from http://www.srk.co.za/en/page/za-cape-winelands-district-municipality-emf)

d) Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, the developer considers the Zen project to be financially viable. The "need and desirability" of the local community as reflected in an IDP, SDF and EMF for the area, is also considered in the EIA. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP, SDF and/ EMF). The Zen wind energy facility project is in line with the Drakenstein Local Municipality Integrated Development Plan (IDP) (2012/17), as discussed above. In terms of the needs on the local community, the SDF & SIA identified the need for development, social services, education and employment opportunities in this area. The Zen project could potentially contribute positively to these community needs. The project will create employment and business opportunities, as well as the opportunity for skills development of for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

e) The Need for the Zen Wind Energy Facility Project

The need for harnessing renewable energy resources (such as wind energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix 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 a goal of ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Zen Wind Farm proposes the establishment of the Zen Wind Energy Facility to add new capacity to the national electricity grid.

The development of the project would benefit the local/regional/national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation and spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the wind energy facility to go back into the community through a social beneficiation scheme. Therefore there is a potential for creation of employment and business

opportunities, and the opportunity for skills development of for the local community.

f) The Desirability for the Zen Wind Energy Facility Project

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while affecting the smallest land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical point of view. Zen Wind Farm Pty Ltd considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development. Wind monitoring is currently being undertaken using a wind monitoring mast in order to confirm the wind resource on the site, and ultimately inform the layout of the facility well as the turbine selection process.

The current land-use on the site is agriculture, mainly wheat and cereal production due to the winter rainfall and game farming. Summer land uses include extensive grazing of crop rests or fallows. Irrigated crop production is occasionally practiced where water is available. The development of the wind energy facility will allow crop production (mainly for feeding livestock) and current livestock and/or gamefarming on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. This represents a win-win situation of landowners, the site and the developer.

g) How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through compliance with the requirements of the relevant legislation in undertaking the assessment of potential impacts, as well as through the implementation of the

principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

1.3. Technical Motivation for the Project

The proposed Zen Wind Energy Facility was identified by Zen Wind Farm as a highly desirable site based on the average wind speeds recorded in the area. The proposed Zen Wind Energy Facility site displays characteristics which makes it a preferred site for a Wind Energy Facility such as land availability, connection to the Eskom grid, existing land-use (dry-land crop production and game farming, wind resources and a network of farm access roads for ease of access). The proposed farm portions cover an area approximately 3 542a in extent, which is sufficient for placement of up to 46 wind turbines. The proposed Zen Wind Energy Facility is proposed to connect to the future LeBonne Substation[2] for ease of grid connection, without the need for additional long power lines for connection. In addition, the construction and operation of the wind energy facility would permit the continuation of present farming activities and as such would not result in a significant loss of agricultural land. A detailed letter of motivation for selection of this site by the developer for the Zen Wind Energy Facility is attached to Appendix Q.

[2] Le Bonne Substation is proposed to be built as part of the Gouda Wind Energy facility, which received preferred bidder status in REIPPP Round 2 and is currently under construction.

1.4. Environmental Sensitivities Identified during the Scoping Phase

A scoping study was conducted in August 2012 and accepted by DEA in November 2012. The scoping report identified areas of potential environmental sensitivity to inform the design of the wind energy facility and for further investigation during the EIA phase. These sensitive areas are shown in Figure 1.4 and include:

» ***Sensitive ecological areas and potential habitat for protected flora and fauna**:* The eastern portion of the site contains the only extensive tract of intact vegetation at the site. This section consists of Critically Endangered Swartland Alluvium Fynbos and Swartland Shale Renosterveld. These areas are classified as Very High Sensitivity and intact areas of these vegetation units should be considered no-go areas. Figure 1.4 illustrates the very high sensitivity in red and the low in green.

» ***Wetlands:*** The proposed site is bounded by the base of the Roodesandberge mountain range is to the east and the Great Berg River to the west. The Klein Berg River bisects the site and drains south towards the Tulbagh valley. There are a number of drainage lines and wet areas on the site. The desktop ecological, avifauna and bat studies identified these areas to have the potential to be of high sensitivity. It is recommended that infrastructure be located 32m from any bank and the relevant water use licences be obtained prior to development of the proposed facility.

» ***Potential bird and bat sensitive areas:*** The potential for occurrence of birds and bats on the proposed development site is high. There is the possibility that 196 bird species may occur with some regularity within the anticipated impact zone of the wind energy facility, including 43 endemic or near-endemic species, 13 red-listed species. In addition, it is possible for a number of bats species to occur within the proposed development area. Therefore, an in-depth assessment of habitat and areas considered most sensitive to bird and bat species should be avoided by any proposed infrastructure.

» ***Areas with sensitive noise receptors:*** The character of the area is predominantly rural except to the north of the site, which is regarded as residential and commercial (i.e. in the town of Saron).

» ***Heritage Resources:*** The most significant impacts of the development are considered to be to the cultural and natural landscape and the scenic routes that pass through the region.

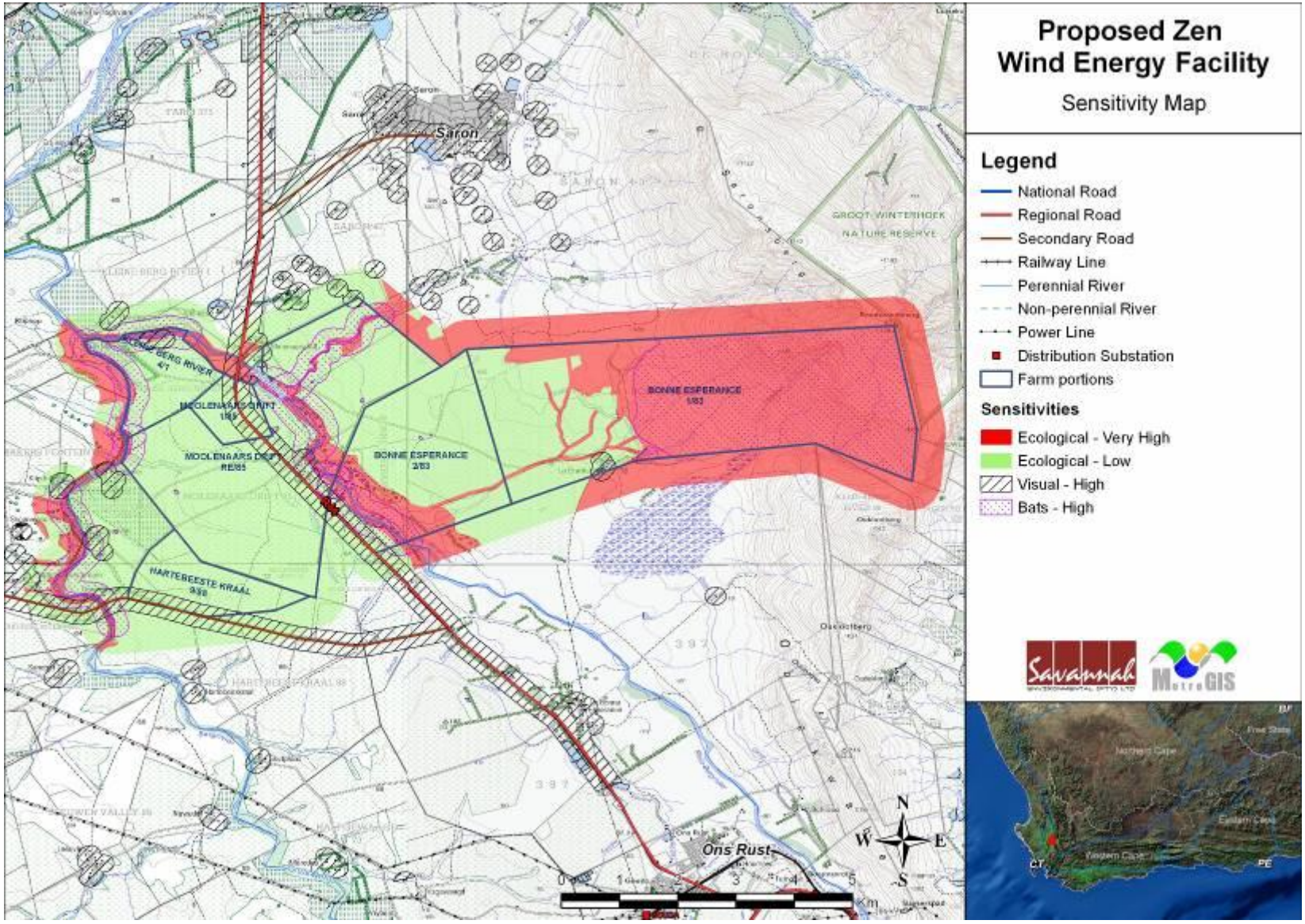

Figure 1.4: Scoping study desktop environmental sensitivity map for the proposed Zen Wind Energy Facility

The scoping phase sensitivity map provides a rough scale estimate of sensitivity on the site, and these areas were subject to survey and ground-truthing during the EIA phase of the project. Based on the scoping environmental sensitivity map (Figure 1.4) it was recommended that areas of high environmental sensitivity should be avoided, while areas of medium and low environmental sensitivity could be considered for the location of the wind turbines and associated infrastructure.

Further to the process of determining constraining factors and environmentally sensitive areas during the scoping phases, the findings of the EIA Phase as well as the findings from the pre-construction monitoring programmes have also been considered. The layout of the wind turbines and infrastructure developed by Zen Wind Farm and assessed in the EIA Phase has been revised in response to sensitivities highlighted by EIA findings, habitats and the bird and bat monitoring programmes. Changes to two turbine positions (turbines 33 and 43) have been made in order to address areas of sensitivity. This layout is considered to be an 80% accurate layout, and allows for some adjustment to avoid any further site-specific environmental constraints identified, where necessary.

The components of the proposed Zen Wind Energy Facility, (for the construction, operation and decommissioning phases) are discussed in more detail in Chapter 7.

1.5. Requirement for an Environmental Impact Assessment Process

The proposed project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) of June 2010 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 of June 2010 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: 14/12/16/3/3/2/322). Through the decision-making process, the DEA will be supported by the Western Cape Department of Environment Affairs and Development Planning (Western Cape DEA&DP), as the commenting authority for the project.

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. Zen Wind Farm 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 R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010). This report documents the assessment of the potential environmental impacts of the proposed construction and operation of the Zen Wind Energy Facility, as proposed by Zen Wind Farm. This study concludes the EIA process and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.6. 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 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 a draft EIA Report and this Final EIA Report provided stakeholders with an opportunity to verify the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report incorporated all issues and responses raised during the public review of the draft EIA Report prior to submission to DEA.

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

Savannah Environmental was contracted by Zen Wind Farm as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Zen Wind Farm. 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:

» Karen Jodas - a registered Professional Natural Scientist and holds a Master of Science degree. She has 16 years of experience consulting in the environmental field. 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.

» John von Mayer – the principle author of this report holds an Bachelor of Science Honours degree in Environmental Science and has 7 years of experience in environmental management and EIA. He is currently the responsible EAP for several renewable energy projects 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:

Specialist	**Area of Expertise**
Simon Todd of Simon Todd Consulting	Ecology
Tony Williams of African Insights	Avifauna
Bárbara Monteiro and Ricardo Ramalho of Bio3	Bats
Lourens du Plessis of MetroGIS	Visual impacts
Jayson Orton of ACO Associates	Heritage
Tony Barbour Environmental Consulting and Research	Social
J.H. van der Waals of Terra soil	Soils, erosion and agricultural potential
Morne de Jager of M2 Environmental Connections CC	Noise
John Almond of Natura Viva	Palaeontology

The curricula vitae for EAPs from Savannah Environmental as well as the specialist consultant's team are included in **Appendix A**.

The site identified for consideration of the Zen Wind Energy Facility occurs within the Drakenstein Local Municipality in the Western Cape Province, and lies approximately 6 km south of Saron. Up to 46 wind turbines are proposed to be constructed over an area of approximately 3 542ha in extent. Associated infrastructure proposed includes a substation, access roads, office and a power line.

The technical design and layout of the wind energy facility is illustrated in Figure 2.1. **Appendix P** contains A3 maps showing the detail of the layout of the facility. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 140MW and will comprise of the following infrastructure:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel tower, a hub (up to 110 above ground level, depending on the turbine size decided upon) and three blades.
» Internal/ access roads (up to 6m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Two power line route alternatives were assessed in the EIA.

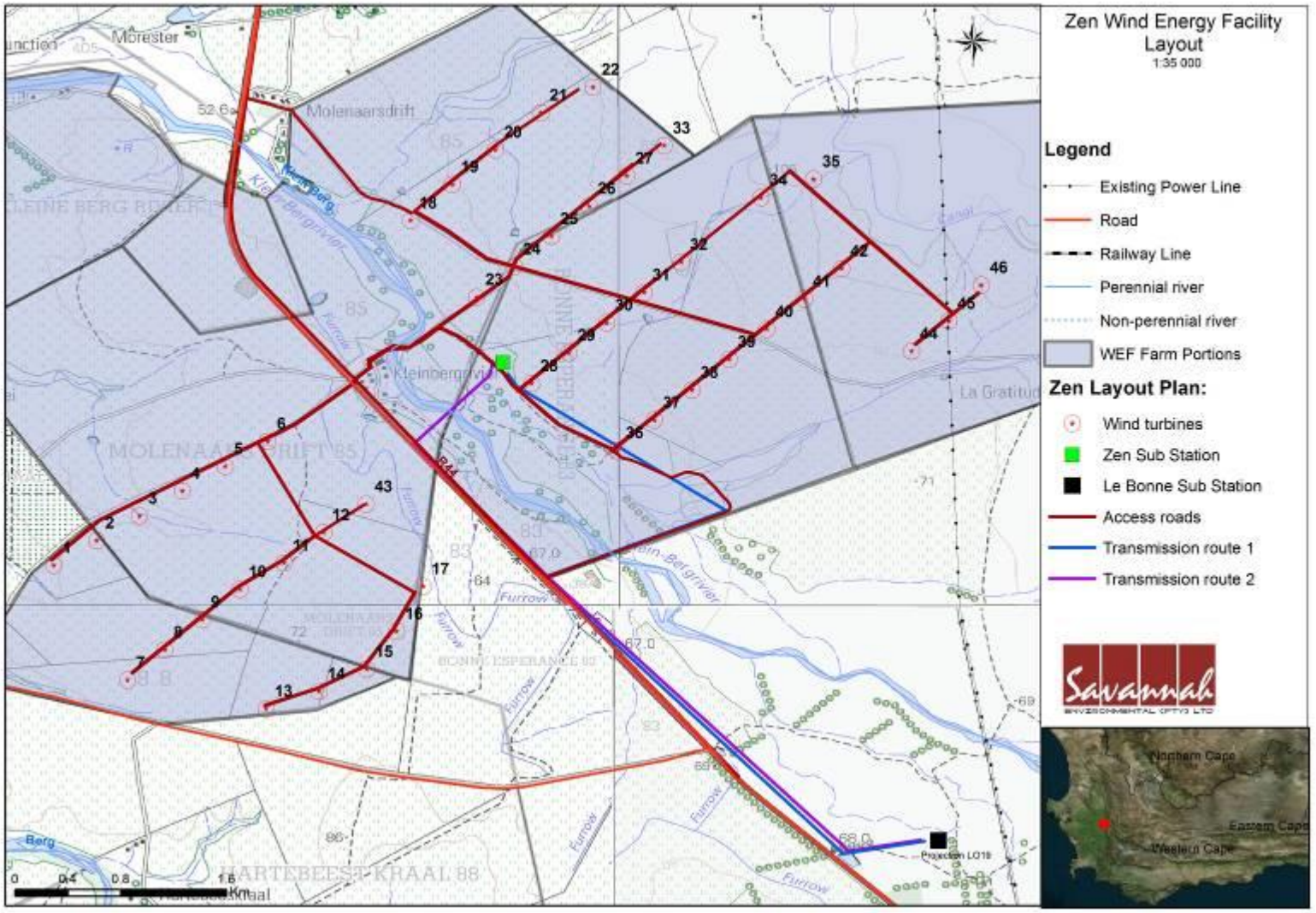

Figure 2.1: Layout map showing the technical design and layout of the Zen Wind Energy Facility and associated infrastructure

2.1. Site Selection and Pre-Feasibility Analysis

The proposed site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical point of view. Appendix Q provides more information from the Project Developer on the site selection process, suitability of the site for development of a wind energy facility and motivation for no site alternatives. Zen Wind Farm considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development. Wind monitoring is currently being undertaken using a wind monitoring mast in order to confirm the wind resource on the site, and ultimately inform the layout of the facility well as the turbine selection process.

2.2 Technology Alternatives

Based on site characteristics it was determined by Zen Wind Farm that the site would only be suitable for a wind energy facility, and is not suitable for the installation of other renewable energy technologies. Through the project development process, Zen Wind Farm is considering various wind turbine designs in order to maximise the capacity of the site. It is anticipated that the turbines utilised for the proposed Zen Wind Energy Facility will have a hub height of up to 110 m, and rotor diameter of up to 122 m. The technology provider has not yet been confirmed, and will only be decided after further wind analysis as well as a tender process. As this stage, the use of 3MW turbines has been assumed to be utilised at the site, and have been assessed in the EIA (as the worst case scenario).

2.3 Site-specific or Layout Design Alternatives

A wind turbine layout has been undertaken to effectively 'design' the wind energy facility. Through the process of determining constraining factors and environmentally sensitive areas during the scoping and EIA phases, as well as considering the findings from the pre-construction monitoring programmes, the layout of the wind turbines and infrastructure has been developed by Zen Wind Farm (refer to layout as shown in Figure 2.1, which is a revised layout in response to sensitivities identified through the bird and bat monitoring programmes.) This layout is considered to be an 80% accurate layout, and allows for some adjustment to avoid site-specific environmental constraints identified through the EIA phase, where necessary. The overall aim of the layout is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. This micro-siting information informed the specialist impact

assessments in this EIA phase, and where required, specialists have considered the revision to the layout. The planning process also included the positioning of other ancillary infrastructure, including, the power line and internal substation site/s.

Planning and design for the transmission of the power generated at the wind energy facility is being undertaken. This has been informed through understanding the local power requirements and the stability of the local electricity network.

» Layout alternatives assessed in the EIA phase include two options for grid connection (power line routes)

These layout alternatives are shown in Figure 2.1, are described below, and assessed in Chapter 8.

2.3.1 Two options for grid connection (power line routes)

Two power line route alternatives were assessed in the EIA. A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site).

Two power line alignment alternatives are proposed in order to link the proposed Zen Substation to the La Bonne Substation which is located ~4.5 km to the south of the Zen site. Both alternatives are aligned along and to the north of the R44, and the final ~3.5 km of the alignments are essentially identical. Route 1 (~6.5 km in length) is planned to run across Farm Bonne Esperance, then turn towards the R44 and run along the R44. Route 2 runs along the R44 to the LeBonne Substation and is ~5.5 km in length. Both power line routes cross over the Kleinberg River at different points. The 132 kV power line will have servitude of up to 36m wide.

2.4 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Zen Wind Energy Facility on the proposed site.

The primary considerations pertaining to the do-nothing alternative relate to:
1. The current land-use regime of the site; and
2. The need to diversify the energy mix is South Africa.

These are discussed in further detail below.

1. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have moderate to high agricultural potential. The "do nothing" alternative would however leave current land-use (crop production and game farming), with losing out the opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that outside of the proposed wind energy facility infrastructure. The current land-use on the site is agriculture (mainly wheat and cereal production due to the winter rainfall). Summer land uses include extensive grazing of crop rests or fallows. The development of the wind energy facility will allow current crop production on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. This represents a win-win situation of landowners, the site and the developer. Therefore, from a land-use perspective, the do nothing alternative is not preferred.

2. The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. 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 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 - and more so when social and environmental costs are taken into account.

   The generation of electricity from renewable energy in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in further by NERSA (March 2009), and include:

   » **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

- **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, where compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.
- **Exploitation of our significant renewable energy resource:** At present, valuable national resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
- **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
- **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.
- **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
- **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.
- **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
- **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.
- **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to final energy consumption by 2013. Furthermore the IRP 2010 states that 42% share of all new power generation should be derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010 – 2030). The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DME's macroeconomic study on renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. In addition, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh (NERSA, March 2009).

The Climate Change Strategy and Action Plan for the Western Cape (2008) identified solar and wind energy as suitable renewable technologies for the Western Cape. The White Paper on Sustainable Energy for the Western Cape (2008) compliments the Climate Change Strategy and Action Plan, specifically by setting targets for renewable energy generation for the province. The Western Cape's target for electricity generated from renewable sources is that 15% of the electricity consumed in the Western Cape will come from renewable energy sources by 2014. Through research, the viability of the Zen Wind Energy Facility has been established, and the developer proposes that up to 46 turbines (depending on the turbine selected) can be established as part of the facility. The 'do nothing' alternative will not assist the South African government in reaching the set targets for renewable energy. In addition the Western Cape's power supply will not be strengthened by the additional generated power being evacuated directly into the Provinces' electricity grid.

The 'do nothing' alternative is not a preferred alternative, as the result of not developing the wind energy facility will be that the following positive impacts 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.

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while affecting the smallest land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The power generated from the Zen Wind Energy Facility will be up to 140MW, at a commercial scale to feed into the Eskom grid.

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 and approaches are being developed to reduce emissions. However, it is important to acknowledge that the more cost-effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy 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.

3.1 The Importance of the Wind Resource for Energy Generation

The importance of using the wind resource for energy generation 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. The doubling of wind speed increases the wind power by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating at wind speeds of between ~3 m/s to 4 m/s, with wind speeds greater than 6 m/s currently required for a wind energy facility to be economically viable. Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. 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 influences the flow of air, and results in turbulence within the air stream, and this has to be considered in the placement of turbines.

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

» **Wind direction** is reported by the direction from which it originates. Wind direction at a site is important to understand, but it is not typically critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

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

The placement of the individual turbines within a wind energy facility must consider the following technical factors:

» Predominant wind direction, wind strength and frequency
» Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)
» Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 3 to 8 times the rotor diameter apart in order 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 spacing requirements will be considered through the process of micro-siting the turbines on the site.

3.2 What is a Wind Turbine and How Does It Work

The kinetic energy of wind is used to turn a wind turbine to generate electricity. A wind turbine typically consists of **three rotor blades** and a **nacelle** mounted

at the top of a tapered **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 Zen Wind Energy Facility in the Western Cape Province will have a maximum hub height of up to 110 m, and rotor diameter of up to 122 m. These turbines would be capable of generating in the order of up to 3 MW each (in optimal wind conditions).

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components:

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

The foundation
The foundation is used to secure each wind turbine to the ground. These structures are commonly made of concrete and are designed for vertical loads (weight) and lateral loads (wind).

The tower
The tower, which supports the rotor, is constructed from tubular steel or concrete. The towers planned to be used for this project are up to 110m in height. The nacelle and the rotor are attached to the top of the tower.

The tower is part of the overall wind turbine 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.

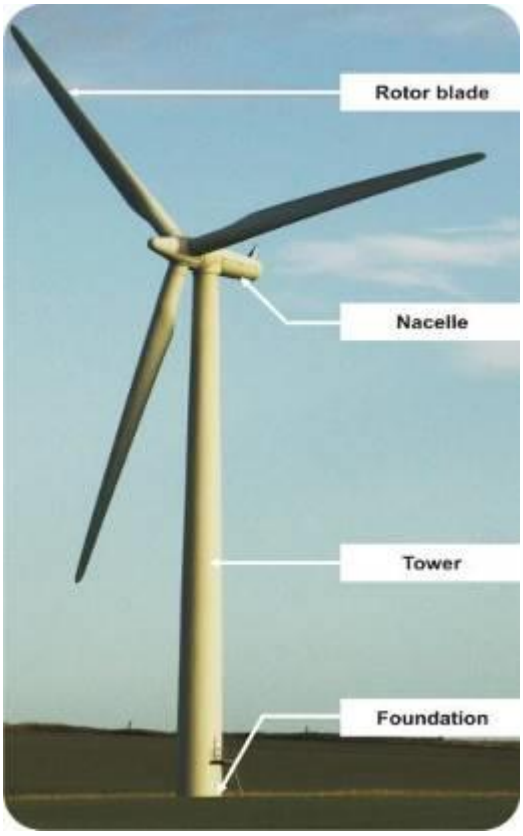

Figure 3.1: Illustration of the main components of a wind turbine

The rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades, typically made from fibreglass materials or carbon fibre reinforced plastics. When a rotor blade is in contact with wind, the airflow is deflected, airflow over the top arched edge has to take a longer path than at the relatively straight underside. This results in a low pressure at the upper side and a high pressure at the lower side. The pressure differential causes the blades to start moving. The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

The nacelle (geared)

The nacelle at the top of the tower accommodates the gears, the generator, anemometer for monitoring the wind speed and direction, cooling and electronic control devices, and yaw mechanism. Geared nacelles generally have a longer form than a gearless 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 farm can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 3 m/s and 4 m/s.

At very high wind speeds, typically over 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.

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.

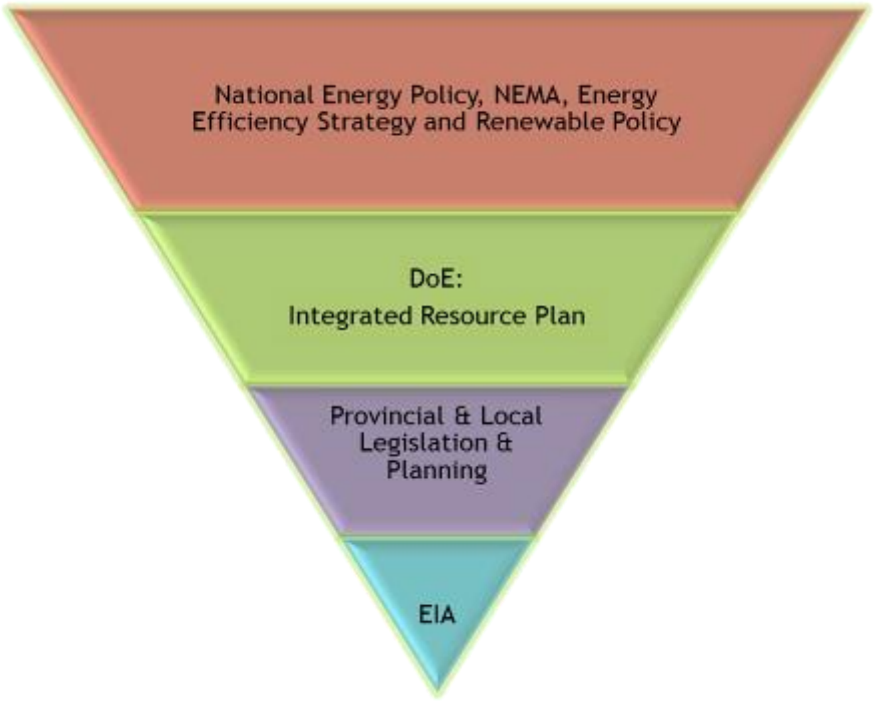

Figure 4.1: Hierarchy of electricity policy and planning documents

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.

The DoE has released a draft Integrated Energy Planning Report (June 2013) for public comment. The Draft Integrated Energy Planning Report gives insight on the possible implications of pursuing alternative energy policy options in South Africa. Once the implications of all the alternative options have been explored and evaluated against each of the eight (8) key objectives, final recommendations will be made in the form of the Final IEP Report.

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.

4.1.5. Department of Energy Process for Independent Power Producers (IPPs)

In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix 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 being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Zen Wind Farm (Pty) Ltd proposes the establishment of the Zen Wind Energy Facility to add new capacity to the national electricity grid. Zen Wind Farm (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (i.e. typically for a period of 20 - 25 years) in order to build and operate the proposed wind energy facility. As part of the agreement, Zen Wind Farm (Pty) Ltd would be remunerated per kWh by Eskom or subsequent authority/market operator. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned, or the power purchase agreement renegotiated and extended.

The IPP will undergo a bidding process in which the Department of Energy will determine preferred bidders. A Preferred Bidder will be held to compliance with the price and economic development proposals in its bid, with regular reporting to demonstrate compliance during the life of the project.

The DoE IPP Procurement Programme is currently underway. During 2012, the government signed contracts for 28 IPP projects, which include wind, solar and small hydro technologies to be developed in the Eastern Cape, Western Cape,

Northern Cape and Free State provinces. The first IPP Bid submission (Round 1) was in November 2011, the second bid submission (Round 2) in March 2012, and the third Bid submission (Round 3) in August 2013. Zen Wind Farm (Pty) Ltd intend bidding the project to the DoE for the bid submission in 2015. Following Rounds 1, 2 and 3 bid submissions to the DoE, a total of 22 wind energy facility projects have been awarded preferred bidders status. Construction of various wind projects have already commenced. This includes the Gouda Wind Farm which is directly adjacent to the Zen site.

4.2. 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 (DOE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). Wind energy is considered under the White Paper for Renewable Energy (2003) and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *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. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *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.
» *South African Civil Aviation Authority (SACAA):* This Department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *South African National Roads Agency (SANRAL):* This agency of the Department of Transport is responsible for all National road routes.

» *Department of Water Affairs (DWA):* This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development.
» *Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department has published a guideline for the development of wind farms on agricultural land.
» *Department of Mineral Resources:* Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resources that might occur on site.

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

» *Provincial Government of the Western Cape – Department of Environmental Affairs and Development Planning (DEA&DP):* This department is the commenting authority for this project.
» *Department of Transport and Public Works (Western Cape):* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *CapeNature:* This Department's involvement relates specifically to the biodiversity and ecological aspects of the proposed development activities on the receiving environment to ensure that developments do not compromise the biodiversity value of an area. The Department considers the significance of impacts specifically in threatened ecosystems as identified by the National Spatial Biodiversity Assessment or systematic biodiversity plans.
» *Department of Agriculture and Land Care:* This Department's involvement relates specifically to sustainable resource management and land care.
» *Heritage Western Cape:* Heritage Western Cape is a provincial heritage resources authority. This public entity seeks to identify, protect and conserve the rich and diverse heritage resources of the Western Cape.
» *Department of Water Affairs:* This Department is responsible for evaluating and issuing licenses pertaining to water use.

At a **Local Level**, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. The Drakenstein Local Municipality was identified as having jurisdiction over the area in which the proposed facility is foreseen to be established. The Drakenstein Local Municipality also forms part of the Cape Winelands District Municipality.

Both of these municipalities have been consulted with throughout the EIA process.

» 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 facility development.

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

Several Acts, standards, or guidelines have informed the project process and the scope of issues addressed and assessed in this EIA Report:

» National Environmental Management Act (Act No. 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)
  * Integrated Environmental Management Guideline Series 9 (Need And Desirability Guideline Document)
» Drakenstein Local Municipality Integrated Development Plan (2010/ 2011)
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

» Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: Guideline for Environmental Management Plans. 2005
» Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: Guideline for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002)
» Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa" (Jenkins et al 2012)
» South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments. Wildlife & Energy Programme of the Endangered Wildlife Trust (2011).

A review of legislative requirements applicable to the proposed project is provided in the table in Table 4.1.

Table 4.1: Relevant legislative permitting requirements applicable to the Zen 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 543 of July 2010, 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 duty of a project proponent to consider a	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
	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. » GNR921 of November 2013 provides listed activities requiring a waste license.	Hazardous Waste – National DEA General Waste – WC DEA&DP	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 No R55 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 Western Cape Province. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns.	National Department of Environmental Affairs Provincial Environmental Department - commenting authority. 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 K). There are noise level limits which must be adhered to.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
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. 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	A water use permits or licenses are required to be applied for or obtained, if infrastructure such as access roads, cabling or power lines cross watercourses, or for infrastructure within 500m of a wetland or watercourse (Section 21 c and i) . If ground or surface water is planned to be abstracted for use at the facility (either during construction or operation), this will also require a water use licence (Section 21 a and b).
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. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (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. A S53 approval will be required to be obtained.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.		
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. 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. Dust control regulations promulgated in November 2013 may require the implementation of a dust management plan	–Local Municipality	No permitting or licensing requirements applicable for air quality aspects. 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. The Air Emissions Authority (AEL)

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			may require the compilation of a dust management plan.
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 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	» South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » Heritage Western Cape – Issue of permits for removal or destruction of heritage resources in the 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 site be required to be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened & protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary	National Department of Environmental Affairs	Specialist flora and fauna studies are required to be undertaken as part of the EIA process. 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 listed plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011). » This Act also regulates alien and invader species (as detailed in GNR 598 of 01 August 2014). Alien and invader species are listed in terms of GNR 599 of 01 August 2014. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. 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 ensuring that all development within the area are in line with ecological sustainable development and protection of		

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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 floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be 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.
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	Department of Water Affairs	While no permitting or licensing requirements arise from this

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		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 a licence.	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. Note that the site does not comprise of any protected tree species.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean	Civil Aviation Authority (CAA)	This act will find application during the operational phase of the project. Appropriate marking is required to

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Regulations (CARS) 1997	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.		meet the specifications as detailed in the CAR Part 139.01.33. An obstacle approval for the wind energy facility is required to be obtained from the CAA.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.	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 obtained from the Department of Health.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» 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.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions	» 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 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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		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 Department of Environmental Affairs and Development Planning (DEA&DP) - Drakenstein 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 establish a land development area must comply with procedures set out in the DFA.
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	» In terms of Section 3 the government is	National Department of	No permitting or licensing

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Justice Act (Act No 3 of 2000)	required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested & affected parties have right to be heard	Environmental Affairs (DEA)	requirements. This act will find application during through the project EIA.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land.	Provincial Environmental Department - commenting authority. Local Municipality, District Municipality	Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an environmental authorization for the proposed project.
Provincial Policies / Legislation			
Western Cape Noise Control Regulations: PN 627 of 1998	The control of noise in the Western Cape Province is legislated in the form of Noise Control Regulations promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989.	Western Cape DEA&DP	In terms of Regulation 4 of the Noise Control Regulations: "No person shall make, produce or cause a disturbing noise (greater than 5 dBA), or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof".
Western Cape Land Use Planning Ordinance 15 of 1985	Details land subdivision and rezoning requirements and procedures PN 189/2011 provides details of specific requirements in terms of land use planning for renewable energy facilities.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Drakenstein Local Municipality	Given that the wind energy development is proposed on land that is zoned for agricultural use, a Consent Use in terms of Section 17 of LUPO will be required. Consent use application is required to be undertaken following the issuing of

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			an environmental Authorisation for the proposed project.
The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000	The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000) defines the protection status of plants as follows: * **''endangered flora''** means flora of any species which is in danger of extinction and is specified in Schedule 3 or Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include flora of any species specified in such Appendix and Schedule 4; (thus all Schedule 3 species) * **''protected flora''** means any species of flora specified in Schedule 4 or Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include any species of flora specified in such Appendix and Schedule 3 * **''indigenous unprotected flora''** means any species of indigenous flora not specified in Schedule 3 or 4;	Cape Nature	Removal / relocation of protected plant / animal species require a permit to be obtained from the Cape Nature
Local Legislation / Policies / Plans			

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Drakenstein Local Municipality Integrated Development Plan (IDP) 2010/2011	» Provides the overarching strategic framework for the sustainable long-term management of the municipality	Drakenstein Local Municipality.	New developments in the municipality to be in line with the IDP.
Cape Winelands District Municipality EMF (Draft, November 2012)	» The purpose of the CWDM EMF is to integrated biophysical and socio-cultural information for the district's geographically defined area, to promote more environmentally and socially responsible development. Spatially, the draft EMF indicates that the Zen site falls into a low to moderate environmental risk sensitivity zone	Cape Winelands District Municipality	New developments in the district municipality to be in line with the EMF.
Drakenstein Local Municipality Draft Spatial Development Framework	» The SDF notes that the rural land within the municipality is characterised by low levels of access to social services, health and educational facilities and basic infrastructure. The SDF recognises the need for development within small/ rural areas/ settlements (such as Saron). The SDF mapping identified the "Gouda/ Saron Agricultural Land Use" zone which indicates that the area around Gouda and Saron is best suited for the dry land cultivation of annual crops (i.e. cereals and fodder crops) and extensive grazing.	Drakenstein Local Municipality.	New developments in the municipality to be in line with the SDF.
Western Cape Transportation Amendment	» The provincial MEC may grant permit to undertake works within 200m of the	Western Cape Department of Public Transport and Community	Any application for authorisation contemplated in the ECA and NEMA in

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Act of 1996	published route upon receipt of the report assessing the potential impacts thereof.	Liaison	respect of a 200m area on either side of a published route determination for a provincial road must be accompanied by a report that addresses the issues listed in that section of the Act.
Standards/ Guidelines			
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	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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	use purposes.		
Draft Guidelines For The Evaluation And Review Of Applications Pertaining To Wind Farming On Agricultural Land (September 2010)	This document provides an outline of the type of agricultural / soil study required for wind farms and for submission to DAFF.	National Department of Agriculture	Requirements for soils and agricultural potential assessments to inform decisions regarding layouts affecting agricultural land and food security.
The Equator Principles (June 2003)	The Equator principles is benchmark in the financing of projects, which deals with determining, assessing and managing social and environmental risks related to the financing of projects, such as wind energy facilities.	International Finance Corporation (IFC) and World Bank	A wind energy facility is considered a Category B project
Environmental, Health, and Safety (EH&S) Guidelines for Wind Energy (2007)	The EH&S Guidelines for wind energy developments are technical reference documents with general and wind energy specific examples of Good International Industry Practice.	International Finance Corporation (IFC) and World Bank	This document was developed to guide the development of wind projects (which intend on applying for WB/IFC funding). Broad recommendations for management of environmental, health and safety impacts of wing energy facilities are provided in this document, which developers who intend on applying for finance must consider.
Regional Methodology for Wind Energy Site Selection: a Guideline Document prepared by DEA&DP	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	DEA&DP	Developers can use the guideline document as a tool for siting of wind energy facilities in the Western Cape.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	development (on the basis of planning, environmental, infrastructural and landscape parameters) for the Western Cape		

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 programme (EMP)) to the competent authority for decision-making. The EIA process is illustrated below:

Figure 5.1: The four phases of the EIA process

The EIA Phase for the proposed Zen Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice GN33306 of 18 June 2010, in terms of Section 24(5) of 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. Relevant Listed Activities

In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010). The application for authorisation has been made for the following listed activities:

Relevant Notice	Activity No	Description of listed activity
Government Notice R544 *(Last corrected GN R1159 - 10*	10	***The project will entail the construction of a 132 kV overhead distribution line outside an urban area.*** The construction of facilities or infrastructure for

Relevant Notice	Activity No	Description of listed activity
December 2010)		the transmission and distribution of electricity – *(i)* Outside urban areas or industrial complexes with a capacity of more than 33 kV but less than 275 kV; or ~~Inside urban areas or industrial complexes with a capacity of 275 kV or more.~~
Government Notice R544 *(Last corrected GN R1159 - 10 December 2010)*	11	***The project will include the construction of bridge within 32 m of watercourses (such as the Klein Berg River and drainage lines) as part of the upgrade of the existing access roads. The proposed power line and internal access roads will also traverse drainage lines.*** The construction of: ~~(i) Canals;~~ ~~(ii) Channels;~~ (iii) Bridges; ~~(iv) Dams;~~ ~~(v) Weirs;~~ ~~(vi) Bulk stormwater outlet structures;~~ ~~(vii) Marinas;~~ ~~(viii) Jetties exceeding 50 square metres in size~~ ~~(ix) Slipways exceeding 50 square metres in size~~ ~~(x) Buildings exceeding 50 square metres in size; or~~ (xi) Infrastructure or structures covering 50 square metres or more. Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse~~, excluding where such construction will occur behind the development setback line~~.
Government Notice R544 *(Last corrected GN R1159 - 10 December 2010*)	13	***The project will require facilities for storage of fuels / oils that are up to 500m^3*** The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.
Government Notice R544 *(Last corrected GN R1159 - 10 December*	18	***The project will include the construction of bridge within a watercourse (the Klein Berg River) as part of the upgrade of the existing access roads. This activity will involve excavation, removal and moving of material***

Relevant Notice	Activity No	Description of listed activity
2010)		***exceeding 5m^3.*** The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from: (i) a watercourse; ~~(ii) the sea;~~ ~~(iii) the seashore;~~ ~~(iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever distance is the greater~~ but excluding where such infilling, depositing , dredging, excavation, removal or moving; (a) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (b) occurs behind the development setback line.
Government Notice R544 *(Last corrected GN R1159 - 10 December 2010)*	47	***Existing gravel access roads will be widened up to 10 metres.*** The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – *(i)* Where the existing road reserve is wider than 13.5 metres; or *(ii)* Where no reserve exists, where the existing road is wider than 8 metres – ~~Excluding widening or lengthening occurring inside urban areas.~~
Government Notice R545 *(Last corrected GN R1159 - 10 December 2010)*	1	***The project will consist of wind turbines for electricity generation of up to 140MW. Power lines and substations are ancillary infrastructure for this wind energy generation facility.*** The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.
Government Notice R545 *(Last corrected GN R1159 - 10 December 2010)*	15	***The footprint of the facility to be transformed will be greater than 20 hectares.*** Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or

Relevant Notice	Activity No	Description of listed activity
		more; ~~Except where such physical alteration takes place for:~~ ~~*(i)* Linear development activities.~~ ~~Agriculture or afforestation where activity 16 in this schedule will apply.~~
Government Notice R546 *(Last corrected GN R1159 - 10 December 2010)*	4	***The project will require access roads to be constructed that are wider than 6m.*** The construction of a road wider than 4 m with a reserve less than 13,5m. (d) In Western Cape: (ii) all areas outside urban areas
Government Notice R546 *(Last corrected GN R1159 - 10 December 2010)*	12	***This site consists predominatly of cultivated land. Outside of these transformed areas are disturbed patches of fynbos and renosterveld vegetation. The National List of Threatened Ecosystems (2011) lists Swartland Alluvium Fynbos and Swartland Shale Renosterveld as Critically Endangered. The project will require the clearance of more than 300m^2 of critically endangered indigenous vegetation.*** The Clearance of an area 300 square metres or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation. *(a) Within any critically endangered or endangered ecosystem listed in terms section 52 of the NEMBA or prior to the publication of such a list, within a area that has been identified as critically endangered in the National Spat Biodiversity Assessment 2004;* *(b) Within critical biodiversity areas identified in bioregional plans*
Government Notice R546 *(Last corrected GN R1159 - 10 December 2010)*	13	***More than 1 hectare of indigenous vegetation will be cleared during construction of the wind energy facility. There are parts of the broader site (along the Klein Berg River) which fall within critical biodiversity areas, and which is also recognised as sensitive in the WCDM's EMF.*** *The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative*

Relevant Notice	Activity No	Description of listed activity
		cover constitutes indigenous vegetation~~, except where such removal of vegetation is required for:~~ *~~(1) The undertaking of a process or activity included in the list of waste management published in terms of section 19 of the National Environmental Waste Act, 2008 (Act No 59 of 2008), in which case the activity is regarded to be excluded from this list.~~* *~~(2) The undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010.~~* *(a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority.;* *~~(b) National Protected Area Expansion Strategy Focus areas~~* **In the Western Cape:** **~~i. In an estuary;~~** **ii. Outside urban areas, the following:** *~~(aa) A protected area identified in terms of NEMPAA,~~* *~~(bb)National Protected Area Expansion Strategy Focus areas;~~* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *~~(dd) Sites or areas identified in terms of an International Convention~~* *~~(ee) Core areas in biosphere reserves;~~* *(ff) Areas within10 kilometres from national parks ~~or world heritage sites or~~ ~~5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve~~* *~~(gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.~~*
Government Notice R546 *(Last corrected*	14	GN 546,14 The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover

Relevant Notice	Activity No	Description of listed activity
GN R1159 - 10 December 2010)		constitutes indigenous vegetation : a) In ~~Eastern Cape, Free State, KwaZulu-Natal, Gauteng, Limpopo, Mpumalanga, Northern Cape, Northwest and~~ Western Cape: i. All areas outside urban areas
Government Notice R546 *(Last corrected GN R1159 - 10 December 2010)*	16	GN 546, 16 ~~(iii),~~ (iv), (a) (bb) (ff) and 16 (d) (ii) (bb) (ff) The construction of ~~(iii) buildings with a footprint exceeding 10 square metres in size or~~ (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. a) In ~~Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga~~ and Northern Cape: ~~i. In an estuary;~~ ii. Outside urban areas, in: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) World Heritage Sites;~~ ~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(ee) Sites or areas identified in terms of an International Convention;~~ (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(gg) Core areas in biosphere reserves;~~ ~~(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;~~ ~~(ii) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if~~

Relevant Notice	Activity No	Description of listed activity
		~~no such development setback line is determined.~~ (d) In the Western Cape: ~~i. In an estuary~~ ii. Outside urban areas, in: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ (bb) National Protected Area Expansion Strategy Focus areas; ~~(cc) World Heritage Sites;~~ ~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(ee) Sites or areas identified in terms of an International Convention;~~ (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(gg) Core areas in biosphere reserves;~~ ~~(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;~~ ~~(ii) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.~~

The EIA Regulations were revised in December 2014 in terms of GNR 982 – 985. In terms of Sub-Regulations 53(2) and 53(3) of these Regulations) Transitional Arrangements):

" If a situation arises where an activity or activities, identified under the previous NEMA Notices, no longer requires environmental authorisation in terms of the current activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and where a decision on an application submitted under the previous NEMA regulations is still pending, the competent authority will consider such application to be withdrawn".

and
"Where an application submitted in terms of the previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Therefore, similarly listed and additional activities relevant to the current application have been identified and are listed in the table below.

Activity listed in GNR 544 - 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
GN544, activity 10 The construction of facilities or infrastructure for the transmission and distribution of electricity – Outside urban areas or industrial complexes with a capacity of more than 33kV but less than 275kV	GN983, activity 11 (i) The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	An on-site substation (132kV) is required for the project
GN544, activity 11 The construction of: (x) Buildings exceeding 50 m^2 in size; or (xi) Infrastructure or structures covering 50 m^2 or more. Where such construction occurs within a watercourse or within 32 m of a watercourse, measures from the edge of a watercourse.	GN983, activity 12 The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs-(a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -	The proposed facility will impact on drainage lines or other watercourses.
GN544, activity 13: The construction of facilities or infrastructure for the storage, or for the storage and handling, of a	GN983, activity 14: The development of facilities or infrastructure, for the storage, or for the storage and	The on-site storage of diesel and fuel in containers for construction machinery and vehicles.

Activity listed in GNR 544 - 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500m^3.	handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	
GN544, activity 18: The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from: (i) a watercourse	GN983, activity 19: The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-(i) a watercourse	The proposed facility will impact on drainage lines or other watercourses.
GN544, activity 22: The construction of a road, outside urban areas, iii) Where no road reserve exists where the road is wider than 8 m	GN983, activity 24: The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 6 m in width.
GN544, activity 47: The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – *(ii)* Where no reserve exists, where the existing road is wider than 8 m	GN983, activity 56: The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 6 m in width.
GN545, activity 1: The construction of facilities or infrastructure, for the generation of electricity where the output is 20 MW or more.	GN984, activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more	Proposed establishment of a wind farm up to 140 MW.
GN545, activity 15:	GN983, activity 28	The facility is proposed to be

Activity listed in GNR 544 - 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 ha or more.	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare	established within an area of over 20 ha in extent.
GN546, activity 4: The construction of a road wider than 4 m with a reserve less than 13,5m. (d) In Western Cape: (ii) all areas outside urban areas.	GN985, activity 4: The development of a road wider than 4 metres with a reserve less than 13,5 metres. f) in the Western Cape i) Outside urban areas aa) Areas containing natural vegetation	External and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 13 m in width.
GN546. Activity 12 (b) The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.	GN983, activity 27: The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation GN 985, activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. a) In the Western Cape i) Within any critically endangered or endangered	Some of the wind energy facility infrastructure is proposed in natural vegetation which is classified as endangered and falls within an area defined as a CBA.

Activity listed in GNR 544 - 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
	ecosystem ii) Within critical biodiversity areas identified in bioregional plans	
GN546, activity 16(d)(ii)(ff) The construction of: (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse.	GN 985, activity 14 The development of: (xii) infrastructure or structures with a physical footprint of 10 square metres or more. f) in the Western Cape i) Outside urban areas in: ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Some of the wind energy facility infrastructure is proposed in an area defined as a CBA. Infrastructure exceeding 10 square metres may be required within 32 m of a drainage line or other watercourses within this area.

No additional listed activities within the EIA Regulations of December 2014 are relevant to the project.

5.2. Phase 1: Scoping Study

The Final Scoping Report was accepted by DEA in November 2012. The scoping report 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 Zen 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 28 June 2012 – 27 July 2012. 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.

A site visit was held with DEA, WC DEA&DP and the Drakenstein Local Municipality in July 2012 in in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) in August 2012. The Final Scoping Report was accepted by the DEA in November 2012, as the competent authority (refer to Appendix B). 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.

5.3. Phase 2: Environmental Impact Assessment

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted and are discussed in more detail in Chapter 8 of this report. 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 Zen 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.

5.4. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations June 2010, 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 participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 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 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

5.4.1. 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 DEA&DP) has continued throughout the EIA process. On-going consultation included the following:

» Submission of a Final Scoping Report (August 2012) following a public review period (and consideration of stakeholder comments received).
» A site visit was held with DEA, DEA&DP and the Drakenstein Local Municipality in July 2012 in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following has also been undertaken as part of this EIA process:

» Submission of a Final Environmental Impact Assessment (EIA) Report following the public review period.
» Consultation with Organs of State that may have jurisdiction over the project:
  * Western Cape DEA&DP
  * Department of Energy
  * Department of Water Affairs
  * Department of Agriculture, Forestry and Fisheries (DAFF)

* Department of Mineral Resources (DMR)
* South African Heritage Resources Agency (SAHRA)
* Civil Aviation Authority (CAA)

Provincial Authorities

* Heritage Western Cape
* Department of Transport and Public Works and various District Roads Departments
* Department of Water Affairs
* South African National Roads Agency
* Department of Land Affairs
* Drakenstein Local Municipality
* Cape Winelands District Municipality
* Cape Nature

The table below (last updated November 2013) shows the organs of state that were consulted during the commenting period for the Draft Environmental Impact Assessment Report review period (in 2013) and the details of how each were consulted as well as whether comments have been received.

ORGAN OF STATE / GOVERNMENT BODY	NAME AND SURNAME	CONTACT DETAILS	CONSULTATION	COMMENTS RECEIVED
National Department of Agriculture, Forestry & Fisheries	Sambulo Mnguni	Tel: 012 3197414 sambulom@nda.agric.za	• Meeting held on 17 October 2012 • Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
Provincial DoA – Land-Use Management	Cor van der Walt	Tel: 021 8085099	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
Department of Energy	DDG Programmes and Projects	Tel: 012 406 7568	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• No
Department of Water Affairs: Berg River Catchment Western Cape	Mzikisi Noqhamza	Tel: 021 941 6238	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• No
Eskom	Mr John Geeringh	Tel: 011 516 7233	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• No
WC DEA&DP	Samornay	Tel: 021 483 5828	• Site Visit & Meeting	• Yes

ORGAN OF STATE / GOVERNMENT BODY	NAME AND SURNAME	CONTACT DETAILS	CONSULTATION	COMMENTS RECEIVED
	Smidt		held in October 2012 • Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	
WC Department of Transport and Public Works	Grace Swanepoel	Tel: 022 483 4669	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
Cape Winelands District Municipality	Martin Albertus	Tel: 021 8885121	• Site Visit & Meeting held in October 2012 • Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• No
Drakenstein Local Municipality	Jimmy Knaggs	Tel: 021 807 4707	• Site Visit & Meeting held in October 2012 • Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
Heritage Western Cape	Troy Smuts	Tel: 021 483 9543	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
Cape Nature	Allan-Duffel Canham	Tel: 021 866 8029	• Meeting held in January 2013 • Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• Yes
South African Civil Aviation Authority	Lizell Stroh	Tel: 011 545 1232	• Draft Scoping & EIA Reports sent via courier – see Appendix E for proof of delivery of reports	• No

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 process is included within **Appendix B**.

5.4.2. 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 were identified and informed of the project (refer to landowner map in **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:

» Several focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local and regional press: Witzenburg Herald and in Die Burger)
» 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 (Witzenburg Herald and Die Burger)	May 2012
	Focus group meetings and public meeting	July 2012
	Advertisement of Public Meeting & Availability of Scoping report for public review (Witzenburg Herald and Die Burger)– Second round of adverts	June 2012
	Document (BID) and written notice Distribution of Background Information	June 2012 – August 2012
	Focus group meetings and site visit with DEA&DP, DEA & DLM	July 2012

	Public review period for DSR	28 June 2012 – 27 July 2012
	Public meeting	17 July 2012
	Notification to registered I&APs that the Final Scoping report was available & submitted to DEA	August 2012
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting (Witzenburg Herald and Die Burger)– – Third round of adverts	22 November 2012 – 11 January 2013
	Public meeting & stakeholder meetings	November 2012 - December 2012
	Public Review Period for the Final EIA Report	14 November 2013 – 14 December 2013

5.4.3. 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.

5.4.4. 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.

Specialist	**Area of Expertise**	**Appendix to EIA Report**
Simon Todd of Simon Todd Consulting	Ecology	F
Tony Williams of African Insights	Avifauna	G
J.H. van der Waals of Terrasoil Science	Soils, erosion and agricultural potential	H
Lourens du Plessis of MetroGIS	Visual	I
Jayson Orton of ACO Associates	Heritage	J
Morne de Jager of M2 Environmental	Noise	K

Connections CC		
Tony Barbour Environmental Consulting and Research	Social	L
Bárbara Monteiro and Ricardo Ramalho of Bio3	Bats	M

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Zen 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 Zen Wind Farm 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. The Environmental Management Programme is included as **Appendix N**.

5.4.5. 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 Zen Wind Farm 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 Zen Wind Farm will be sufficient to motivate the selection of the site to DEA.
- It is assumed that the development site identified by Zen Wind Farm represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure.
- It is assumed that the new LeBonne Substation will be built/operated by Eskom.
- The EIA study was conducted based on a preliminary layout of the wind energy facility provided by Zen Wind Farm. It is understood that this layout is preliminary at this stage, but it is assumed that the layout is approximately 80% accurate, and subject to change based on the environmental sensitivities/outcomes from this EIA phase.

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- M** for more details).

5.4.6. Public Review of Draft EIA Report and Feedback Meeting

The Draft EIA report has been made available for public review from **22 November 2012 – 11 January 2013 (an extended public review period)** at the following locations:

- Gouda Library
- Saron Library

The report was also made available electronically on www.savannahSA.com.

Comments could be submitted to **Sustainable Futures ZA** by 11 January 2013 as written submission via fax, post or e-mail.

In order to facilitate comments on the Draft EIA Report, a public feedback meeting was held during the review period for the Draft EIA Report as follows:

» **Date:** Monday, 10 December 2012
» **Time:** 19:00 -20:30
» **Venue:** Saron Sports Complex Hall, Saron

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Die Burger and The Witzenburg Herald on 23 November 2012 (refer to **Appendix D**).

5.4.7. Final Environmental Impact Assessment (EIA) Report (submitted to DEA in January 2014)

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.
» Updating the project description and consideration of any impacts/changes associated with use of wind turbines with a rotor diameter of up to 122m. The turbines remain as each having a capacity of approximately 3MW and a maximum hub height of up to 110m. Only the rotor diameter changed from 110m to a maximum of 122m, as the largest potential turbine to be used for this site.
» Updating the impact assessment based on the results of the bird radar survey undertaken. The results of the radar survey have also been taken into account in the avifaunal impact assessment and the EIA report.
» Updating the impact assessment based on the results of the bird and bat pre-construction monitoring programme. The results of the pre-construction monitoring have also been taken into account in the avifaunal impact assessment and bat impact assessment, as well as the EIA report.
» The change in the layout/location of wind turbines to address areas of sensitivity highlighted by the bird and bat monitoring.
» Addition of an access road within the site development footprint.

The stakeholders and I&APs registered on the project database were updated in 2013 regarding the additional work that was being done to conclude the bird and bat pre-construction monitoring programmes and advised regarding the delay in the finalisation of the EIA report.

The Final EIA Report was also made available for public review for a 30 day period from 14 November 2013 - 14 December 2013. Following this review period, the Final EIA Report was submitted to DEA for final consideration.

5.4.8. Need for an Amended Final Environmental Impact Assessment (EIA) Report

In April 2014 the DEA rejected the Final EIA report submitted in January 2014 and requested that the Final EIA report be amended to include the following:

a) The findings of an additional bird monitoring study (3 key vantage points, from which all proposed turbine areas were covered, each monitored for a total of 12 hours in all seasons);
b) Amendments to the facility layout plan where required, in line with the recommendations of the additional bird monitoring study;
c) Cumulative Impact Assessment.

A pre-construction bird monitoring programme was conducted across a 27 month period from September 2012 to December 2014, and for a total observation period of > 400 hours. The monitoring followed BirdLife South Africa's guidelines (version 2, Jenkins et al. 2012)). The purpose of the bird pre-construction monitoring programmes was to provide baseline data to inform the findings of the avifauna impact assessment and management plan. The bird pre-construction monitoring programme for the Zen Wind Energy Facility has been completed, and the results of the monitoring have been considered in this Amended Final EIA Report.

Changes made in this report have been underlined for ease of reference. The findings, conclusions and recommendations remain consistent with the Final Report submitted in January 2014.

The Final EIA report submitted by Savannah Environmental for the above mentioned project (Zen Wind Energy Facility – DEA Ref 14/12/16/3/3/2/322) dated January 2014 was rejected by DEA on 3 April 2014. The department requested the EIAr be amended to include:

a) The findings of an additional required bird monitoring study (including monitoring from additional vantage points);
b) Amended layout plan taking into consideration the recommendations of the additional bird monitoring study;
c) The additional bird monitoring study to be submitted to Birdlife South Africa;
d) A cumulative Impact Assessment as part of the amended EIAr; and
e) Shapefiles of the preferred development footprint be submitted to the department.

Savannah Environmental received and reviewed the bird monitoring report detailing the findings of the bird monitoring over an additional four season period as requested by DEA and Birdlife South Africa. The findings do not differ from those previously presented.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the EIA Report provides a description of the environment that may be affected by the proposed Zen Wind Energy Facility. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices F – U.**

6.1 Regional Setting: Location of the Study Area

The proposed development area is located approximately 6 km south of Saron within the Cape Winelands District of the Western Cape Province. The town of Gouda lies 10km to the south. The eastern portion of the site lies at the foot of the Roodesandberge mountain range. The Roodesandberge range is the source of a few drainage lines which flow through the site in a westerly direction and feed into the Klein Berg River. The Klein Berg River bisects the site to the east of the R44 main road. The river drains south towards the Tulbagh Valley. Voelvlei dam is located more than 10 km south of the Zen site. The Voelvlei canal runs along the far eastern side of the site towards Voelvlei Dam.

6.2 Climatic Conditions

The climate of the area can be regarded as typical of the southern Cape, with a low, generally all-year round rainfall distribution (although most rainfall is experienced in the winter months), warm to hot summers, and cool winters. The extreme high temperature that has been recorded is 41.8°C and the extreme low –1.5ºC. Frost is rare, occurring at most once or twice per year.

6.3 Topographical & Geological Profile

The topography of the site is undulating in the west to mountainous in the east (refer to the relief map included in Figure 6.1). The proposed site is bounded by the base of the Roodesandberge mountain range to the east and the Great Berg River to the west. The Klein Berg River bisects the site and drains south towards the Tulbagh valley. The site is underlain by shale, schist, quartzitic sandstone, alluvium and terrace gravel.

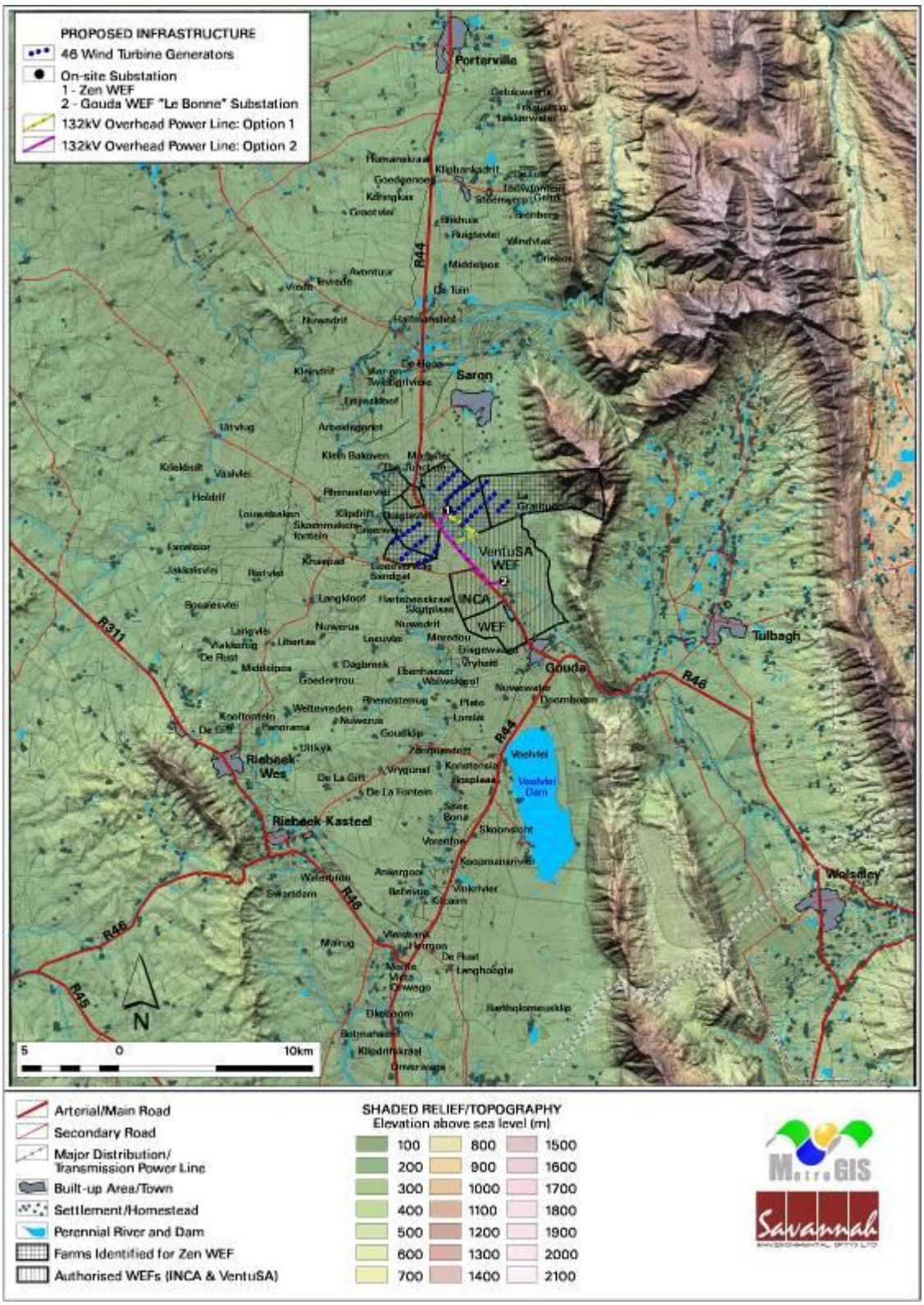

Figure 6.1: Shaded relief/ topographical map for the Zen site and broader study area

6.4 Land-Use / Land Cover

The Zen site is predominantly cultivated with dry land wheat and other cereal production. Cattle production is also practiced on a limited scale. Some of the flatter areas on this site have been used and are being developed for irrigated agriculture in the form of centre pivots. The far eastern part of the site contains natural vegetation and is currently not used for crop production purposes. The Farm Bonne Esperance is also use for game farming. Therefore the site has a mixed agricultural land-use.

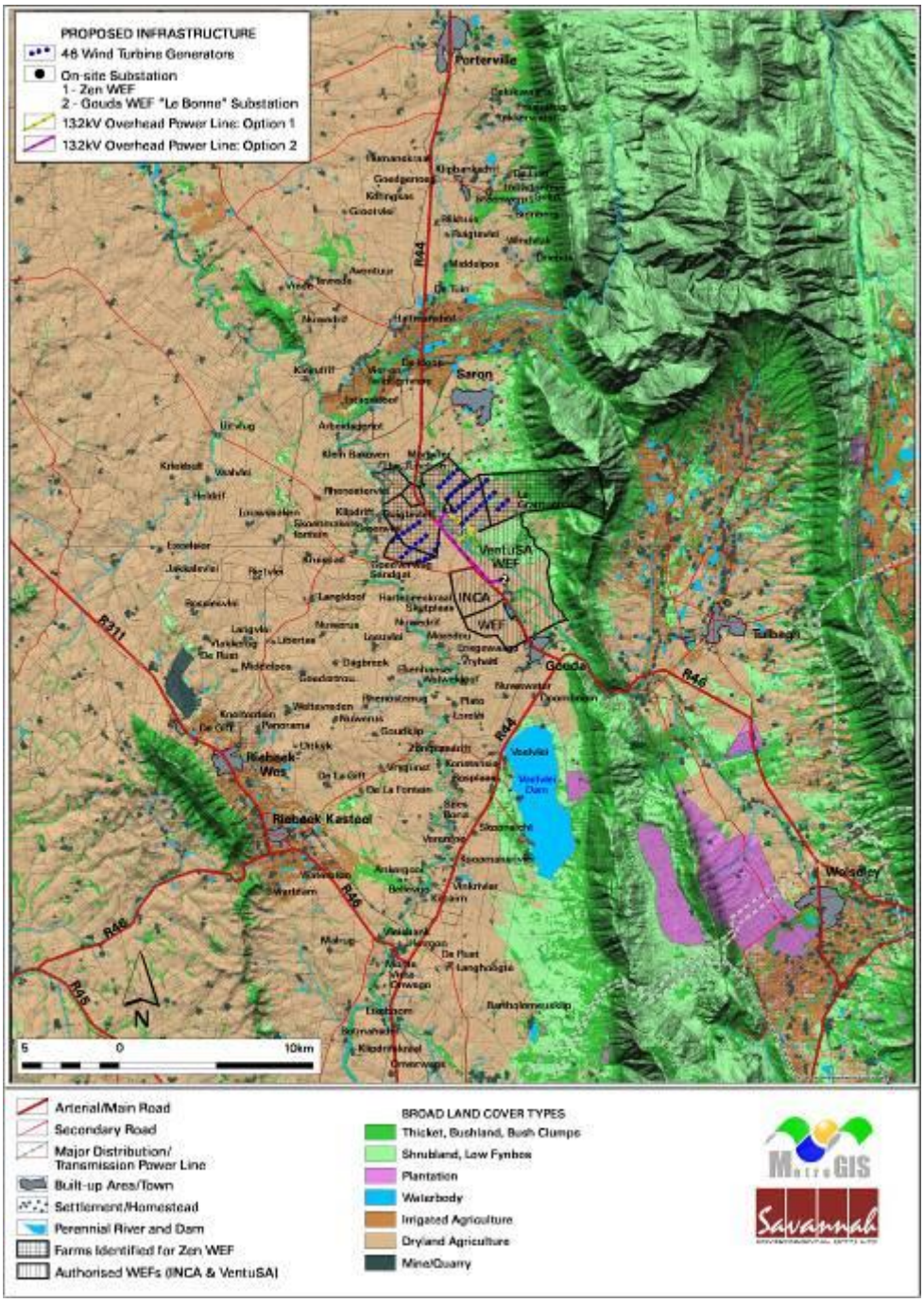

Figure 6.2: Land-Use / Land Cover Map for Zen site and broader study area

6.5 Ecological Profile

Most of the Zen site, and areas to the west, form a flat to gently undulating plain which is bounded in the east by the Winterhoek Mountains. Two rivers, the Berg and Kleinberg, are incised into the plain. The Berg River valley bounds the Zen site to the west and the Kleinberg effectively bisects the site.

The majority of the original natural vegetation of the Zen site has been completely transformed into agricultural land and now has predominantly cereal, pasture, or fallow cover. An area of degraded alluvial fynbos adjoins the east of the Zen site and there is relatively undisturbed Winterhoek Sandstone Fynbos on the mountain slopes east of the alluvial belt.

Trees, most of which are alien, are confined either to the riparian periphery of the two rivers or occur as artificial plantings as windbreaks, or around buildings. Wheat fields - either planted, as stubble, or being rested as fallow - dominate the Zen site, particularly west of the R44 road. East of this road there are some wheat fields but most of the ground is pastureland and, in 2014, an irrigated field of potatoes impinged on the southern boundary of the Zen site.

6.5.1 Critical Biodiversity Areas

The Critical Biodiversity Areas (CBA) map for the Zen Wind Energy Facility site is illustrated in Figure 6.3. There are some small fragments within the active and old lands that have been classified as CBA but which were not observed to be natural vegetation during the site survey. The land-cover on which the CBA is partially based is, however, not very accurate within the study area with the result is that the finer details of the CBA map are not considered reliable, at least within the study area. The ecological sensitivity map prepared in the ecology study (refer to Appendix F) should therefore be the primary tool to guide development on the site (as it is based on ground-truthed data), and not the CBA map. The important aspect of the CBA map is that all of the intact vegetation fragments within the Renosterveld vegetation types are classified as CBA, and consequently unsuitable for development on these grounds.

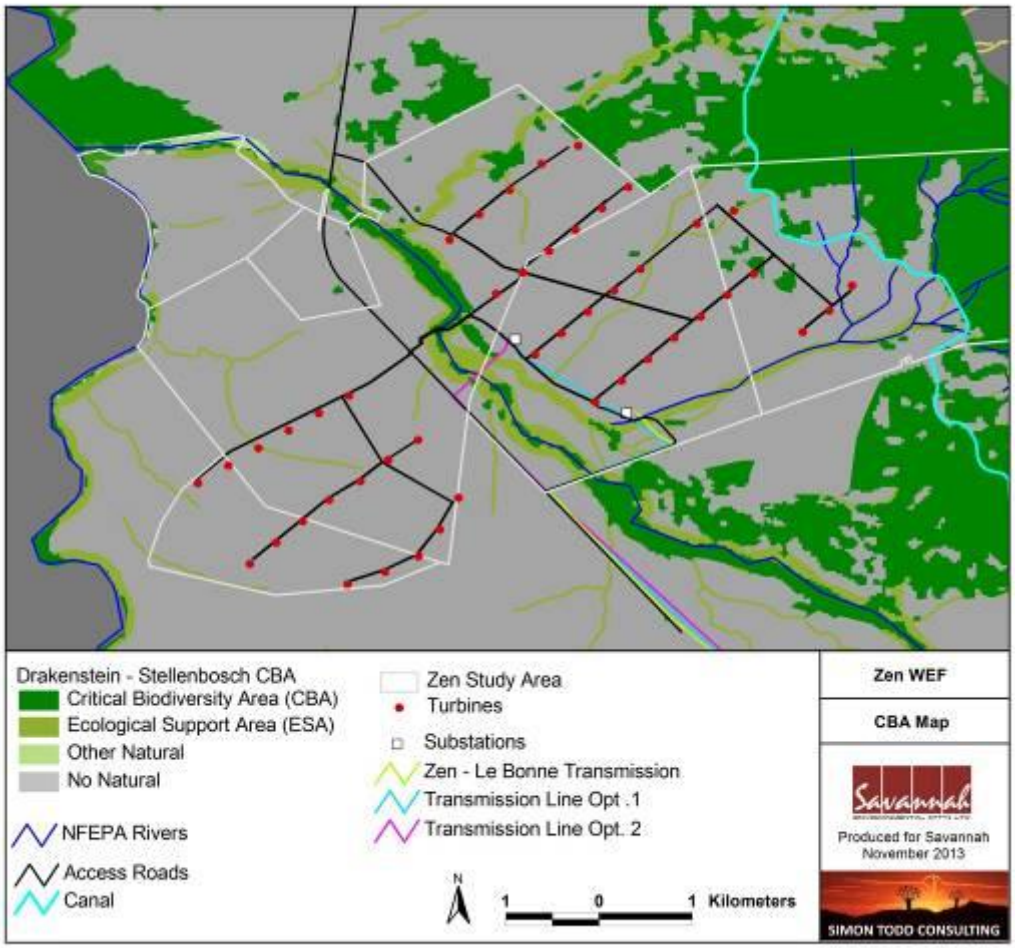

Figure 6.3: The CBA map for the Zen Wind Energy Facility, from Kirkwood et al. (2010), illustrating the turbine layout. Note that ground-truthing of the site revealed that the finer details of the CBA map are not accurate

6.5.2 Vegetation Types

The study area lies within the Fynbos Biome and the Cape Floristic Region. According to the national vegetation map (Mucina and Rutherford 2006), four vegetation types occur within the study area (shown on Figure 6.4):

» Swartland Alluvium Fynbos
» Atlantis Sand Fynbos
» Winterhoek Sandstone Fynbos
» Swartland Shale Renosterveld

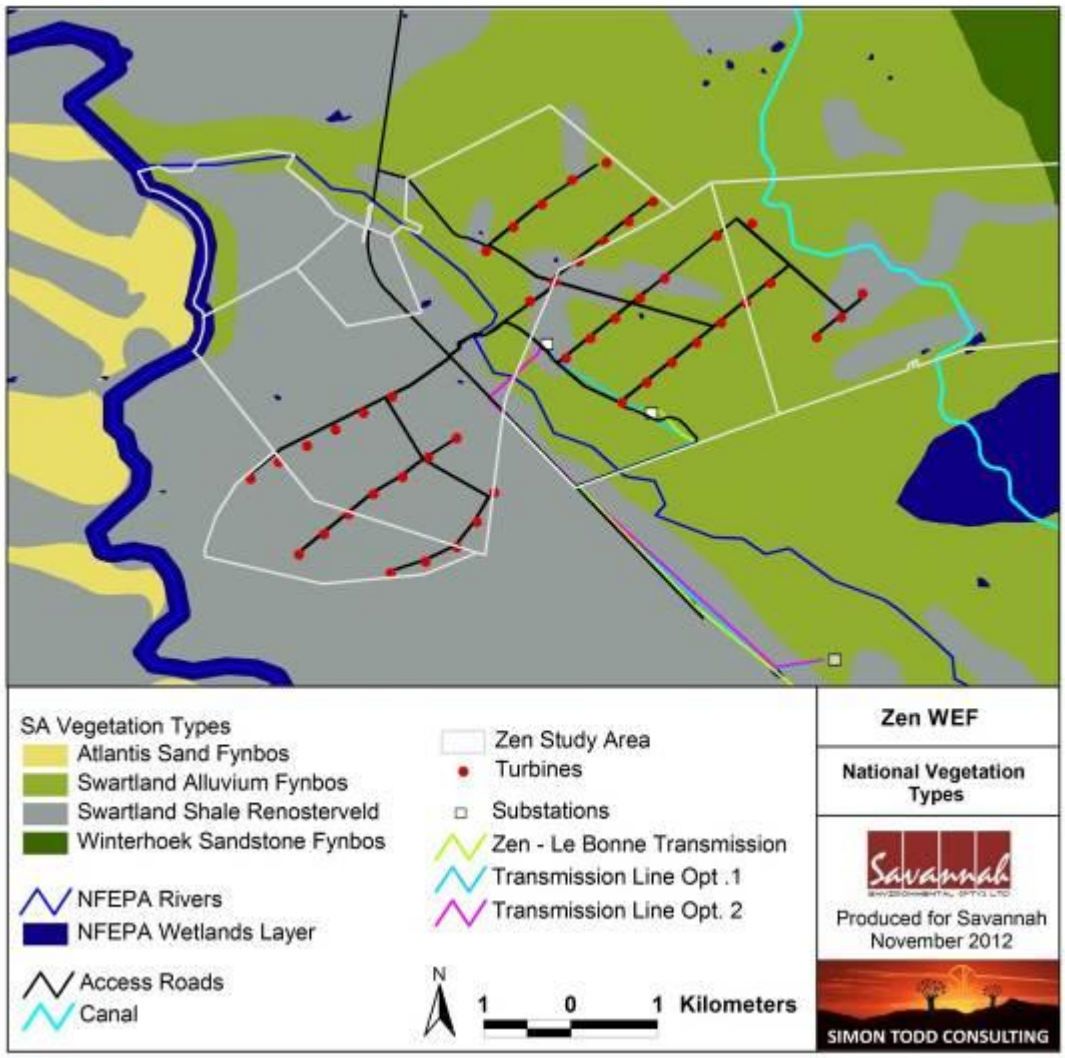

Figure 6.4: The broad-scale vegetation in and around the proposed Zen Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006).

Table 6.1 lists the conservation statistics and status of the different vegetation units which occur within the study area.

Table 6.1: The conservation statistics and status of the different vegetation units which occur within the study area

Name	% Protected	% Remaining	Status	Ha in Study area
Swartland Alluvium Fynbos	2%	27%	Critically Endangered	1449.11
Atlantis Sand Fynbos	6%	51%	Critically Endangered	0.47
Winterhoek Sandstone Fynbos	24.2% (+58.6%)	94.9%	Least Threatened	569.02

Swartland Shale Renosterveld	<1%	8%	Critically Endangered	1524.17

The National List of Threatened Ecosystems (2011) lists Swartland Alluvium Fynbos, Swartland Shale Renosterveld and Atlantis Sand Fynbos as Critically Endangered. However, the Atlantis Sand Fynbos occurs west of the Berg River and does not actually occur within the site. The majority of Swartland Shale Renosterveld within the site occurs west of the Klein Berg River, and the vast majority of the site to the west to the R44 consists of this vegetation type. There is, however, no remaining extent of Swartland Shale Renosterveld west of the R44 and the entire extent of the study site in this area has been transformed. East of the Klein Berg River, there are some areas of Swartland Shale Renosterveld in several distinct patches. The majority of the site to the east of the Klein Berg River however consists of Swartland Alluvium Fynbos. The Winterhoek Sandstone Fynbos which occurs within the site occurs on the slopes of the Obiekwaberg, and is outside the development footprint for the wind energy facility. Given the high threat status of the Swartland Alluvium Fynbos and Swartland Shale Renosterveld which predominate in the study area, any remnants of these vegetation types, even those in poor condition, should be considered potentially irreplaceable and unsuitable for development.

6.5.3 Fine-Scale Vegetation Patterns

In this section the different habitats and vegetation types observed on the site are described in terms of their characteristic and significant species and their potential sensitivity in terms of development potential.

a. <u>Transformed Areas</u>

The largest proportion of the Zen site consists of transformed areas currently used for rain fed wheat production or maintained in a fallow state for livestock grazing. There is a small extent of irrigated pasture along the banks of the Klein Berg River. In addition, there is an area that has been set aside for game (Springbuck, Blesbuck and Wildebeest), which consists largely of fields that were ploughed in the past and have recovered some natural vegetation. The areas that have been recently cultivated are of very low diversity with almost no indigenous species remaining. These areas are of low ecological sensitivity. Within the areas that have not been ploughed for some time, diversity is significantly higher than the cultivated areas, but a large proportion of the species present are alien species such as *Bromus tectorum*, *Bromus japonicus*, E*chium plantagineum* and *Hypochaeris radicata*. Indigenous species which are recolonising the old lands include *Galenia africana*, *Athanasia trifurcata* and

Aspalathus acuminata. Within the areas that show some signs of recovery, there are not likely to be significant number of species of conservation concern present and although some caution should be exercised, development within these areas also poses little risk to biodiversity.

b. <u>Swartland Alluvium Fynbos Remnants</u>

There are some very small relicts as well as a significant remnant of Swartland Alluvium Fynbos towards the north-east of the site, just to the west of the canal. Although disturbed, there are some areas which do not appear to have been ploughed, at all or at least not for several decades. This is one of the few remaining areas of semi-natural vegetation within the area targeted for development. The vegetation consists of a mix of low and medium tall shrubs with tussock grasses. Species observed in this area includes shrubs such as *Aspalathus pinguis* subsp. *pinguis*, *Aspalathus tridentata* subsp. *tridentata*, *Aspalathus perfoliata* subsp. *phillipsii*, *Aspalathus uniflora*, Hermannia multiflora Searsia dissecta Searsia incisa var. incise. Grasses observed in the area include *Merxmuellera stricta*, *Eragrostis curvula*, *Ehrharta ramosa* and *Stipagrostis zeyheri* subsp. z*eyheri*. A number of geophytes were also observed in the area including *Watsonia marginata*, *Lapeirousia anceps* and *Ferraria uncinata*, which suggests that additional geophyte species are also likely to be present in this area, but were likely already over at the time of the site visit. Species of conservation concern observed in this area include *Aspalathus aculeata* which is classified as Vulnerable and *Phylica plumosa* which is classified as Declining. The presence of these species in the area suggests that there may be other species of conservation concern present as well, especially geophytes which were over at the time of the site visit. Given the presence of the listed species in the area, as well as Critically Endangered status of the Swartland Alluvium Fynbos, this area is considered highly sensitive and not suitable for development.

Towards the eastern limit of the proposed development area, adjacent to the canal, there is also an area which has been mapped by Mucina and Rutherford as Swartland Alluvium Fynbos, but is distinct in terms of vegetation composition from the above described remnants and has greater affinity with Swartland Shale Renosterveld. This area was dominated by *Dicerothamnus rhinocerotis* with other shrubs including *Anthospermum spathulatum* subsp. *spathulatum*, *Ursinia chrysanthemoides*, *Chrysocoma ciliata* and *Athanasia trifurcata*. Other species observed in this area which were not common elsewhere include *Moraea lewisiae*, *Hyparrhenia hirta* and *Pentaschistis patula*. It is likely that parts or all of this area have been disturbed in the distant past, but a significant amount of recovery has taken place and this area is considered sensitive.

Historically the Renosterveld and fynbos vegetation types in the area would have burnt on an occasional basis and the majority of plant species present are well adapted to dealing with fire and many fynbos species in fact require fire for recruitment. In the current fragmented landscape, processes such as fire no longer occur and this has long-term negative consequences for biodiversity. Lighting is the most common source of natural ignitions and usually occurs on higher ground. The site has however been cut-off from the adjacent mountains by the canal which would be a very effective fire break. The remnant patch of Swartland Alluvium Fynbos described at the site appeared to be fairly moribund and would probably benefit from a burn, preferably in the autumn.

6.5.4 Listed Plant Species

A large number of listed plant species are known from the area. Table 6.2 suggests that at least 46 species of high conservation concern and an additional 21 of moderate conservation concern known from the immediate area. In addition, according to the Threatened Ecosystems in South Africa: Descriptions and Maps (SANBI/DEAT 2009), Swartland Alluvium Fynbos contains 57 Red Data plant species (EX, EW, CR, EN & VU excl VU D2) and 13 endemic plant species. The situation for Swartland Shale Renosterveld is even more severe with 151 Red Data plant species (EX, EW, CR, EN & VU excl VU D2) and 35 endemic plant species. Although not all of these species would occur within the study area, these alarming statistics serve to highlight the imperiled state of these vegetation types and underscore the potential for significant ecological impact, should the facility impinge on the intact ecosystems at the site. Although only two species of conservation concern were observed at the site, it is highly likely that more are present. For example there are many listed *Babiana* species, and although some *Babiana* plants were observed at the site, it is was not possible to identify the plants as their flowers were over. In addition, many of the listed species are by their nature rare and targeted searching would likely turn some of these species up in time. The main implication of these results is that all natural and semi-natural remnants are potentially important sites for listed species and are best avoided.

Table 6.2: IUCN status of plant species observed during the site visit or known to occur in the vicinity of the proposed Zen Wind Energy Facility, based on the SANBI SIBIS database. Threat status is according to the Red List of South African Plants (SANBI 2012).

Status	No.Species	Observed
Critically Endangered - Possibly Extinct (CR PE)	2	
Critically Endangered (CR)	6	
Endangered (EN)	22	
Vulnerable (VU)	16	1
Near Threatened (NT)	11	
Rare	3	
Declining	4	1
Data Deficient - Insufficient Information (DDD)	3	
Data Deficient - Taxonomically Problematic (DDT)	7	
Least Concern	365	87
Not Evaluated (Species not recognised)	9	
Alien (Not Evaluated)	45	35
Grand Total	**493**	**125**

6.5.5 Faunal Communities

a. ***Mammals***

In terms of terrestrial mammals, as many as 52 species potentially occur in the area. However, given the highly impacted nature of the study area and in particular the area affected by the development, it is likely that only a small proportion of these would actually occur within the affected areas. Free-ranging species observed during the site visit includes Steenbok *Raphicerus campestris*, Common Duiker *Sylvicapra grimmia*, Vlei Rat *Otomys irroratus,* Cape Grey Mongoose *Herpestes pulverulentus,* Cape Porcupine *Hystrix africaeaustralis,* African Mole Rat *Cryptomys hottentotus*, Cape Mole Rat *Georychus capensis* and Cape Gerbil *Gerbilliscus afra.* Three species of conservation concern potentially occur at the site, the White-tailed Mouse *Mystromys albicaudatus* (Endangered), Leopard *Panthera pardus* (Near Threatened) and the Honey Badger *Mellivora capensis* (SA RDB Endangered). All three potentially occur within the broader study area, but would be restricted to the vicinity of the natural fynbos vegetation on the upper slopes towards the east of the site and would not be impacted by turbines placed within the transformed areas. Provided that the turbines are restricted to transformed and degraded habitats, the development is not likely to have a significant impact on terrestrial mammals.

b. Reptiles

The site lies within the distribution range of as many as 56 different reptiles, suggesting that the reptile diversity of the area is potentially high. However, given the highly transformed nature of the site as well as the lack of a diversity of reptile habitats, it seems unlikely that a large proportion of these would occur at the site. Despite the warm conditions during the site visit and active searching, very few reptiles were observed at the site and the only species observed was the Angulate Tortoise. Although it is likely that many of the common snakes and lizards from the area occur at the site, the transformed habitats at the site would be unfavourable to most reptiles on account of the lack of cover which characterises these areas for a large proportion of the time, as well as periodic disturbance related to planting and harvesting. Although the Geometric Tortoise, *Psammobates geometricus* which is classified as Critically Endangered is known from the broader area, it is not likely that it occurs at the site on account of the lack of suitable habitat. Given the impacted nature of the proposed development areas as well as the apparent lack of reptiles at the site, it seems highly unlikely that the development of the wind energy facility would have a significant negative impact on reptiles.

c. Amphibians

Thirteen frog species may occur within the site and although this includes a number of range-restricted species, the only listed species is the Cape Caco *Cacosternum capense* which is listed as *Vulnerable*. This species is restricted to low-lying flat or gently undulating areas with poorly-drained clay or loamy soils and breeds in shallow, temporary rain-filled depressions, pans or cultivated land (du Preez & Carruthers 2009). Although it was not observed it is possible that this species occurs at the site. Species observed at the site were the Common Platanna *Xenopus laevis* which was observed in the farm dams and the Cape River Frog *Amietia fuscigula* which was abundant in the pools along the smaller drainage courses as well as in sheltered sites along the Klein Berg River. As the majority of drainage lines at the site had been highly impacted by agriculture and there were no extensive wetlands at the site, it is highly unlikely that the site is an important for amphibians. Given the location of the majority of turbines within the transformed areas, it is not likely that the development would have a significant impact on amphibians.

6.5.6 Watercourses

The major drainage feature which occurs within the site is Klein Berg River which bisects the site, more or less parallel to the R44. Historically the Klein Berg River would have contained a lot of riparian vegetation as well as an extensive

associated floodplain. Historically and currently, this area has been very heavily impacted by agriculture and little of the original vegetation still exists. The banks of the river are dominated by alien woody species, mainly *Eucalyptus camaldulensis*, *Acacia saligna* and *Sesbania punicea*. Along the banks and side channels, species such as *Bolboschoenus maritimus*, *Cotula turbinata*, *Cotula coronopifolia*, *Persicaria attenuata* subsp. *attenuata* and *Rumex crispus* were observed. Outside of the main channel itself, the floodplain consists of sandy flats and hummocks dominated by *Cynodon dactylon* and various shrubs and forbs such as *Wiborgia fusca* subsp. *fusca*, *Eriocephalus africanus* var. *africanus*, *Galenia africana*, *Leysera gnaphalodes*, *Lobelia erinus* and *Monopsis simplex*. Alien species were also common or dominant in this area and included *Bromus diandrus*, *Echium plantageum*, *Lolium rigidum*, *Polypogon monspeliensis*, *Erodium cicutarium*, *Hordeum murinum* and *Hypochaeris radicata*. Despite the obvious degradation of the area, the river and floodplain are considered sensitive on account of the ecological role and function provided by the riverine corridor. This area was identified as sensitive during the scoping phase and the development footprint largely avoids impact to this area, with the only infrastructure elements within this area being the access roads and power line infrastructure.

Away from the Klein Berg River, there are a number of small dams on the property which are used for livestock watering and a newly built larger dam which is presumably for irrigation purposes. The dams are fringed by *Cynodon dactylon* with sedges and forbs such as *Bolboschoenus maritimus*, with occasional larger species such as *Typha capensis* and *Pseudoschoenus inanis*. The inflows of the dams have developed into small wetlands with species such as *Pennisetum macrourum* and *Micranthus alopecuroides* present. The minor drainage lines within the site have been heavily impacted and most have been canalized or are incised as a result of erosion. There is little vegetation within the eroded channels themselves, but some remnants of the original flanking vegetation persist and includes species such as *Salvia africana-caerulea*, *Athanasia trifurcata*, *Dicerothamnus rhinocerotis*, *Berkheya rigida*, *Senecio pubigerus*, *Relhania fruticosa* and *Conyza scabrida* as well as the usual complement of alien annual grasses. Due to the habitat these areas provide as well as their ecological role in flow regulation, these areas should be disturbed as little as possible. There are however no turbines within or in close proximity to the drainage lines or dams and the development is not likely to have a significant impact on these areas.

6.5.7 Avifauna

The study area is located adjacent to the northern extremity of the Eastern False Bay Mountains Important Bird Area and more than 10 km from the Voëlvlei Dam, a large, artificial impoundment which is considered to be locally significant for wetland species.

A total of 214 bird species may occur in the Zen region (Jenkins 2012). Of these 161 species were recorded during the field surveys of which 94 species were recorded within 750 m of the proposed turbine strings. Ten species in the current national red-data list (Taylor 2014) were recorded during the two years of observations. Only three red-listed species were resident in the Zen area. These were: Black Harrier – rated Endangered; Southern Black Korhaan – Vulnerable; and Blue Crane – Near Threatened. The other 7 red-listed species, were seldom seen and or in very small numbers. These were five birds of prey and two waterbirds.

A pre-construction bird monitoring programme and radar survey has been undertaken for the Zen site and at a control site. A pre-construction programme of bird monitoring was conducted across a 27 month period from September 2012 to December 2014, and for a total observation period of > 400 hours. The monitoring followed BirdLife South Africa's guidelines (version 2, Jenkins *et al*. 2012)). Field techniques employed in 2012-2013 were: observations from 6 vantage points; 8 walked linear transects (3 of them controls); 2 driven transects; inspection of identified focal sites; and incidental observations made by observers while traversing the study area. In 2014, 3 key vantage points, from which all proposed turbine areas were covered, were each monitored for a total of 12 h in all seasons.

Four specialists have been involved in this avifaunal pre-construction assessment. These are: 1) Avisense, responsible for the initial scoping report (Jenkins 2012); 2) African Insights whose Dr A.J. Williams, responsible for a impact assessment (Williams 2012), the 2013 avifaunal assessment report (Williams 2013), and the 2015 final assessment report (refer to Appendix G; 3) Bioinsight, whose teams conducted the field bird monitoring and data analyses (Bioinsight 2013, 2014); and 4) Echotrack, conducted the radar survey (Echotrack 2013) to monitor bird movement over the Zen site at night.

a. Target / Priority Species

Based on the data collected on birds in the study area, 21 target / priority species were identified (refer to Table 6.3). The primary priority species in the Zen site is the Blue Crane. Of the other priority species most of those that were recorded

during the pre-construction bird monitoring programme occurred in small or negligible numbers and or for short periods in the year.

Table 6.3: Target / priority species for the Zen Wind Energy Facility study area relative to their conservation status and established risk of mortality due to collision with wind farm structures (see text for explanation)

Species	RDB	ESK	WCP	Comments	Risk
White Stork	[E][1]	3	16	Most are Palaearctic migrants but there is a tiny breeding population in the Western Cape Province	highest
Blue Crane	V	2	12	Widespread in southern Swartland	highest
Lesser Kestrel	V	-	7	Seasonal visitor. AEWA concern. Focal roosts	high
Black Harrier	NT	-		Largely restricted to shrubland habitats	medium
Black Stork	NT	3	15	Critically endangered in WCP. Collision risk similar to White Stork	highest
Greater Flamingo	NT	4	16	AEWA concern. Flocks. Nocturnal flights	high
Secretarybird	NT	9	16	Small population within southern Swartland	high
Lanner Falcon	NT	-	6		medium
Peregrine Falcon	NT	-	10		medium
Great White Pelican	NT	-	15	Large size. Flock flier. Low aerial agility	high
African Sacred Ibis	-	6	6	Large size. Flock flier	Medium
Karoo Shelduck	-	8	9	South African endemic. Nocturnal disperser	Medium-high
Egyptian Goose	-	10		Wetlands. Large. Flock flier. Nocturnal disperser	Medium
Yellow-billed Duck	-	13	6	Wetlands. Nocturnal disperser	Medium
Jackal Buzzard	-	14	9	Widespread terrestrial	Medium
Grey Heron	-	15	7	Large. Wetland rooster & breeder.	Medium
Cattle Egret	-	16	4	Terrestrial forager. Wetland rooster & breeder. Flock flier.	Medium
Black-headed Heron	-	17	6	Terrestrial forager. Wetland rooster & breeder.	Medium
NEAR-ENDEMICS				**Species with an estimated >15% of the global population in the Swartland**	
Cape Shoveler			7	Sn. African endemic. High % population in Swartland	Medium
Cape Teal			5	Sn. African endemic race? High % population in WCP	Medium
Southern Black Korhaan			10	South African endemic.Terrestrial. High display flights	Medium

Notes for Table 1. RDB - Red Data Book (Barnes 2000) status; E - Endangered; V - Vulnerable; NT- Near-threatened; ESK: Top species in Eskom's collision database. WCP (Westen Cape Province): Prioritisation rating (20 = maximum concern, 0 minimum) of bird species for conservation concern in the entire Western Cape Province (Shaw 1995).

Bird species considered likely to occur in the Zen sub-region are considered in terms of broad aerial, dryland, and wetland groups. The avifaunal habitats present on the Zen Wind Energy Facility site are described below.

b. Aerial foragers

These are of two main groups, those: 1) which catch insects in the air; and 2) predatory raptors (including some owls) which locate their prey whilst in flight. Aerial insectivores that occur in the Zen sub-region are swifts, swallows and martins, bee-eaters, nightjars, and a small falcon. Many of these are seasonal migrants only present in the Zen region during spring and summer. All are diurnal foragers except the nightjars which are scarce in the transformed local habitats. Aerial foragers are assumed to have acute vision which should enable them to see turbines. However, when pre-occupied with catching food they may collide with rotor blades. Turbines are apparently attractive to insects as a result of their usual pale colouration and the heat they produce. Their attraction of insects will in turn result in insectivorous birds approaching turbines. The aerial insectivores likely to be at greatest risk of collision with turbines in the Zen area are Little Swifts as there is a substantial breeding colony under the bridge where the R44 road crosses the Klein Berg River.

The only aerial insectivore considered a priority species is the Lesser Kestrel. This migrant falcon is only present in the Western Cape Province in the spring-summer. It is dependent upon tall trees for communal night roosts. The Zen area is some 50 km from the nearest known roost but within the potential daily foraging range of birds from this roost. Only 6 individuals were recorded over the Zen area in the year of monitoring.

The aerially foraging carnivores include several priority rated species. These are the Peregrine and Lanner Falcons and, over the natural scrubland, Black Harrier and Verreaux's (Black) Eagle. As no turbines are planned for erection in scrubland areas the two scrubland foraging raptors are not considered threatened by the Zen wind farm. All four species were observed on only 1-3 few occasions during the monitoring year (Bio3 & Savannah 2013).

c. Dryland habitats

In the simplest terms dryland habitat can be divided into four categories based on plant structure. In decreasing order of height and complexity these are: 1) trees (>2 m high); 2) shrubs (<2 m high); 3) grasses (including cereals); and 4) bare ground (including recently ploughed fields).

» *Trees*: Trees are the most restricted habitat in the Zen area. The only self-spread trees are alien wattles and gums in the riparian zone of the Klein Berg and Berg Rivers. All other stands of trees in the Zen area have been artificially established. These include lines of windbreaks, shelter trees planted near farmsteads, eucalyptus plots formerly coppiced for fence posts etc. and, besides the Berg River, an area of irrigated fruit trees between multiple windbreaks.

The wind turbines are planned to be located in open areas at considerable distance from all trees except a narrow *Casuarina* windbreak. Bird species dependent upon treed areas for food largely remain in or close to the treed habitat and so are unlikely to be affected by the development of the proposed wind energy facility. None of the treed habitat species are considered of conservation priority in this sub-region.

A few bird species that use trees for perching, and in some species for breeding, forage out over adjacent grasslands (as here defined – see below). These are predominantly birds of prey e.g. buzzards which search for prey whilst in flight. Although these birds forage by day and have acute eyesight they are subject to collision with turbines when their sight is focused on prey search on the ground below rather than structures in front of them. The Jackal Buzzard, whose local population is <10, is the only priority species in this habitat category. Since it is a resident species it should become familiarised with the turbine locations and collision risk is considered minimal.

» *Shrubs:* There are two broad types of shrub habitats in the Zen area. These are: 1) a fringe of alien shrubs along the outer riparian zone of the Klein Berg and Berg Rivers; and 2) native shrubs (renosterveld or fynbos) confined to the Saronsberg and to adjacent foothills that have proven too stony for agricultural use. No turbines are proposed in the shrubland habitats so little impact is likely. Three priority species, all of which may breed locally, occur in this habitat. These are the Black Harrier, Verreaux's Eagle and the Southern Black Korhaan. None of these are likely to be other than marginally impacted by the proposed wind farm.

» *Grasslands:* Grasslands are, by far, the predominant dryland habitat of the Zen area. There are three basic types all on land transformed from former shrubland. These types are 1) seeded pastures; 2) cereal croplands; and 3)

fallow. Grasslands, especially cereals, undergo seasonal changes in structure and so differ from trees and shrubs, which in this region do not vary seasonally in structure. Seeds sprout with winter rains and grasses and cereals grow through the rainy season to achieve maximum height in late October. In the pastures grasses subsequently dry out and die back or are eaten down to a low level by the end of summer. Cereals, here almost exclusively wheat, are harvested in late October-November leaving, initially hard stalked, stubble. Only when the dry stalks wither and, with the removal of dense cover, "weeds" grow and foster insects do stubble field become attractive to birds. Breeding birds need stability in the vegetation where they nest and few can cope with the seasonal changes in cropland. This situation is exacerbated by repeated major human disturbances – ploughing, spraying, harvesting, stubble burning etc. The absence of cover over wide areas renders birds exposed to avian predators.

The croplands present are a shifting mosaic of habitats that may vary on an intra- and inter-annual basis. A typical cycle is of ploughing followed by sowing, cereal growth, and post-reaping stubble. There is abrupt human disturbance at three or more stages in this cycle – ploughing, sowing, reaping and sometimes spraying. These disruptions cause birds to move locally and are spaced in time across the mosaic of fields so that e.g. during reaping birds like the Blue Crane are forced to move a number of times. The cereal cycle may then be repeated or the field may be left fallow for a year or more. Fallowed fields are generally used for stock grazing, in this area mainly for beef cattle. Most birds that can cope with such disturbed conditions will be able to cope with any disturbance and potential displacement resulting from development of a wind farm in this habitat.

» *Bare ground: B*are ground occurs as newly ploughed fields, small patches among vegetation or wider spaces such as gravel roads. Birds, especially precocial chicks, find most bare ground easier to walk or run on. Bare ground is attractive to birds which find seeds or insects easier to locate on the exposed surface than on or among vegetation. The birds which most frequent bare ground are those that are also common in short grasslands. Bare ground, including ploughed or heavily grazed fallow cropland, is particularly important in the spring when the dense growth of grass or wheat precludes many birds from the extensive pastures and cropland.

d. Waterbirds

The wind farm does not impinge on actual wetlands, birds from these wetlands must move across, and in some cases forage on, the areas where the turbines are to be located. Most movements between wetlands, and most "terrestrial" foraging –by waterbirds, notably geese, is at night. In making these, largely

nocturnal movements "resident" waterbirds will be vulnerable to collision with turbines. The waterbird species at greatest risk of collision with turbines in the Zen area are the Blue Crane and Spurwinged and Egyptian Geese. These three species have appreciable local populations that move between wetland roosts and agricultural lands where they forage, and in the case of the Blue Crane breed. Several other priority waterbird species occur in the Zen site. Most of these are restricted to still waterbodies and make limited use of adjacent terrestrial ground. Of the three local waterbodies the flooded borrow pit beside the R44 is the most important for waterbirds as, despite being situated beside the busy R44 road, it supports a larger diversity of waterbird species and is used by three species for breeding and probably by Blue Cranes as a night roost. Waterbirds unfamiliar with an area often use the presence of local waterbirds as an indication of suitable conditions and recruit to such wetlands. This further emphasises the importance of the borrow pit waterbody. Among the priority waterbird species Greater Flamingo's were only recorded twice during the year and flocks of White Pelicans on several occasions but only during the autumn. Black Storks, a species endangered within the Western Cape, are unlikely to occur given their tiny population in the Western Cape and the unavailability of suitable habitat.

Waterbird moult and movements

Many waterbirds become flightless for 4-6 weeks during their annual complete moult. This moult usually follows 1-2 months after breeding and so is seasonally synchronised. In the Swartland most waterbodies are too small or ephemeral to serve as safe moult refuges. One of the very few suitable moult refuges in the region is Voelvlei Dam, a large, deep, and artificially enlarged, reservoir constructed over an original lake, located 10 km south of the Zen site. Voelvlei Dam supports waterbirds most of which use the vlei as a moult refuge. There are particularly large numbers of Egyptian Goose (>8,000), Karoo Shelducks (>1,400), Red-knobbed Coot (>500), and Spurwinged Goose (>300) (unpublished CWAC data provided by the ADU). To attain these numbers birds must gather from across a wide area of the Swartland and, in the case of the Karoo Shelduck, probably from beyond. Many of these waterbirds must be night-time transients across the Zen site and or the two adjacent proposed windfarms.

Blue Cranes are known to gather in large numbers at refuges during their 4-6 week flightless moult. In the cropland regions of the Western Cape Province this moult occurs in March to May. There is a strong possibility that Voelvlei Dam is a significant moult refuge for Blue Cranes but unfortunately there have been no counts of waterbirds at Voelvlei during the crane moult period.

The Karoo Shelduck is effectively endemic to the Karoo and adjoining areas of South Africa (only small populations occur in neighbouring countries). The global

population is 35,000-40,000 individuals (Williams unpublished analysis) so the count of 1,600 at Voelvlei represents 3-4 % of the global population. However, in prolonged drought periods when for several years breeding success is extremely low the global population may drop to 19,000. In such drought periods more shelducks move into the winter rainfall region. The number supported at Voelvlei Dam may then reach 8% of the global population.

During the pre-construction bird monitoring no Karoo Shelducks were observed in or over the Zen study area. This is not surprising as little if any habitat on the Zen site is suitable for this duck and passage would be at night. However, this does not preclude the potential for a sizeable proportion of the global population moving across the Zen area during their moult season (November-February (Allan 2005b)) when approaching, or departing from, Voelvlei.

Supplementary to the pre-construction bird monitoring, the avifauna specialist conducted a site visit to Voelvlei Dam in December 2013. During the observations fewer than 50 waterbirds were seen. These were: 3 Caspian Terns, 15-20 Spurwinged Geese, and 3 parties of 4-6 Egyptian Geese. No Karoo Shelducks were seen. The geese were all initially resting on the eastern shore i.e. the most "sheltered" side of the dam. This was the only area where waterbirds could rest out of, but close to, the water. The terns were only observed in flight.

Substantial numbers of waterbirds have been reported previously at the Voelvlei dam (CWAC data archived by the Animal Demography Unit at UCT) though no earlier counts are available for November-December. There are two related reasons why waterbird numbers at Voelvlei dam in 2013 were lower than predicted. One is that, due to the above-average winter rainfall, water levels were higher than usual so that there was less exposed shore where birds could rest (as, for energetic reasons, they prefer to rest along the shore than swim in the cool, and wave disturbed, water). The second potential reason is that, because the winter rains were late, waterbirds will have bred later than usual so that their flightless, post-breeding, moult was also delayed.

e. The Radar Survey

A radar survey of bird movements was undertaken for the following reasons: 1) the substantial number of waterbirds known, or likely, to moult at Voelvlei; 2) the potential for large numbers of these birds to transit the Zen and two adjoining proposed windfarms; 3) the known high collision risk for most waterfowl and for Blue Cranes (Martin & Shaw 2010); 4) that many travel in flocks, so that there may be multiple mortalities in a single collision event; and, especially, 5) the sizable percentage of the global population of the Karoo Shelduck at risk. The aims of the radar survey were to determine whether the waterbirds flying in or across the Zen site fly at blade height and if so when (day or night), where and whether singly or in groups. These records were supplemented by daytime counts of the numbers of waterbirds at Voelvlei. The radar survey showed that: 36% of bird flights were at night; large groups of birds were involved; most flew along a NW-SE direction (either to or from Voelvlei); and flew at average heights of 93 m.

6.5.8 Bat Communities

In order to characterise the bat community (baseline) a pre-construction bat monitoring programme was undertaken at the Zen Wind Energy Facility site and at a control site.

a. Potential bat species

Considering the species probability of occurrence at the study area, it was concluded that 16 bat species may occur in the vicinity of site, which corresponds to 24% of overall species in South Africa. Of the 16 bat species considered to potentially occur in the area, 14 are considered to have a high probability of occurrence, one with medium probability, and one considered to have low probability of occurrence. Of the total species considered, one is a frugivorous bat, the Egyptian rousette (*Rousettus aegyptiacus*), considered to be of "Least Concern", however with a high probability of occurrence due to the presence of favourable foraging areas (e.g. orchards).

From the total list of 16 species with potential occurrence in the area, 8 are of conservation concern in South Africa, namely: *Miniopterus fraterculus, Miniopterus natalensis, Cistugo leseueri, Myotis tricolor, Rhinolophus capensis, Rhinolophus clivosus* and *Rhinolophus darlingi*, considered as "Near threatened"; Cistugo seabrae considered "Vulnerable" (Friedmann & Daly, 2004). Of these species, all have a high probability of occurrence at the study area, with the exception of *Rhinolophus darlingi* which is considered to have a moderate probability, as the habitat may not entirely suit its preferences. Five of these species of conservation concern have a low risk of collision with wind turbines

(Rhinolophus capensis, Rhinolophus clivosus, Rhinolophus darling, Cistugo seabrae and Cistugo leseueri), while the remaining three species (*Miniopterus fraterculus, Miniopterus natalensis, Myotis tricolor*) have a medium-high risk of collision with wind turbines (Sowler & Stoffberg, 2012).

The only species with a low probability of occurrence in the study area is the Mauritian tomb bat (*Taphozous mauritianus*) included in this analysis due to the existence of a confirmed record of this species in the south area of Western Cape (Cape Agulhas). However this is an isolated record, dated from 1970, and it has not been confirmed in the area ever since, and therefore being considered to have a very low probability of occurrence at Zen Wind Energy Facility study area.

b. Confirmed bat species

Based on the results of the pre-construction bat monitoring programme at the Zen Wind Energy Facility site, a total of 9 bat species were confirmed in the study area. Of the total number of Red Listed bat species referred to in the previous section, five species were confirmed as being present in the proposed site and surroundings during field surveys, i.e.: *Miniopterus natalensis, Myotis tricolor, Rhinolophus capensis, Rhinolophus clivosus* and *Rhinolophus darlingi*, all with populations considered Near Threatened in South Africa (Friedmann & Daly, 2004). The remaining species are considered to be of "Least Concern" in South Africa. One of the species confirmed, the Robert's flat-headed bat (*Sauromys petrophilus*) is considered endemic to Southern Africa (Monadjem *et al*., 2010). With the exception of *Miniopterus natalensis* and *Myotis tricolor* most of these species have a low risk of collision with wind turbines. Both *Miniopterus natalensis* and *Myotis tricolor* have a medium – high risk of collision, due to their known migratory behaviour.

Two additional species were considered to possibly occur in the study area: Lesueur's wing-gland bat (*Cistugo leseueri*) and the Angolan wing-gland bat (*Cistugo seabrae*). Some echolocation calls were identified as belonging to either one of the species and were considered as a species group (*Cistugo leseueri/ Cistugo seabrae*). It was not possible, however, to distinguish which was the species present as their echolocation calls have very similar parameters and cannot be accurately distinguished with a high degree of confidence. Both species have a conservation status of concern, being the first considered "Near Threatened", while the *Cistugo seabrae* is considered as "Vulnerable", according with the South African Red List (Friedmann & Daly, 2004). According to the IUCN, these are also species of conservation concern: *Cistugo leseueri* is globally considered as "Vulnerable" and *Cistugo seabrae* is "Near Threatened" (IUCN, 2012).

The most common and active species detected in the study area was the *Tadarida aegyptiaca*, being recorded in all surveys sampled. Other highly frequent species in the study area were the *Neoromicia capensis*, the *Miniopterus natalensis* and the *Eptesicus hottentotus*, as they were detected in almost all of the surveys conducted. Regarding the remaining five confirmed species, the *Myotis tricolor* was recorded only in October and November; *Sauromys petrophilus* was identified only in the February surveys; *Rhinolophus darlingi* was detected only in April, *Rhinolophus capensis* was detected in July; and *Rhinolophus clivosus* was recorded in November, April and May. For these species that were only detected for short periods of time, it is possible that they could be using the area as a passage route between roosting locations as these months are associated with the breeding seasons.

As for the species that use the study area more frequently, *Eptesicus hottentotus* was predominantly present in the summer season with almost 50% of the contacts recorded during February; also more than a quarter of the contacts obtained with this species were recorded during spring. On the other hand, both *Miniopterus natalensis* and *Tadarida aegyptiaca* were mostly active during the spring season, between September and December. Considering bat biology, it is in this time of the year when births usually occur, being possible that this higher number of detections may be due to parents foraging for food for their young. This would indicate the proximity of at least one roost where these species are present. *Miniopterus natalensis* was also quite frequent during the autumn season (between March and April). At this time of the year the species is known to breed reinforcing the hypothesis that the study area may play an important role in the life cycle of this species.

Neoromicia capensis was detected almost equal frequency in all surveys, with a slight predominance to the February, April and May surveys. Although this may indicate that the species is also present in the study area during their breeding season (March to April), there is no corresponding increase in contacts in the breeding season.

It is also consistent across all species detected that the number of contacts obtained during the winter season (between June and August) is low, indicating that it is possible that some of these bat species may hibernate in the study area, due to lack of food and lower temperatures in this time of the year.

6.6 Land Types, Soils and Agricultural Potential

6.6.1 Land Types

The land types found on the site are **Db47, Db48, Ic103, Ic104 and Ic122** (Land Type Survey Staff, 1972 – 2006). The land type data indicates that the site is underlain predominantly by shale, schist, quartzitic sandstone and alluvium and terrace gravel. Below follows a brief description of the land type in terms of soils, land capability, land use and agricultural potential. Figure 6.4 shows the land types on the Zen site.

Land Types Db47 and Db48 can be described as having the following haracteristics:

- **Soils:** Shallow yellow-brown and grey soils with and without duplex character in upland and midslope positions. Rock outcrops and shallow rocky soils occur throughout. Valley bottom and drainage feature soils vary from structured to apedal and often with signs of incipient soil formation (unconsolidated and transported soil materials).
- **Land capability and land use:** Mainly wheat and cereal production due to the winter rainfall. Summer land uses include extensive grazing of crop rests or fallows. Irrigated crop production is occasionally practiced where water is available.
- **Agricultural potential of land type:** The agricultural potential is entirely linked to the distribution and quantities of rain during the wet winter months. Soils tend to play a smaller role in the potential compared to aspects such as rainfall and wind distribution. The soils on the site have inherent limitations that imply that if the rainfall is reduced or its patterns altered a distinct decrease in yields can be expected.

Land Types Ic103, Ic104, and Ic122 which covers more than 80% of the proposed development area can be described as having the following characteristics:

- **Soils:** Shallow and rocky with and without duplex character in upland and midslope positions. Rock outcrops and shallow rocky soils occur extensively throughout. Valley bottom and drainage feature soils vary from structured to apedal and often with signs of incipient soil formation (unconsolidated and transported soil materials).
- **Land capability and land use:** Predominantly extensive grazing due to climatic and soil constraints.
- **Agricultural potential of land type:** Low potential due to shallow soils.

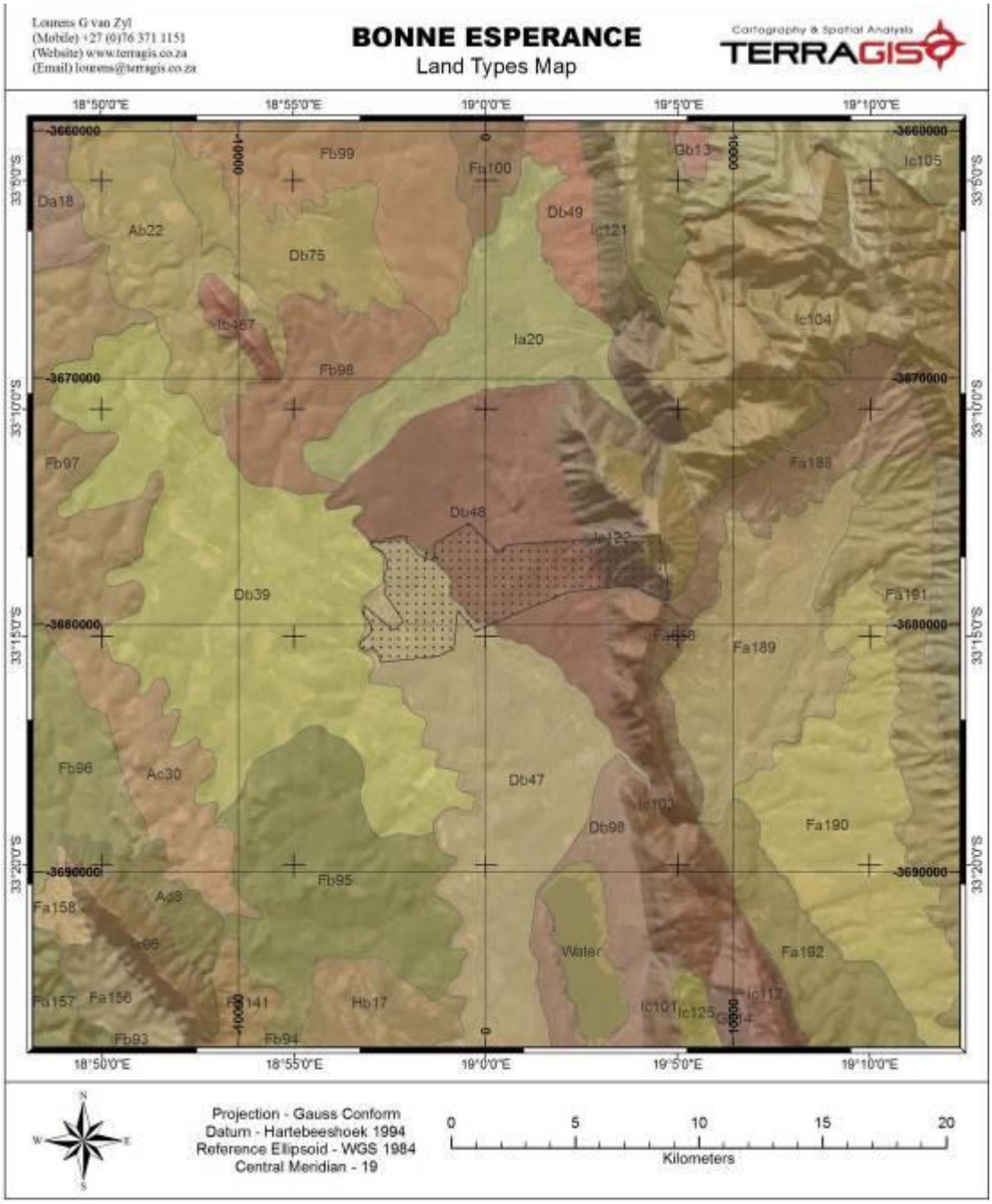

Figure 6.4: Land types on the Zen site

6.6.2 Soils

A generalised soil map is shown in Figure 6.5. The site contains mostly shallow duplex soils, shallow rocky soils and rock outcrops with some alluvial sandy soils. These are described in the section below.

Figure 6.5: generalised soil map for the Zen site

a) <u>Shallow Duplex Soils</u>

This area is dominated by soils of the Swartland (Orthic A-horizon / Pedocutanic B-horizon / Saprolite) form with inclusions of soils of the Estcourt (Orthic A-horizon / E-horizon / Prismacutanic B-horizon), Sterkspruit (Orthic A-horizon / Prismacutanic B-horizon), Valsrivier (Orthic A-horizon / Pedocutanic B-horizon / Unconsolidated material without signs of wetness) and Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) forms. The dominant characteristics of the soils are a

bleached A-horizon, a large stone and pebble content in the A-, B- and subsoil horizons and a marked textural and structural difference between the A- and B-horizons. The soils are generally shallow and very stony at the surface due to tillage but vary in depth according to position in the landscape as well as due to historical land management practices such as the creation of wide ridges. Due to the duplex nature of the soils the landscape is prone to erosion. The agriculture potential of this area is highly dependent on rainfall distribution and quantities. This is quite evident in the fact that the summers are dry and that there is very little water storage capacity in the soils leading to a very low biological productivity in summer months. The distribution and quantity of rainfall in the winter months have a direct bearing on the yields with good rainfall years leading to wheat yields on average of 2.5 tons per hectare or above. Wind frequency, direction and intensity also play a dominant role in that areas closer to the mountain have lower yields than areas further away. This effect is large enough to lead to an average yield of more than a ton per hectare less on the eastern side of the site (at the foot of the mountains with a westerly aspect) compared to the western side of the site. It is therefore evident that the soils play a small part in the agricultural potential when compared to aspects such as rainfall distribution and quantities as well as wind. In the event that the rainfall becomes more erratic on the site the agricultural potential will decrease significantly as the soils do not have the potential to buffer the moisture fluctuations adequately enough for sustainable crop growth.

b) Shallow Rocky Soils and Rock Outcrops

This area includes the mountainous area as well as the footslope areas. The soils range from very rocky and of the Mispah (Orthic A-horizon / Hard Rock) form with numerous rock outcrops in the east to undulating hills on the footlsope where Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) forms dominate. This area is still predominantly under natural vegetation and historic crop production activities have effectively ceased. Some of the soils could be used for specialised crops with irrigation.

c) Alluvial Sandy Soils

The area dominated by alluvial sands lies entirely in the stream channel and floodplain of the Klein Berg Rivier. The soils vary between recently deposited alluvial soils of the Dundee (Orthic Ahorizon / Stratified Alluvium) form or slightly older soils of the Oakleaf (Orthic A-horizon / Neocutanic B-horizon) form. Depending on the interpretation of soil classification criteria soils of the Namib (Orthic A-horizon / Regic Sand) or Fernwood (Orthic A-horizon / E-horizon) forms can also be classified in the dune area. The dune area is currently mined under a valid sand mining license. This area is characterised by an almost exclusive stand of Port Jackson trees and on the specific survey site it is evident that large

numbers have been cleared. Original stands occur on the neighbouring farm within the floodplain of the river. This area is suited to irrigated crop production due to the sandy nature of the soils. Other forms of crop production are considered to be risky due to the poor water storage capacity of the soils as well as deep profiles. Irrigated crop production in this area needs to be managed from a fertilizer application perspective as the soils do not retain nutrients. These nutrients, if not applied judiciously and conservatively can lead to eutrophication of the water of the Klein Berg Rivier with consequences for downstream water users and natural ecosystems. From a wind turbine development perspective this area as well as irrigation infrastructure areas are considered to be sensitive.

6.6.3 Soil Potential Linked To Current Land Use and Status

The western part of the site is used for wheat farming. The eastern part of the site is used for grazing of livestock and game farming. Centre pivots occur on the eastern part of the site. The potential of the soils on the site for crop production is limited and at present determined by climatic characteristics. There is very little potential of increasing the productivity of the land as the soils are also not ideally suited to long-term irrigation unless significant investments are made in terms of artificial drainage.

The soils are prone to erosion as:

1. they are predominantly shallow with underlying structured and clayey soils or impermeable bedrock,:
2. soils can become saturated rapidly during rainfall events with the subsequent liquefaction of these;
3. the soils are predominantly sandy loams with very little stabilisation in the form of plant roots; and
4. the area is undulating and hilly with subsequent increased erosion pressures due to steep slopes and intensive rainfall events.

6.7 Social Characteristics of the Study Area and Surrounds

The proposed development area is located approximately 6 km south of the settlement Saron, which is located within the Drakenstein Local Municipality, and 6 km west of the town of Tulbagh, which is located within the Witzenberg Local Municipality (WC022). The administrative centre of the Drakenstein and Witzenberg Municipalities are Paarl and Ceres respectively. The Drakenstein and Witzenberg Local Municipalities are two of 6 municipalities that fall within the greater Cape Winelands District Municipality.

The Drakenstein and Witzenberg Local Municipalities are category-B municipalities, which form part of the greater Cape Winelands District Municipality

and are located in the central Western Cape between 62 km (Paarl) and 126 km (Ceres) north east of the City of Cape Town. The Drakenstein and Witzenberg municipalities are divided into 31 and 11 administrative wards respectively.

The region has a rural character, with scattered isolated homesteads occurring within the study area. Large areas, especially within the mountains, have been given over to conservation, or remain in a natural state. Major towns surrounding the proposed site are the towns of Gouda, Saron, Porterville, Riebeeck West and Riebeeck Kasteel). Other areas/homesteads situated within close proximity of the proposed development site include, *inter alia*, De Hoop, Vier-en-Twintigriviere, Ertjieskloof, Arbeidsgenot, Klein Bakoven, Morester, The Junction, Molenaarsdrift, Rhenostervlei, Klipdrift, Skoenmakersfontein, Ruigtevlei, Groenvlei, Goedverwag, Kruispad, Sandgat, Langkloof, Nuwerus, Hartebeeskraal, Skutplaas, Nuwedrif, Leeuvlei, Moredou, Frisgewaagd, Kleinbergrivier, and La Gratitude.

6.7.1 Social and Demographic Profile

The Drakenstein Local Municipality has the largest population of all the municipalities in the Cape Winelands District Municipality with a total of 194 419 inhabitants, approximately 27.3% of the greater Cape Winelands District Municipality (population size ~712 413). The population in the rural areas constitutes 18.28% of the total population while the urban areas constitute 81.72% of the total population.

By contrast, the Witzenberg Local Municipality has the smallest municipal population in the Cape Winelands District Municipality. The total population is 88 390 which constitutes 12.4 % of the greater Cape Winelands District Municipality. The population in the Drakenstein Local Municipality is expected to decline at a rate of –0,2% to 192 336 by 2012 In comparison the Witzenberg Local Municipality population is expected to grow at a rate 0.5% per annum to 90 473 in 2012.

The age profile of the population reveals that approximately 67.1% and 66.2% of the population in the Drakenstein and Witzenberg Local Municipality respectively are potentially economically active falling between the 15 to 65 year old age bracket. The dependency ratio is 0.5 for both Local municipalities, which means that every two working individuals support approximately 1 non-working/unemployed individual.

The population in both Municipalities is largely Coloured (64% in the Drakenstein LM and 71% in the Witzenberg LM) followed by Black African (21% in the Drakenstein LM and 20% in the Witzenberg LM) and White (15% in the Drakenstein LM and 9% in the Witzenberg LM). These demographics are

reflected in the dominant languages within the two Local Municipality with 77% and 81% of the population in the Drakenstein and Witzenberg LM speaking Afrikaans respectively, 19% and 16% speaking isiXhosa respectively, and 3.4% and 1% speaking English respectively. The remainder speaks the other indigenous African languages.

Based on the data from Census 2001, approximately 6% of the population in Drakenstein have no formal education, while approximately 35% have some secondary school education and 21% have a Grade 12 (standard 10) qualification. Approximately 9% of the population have higher education qualifications. According to the Drakenstein IDP (2007-2012), illiteracy stands at 23%, which is less than the average within the Cape Winelands District Municipality (28%).

In Witzenberg, approximately 12% of the population have no formal education, while approximately 32% have some secondary school education and 13% have a Grade 12 (standard 10) qualification. Approximately 6% percent of the population have higher education qualifications.

Employment data for Drakenstein Local Municipality indicates that 49.7% of the population between 15 and 65 are employed in the formal sector and the unemployment rate is ~15%. Based on Drakenstein IDP (2007-2012), the Agricultural sector provides 29% of the formal employment in the Municipality. This sector is followed by the Manufacturing sector that employs ~23% of the employed population and the Wholesale and Retail sector, providing some ~16% of the employment in the area.

Employment data for Witzenberg Local Municipality indicates that 59.1% of the population between 15 and 65 are employed in the formal sector and the unemployment rate is ~10%.

6.7.2 Noise Sensitive Receptors

The assessment indicated there are 24 Noise-sensitive developments that occur in the area. Potential Noise-sensitive developments identified are highlighted in **Figure 6.6** below and considered further in the Noise Impact Assessment (Appendix K).

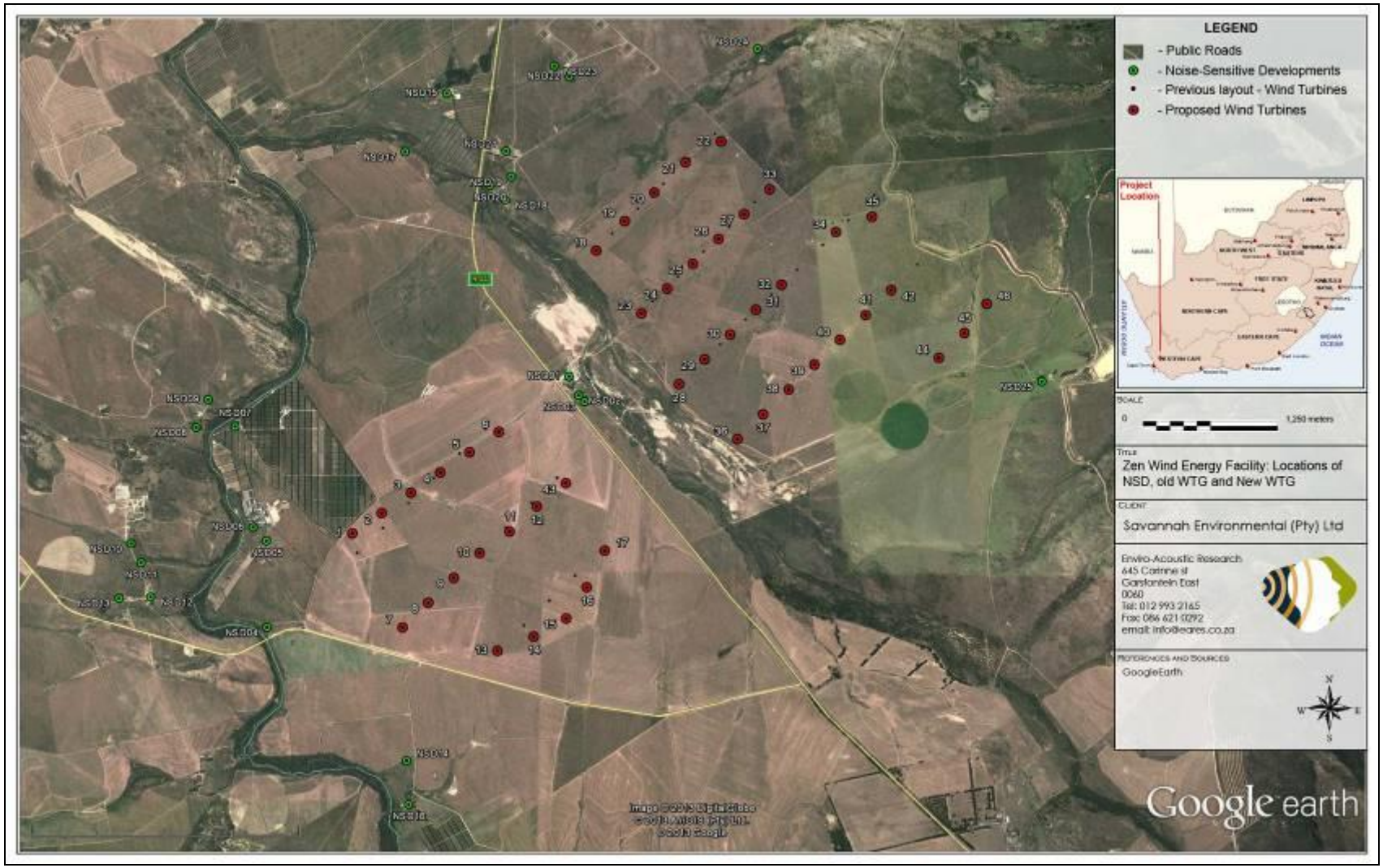

Figure 6.6: Aerial image indicating identified noise-sensitive developments in proximity of the site, and considered in the noise impact assessment

6.8 Scenic routes / Visual Quality of the Area

The broader study area is considered to have distinctive landscape character and a high visual quality. The sense of place is quite distinctive. The towns of Porterville, Saron, Gouda, Tulbach, Wolseley, Riebeeck West and Riebeeck Kasteel account for the highest population concentration within a region, which has an average of 21 people per km^2. Of note is that the town of Saron has some heritage value, in particular the historic core of the town. Most of the farming is dryland agriculture, with large patches of irrigated agriculture in the proximity of the larger towns, and where surface water is available. Wheat and maize farming dominate the land-use character in the western part of the study area. The land use in the eastern part of the study area is primarily conservation, which consists of thicket and bushland on the mountain slopes, giving rise to shrubland and fynbos in the high lying areas. A substantial portion of land cover is allocated to agriculture and forestry. Industrial type infrastructure includes the Riebeeck West PPC Quarry and some major distribution / transmission lines in the far south east of the study area. Several arterial roads traverse the area, namely the R46 from the south east and the south-west, the R311 from the north-west, and the R44, which bisects the area in a north south direction. A number of secondary roads form links between these arterials.

The region has a rural, pastoral character with scattered isolated homesteads occurring within the study area. Large areas, especially within the mountains, have been given over to conservation, or remain in a natural state.

Protected areas and / or important conservation areas include the following:

» The Cape Winelands Biosphere Reserve, of which the core area and buffer areas lie less than 10km to the south east of the site.
» The Cape Floral Region World Heritage Site, situated in the north east of the study area.
» Various important Mountain Catchment areas, also in the north east of the study area.
» The Voelvlei Dam Conservancy located less than 10km to the south east of the site. This conservancy also lies within the Cape Winelands Biosphere Reserve.
» The Kasteelberg Conservancy some 12km to the south west of the site.
» The Elandsberg Private Nature Reserve located about 20km to the south of the site.

The site is located on the eastern edge of the Western Cape coastal plain. The Witsenberge immediately to the east of the site as well as the Kasteelberg in the south west are part of the Western Cape's declared 'scenic mountain ranges', and link with the Cederberg in the north and the Hexriver Mountains in the south.

The area is a popular tourist destination, and is known for its rural pastoral landscapes set against the dramatic backdrop of the mountains. Most of the arterial and secondary roads are therefore assumed to be used as scenic drives by tourists passing through or visiting the region.

6.9 Heritage Profile

6.9.1 Palaeontology

The study area is underlain by deposits of the Malmesbury Group (low-lying areas) and the Cape Supergroup (mountains). According to Almond and Pether (2008) the Malmesbury Group is of low palaeontological significance with no fossils recorded as yet. The Cape Supergroup rocks contain several units with varying palaeontological significance. Generally, the shale units have higher significance than the sandy units but are not well represented in the study area. The lowest rocks, if present, would be Piekenierskloof Formation conglomerates (J. Compton, pers. comm., 2010), while Peninsula Sandstone would overlie them. Norman and Whitfield (2006:fig. 19) show that the more significant Cederberg shale only occurs in the very high reaches of the mountains where turbines would not be constructed. The only shale unit that might be present lower down is the Graafwater Formation, which occurs between the Piekenierskloof and Peninsula Sandstone Formations, but this would be very thin here if present at all.

6.9.2 Archaeology

a) <u>Early and Middle Stone Age</u>

Early Stone Age (ESA) material was common but its density varied considerably according to location. In general, the eastern side of the farm has very few artefacts, while in the west artefacts are present throughout the area but more frequently encountered towards the north than the south. These occurrences are not really 'sites' in the typical sense, since the material is largely in secondary context having been left on the surface after erosion of the overlying deposits. However, in some areas there were particularly high concentrations of artefacts which must broadly reflect the original locations of concentrations after they were made. In general, ESA material in such contexts is considered of little heritage value but the relatively high densities of artefacts encountered in places around Gouda suggest this not to be the case here – some mitigation might be appropriate if these scatters were to be disturbed.

In the areas where ESA artefacts were denser there were certainly also many more isolated artefacts. However, the good scatters were obvious when one encountered them. Why such a high frequency of cores should be present in the absence of large numbers of flakes is unknown. A peculiar find was an eroding sand dune close to the

Klein Berg River and which contained much river gravel and weathered artefacts. These artefacts included a large number of relatively small flakes and very few larger flakes or cores. Whether these are ESA or MSA is unknown but, given the paucity of larger artefacts, they may well be MSA. In one or two areas there were occasional flakes which, from their smaller size and reduced patination, may well have been MSA. In general, however, it seems that the MSA is poorly represented on the landscape.

b) Later Stone Age

Two small LSA scatters were found on the banks of the Berg River in the far west of the site. Neither was dense. Both included flaked artefacts in quartz and one had a small quartzite hammer stone and one quartzite flake present. A small number of isolated quartz flakes were found in sandy ground close to the proposed substation location. They were too dispersed to be able to distinguish any source areas but with the bush present there it is quite likely that an LSA site is present in the immediate vicinity.

No historical artefacts were seen anywhere in the study area.

6.9.3 Graves

No graves were seen in the study area and the farmer commented that no graves were known to be present on the site. Some of the sandy areas close to the river may well contain unmarked pre-colonial graves but, given their proximity to the river, these areas are unlikely to be disturbed by the proposed development. Unmarked graves are extremely unlikely in the areas with shale and cobble substrates.

6.9.4 Built environment

The Farm Bonne Esperance has two old buildings. The main house is large and it is not possible without a detailed examination to tell its original form. It has almost certainly been added to over the years but its primary plan form is still the same as it was in 1938. The second structure of antiquity is a store room/outbuilding that likely dates to the late 19th century or early 20th century. It is in very poor condition and of little heritage value. A few other buildings are present in a photograpgh dating back to 1938, but have been since been demolished.

6.9.5 Historical settlements

The village of Saron was originally a mission town established on the farm De Leeuwenklip by the Reverend JH Külpmann in 1846. In 1852 the Rhenish Missionary Society took control of the settlement but it is now under the Dutch Reformed Church (Fransen 2004). Fransen (2004) notes that, in contrast to other mission towns, Saron has been much altered over the years. This was firstly due to dilapidation, then to

modernisation and finally the village suffered a degree of earthquake damage in 1969. Nevertheless, structures dating to the mid-19th to early 20th centuries are scattered throughout the main part of the town. These range from the main mission church to commercial stores to large residential houses and many small cottages. Fransen (2006: 146) states of Saron that "of all mission villages, Saron near Porterville – once Rhenish, now Dutch Reformed – has perhaps lost its character most completely, though it retains a much-altered church of 1853, and a parsonage that was once the original farmhouse of De Leeuwenklip retaining a splendid gable of c.1780." This may be, but nevertheless, the old part of the village currently has a pleasant rural, leafy character which should be preserved.

To the south of the old part of Saron lies the main mission area. Comprised of the church, its hall, the parsonage (original farmhouse), the walled cemetery and a few other older buildings, this area has a spacious feel to it with large open spaces and many tall trees. Although a few buildings undoubtedly predate 1900, the village of Gouda appears not to have been present as a settlement prior to this time. The majority of buildings are quite recent and the town has no significance as a historical settlement.

6.9.6 Cultural landscapes

The historic settlement at the heart of Saron is itself a cultural landscape. Despite substantial increases to the town's footprint in recent years, the original core is still clearly evident today. It is characterised by large trees, quaint houses – many with old fabric – and a reasonable density of early dwellings. A low, rocky ridge lies directly between Saron and the proposed wind energy facility. The nearest turbine will be 2.6 km from the new township and 3.3 km from the historic core of Saron. The core area has many large trees which contribute to the quality of the landscape and greatly reduce the length of views from within the village. The trees would also serve to shield the old village from the proposed wind energy facility. The new township has, to some degree, detracted from the quality of the urban cultural landscape.

The other cultural landscape is the greater Swartland agricultural area that stretches more than 60 km to the north, west and south. The Gouda wind energy facility will introduce 46 turbines to the landscape and the Zen wind energy facility will introduce an additional 46 turbines. The guideline document for introducing wind energy to the Western Cape suggests that it is best to place wind energy developments in clusters far flung from one another rather than having them spread across vast open landscapes (CNdV 2006). With the exception of a few small mountains, the Swartland is relatively flat and certainly has an appearance of vastness is thus advisable to keep wind turbines in clusters and, in the light of the pending construction of the Gouda wind energy facility, the present location of the Zen wind energy facility thus seems appropriate.

6.9.7 Grading of Archaeological resources and built environment resources

Archaeological resources and built environment resources are provisionally graded as shown in Table 6.3. Grading is a means of generalising the degree of heritage significance attached to the resources present. The archaeological resources are of limited significance and do not merit any grading. The farm houses are altered to varying degrees but that at Die Mond appears to contain more original fabric and/or joinery and, upon inspection of its interior, may in fact merit a 3B grading. Furthermore, its context is better with the Kleinbergrivier werf having had modern storage facilities and farm outbuildings added to it. While some individual structures within the historic settlement of Saron likely merit a 3A grading, the majority of its historical structures should probably be 3C or ungraded. However, the overall context of the historic core of Saron is deemed of reasonable significance and might be considered as a grade 3B heritage resource.

Table 6.3: Provisional grading of heritage resources in the ZEN study area.

Heritage resource	Provisional grading
MD2012/001	ungraded
MD2012/002	ungraded
MD2012/003	ungraded
MD2012/004	ungraded
KB2012/001	ungraded
KB2012/002	ungraded
HK2012/001	ungraded
BE2012/002	ungraded
Kleinbergrivier farmhouse	3C
Kleinbergrivier outbuilding	ungraded
Die Mond farmhouse	3B/C
Die Mond outbuilding	ungraded
Saron historical settlement as a whole	3B

This chapter provides details regarding the scope of the proposed Zen Wind Energy Facility, including all required components of the project and necessary steps for the project to be developed.

7.1 Project Construction Phase

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. A construction workforce will be required. Approximately 200 to 266 jobs could be created during the construction phase. As far as possible, local labour will be utilised. The construction phase is anticipated to be between 18 and 24 months in duration.

7.1.1 Dimensions of Components

The infrastructure required will have the following typical dimensions:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a steel tower, a hub (up to 110 above ground level, depending on the turbine size decided upon) and three blades.
» Internal/ access roads (up to 6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection or loop in loop out connection to the proposed LeBonne Substation which is located on the Farm LeBonne Esperance (adjacent to the Zen site). Two power line routes were being considered and assessed in the EIA.

Figure 7.1 illustrates the approximate extent of the wind turbine construction area.

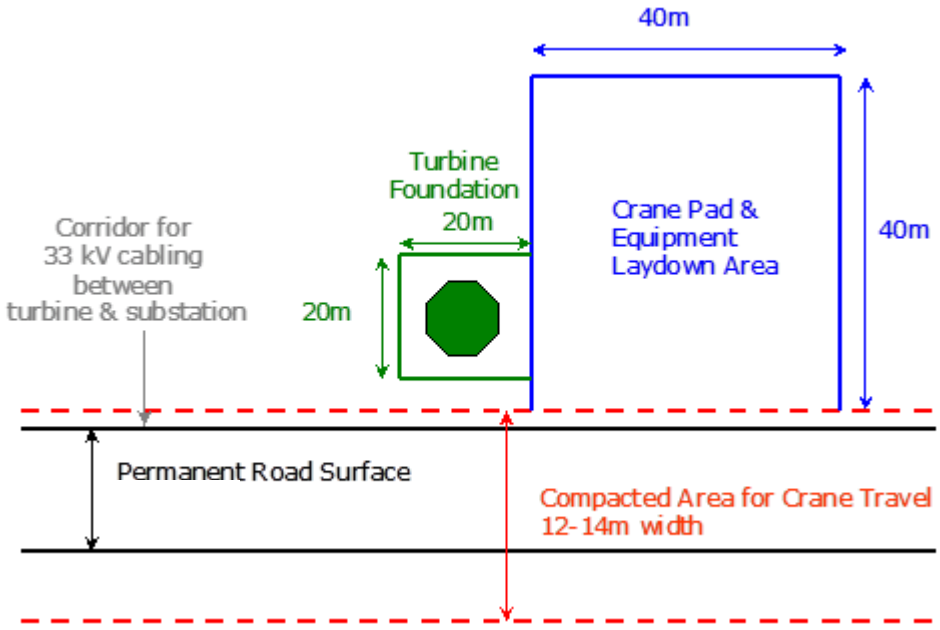

Figure 7.1: Diagrammatic representation of a typical layout of components.

7.2 Activities Associated with Construction of the Wind Energy Facility

The table below highlights the main activities associated with construction of the wind energy facility.

Table 7.1: Activities Associated with Construction of the Wind Energy Facility

Main Activity/Project Component	Components of Activity	Details
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey and confirmation of the infrastructure micro-siting footprint; » Survey of substation sites; and » Survey of power line servitudes to determine tower locations.	» All surveys are to be undertaken prior to initiating construction.
Establishment of access roads and/ bridge.	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). » Temporary access roads will be up to 10 m wide in some places due to turning circles that are required. » Establish internal access roads: up to 6 m wide permanent roadway within the site between the turbines for use during construction and operation phase. » Temporary track of 11 m for use during construction phase only.	» The Zen site is currently accessible from the R44. » Existing access roads will be utilised and upgraded. » A bridge to cross the Klein Berg river may have to be built. » Access roads will be constructed/upgraded 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. » Existing access roads to the site will be utilised, and upgraded where required. 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 is informed by the final micro-siting/positioning of the wind turbines (as well as specialist surveys). To accommodate the large crawler crane required for turbine assembly, a track of up to 11 m in width is required to be established on the site (as advised to be required by the developer).
Undertake site preparation	» Site establishment of offices / workshop with ablutions and stores and contractors' yards.	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.

Main Activity/Project Component	Components of Activity	Details
	» Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the footprint of each turbine » Excavations for foundations	
Establishment of laydown areas on site	» Laydown areas at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area for crane assembly.	» Each turbine needs a flat and hardened lay down area of ~2400 m^2 during the construction process. » This area can be rehabilitated after construction. » The lay down area will need to accommodate the cranes required in tower/turbine assembly. Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. A large lay down area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations of approximately of up to 20 m x 20 m x 4 m depth at each turbine location (final dimensions to be defined by geotechnical survey of the site).	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities. » Concrete may to be brought to site as ready-mix or batched on site if no suitable concrete suppliers are available in the vicinity. The reinforced concrete foundation will be poured

Main Activity/Project Component	Components of Activity	Details
		and will support a mounting ring. The foundation will then be left up to a week to cure.
Transport of components and equipment to site	» Flatbed trucks will be used to transport the majority of components to site from the nearest port (Cape Town). * Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades (rotor diameter of 122 m). * Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and main lift crawler crane) to erect the wind turbines. * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment etc.). * The components required for the establishment of the substations (including transformers) * Components required for the establishment of the power line (including towers and cabling) * Ready-mix cement trucks for turbine and substation foundations	» Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines. Other components include components required for the establishment of the substations (including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine, including tower, will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.), and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.

Main Activity/Project Component	Components of Activity	Details
Erect turbines	» Large lifting crane used for lifting of large, heavy components » A crane for the assembly of the rotor	» The large lifting crane will lift the tower sections into place. » The nacelle, which contains the gearbox, generator, and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground. It will then be lifted to the nacelle and bolted in place. » It will take approximately 2 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.
Construct substations and associated ancillary infrastructure.	» Substations and associated components; » Security fencing around high-voltage (HV) yard; and » An operations and maintenance building, including a workshop building, is proposed. Some of the existing on-site buildings may be utilised where practical.	» A temporary construction area is needed for containers, toilets, and equipment. » Permanent operational buildings are as follows: * Operations and maintenance facility, including a storage building (100m x 100m m), 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. » The on-site substation will be constructed with a HV yard footprint of up to 200 m x 200 m. » The substation would be constructed as follows: * 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 foundations

Main Activity/Project Component	Components of Activity	Details
		* 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.
Connection of the wind turbines to the on-site substations	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substations.	» 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 would follow the internal access roads as far as reasonably possible.
Connect substations to power grid	» A new 132kV overhead power line feeding into the power grid at the new LeBonne Substation.	» The route for the power line will be assessed, surveyed, and pegged prior to construction. » A servitude of approximately 32 m will be required for the power line.
Commissioning of the facility	» Start up for electricity generation	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site remediation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas 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.

7.3 Project Operation Phase

An artist's impression of a typical wind energy facility, illustrating the various components and associated infrastructure is shown in Figure 7.2. Based on information from other proposed wind energy facilities, the establishment of a wind energy facility will create approximately 7 permanent and 9 temporary employment opportunities. It is anticipated that there could be security and maintenance staff required on site. 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. Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions or maintenance activities. The table below highlights the main activities associated with operation of the wind energy facility.

Table 7.2: Activities Associated with Operation of the Wind Energy Facility

Main Activity/Project Component	Components of Activity	Details
Operation	» Operation of the wind turbines	» Once operational, the Wind Energy Facility will be monitored. » It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities.
Maintenance	Maintenance activities include: » Oil and grease – turbines; » Transformer oil – substation; and » Waste product disposal » Cleaning of turbines	» The wind turbines will be subject to periodic maintenance and inspection. » Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 25 - 30 years, with maintenance.

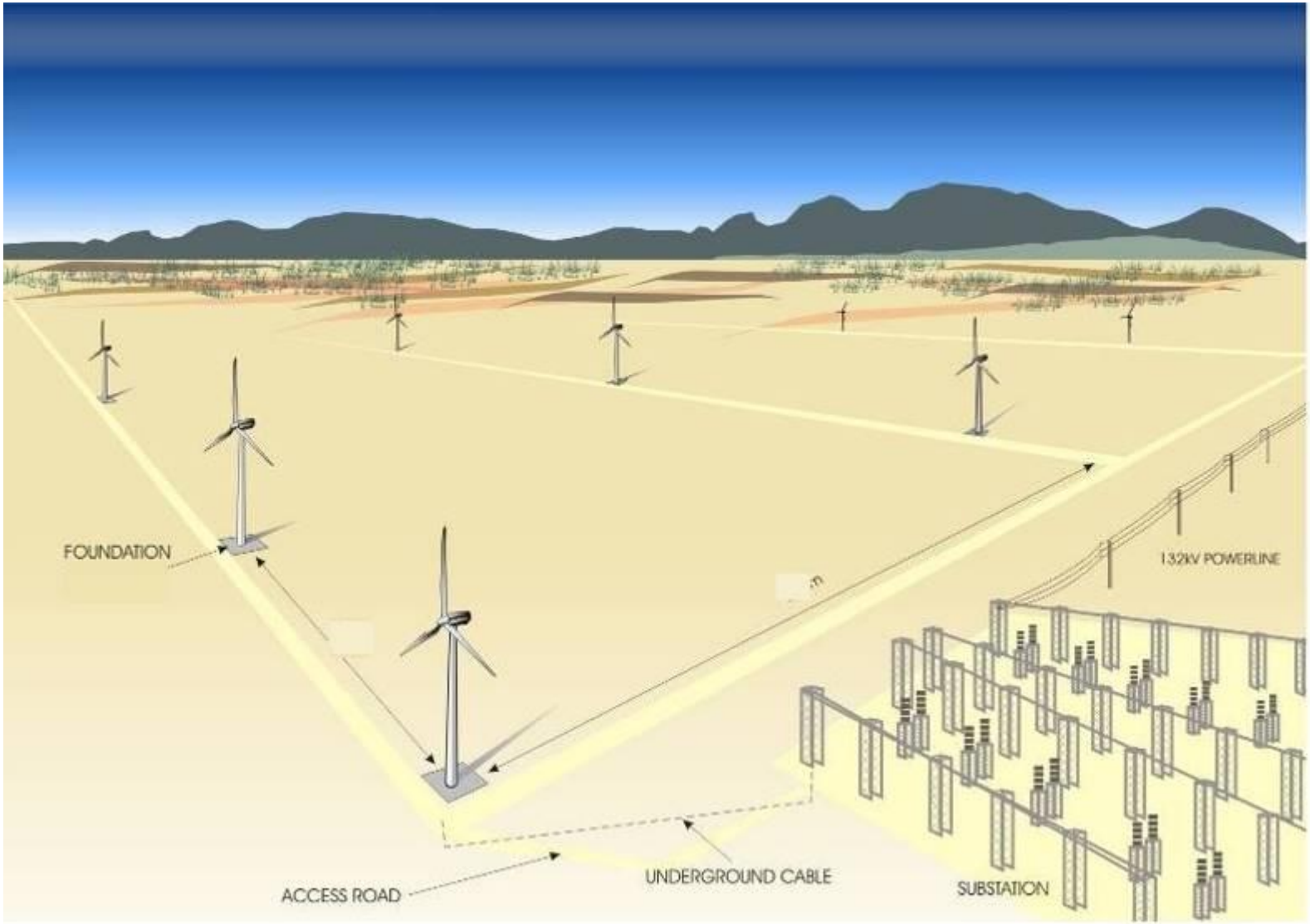

Figure 7.2: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

7.4 Decommissioning

The turbine infrastructure which will be utilised for the proposed project is expected to have a lifespan of approximately 20 – 30 years (with maintenance). Generally a power purchase agreement of 20 years is signed with the energy buyer. After the PPA comes to an end the PPA may be renegotiated at terms that are financially viable at that point in time. The PPA may be based on a shorter term agreement using the existing turbines (if the existing turbines are still suitable) or a new longer term PPA may be negotiated based on re powering (refurbishment) of the wind farm. It is most likely that refurbishment 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. New turbine technology may also reduce potential environmental impacts. Where no new PPA can be negotiated it is likely that the wind farm will be decommissioned as required in the EMP. The following decommissioning and/or repowering activities have been considered to form part of the project scope of the proposed wind energy facility.

Table 7.3: Activities Associated with Decommissioning of the Wind Energy Facility

Main Activity/Project Component	Components of Activity	Details
Site preparation	» 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) » Mobilisation of construction equipment	» 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 would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.
Disassemble wind turbines	» A large crane will be used to disassemble the turbine and tower sections. » The turbines will be disassembled and removed.	» Turbine components would be reused, recycled, or disposed of in accordance with regulatory requirements.

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY, POWER LINE & ASSOCIATED INFRASTRUCTURE CHAPTER 8

Environmental impacts associated with the proposed Zen 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 energy facility is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction of a wind energy facility project includes 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 barotrauma; 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 Programme (refer to **Appendix N**).

In order to assess the impacts associated with the proposed Zen 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. The study area for the Zen site (approximately ~83km^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 8.1** below, and includes the area covered by the following farm portions:

» Portion 1 of the farm Bonne Esperance 83
» Portion 2 of the farm Bonne Esperance 83
» Portion 9 of the farm No. 88
» Remainder of Portion 4 of the farm Kleinbergrivier No.1
» Remainder of the farm Moolenaars Drift No. 85
» Remainder of Portion 1 of the farm Moolenaars Drift No. 85

The project will include the following infrastructure:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a tower, a hub (up to 110m above ground level, depending on the turbine decided upon) and three blades.
» Permanent internal/access roads (up to 6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection or loop in loop out connection to the proposed LeBonne Substation which is located on the Farm LeBonne Esperance (adjacent to the Zen site). Two options are being considered and assessed in the EIA.

The assessment presented within this chapter of the report is on the basis of a facility layout provided by Zen Wind Farm (Pty) Ltd. This layout indicates **46 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies and addendums to these studies attached within **Appendices F – M**) considers the worst-case scenario in terms of potential impacts.

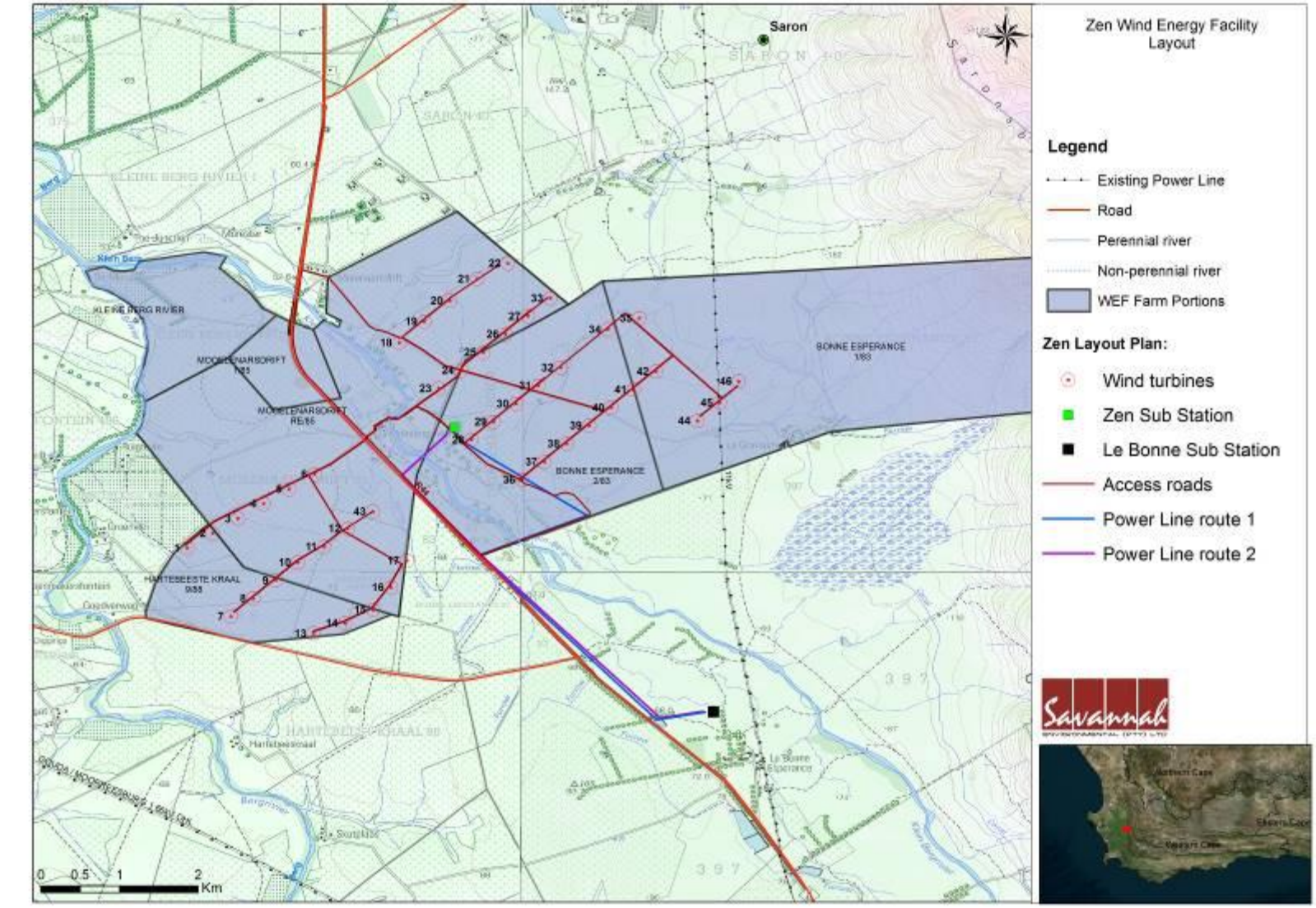

Figure 8.1: Layout map showing the revised technical design and layout of the Zen Wind Energy Facility

8.1 Assessment of Potential Impacts on Ecology

Potential ecological impacts resulting from the development of a wind energy facility at the Zen site would stem from a variety of different activities associated with the construction and operational phases of the project including the following:

- Construction Phase
  - Vegetation clearing and site preparation
  - Operation of heavy machinery at the site
  - Human presence
- Operational Phase
  - Site maintenance activities
  - Human presence
  - Operation of the turbines

The above activities may result in the following impacts on ecology:

- Impacts on vegetation and listed plant species
- Faunal impacts
- Increased alien plant invasion risk
- Increased soil erosion risk
- Reduced landscape connectivity

These impacts are discussed and assessed in the subsections below. An ecological sensitivity map for the Zen site is provided in Figure 8.2. The site consists of highly contrasting ecological sensitivity, with the transformed areas being of low sensitivity and the intact remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld being of very high sensitivity. Given the Critically Endangered status of these vegetation types and the confirmed presence of species of conservation concern on the site, the intact remnants should be considered highly sensitive and not suitable for development. The vast majority of the proposed development area is however transformed and retains very little biodiversity. Development within these areas would result in very little impact on terrestrial biodiversity and would pose little long-term risk of degradation or other negative impact on the local environment. There are no significant biodiversity features or areas of natural vegetation within the western section of the site. This area is also flat with the result that the risk of erosion and other secondary impact is also very low. It is highly unlikely that development within this area would have much impact on terrestrial ecosystems.

Within the eastern part of the site, there are several features of higher ecological sensitivity present including:

- ***The Klein Berg River which bisects the site***: There are no turbines located within the floodplain of the river and the Klein Berg River would not be directly impacted by the development. However, an upgrade to the current farm bridge

is required for access to the site, but as this area is already disturbed, it is not likely to generate significant impact.

» ***Remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld***: This vegetation occurs on the eastern section of the site. These are Critically Endangered vegetation types and despite their disturbed nature, the presence of some species of conservation concern was confirmed for these areas. No turbines are located within the intact patches of remaining natural vegetation under the current layout. The access road and presumably the cable trench from Turbine 35 to Turbine 45 traverse one of these intact patches.

A large number of listed plant species are known from the area. Table 8.1 suggests that at least 46 species of high conservation concern and an additional 21 of moderate conservation concern known from the immediate area. In addition, according to the Threatened Ecosystems in South Africa: Descriptions and Maps (SANBI/DEAT 2009), Swartland Alluvium Fynbos contains 57 Red Data plant species (EX, EW, CR, EN & VU excl VU D2) and 13 endemic plant species. Although not all of these species would occur within the site development footprint, these alarming statistics serve to highlight the imperilled state of these vegetation types and underscore the potential for significant ecological impact, should the facility impinge on the intact ecosystems at the site. Although only two species of conservation concern were observed at the site, it is highly likely that more are present. For example there are many listed *Babiana* species, and although some *Babiana* plants were observed at the site, it is was not possible to identify the plants as the flower were over. In addition, many of the listed species are by their nature rare and targeted searching would likely turn some of these species up in time. The main implication of these results is that all natural and semi-natural remnants are potentially important sites for listed species and are best avoided.

Table 8.1: IUCN status of plant species observed during the site visit or known to occur in the vicinity of the proposed Zen Wind Energy Facility, based on the SANBI SIBIS database. Threat status is according to the Red List of South African Plants (SANBI 2012).

Status	No. Species	Observed
Critically Endangered - Possibly Extinct (CR PE)	2	
Critically Endangered (CR)	6	
Endangered (EN)	22	
Vulnerable (VU)	16	1
Near Threatened (NT)	11	
Rare	3	
Declining	4	1
Data Deficient - Insufficient Information (DDD)	3	
Data Deficient - Taxonomically Problematic (DDT)	7	
Least Concern	365	87
Not Evaluated (Species not recognised)	9	
Alien (Not Evaluated)	45	35
Grand Total	**493**	**125**

Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Nature and Environmental Conservation Ordinance of 1974 and the Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000)

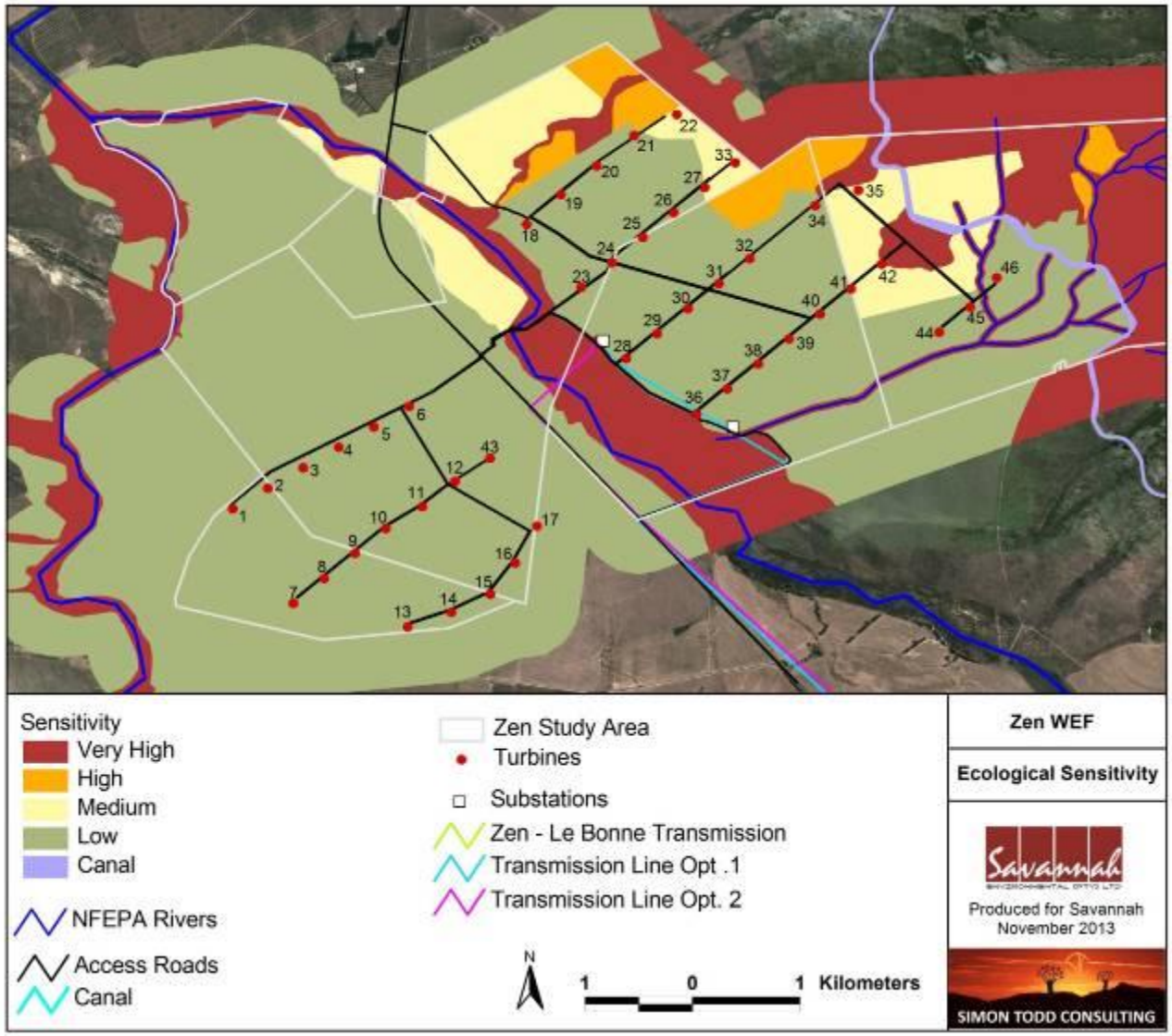

Figure 8.2: Ecological sensitivity map for the Zen wind energy facility site, illustrating the location of sensitive vegetation and the Klein Berg River

8.1.1 Impacts on vegetation and protected plant species

Given the Critically Endangered status of the Swartland Alluvium Fynbos and Swartland Shale Renosterveld any further loss of these vegetation types would be highly undesirable. In addition, these areas are known to harbour species of conservation concern and development within the remnants would be likely to impact listed species.

Impact Table - Impact on vegetation and protected plant species

Nature: Impacts on listed vegetation types and protected plant species would potentially occur due to the construction of the facility.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (2)
Magnitude	Medium (7)	Low (3)
Probability	Highly Probable (4)	Unlikely (2)
Significance	**Medium (52)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation » Remnant patches of listed vegetation types to be avoided by construction activities and infrastructure (the turbines within the ecologically sensitive areas were relocated to adjacent less sensitive areas). The location of turbines 34 and 42 should be adjusted during micro-siting to avoid any sensitivities. » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. » Where roads and other infrastructure cross sensitive features such as drainage lines, caution should be exercised to ensure that impact to these features are minimised. » Within areas that may contain species of conservation concern, the final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction.		
Cumulative Impacts There are two other wind energy facilities in the area, but the potential for cumulative impacts on ecology would be low if the remnants of the sensitive vegetation types can be avoided.		
Residual Impacts If the sensitive parts of the site can be avoided, there will be very little residual impacts on the terrestrial environment.		

8.1.2 Impacts on Watercourses

Construction may lead to some direct or indirect loss of or damage to the Klein Berg River (due to the construction of a bridge and access road and power line

across the river) and drainage lines or impacts that affect the catchment of these watercourses. Without mitigation, this could lead to localised loss of riparian habitat and may lead to downstream impacts that affect a greater extent of the watercourses or impact on their functioning. 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.

The wind turbine are not located on watercourses and avoids drainage lines present on the site; however access roads and the power line will cross the Klein Berg River and some drainage lines.

Impact Table - Impact on Watercourses/ Drainage Lines

Nature: Damage to drainage lines on the site		
	Without mitigation	**With mitigation**
Extent	Local And Surroundings (2)	Local And Surroundings (2)
Duration	Long-Term (4)	Short-Term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible To Some Degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Control stormwater and runoff water and inhibit erosion. » Disturbed areas must be rehabilitated as soon as possible. » Align internal access roads so that they branch directly from existing roads and avoid traversing drainage lines as far as possible. where this is not possible, then the following measures must be applied: • Obtain a permit from DWA to impact on any water resource. • Cross watercourses close to existing disturbances. • Adequate culvert and/or bridge structures are required at crossings.		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on riparian habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

8.1.3 Impacts on threatened animals and associated habitat

Given the highly impacted nature of the study area and in particular site affected by the development, it is likely that only a small proportion of fauna would actually

occur within the site. Free-ranging species observed during the site visit includes Steenbok *Raphicerus campestris*, Common Duiker *Sylvicapra grimmia*, Vlei Rat *Otomys irroratus,* Cape Grey Mongoose *Herpestes pulverulentus,* Cape Porcupine *Hystrix africaeaustralis,* African Mole Rat *Cryptomys hottentotus*, Cape Mole Rat *Georychus capensis* and Cape Gerbil *Gerbilliscus afra.* Three species of conservation concern potentially occur at the site, the White-tailed Mouse *Mystromys albicaudatus* (Endangered), Leopard *Panthera pardus* (Near Threatened) and the Honey Badger *Mellivora capensis* (SA RDB Endangered). All three potentially occur within the broader study area, but would be restricted to the vicinity of the natural fynbos vegetation on the upper slopes towards the east of the site and would not be impacted by turbines placed within the transformed areas. Provided that the turbines are restricted to transformed and degraded habitats, the development is not likely to have a significant impact on terrestrial mammals.

Faunal impacts are likely to most intense during the construction phase of the development on account of the large amount of physical and noise disturbance generated at this time. The presence of large number of construction personnel will also lead to increased risk to species such as snakes, tortoises and mammals which would be vulnerable to poaching for food, trade or killed out of fear and superstition. The faunal impact is likely to be strongly related to the final development footprint, with development within the transformed areas generating low faunal impact.

Impact Table - Impact on threatened animals / habitat

***Nature**:* Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated? Most aspects such as those relating to human activity can be mitigated, and habitat loss can be mitigated by avoiding the sensitive areas of the site.		
Mitigation » Any fauna directly threatened by the construction activities should be removed to a safe		

location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site. » Fires should only be allowed within fire-safe demarcated areas. » No fuel wood collection should be allowed on-site. » If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » No unauthorized persons should be allowed onto the site. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
Cumulative Impacts Given the highly transformed nature of the site and the low likely abundance of fauna of conservation concern within the development area, the contribution to cumulative faunal impacts would be very small and is not considered significant.
Residual Impacts Provided that mitigation is implemented, there are likely to be few residual impacts from the development.

8.1.4 Establishment of declared weeds and alien invader plants

Large parts of the site are already dominated by alien species or are used for agriculture and it is not likely that most of the smaller species can be controlled Disturbance created at the site during construction would leave the site vulnerable to alien plant invasion. A wide variety of alien species are already present at the site and so further disturbance would serve to exacerbate these problems. As the majority of the site is already transformed or dominated by alien species, this impact would mainly be of concern should the development footprint impinge on areas of currently intact vegetation.

Impact Table - Alien vegetation growth due to disturbance

Nature: Alien plants are likely to invade the site as a result of disturbance created during construction		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (4)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (40)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of	Yes	No

resources		
Can impacts be mitigated?	Yes	
Mitigation		
» Large parts of the site are already dominated by alien species or are used for agriculture and it is not likely that most of the smaller species can be controlled. » Larger woody species such as *Acacia saligna* should however be managed, especially along the floodplain of the Klein Berg River. » Disturbance and impact to natural and semi-natural areas should be avoided.		
Cumulative Impacts		
Given the anthropogenic nature of the landscape, and the development footprint which avoids the sensitive features of the site such as Klein Berg River, there are not likely to be significant cumulative impacts in terms of alien plant invasion.		
Residual Impacts		
If woody alien species at the site are controlled, then there will be very little residual impact		

8.1.5 Vegetation and Habitat Loss due to Access Roads

Existing access roads will be upgraded to access the site and each turbine. The layout reflect that almost all existing access roads will be used and will be widened and upgraded. Access roads will entail clearing of vegetation, therefore vegetation loss and habitat loss for plant species. Creation of access roads causes nodes of disturbance, and may become hotpots for soil erosion. This impact could occur on the site, and presents a risk particularly on steep slopes and hills, where turbines are proposed. Some access roads may inevitably cross drainage lines, which may cause cumulative downstream effects on watercourses. Therefore the impact of access roads, without environmental control measures may be of a high significance and with mitigation this impact could be manageable. This may have some impact on landscape connectivity for fauna which avoid traversing open areas or are vulnerable to predation in the open. Slow moving species such as tortoises and some snakes are vulnerable to this impact. Although the impact at any one time is small, the roads may result in a longer-term cumulative impact and species which reproduce slowly such tortoises may be particularly affected. Larger mammals are likely to be less impacted due to their mobility, but non-resident fauna may avoid the area on account of the noise generated by the turbines.

Impact Table – Impact of access roads on ecology

Nature: Loss of habitat within indigenous natural vegetation types, disturbance and soil erosion due to creation of permanent access roads.		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate (5)
Probability	definite (5)	probable (3)
Significance	**medium (60)**	**medium (33)**

Status (positive or negative)	negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: » Internal access roads must make use of existing roads on site, as much as possible. Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas. » Avoid unnecessary impacts on natural vegetation surrounding the turbines. The construction impacts must be contained to the footprint of the turbine and laydown area. » Disturbed areas must be rehabilitated as quickly as possible.		
Cumulative impacts: Soil erosion, alien invasions, damage to watercourses may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of natural vegetation type is likely to occur, but only a small extent is potentially at risk.		

8.1.6 Comparative Assessment of Power Line Alternatives

In terms of the different transmission line options, the power line Route 2 is identified as the preferred alternative from an ecological perspective, as it traverses less of the high ecological sensitivity areas, and is 1km shorter than Route 1. Route 2 is aligned adjacent to the R44 would also serve to reduce its potential ecological impact as compared to the Route 1. Therefore the power line Route 2 is nominated as preferred from an ecological perspective.

8.1.7 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. Cumulative impacts for this assessment will include any approved wind energy facilities in the area. There is one approved wind energy facility which is under construction adjacent to the Zen site, i.e. the Proposed Gouda wind energy facility.

Cumulative ecological impacts are therefore expected due to the additive effect on two wind energy facilities on the site and are expected to be of a moderate significance and include cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion), and can be effectively mitigated through sound environmental management (mitigation measures) during construction and operation covered in the EMP and by formal conservation and

active management of the natural areas on site. Given the anthropogenic influence of the landscape, and the development footprint which avoids the sensitive features of the site such as Klein Berg River and majority of the remaining natural vegetation, there are not likely to be significant cumulative impacts on ecology. With the implementation of this mitigation, cumulative impacts on ecology as a result of the establishment of the project are of an acceptable level.

8.1.8 Conclusions and Recommendations

The site consists of highly contrasting ecological sensitivity, with the transformed areas being of low sensitivity and the intact remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld being of very high sensitivity. Given the Critically Endangered status of these vegetation types and the confirmed presence of species of conservation concern on the site, the intact remnants should be considered highly sensitive and not suitable for development. The vast majority of the proposed development area is, however, transformed and retains very little biodiversity. Development within these areas would result in very little impact on terrestrial biodiversity and would pose little long-term risk of degradation or other negative impact on the local environment.

The following recommendations are made:

» Under the layout provided for this assessment, there are no turbines within intact vegetation remnants. However, a section of access road between turbines 35 and 45 traverses an intact vegetation remnant of Swartland Alluvial Fynbos which is listed under the National List of Threatened Ecosystems as Critically Endangered. A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is 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.
» No TOPS species where identified on the site during the felid survey. Should TOPS species be identified during the final ecological survey, in terms of the NEM:BA a permit (a TOPS permit) will be required for any activities/ removal of TOPS listed species.

» Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Nature and Environmental Conservation Ordinance of 1974 and the Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000)Establish an on-going monitoring programme to detect and quantify any alien plant species that may become established as a result of disturbance.
» Implement mitigation measures during construction and in the long term as stipulated in the EMPr.
» Appoint an ECO during construction.

8.2 Assessment of Potential Impacts on Avifauna

The avifauna specialist study recommended that a radar survey be undertaken to understand night-time movement of birds across the site. The results of the radar survey were taken into account in the avifauna impact assessment.

The completion of the bird and bat pre-construction monitoring programmes, and an updated impact assessment based on the results of the bird and bat pre-construction monitoring programme.

Pre-construction bird monitoring programme

A pre-construction bird monitoring programme conducted across a 27 month period from September 2012 to December 2014, and for a total observation period of more than 400 hours. The monitoring followed BirdLife South Africa's guidelines (version 2, Jenkins et al. 2012)). Field techniques employed in 2012-2013 were: observations from 6 vantage points; 8 walked linear transects (3 of them controls); 2 driven transects; inspection of identified focal sites; and incidental observations made by observers while traversing the study area. In 2014, 3 key vantage points, from which all proposed turbine areas were visible, were each monitored for a total of 12 hours in four seasons. The baseline data from the bird monitoring programme has been considered in the avifaunal assessment to support the EIA field survey and inform the impact assessment (refer to Appendix G).

Radar Survey

In addition to the pre-construction monitoring programme, the avifauna specialist study recommended that a radar survey be undertaken due to the need for a better understanding of the risk to waterbirds moving to and from Voelvlei dam at night. Water birds transit the area on route to the wetland to the south of the ste. However, it was not known how much of this movement occurs at night or under other conditions of poor visibility. The developer appointed EchoTrack to monitor the use of this area by water birds using remote sensing (radar-acoustics). The radar study was designed to investigate the potential for collision risk to water birds

in the area planned for wind turbine development. It is supplementary to the overall EIA. The monitored data was available to the avifaunal specialist and has been considered in the avifaunal assessment to support the EIA field survey (refer to Appendix G).

Habitat for Birds

The site provides a moderate diversity of habitats for birds. Investigation of the study area and the Zen site revealed the following bird micro-habitats on the site:

» Rivers or streams and drainage lines: the Klein Berg River traverses the site.
» Dams: farm Dams and the Voelvlei Dam and canal (located outside the site; >10km south of the site).
» Dryland habitat: trees, shrubs, grasslands and croplands.

The study area is located adjacent to the northern extremity of the Eastern False Bay Mountains Important Bird Area and more than 10 km of the Voëlvlei Dam, an artificial impoundment which is locally significant for wetland species. Blue cranes and fish eagles have been confirmed to occur on the site during bird monitoring. Based on the data collected on birds in the study area, 21 target/priority species were identified (refer to Table 8.2). The primary priority species in the Zen site is the Blue Crane. Of the other priority species most of those that were recorded during the pre-construction bird monitoring programme occurred in small or negligible numbers and or for short periods in the year.

Table 8.2: Target / priority species for the Zen study area relative to their conservation status and established risk of mortality due to collision with wind energy facility structures (see text for explanation).

Species	RDB	ESK	WCP	Comments	Risk
White Stork	[E][1]	3	16	Most are Palaearctic migrants but there is a tiny breeding population in the Western Cape Province	highest
Blue Crane	V	2	12	Widespread in southern Swartland	highest
Lesser Kestrel	V	-	7	Seasonal visitor. AEWA concern. Focal roosts	high
Black Harrier	NT	-		Largely restricted to shrubland habitats	medium
Black Stork	NT	3	15	Critically endangered in WCP. Collision risk similar to White Stork	highest
Greater Flamingo	NT	4	16	AEWA concern. Flocks. Nocturnal flights	high
Secretarybird	NT	9	16	Small population within southern Swartland	high
Lanner Falcon	NT	-	6		medium
Peregrine Falcon	NT	-	10		medium
Great White Pelican	NT	-	15	Large size. Flock flier. Low aerial agility	high

Species	RDB	ESK	WCP	Comments	Risk
African Sacred Ibis	-	6	6	Large size. Flock flier	Medium
Karoo Shelduck	-	8	9	South African endemic. Nocturnal disperser	Medium-high
Egyptian Goose	-	10		Wetlands. Large. Flock flier. Nocturnal disperser	Medium
Yellow-billed Duck	-	13	6	Wetlands. Nocturnal disperser	Medium
Jackal Buzzard	-	14	9	Widespread terrestrial	Medium
Grey Heron	-	15	7	Large. Wetland rooster & breeder.	Medium
Cattle Egret	-	16	4	Terrestrial forager. Wetland rooster & breeder. Flock flier.	Medium
Black-headed Heron	-	17	6	Terrestrial forager. Wetland rooster & breeder.	Medium
NEAR-ENDEMICS				**Species with an estimated >15% of the global population in the Swartland**	
Cape Shoveler			7	Sn. African endemic. High % population in Swartland	Medium
Cape Teal			5	Sn. African endemic race? High % population in WCP	Medium
Southern Black Korhaan			10	South African endemic.Terrestrial. High display flights	Medium

Notes for Table 1. RDB - Red Data Book (Barnes 2000) status; E - Endangered; V - Vulnerable; NT- Near-threatened; ESK: Top species in Eskom's collision database. WCP (Westen Cape Province): Prioritisation rating (20 = maximum concern, 0 minimum) of bird species for conservation concern in the entire Western Cape Province (Shaw 1995).

Several other priority waterbird species occur on the Zen site. Most of these are restricted to still waterbodies and make limited use of adjacent terrestrial ground. Of the three local waterbodies, the flooded borrow pit beside the R44 is the most important for waterbirds as, despite being situated beside the busy R44 road, it supports a larger diversity of waterbird species and is used by three species for breeding and probably by Blue Cranes as a night roost. Waterbirds unfamiliar with an area often use the presence of local waterbirds as an indication of suitable conditions. This further emphasises the importance of the borrow pit waterbody. Among the priority waterbird species Greater Flamingo's and White Pelicans can only be considered irregular visitors in small numbers and Black Storks are unlikely to occur given their tiny population in the Western Cape.

Wind energy facilities have three forms of impact on birds – habitat destruction, population displacement, and, in particular, mortality through collisions. These potential impacts are assessed below.

8.2.1 Displacement of Birds due to Disturbance

Development of the footprint (roads, turbine bases etc.) inevitably causes the loss of foraging and nesting habitat for most species of birds. Birds displaced by this loss of habitat must find alternative suitable habitat, which may be less favourable. The displaced birds must compete for resources with the established population of birds of the same or other species potentially to the detriment of both. The result is a reduction in the local population of most small birds. This is not considered to be a major concern in the Zen wind farm. The passerines that currently occur in the agricultural lands have increased their regional population with the transformation of the Swartland from predominantly scrublands to quasi-grassland. The species that are most prolific are adapted to local nomadism shifting between fields according to changes in the micro-habitats. The populations of some species may even increase. These include birds which may forage and display along seldom used gravel access roads (Douglas *et al.* 2011) and, if turbines deter avian predators the populations of prey species may locally increase (Leddy *et al*. 1999).

Habitat destruction is scarcely an issue for the proposed Zen wind energy facility as it will be constructed on already transformed, agricultural land with the turbines and associated infrastructure located at a reasonable distance from any uncultivated vegetation or any wetland. Nor is population displacement a major issue for most resident bird species since they already cope with local displacement through intra-annual changes in crop growth and on an inter-annual basis through changes in fields from cereal cropping in some years to fallow in others.

Construction period disturbance and subsequent maintenance are also unlikely to have substantial negative effects on resident bird populations since the species affected are already accustomed to major disturbances as a result of agricultural practises – ploughing, sowing, harvesting etc. A potentially negative issue is the effect turbine noise may have on birds accustomed to generally quiet habitats. Turbines create noise that can be heard by humans up to 2 km distant. Studies of birds along roads have shown that due to traffic noise some bird species are less common, or even absent, within 2-5 km of major roads (Forman & Deblinger 2000, Rheindt 2003). To date there has been no assessment anywhere in the world on the effect that wind turbine noise may have on local bird populations.

Impact Table - Impact on birds due to disturbance

Nature: Movement and noise during the construction process is likely to impact all birds in the immediate area. Larger species will be the most affected.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short (1)	Short (1)

Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Definite (5)
Significance	**Low (20)**	**Low (20)**
Status	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources	Unlikely	Unlikely
Can impacts be mitigated	No	
Mitigation: Not deemed necessary. The priority bird species affected are accustomed to substantial disturbance from agricultural activities and will merely move to similar habitat in nearby undisturbed areas.		
Cumulative impacts: There are two other proposed wind energy facilities on adjacent properties. Should construction be concurrent there will be displacement on a broader basis than for the Zen site alone.		
Residual impacts: No birds in priority species are likely to recruit to the affected area during construction.		

8.2.2 Bird Mortalities due to collisions with wind turbines

The crucial issue of concern is mortality of birds through collision with the turbine rotor blades and the degree to which such mortality is acceptable for particular groups or species of birds. The risk of collision mortality varies in several general ways and these affect the manner in which collision mortality can be mitigated. Birds flying in daylight have a better chance of seeing and avoiding turbines than those flying at night –hence the major concern raised earlier over the night moving transients. Daylight fliers may have an increased risk in periods of fog or mist when visibility is severely reduced. In the Swartland fog is associated with low-lying riverine areas. Most of the planned turbines are located well away from the two local rivers so fog collisions are not considered a substantial risk. The other factors that affect bird collision with turbines are: 1) the degree to which birds fly at heights equivalent to the turbine rotor blade arcs which in the Zen Wind Energy Facility are planned to be between 20-35m to 130-150 m above ground level; 2) their ability to manoeuvre in flight – which is lower for larger and heavier bird species; 3) the degree to which birds may be pre-occupied - i.e. through chasing prey or in courtship display – and so pay less attention to moving rotor blades; 4) familiarity with the location of turbines; 5) the frequency with which they place themselves at risk of collision; and 6) the angle of approach since rotor blades are more conspicuous seen head on than from the side.

Most bird species will in some conditions fly in the height band that would place them at risk of collision with rotor blades though some do so considerably more often than others. An important, but arbitrary, division can be made between smaller birds which are more manoeuvrable in flight, generally more fecund, and with a larger population per area than larger, less manoeuvrable, less fecund, birds

which have far lower population densities. Collision mortalities have a lower impact on populations of smaller birds, which are geared to rapid reproduction, than populations of larger birds. Also because smaller birds are more often resident in relatively small territories they are more familiar with, and so theoretically better able to avoid, the location of turbines than larger birds which move over greater areas. However, resident small birds are likely to pass close to local turbines, and from the side, more frequently than larger birds, and are more likely to collide with turbines in windier weather. Birds with display flights and aerial foragers are more prone to collision than those that remain and forage close to or on the ground.

Avifaunal Sensitive Areas and Collision Risk Areas

In order to determine the Collision Hazard Index (CHI) for avifauna, a differential value was attributed to each different type and height of flight of the birds observed during the pre-construction monitoring programme. The collision risk was considered higher when the flight height coincided with the swept area of the turbine blades. At the same time, behaviours in flight such as hunting, territorial or exhibition and soaring flights were considered as posing higher risks and were attributed a higher score (Barrios & Rodriguez, 2006). The classifications and numerical values given to each type of flight are listed in in the tables below. CHI values for each flight observed were calculated using a mathematical formula.

Table 8.3: Collision risk by flight type.

Behaviour	Flight Type	Risk classification
Passage / Commuting	Passage flights	1
Soaring	Soaring flights	2
Hovering	Hunting flights	2
Hunting (including nose dives)		2
Display/territorial	Territorial flights	2
Resting/sitting/perching	Other	1
Calling		1

Table 8.4: Collision risk by flight height

Flight Height	Risk classification
Bellow rotor height (<50 m)	2
Rotor height (50m – 150m)	4
Above rotor height(>150 m)	1

Figure 8.3 shows sensitive habitat and potential collision risk areas for the Zen Wind Energy Facility site. The results of the pre-construction bird monitoring show that:

» The north western quadrant of the study area is considered to have the higher potential collision risk. No turbines are located in this quadrant.
» The junction between the two rivers bisecting the study area (the Berg River and the Klein Berg River) is an area of higher activity for waterbirds and for raptors, in general.
» The area along the two rivers and at water bodies presents higher potential collision risk.
» Cranes were detected fairly widespread throughout the study area, presenting highest numbers in the area of the southern cluster of turbines.

The results of the pre-construction bird monitoring revealed that the collision hazard indexes for the different groups (waterbirds, cranes, accipitrid raptors and falcons) and for the general bird community were higher within 200m from rivers, streams and water bodies. The Blue Crane was not affected by this factor though, and therefore its distribution should be conditioned mainly by other environmental factors, such as the agriculture practices or food availability. Waterbirds are very abundant in the area and therefore present the highest collision risk of all the groups. The Klein Berg and Berg Rivers are areas of potential collision risk for accipitrid raptors and waterbirds. This is particularly evident at the junction of these two rivers, to the north of the development area, where no turbines are planned to be constructed.

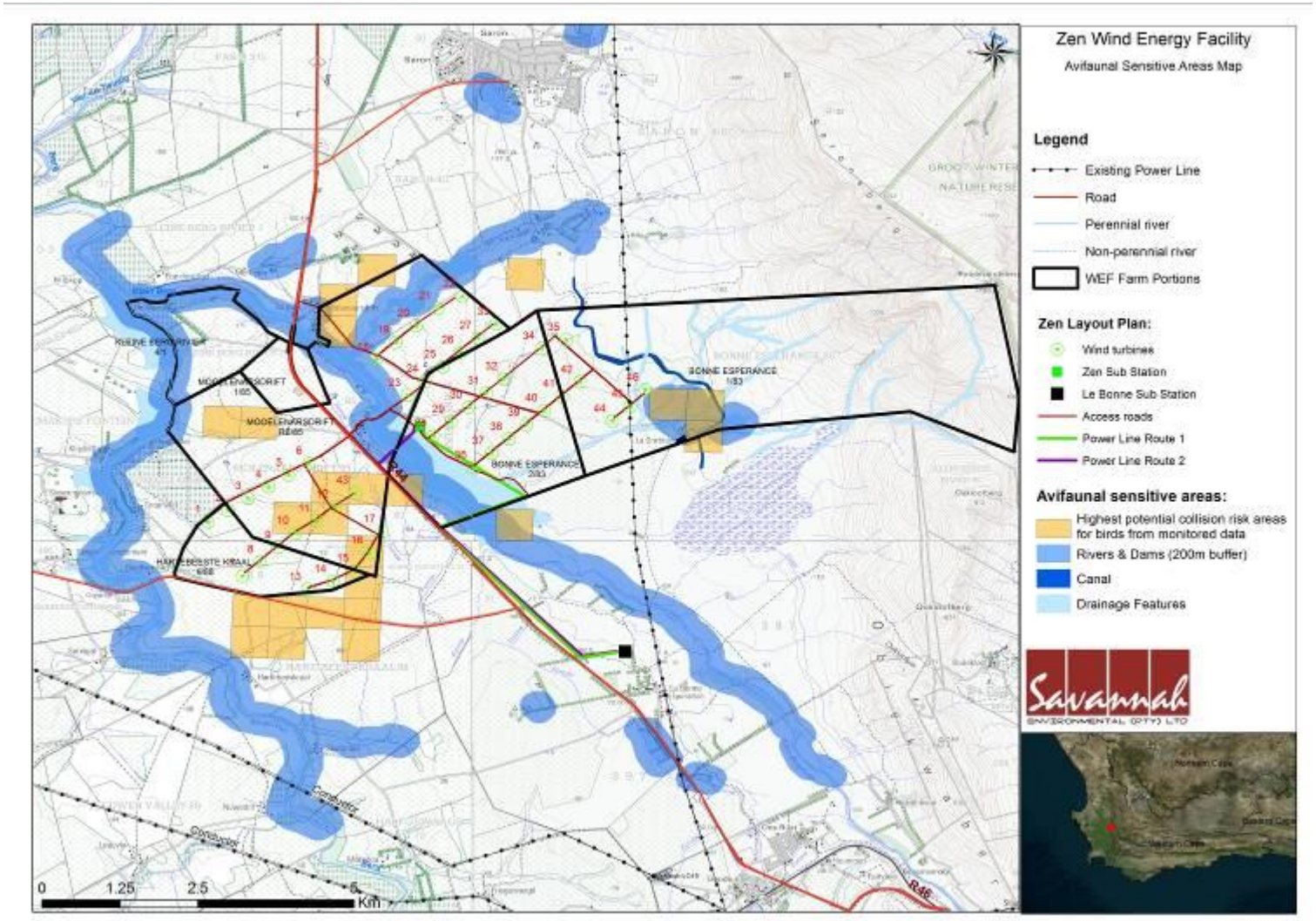

Figure 8.3: Map showing avifaunal sensitive areas and areas of highest collision risk for the Zen site

Impact Table - Bird Mortalities due to collisions with wind turbines

Nature: Collision of birds with wind turbines		
	Without mitigation	With mitigation
Extent	Regional (5)	Regional (5)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Moderate (8)
Probability	Highly probable (4)	Probable (3)
Significance	**High (76)**	**Medium (51)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Possible
Can impacts be mitigated	Yes	Yes
Mitigation: » Additional available or potential mitigation options would need to be employed once the turbines are already operational, if monitoring reveals significant impacts. » Adequate illumination of rotor blades at night using intermittent, and ideally, green or blue light. » Continue operational phase bird monitoring.		
Cumulative impacts: Multiple wind energy facilities may result in a larger impact on birds in the area.		
Residual impacts: Some mortalities will occur regardless of mitigation.		

8.2.3 Collision / Electrocution of Birds by Power line

The Klein Berg River is a flight-line for waterbirds and the riparian trees form a flight-line for woodland birds. Woodland birds are adapted to see and avoid obstructions, such a twigs and branches, and the risk of their collision with the power lines is considered negligible. Waterbirds are used to flight over open water with no obstructions and so are prone to collisions especially so if they travel at night or during foggy conditions. To minimise collision mortality the new power line must be equipped with bird diverters that are visible both by day and night. Diverters that use solar charge to glow at night are available.

» **Collisions** are one of the biggest single threats posed by overhead power lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. 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). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or

breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the result that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term.

» Avian **electrocutions** occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman et al. 2007). Electrocution risk is strongly influenced by the voltage and design of the hardware installed (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components. Mitigation of electrocution risk involves the use of bird-safe structures (ideally with critical air gaps >2 m), the physical exclusion of birds from high risk areas of live infrastructure, and comprehensive insulation of such areas (van Rooyen 2004b, Lehman et al. 2007).

Impact Tables – Electrocution / Collision of birds with the Power line

Nature: Electrocution of birds on the overhead power line.		
	Without mitigation	With mitigation
Extent	Regional (3)	Local (1)
Duration	Long term (5)	Long term (5)
Magnitude	Medium (3)	Low (1)
Probability	Definite (5)	Highly probable (4)
Significance	**Medium (55)**	**Low (28)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: » A bird friendly mono-pole design, with bird perch (as per Eskom Guidelines) should be used in order to prevent electrocutions. » Bird diverter devices spaced at 1 m intervals along the line (as the flight line is narrow) where it crosses the river. The devices used must have nocturnal illumination.		
Cumulative impacts: Compounding		
Residual impacts: Medium		

8.2.4 Cumulative impacts

There are several forms of cumulative effects relative to wind farm developments. One is when a bird species resident in a proposed wind energy facility is likely to be affected by not one but several impacts. Another is the effect of impacts in the immediate neighbourhood of the proposed farm. This may be from the development of other wind energy facilities – as proposed for the area immediately

south of the Zen farm – or other significant land use changes. A third is when changes at some distance (even continentally) have the effect of depressing the population of a bird species which is then further impacted through loss of habitat or collision mortality at the wind energy facility. All these cumulative effects can be subject to further cumulative effect over time. Development of the Zen Wind Energy Facility may lead to examples of all three types of cumulative effects. Here they are considered in reverse order.

Karoo Shelducks undergo marked population fluctuations related to changes in rainfall in their primarily karoo breeding habitat. In periods of drought the population is decreased and more birds move into wetlands in the winter rainfall region of southern Africa. This is likely to result in more birds, and a higher proportion of the global population, using Voelvlei as a moult refuge. Should numbers of these night moving ducks die through collision with wind turbines at the Zen and proposed adjoining wind farms, turbines collision mortalities could feasibly further depress the global population, especially if such mortalities persisted over a prolonged (several years) drought period. If, as predicted, rainfall in the karoo becomes lower and more irregular as a result of global climate change the global population of this endemic shelduck will decrease and mortality through collision with wind turbines would be of increasing concern.

The Zen wind energy facility is proposed because it is situated in an area of persistent strong winds. Already two other wind energy facilities have been proposed on adjoining land. The total number of turbines in the three already proposed wind energy facility's is about 102. In all probability further wind energy facility's will be proposed in the Zen sub-region. Each wind energy facility development will result in collision mortalities and the likely displacement of the more sensitive species. If, for example, each turbine kills 3 locally resident birds a year then already the annual mortality over the three wind energy facility's will be 600 and this rate would probably persist for the full 20 years of expected operational life of each turbine. For species with a relatively high collision mortality rate and a small local population this could lead to progressive population depression which would be of particular concern if these were already conservation priority species.

The Blue Crane epitomizes the cumulative effects of wind energy facility developments on a single species. These large birds are prone to collisions and sometimes fly at heights that correspond with rotor blade sweep areas and move across country at night as well as by day. In the Zen area Blue Cranes occur largely in the croplands and pastures, including those where turbines are planned to be located. Though tolerant of disturbance e.g. road traffic, the cranes are likely to experience a degree of habitat loss and potentially displacement in addition to collision mortalities. This species is endemic to southern Africa where it is the

national bird of South Africa. It is classed as vulnerable to extinction because the population has fallen from an estimated 100,000 in the 1960s to between 15,000 and 25,000 in latest available assessment in 1998-2003 (Allan 2005a).

8.2.5 Comparative Assessment of Power Line Alternatives

A new power line will cross the Klein Berg River from the proposed Zen Substation. This line will form an obstruction to birds which use the river and its associated vegetation as a flight line. Collision with this line must be mitigated by installation of bird diverters where the line crosses the river. As many water birds travel by night, and the valley is seasonally subject to mists and fog, the bird diverters must be of a kind that is illuminated.

Route 1 (~6.5 km in length) is planned to run inland across Farm Bonne Esperance, then turn towards the R44 and run along the R44. The power line Route 2 runs along the R44 to the LeBonne Substation and is ~5.5 km in length. Both power line routes cross over the Klein Berg River at different points. Route 2 is identified as the preferred alternative from an avifaunal perspective, as it is aligned adjacent to the R44 and is shorter in length than Route 1. Therefore the power line Route 2 is nominated as preferred from an avifaunal perspective.

8.2.6 Conclusions and Recommendations – Avifauna

The main area of concern for avifauna is mortality through collisions with rotor blades. Of the bird species that may be affected, many have large populations across the Swartland and most of the others occur in the Zen area in very small numbers so that a low level of collision mortality will have no marked effect. Of the 21 identified priority species, two local resident species – Blue Crane and Spurwinged Goose - are at highest risk of mortality through collision and potentially also through displacement from breeding or foraging areas. Most of the other priority species e.g. Greater Flamingo and Martial Eagle, occur in the Zen area in far smaller or negligible numbers, and/or too infrequently, to be a source of concern. Karoo Shelduck and Egyptian geese are other species occurring in the area noted to be at higher risk of collision.

As the adjoining Gouda Wind Energy Facility is currently under construction, and has similar habitat and bird species, this presents a unique opportunity for the Zen Wind Energy Facility developers to consider actual mortality rates for a wind project in this area. Any data collected post-construction at Gouda Wind Energy Facility would improve the confidence in mortality prediction and should be considered for the Zen project.

8.3 Assessment of Impacts on Bats

The bat pre-construction monitoring programme commenced in September 2012 and has been completed for the Zen Wind Energy Facility. The purpose of the bat pre-construction monitoring programme was to support the findings of the bat impact assessment in line with the Best Practice Guidelines for bat monitoring, and to ensure that appropriate mitigation measures are recommended. This approach also aimed to ensure that the DEA has sufficient information on which to make a decision. The results of the pre-construction monitoring have been considered in this Final EIA Report.

8.3.1 Bat Communities

Through the pre-construction bat monitoring programme conducted between September 2012 and August 2013, a total of 9 bat species were confirmed in the study area. Five Red Listed bat species were confirmed on the site i.e.: *Miniopterus natalensis, Myotis tricolor, Rhinolophus capensis, Rhinolophus clivosus* and *Rhinolophus darlingi*, all with populations considered Near Threatened in South Africa (Friedmann & Daly, 2004). The remaining species are considered to be of "Least Concern" in South Africa. One of the species confirmed, the Robert's flat-headed bat (*Sauromys petrophilus*) is considered endemic to Southern Africa (Monadjem *et al*., 2010). With the exception of *Miniopterus natalensis* and *Myotis tricolor* most of these species have a low risk of collision with wind turbines. Both *Miniopterus natalensis* and *Myotis tricolor* have a medium – high risk of collision, due to their known migratory behaviour. Two additional species were considered to possibly occur in the study area: Lesueur's wing-gland bat (*Cistugo leseueri*) and the Angolan wing-gland bat (*Cistugo seabrae*). Some echolocation calls were identified as belonging to either one of the species and were considered as a species group (*Cistugo leseueri/ Cistugo seabrae*). It was not possible, however, to distinguish which was the species present as their echolocation calls have very similar parameters and cannot be accurately distinguished with a high degree of confidence. Both species have a conservation status of concern, being the first considered "Near Threatened", while the *Cistugo seabrae* is considered as "Vulnerable", according with the South African Red List (Friedmann & Daly, 2004). According to the IUCN, these are also species of conservation concern: *Cistugo leseueri* is globally considered as "Vulnerable" and *Cistugo seabrae* is "Near Threatened" (IUCN, 2012).

The most common and active species detected in the study area was the *Tadarida aegyptiaca*, being recorded in all surveys sampled. Other highly frequent species in the study area were the *Neoromicia capensis*, the *Miniopterus natalensis* and the *Eptesicus hottentotus*, as they were detected in almost all of the surveys conducted). Regarding the remaining five confirmed species, the *Myotis tricolor* was recorded only in October and November; *Sauromys petrophilus* was identified only in the February surveys; *Rhinolophus darlingi* was detected only in April,

Rhinolophus capensis was detected in July; and *Rhinolophus clivosus* was recorded in November, April and May.

8.3.2 Bat Roosts

The pre-construction bat monitoring programme recorded a total of 23 potential roost structures: 21 structures and 2 orchards, with the presence or evidence of bats or individuals found in 12 of the structures inspected. At Bonne Esperance 6 three unidentified bats were observed in a small crevice. At the Mond 2 individuals was detected between the roof and the wood bracket, but also did not allow for the species identification. At the Goedverwag, 1 roost the individual observed was found dead in one of the rooms, being identified as *Neoromicia* sp. (most likely *Neoromicia capensis)*. At the Mond 2 bat droppings were observed and 25 individuals possibly of *Neoromicia capensis* were detected leaving the building for forage. Bonne Esperance roosts were revisited in May 2013, revealing that some of the structures (Bonne Esperance 1, 2, 3, 4, 5, 7, 8, 9 and 10) had since had their roof structures removed, and were therefore considered not to have any potential to provide roosting for the bat species from the site.

Considering all roosts observed, one single genus was confirmed using the locations identified (*Neoromicia sp.*). In the study area, a species of this genus was confirmed, the *Neoromicia capesis*, which has "Least Concern" conservation status according to the South Africa Red List, and medium probability of collision with wind turbines (Sowler & Stoffberg, 2012).
The confirmed bat roost closest to a wind turbine is Gratitude 3 (850m). However the presence of wind turbines within a distance of 1000 meters from roosts may not constitute an increase in the risk of bat fatality with wind turbines, since when bat species forage they tend to look for areas far from their daytime roosts (Brigham, 1991; Heithaus & Fleming, 1978). Considering that at this roost only small accumulations of guano were observed, it is not expected to be a particularly important roost for the bat community of the study area. A 500 m buffer surrounding bat roosts has been applied (refer to Figure 8.4). No turbines occur within 500 of a bat roost.

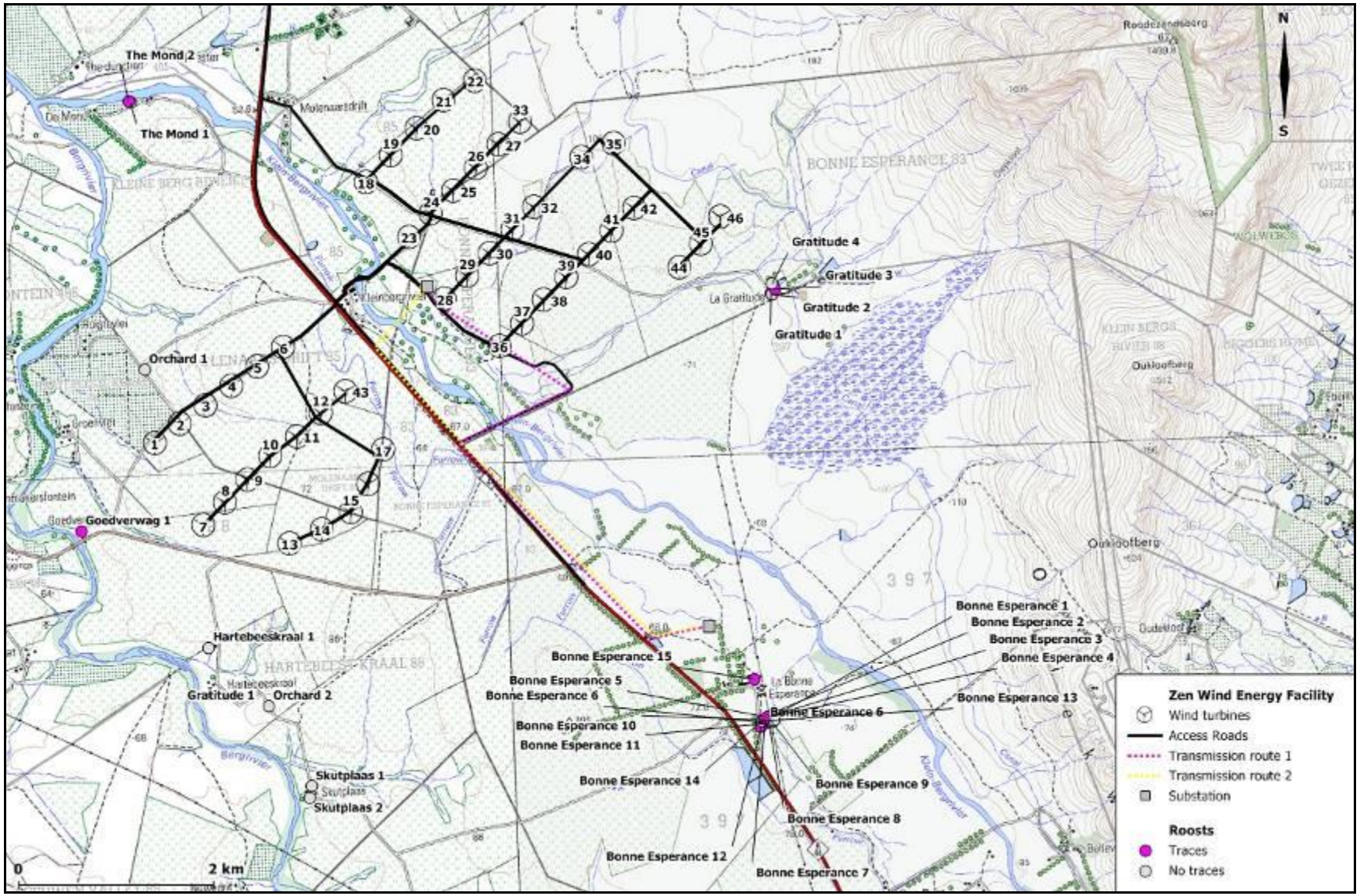

Figure 8.3: Bat roosts locations identified in the broader study area

8.3.3 Habitat for Bats on the Site

Most of the site is considered as medium sensitivity to bats, due to the presence of important biotopes for bats associated with several roosting locations. The mountain side, rivers, water bodies, and cropland areas were considered of habitat sensitivity areas for bats (refer to Figure 8.4). The following are bat sensitive habitat:

» The Berg River and the Klein Berg River. A minimum restrictive buffer of 200 m has been applied where turbines should be excluded from development.
» Cereal plantations which are bat foraging areas. These are not no-go areas, but it is preferred that foraging conditions remain available for bats. Therefore, mitigation measures are proposed to a) intensify the opportunity for foraging in areas where turbines are not located, and b) reduce the potential collision risk for bats around the turbine locations. Land management practices beneath the turbines should ideally not attract bat species vulnerable to collision (e.g. open air-foragers or clutter-edge foragers).
» Bat roosts. A 500m buffer on bat roosts is recommended. These buffer areas should also be considered as indicative of highly sensitive areas that should not be disturbed in order to prevent disruptions of two of the most sensitive events for bats: hibernation and reproduction. The preference is for wind turbines to not be implemented within these areas, however, the buffer area is not listed as an exclusion area where wind turbines cannot be placed. Disturbance should, however, be avoided and minimised within the buffers.

The areas of higher sensitivity identified for bats through the pre-construction bat monitoring programme are, in general, in accordance with the already presented sensitive locations in the draft EIA report (Savannah Environmental, 2012). The only two differences considered were that a) previously the cereal cropland was not identified as an important area for bats, since the results from two sampling surveys undertaken at that time were not robust enough to predict this trend; b) the inclusion of the mountain side was not considered in the mapping of the sensitive areas. No turbines are proposed on the mountainous area (located at the extreme eastern part of the affected farm portions), and therefore not considered relevant for the micro-sitting analysis of the proposed wind turbines of the present layout. The mountain side is, however, still considered as a very important and sensitive area for bats, being possibly the location of several roosts for the bats species identified at the study site.

For an optimal turbine layout any of the mentioned sensitive areas for the bat communities should be avoided or modified as little as possible. Disturbance within the considered sensitive areas should be avoided both during the construction and operation phase of the development. The following information is relevant in terms of the final layout proposed for the Zen wind energy facility:

» 32 of the 46 wind turbines are located within areas considered to be sensitive for bats as being located inside cropland areas. However, no relocation of the wind turbines is required if the correct mitigation measures are implemented during operation of the wind farm.
» No wind turbines are proposed within riparian vegetation or within the defined 200 m buffer.
» No wind turbines are proposed within the 500 m buffer surrounding bat roosts.

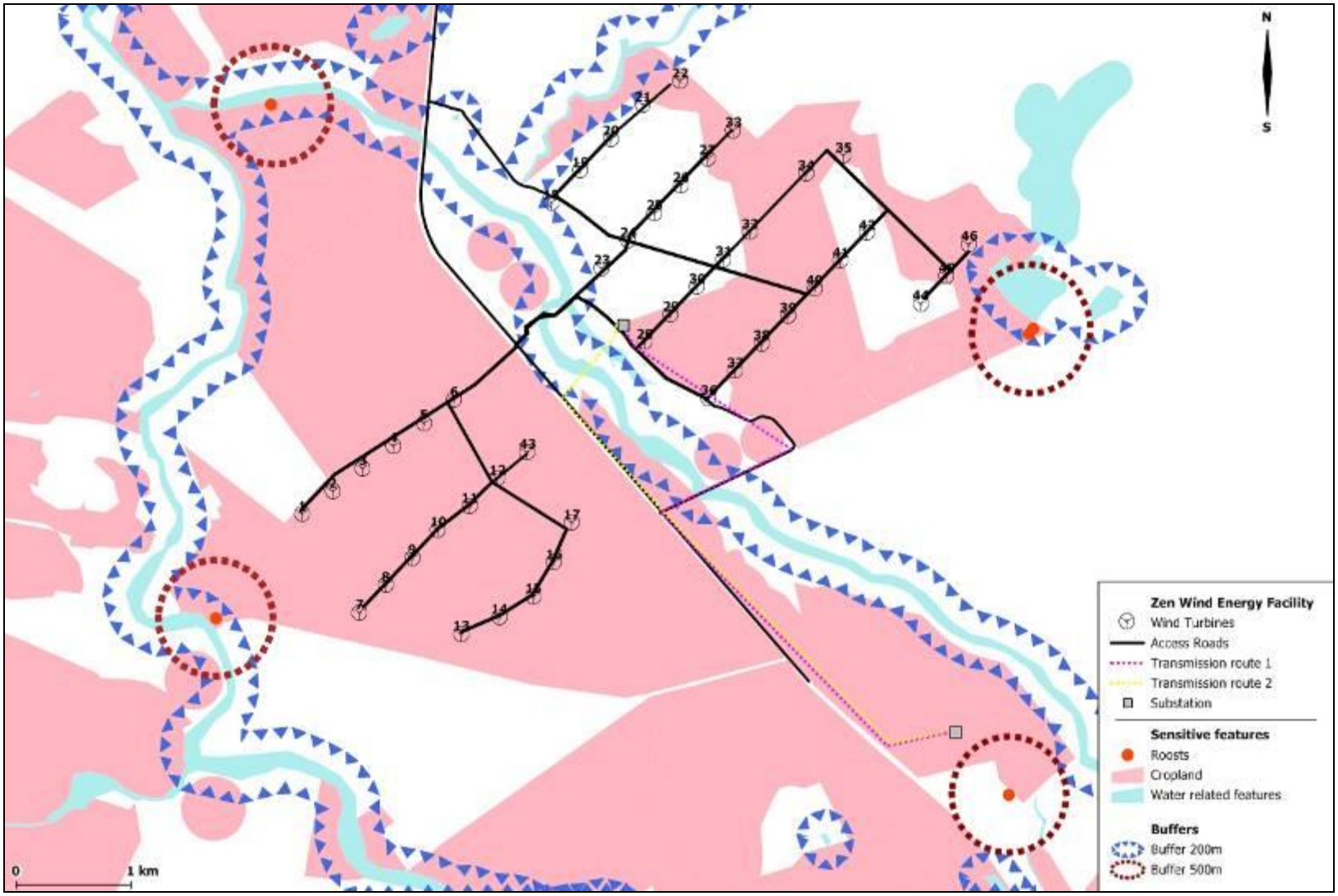

Figure 8.3: Bat sensitive habitats identified through the pre-construction monitoring undertaken within the study area

8.3.4 Disturbance and/or destruction of bat roosts due to construction activities

The main impacts resulting from the construction phase will be habitat destruction due to the clearance of the working areas and disturbance of bats due to the increase of people and vehicles in the area, high levels of noise and machinery movements. The study area is predominantly agricultural land (cereal cropland and pastures) and natural vegetation (on the eastern part of the affected farm portions, close to the mountain). The two rivers which bisect the study area are characterised by riparian vegetation, as well as some dams and wetlands spread across the site. It is expected that the affected biotopes will be mostly agricultural areas once all the turbines and most of the road accesses and underground cabling are proposed to be implemented in agriculture areas, road accesses are proposed on existing roads for most of their extent, except when is not possible. The agricultural lands and water features are biotopes with medium value, as the species that can use these are not threatened or with declining populations, but the analysis of bat activity in the study area proved that bats actively use these biotope types. Agricultural areas are easily recovered to their pre-construction condition, once the construction activities ceases, however wetland vegetation is more sensitive and may not recover as fast.

The areas of natural vegetation and pasture are considered biotopes with low value; bats in the study area have not been recorded to use them actively. However areas of natural vegetation are potentially used by threatened species, being also more susceptible to impact due to their slower regeneration.

Overall, the impacts during the construction phase are mainly related to habitat destruction. However, due to the limited extent of the affected areas, and these are located primarily on transformed habitats, these can be expected to be of medium/low significance, once the mitigation measures are implemented.

Two other wind energy facilities are being planned to the south of the proposed Zen Wind Energy Facility site (Gouda Wind Farm - 120 MW and Inca Gouda 2 - 30 MW). The Gouda Wind Farm is currently commencing with the construction phase. Potential cumulative impacts[3] may derive from the wind energy facilities to the south, but its significance will depend on the timing of the construction, with the significance of these cumulative impacts being higher if the construction of both developments occurs simultaneously and lower if development is not simultaneous, and lowest if these events occur after the regeneration/rehabilitation of the affected vegetation of the first facility constructed. The cumulative impacts associated with

[3] Cumulative impacts derived from one particular project can be defined as "the impacts resulting from incremental actions or activities of the project in study with impacts resulting from other activities or projects from the past, present or reasonably predicted" (Hyder, 1999).

the construction phase are considered to be of very low significance. It is considered unlikely that the construction of two developments will occur simultaneously, and considering that the impacts during the construction phase are mainly related to habitat destruction and the expected limited extent of the affected areas, the cumulative impacts associated with the construction phase are considered to be of general low significance.

Impact Tables summarising impact of construction of bats

Nature: Destruction of agricultural areas and wetlands due to platforms construction, workstation and substation construction, internal access roads construction, and turbines, underground cabling and overhead power lines installation		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (45)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible	No
Can impacts be mitigated?	Yes	-
Mitigation: The minimisation of this impact is mainly achieved through the avoidance of siting of infrastructure in the layout planning phase, specifically turbines, in the identified sensitive areas or through the minimisation of the affected areas as far as possible in the activities of clearance and removal of vegetation. Existing roads and infrastructure should be used in order to minimise landscape changes. If large portions of sensitive areas are affected, measures should be taken to restore vegetation as soon as possible after construction is completed. Movements of machinery, vehicles and persons should be restricted to the existing roads and avoid the existing natural areas.		
Cumulative Impacts: As two other Wind Energy Facility are being planned in close proximity to the study area (less than 2 km), cumullative impacts will result if the construction phases are simultaneous. It is likely that this impact will persist and increase its duration and magnitude.		
Residual Impacts: Once the construction ceases and if the mitigation measures are implemented no residual impacts are expected.		

Nature: Destruction of natural vegetated areas and pasture areas due to platforms construction, workstation and substation construction, internal access roads construction, and turbines, underground cabling and overhead power lines installation		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)

Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Highly probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible	No
Can impacts be mitigated?	Yes	-
Mitigation: The minimization of this impact is mainly achieved through the avoidance of setting of infrastructure, especially turbines, in the sensitive areas, in a layout planning phase, or through minimisation of the affected area as far as possible as a result of the activities of clearance and removal of vegetation. Movement of machinery, vehicles and persons should be restricted to the existing roads and avoid the existing natural areas.		
Cumulative Impacts: Due to the low significance of this impact the cumulative impacts are considered negligible.		
Residual Impacts: Once the construction ceases and if the mitigation measures are implemented no residual impacts are expected.		

Nature: Disturbance of bat community due to the increase of people and vehicles in the area, and destruction of roost locations		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Very short (1)	Very short (1)
Magnitude	Low (3)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	-
Mitigation: In order to minimize this impact certain measures can be taken, such as avoid the presence of people and vehicles in the sensitive areas as possible; whenever possible schedule activities in order not to cause disturbance during the breeding season; lower the levels of noise whenever possible around the sensitive areas; avoid construction works during the night and avoid the destruction or disturbance of identified roosting sites.		
Cumulative Impacts: As two other Wind Energy Facility are being planned in close proximity to the study area (less than 2 km), cumullative impacts will result if the construction phases are simultaneous. It is likely that this impact will persist and increase its duration and magnitude.		
Residual Impacts: Not likely to happen, once the construction ceases.		

8.3.5 Mortality of bat species through collision with turbines or barotrauma caused by turbines operation

The most significant potential impacts on bat communities can occur during the operation phase. These impacts are mostly related with bat mortality due to collision with turbine blades or barotrauma. The potential collision risk is not the same for all bat species and it varies according to the species' habits and ecology. Certain bat habits, such as migration, high flight, clutter-edge foraging or open air foraging, contribute to species susceptibility to collision (EUROBATS, 2013). On the other hand the barotrauma phenomenon is caused by the change of pressure on the back side of the blade, so the specimens do not contact directly with the blades. Once more, the species that fly at blade height are susceptible to suffer barotrauma. In South Africa the information regarding bat behaviour is still scarce so the measurement of collision risk can be difficult to predict.

From the 16 species with possible occurrence in the study area, 3 have high risk of collision with turbines (Sowler & Stoffberg, 2012). None of these are species of conservation concern (Friedmann & Daly, 2004; IUCN, 2012). Five of the species that can potentially occur in the study area have medium to high collision risk and three are classified as "Near Threatened" by the South Africa Red List (Friedmann & Daly, 2004): *Miniopterus fraterculus*, *Miniopterus natalensis* and *Myotis tricolor*. It is also important to note that two of the confirmed species have documented collisions with wind turbines operating in South Africa, *Neorimica capensis* and *Tadarida aegyptiaca* (Aronson *et al*., 2013; Doty & Martin, 2013).

Understanding the potential risk of fatality of bats in the study area, species of low and medium ecological value will potentially suffer from mortality events as a result of the wind energy facility. The mortality of bats is considered to be an impact of medium significance, mostly due to the high probability of occurrence of the impact.

Considering the disturbance of the bat community resulting from human activities and turbines operation in the study area, the impact is of medium to low significance. This is mostly due to the high probability of occurrence of this impact and the impact it can have in population dynamics through the alteration of activity pattern and possible presence of attraction and/or exclusion areas in the wind energy facility.

Impacts on bat communities as a result of electrocution by power lines is considered to be low. Impacts would be primarily associated with fruit bats, and the presence of fruit bats has not been confirmed for this study area.

Overall, the impacts during operational phase pertain to bat mortality and the significance is of medium to low significance with the implementation of mitigation measures.

Impact Tables summarising impact on bats

Nature: Mortality of species due to collision with turbine blades or barotrauma caused by turbines operation		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-
Mitigation: The minimisation of deaths caused by wind turbines can be achieved through the avoidance of turbines installation in sensitive areas for bats. From the proposed layout, 29 of the 46 turbines are placed within a potentially sensitive habitat of moderate bat activity (agricultural areas – cereal cropland with increased potential for foraging). As estimated bat activity in the study area is not high, and most of the area is occupied by this habitat, relocation of turbines is not considered necessary. As this habitat does not comprise high/tall vegetation, collision risk is considered to be lower and the importance of these areas is related mostly to its usage for foraging species. However, this is not an indication of a no-go area, but rather an indication of an area which is used for foraging by bats. It is preferred that foraging conditions remain available for bats. Therefore, mitigation measures are proposed to a) intensify the opportunity for foraging in areas where turbines are not located, and b) reduce the potential collision risk for bats around the turbine locations. Land management practices beneath the turbines should ideally not attract bat species vulnerable to collision (e.g. open air-foragers or clutter-edge foragers). Cereal plantations should be limited in the surrounding of the wind turbines to reduce the suitability of the areas for bat foragers. A bat monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bat community, as well as the implementation of mitigation measures, such as the utilization of red lights in the turbines, instead of white, in order to minimize insect attraction and bat foraging behaviours near the turbines.		
Cumulative Impacts: As two other Wind Energy Facility are being planned in close proximity to the study area (less than 2 km), cumullative impacts will result if the construction phases are simultaneous. It is likely that this impact will persist and increase its duration and magnitude. A bat monitoring program should be implemented and will allow determination of the actual cumulative impacts of the wind energy facility on the bat community.		
Residual Impacts: Some collisions are expected despite the implementation of mitigation. This will result in bat fatalities which have potential to result in residual impacts.		

Nature: Disturbance of bat community due to noise and movement generated by turbines operation and increase of people and vehicles in the area associated with maintenance activities.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-
Mitigation: The minimization of bat community disturbance can be achieved through the avoidance of presence of people and vehicles in the sensitive areas. Maintenance operations, during the operation phase should avoid the periods most sensible for bats (e.g. breeding season).		
Cumulative Impacts: As two other Wind Energy Facility are being planned in close proximity to the study area (less than 2 km), cumullative impacts will result if the construction phases are simultaneous. It is likely that this impact will persist and increase its duration and magnitude. A bat monitoring program should be implemented and will allow determination of the actual cumulative impacts of the wind energy facility on the bat community.		
Residual Impacts: Some species may move away from the area regardless of any mitigation measures implemented. A bat monitoring program should be implemented in order to determine the actual impacts of the wind energy facility on the bat community.		

8.3.6 Cumulative impacts during operation

The main known activities or projects, relevant for the cumulative impacts analysis, known in the broader area of the Zen Wind Energy Facility are: human activities, namely agriculture and conversion of natural areas for agriculture, and other proposed wind energy facilities.

The study area falls within a transformed habitat for agricultural purposes. Presently the area is mostly used for cereal cultivation, as well as for grazing. There are, however, some areas with remaining natural vegetation, including the riparian strips along watercourses. As this area is under a high human pressure it is expected that the natural areas could be subjected in the future to some level of degradation.

There are at least seventeen other known proposed wind energy facility in the broader vicinity of the Zen project (up to a distance of 130km away). Of these projects, three have been awarded preferred bidder status, including the Gouda wind energy facility, and these are currently under construction.

The Gouda wind energy facility (up to 120 MW, with up to 46 wind turbines) and the Inca Gouda 2 Wind Energy Facility (up to 30 MW with up to 10 wind turbines) are the closest projects to the Zen site, and therefore more likely to influence the impacts assessed. As the distance that separates these facilities from the Zen Wind Energy Facility is small, it is expected that most of the present and possibly occurring bat species within Zen wind energy facility area will be affected by the resulting cumulative impacts. Bats roosting at the Zen site will possibly travel to the Gouda site to forage, and visa versa. Therefore cumulative impacts may result due to the existence of other wind energy facility in close proximity, and in areas that bat species may use frequently.

As for the remaining facilities, it is not expected that they should result in additional cumulative impacts, as bats usually do not commonly travel distances of more than 50 km between summer and winter roosts (Kunz *et al.,* 2007; Monadjem *et al.*, 2010). The main concern from the wind facilities located in the broader region relates to bat species that make medium to long migrations such as *Miniopterus natalensis, Myotis tricolor* or *Rousettus aegyptiacus*. The Die Hel Cave is located at a minimum distance of 20 km from the study area. These caves are a known roost of *Rousettus aegyptiacus* and other migratory species such as *Miniopterus natalensis*. In the study area, two of these species with migratory habits have been confirmed using the Zen Wind Energy Facility site: *Miniopterus natalensis* and *Myotis tricolor* being possible to expect that potential cumulative impacts result for these species while commuting between roosts.

Baseline information on migration and dispersion of bat species in South Africa is deficient and it is possible that the individuals identified were not using the area while on migration, but rather as a foraging area. This diminishes the probability of impact on these species, from cumulative impacts. Other wind energy facilities may be proposed in the area, as the industry is rapidly expanding in South Africa but at the time of this report compilation, the known information has been presented.

8.3.7 Comparative Assessment of Power Line Alternatives

There is no evidence to suggest that bats which are common to the area are affected by power lines in any way. For this reason, there is no preference between the two power line routes when considering the bat community.

8.3.8 Conclusions and Recommendations

The proposed site for the Zen Wind Energy Facility is located in an area considered to be of medium sensitivity for bat communities. The current layout for the facility excludes all of these identified sensitive areas for bats from the development footprint. The location of some wind turbines in areas with medium importance for the bat community of the study area requires the implementation of mitigation measures during the construction and operational phase, in order to reduce the probability and magnitude of impact. The turbines within the areas of medium sensitivity do not need to be relocated.

Since this is a medium-sized wind project, the overall impact on bats will be of a medium to low level of significance, which emphasizes on the need to comply with a minimum level of mitigation and monitoring regimes. The bat species most likely to suffer the impacts caused by the presence of this infrastructure include mostly open air foragers and clutter-edge foragers species (e.g. *Tadarida aegyptiaca* or *Neoromicia capensis*), which are known to have collisions with other wind energy facilities in South Africa (Darling National Demonstration Wind Farm Project, Western Cape; and Coega Industrial Development Zone, Port Elizabeth, Eastern Cape). Although bat mortality may occur, based on pre-construction results, this is expected to affect mostly common and widespread species. However, if impacts identified in the subsequent phases of the project are more severe than expected additional mitigation measures[4] may be evaluated, particularly if mortality occurs in levels that compromise the local population's viability. Such measures should only be implemented if necessary and they should be carefully planned in order to find the best trade off in reduction of the collision risk and minimize the loss in revenue resulting from mitigation.

The following key mitigation measures are recommended:

» Whenever possible and/or technically viable keep indicated buffers of proposed wind turbine location from:
  * Within 200m of any watercourse or wetland with riparian vegetation;
  * Within 500m of any known or suspected bat roost.
» Structures should be designed to reduce the availability of roosting sites.
» An operational phase bat monitoring program must be implemented to observe the actual impacts of the wind turbines on bats.
» If high collision bat fatalities are recorded, this should be evaluated by the bat specialists as soon as possible. Subsequent mitigation measures, adjusted to

[4] The increase in cut-in speed as well as feathering the blades are measures considered effective reducing bat mortality due to collision and/or barotrauma with wind turbines, enabling to reduce bat fatalities at least by 44% (Arnett *et al.*, 2010; Arnett *et al.,* 2011). Other studies suggest that variables other than wind speed can be considered for the cut-in of the blades rotation, such as temperature or time of night (Arnett *et al.*, 2013).

the risk situation identified, should be implemented and may include, but not restricted to curtailment at specific turbines or blade feathering (Arnett et al., 2013).

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

8.4.1 Impact on the project on Land-use & Agricultural Potential

The Zen Wind Energy Facility site is predominantly cultivated with dry land wheat and other cereal production. Cattle production is also practiced on a limited scale. Some of the flatter areas on this site have been used and are being developed for irrigated agriculture in the form of centre pivots. The southern part site is under natural vegetation and is currently not used for crop production purposes. The Portion 1 and 2 of Farm Bonne Esperance and the R/E of Farm Molenaars Drift are also use for game farming. Therefore the site has a mixed agricultural land-use.

The potential of the soils on the site for crop production is limited and at present determined by climatic characteristics. There is very little potential of increasing the productivity of the land as the soils are also not ideally suited to long-term irrigation unless significant investments are made in terms of artificial drainage.

The soils are prone to erosion as:
1. they are predominantly shallow with underlying structured and clayey soils or impermeable bedrock,:
2. soils can become saturated rapidly during rainfall events with the subsequent liquefaction of these;
3. the soils are predominantly sandy loams with very little stabilisation in the form of plant roots; and
4. the area is undulating and hilly with subsequent increased erosion pressures due to steep slopes and intensive rainfall events.

As evident from the soil and land survey the agricultural potential of the site is linked to climatic parameters mainly due to the shallow and duplex nature of the soils. Additionally, wind prevalence and direction on the eastern side of the farm is such that it poses a risk to crop production. The long-term viability of crop production practices is dependent on management inputs and environmental conditions (predominantly rainfall quantities and distribution). As there is very little diversification potential the farming enterprise is almost completely at the mercy of environmental conditions. Severe droughts could have catastrophic impacts on financial security and individual household food security. There is very little potential of increasing the productivity of the land as the soils are also not ideally suited to long-term irrigation unless significant investments are made in terms of artificial drainage.

From the survey it is clear that agricultural production cannot be intensified on the site without significant infrastructure developments in the form of artificial drainage. Therefore, the potential for generating additional income from farming practices is severely limited. The development of the wind energy facility through the leasing of sections of land provides an opportunity for the land owner to increase his and the farming enterprise's financial security through a constant income. This will aid in the weathering of difficult times during droughts or negative production conditions. In this sense a cost benefit analysis will always indicate a distinct benefit to the land owners without significant negative impacts in terms of agricultural production. In fact, the increased financial security will have a positive influence on the long-term sustainability of the agricultural unit and will have a direct bearing on the financial security of associates and of workers on the farm – if managed correctly.

Development of wind turbines on other parts of the site can be mitigated and managed in terms of their impact on agricultural potential and production. There is no potential for the expanding or intensification of agricultural activities through any means other than establishment of irrigation infrastructure and artificial drainage. Wind turbines can be placed in such a way that they do not influence or negatively impact agricultural activities. The development of a wind energy facility on the site will not have a detrimental effect on the farming enterprises or agricultural production with the use of good soils management measures during construction and operations.

The soils with "high soil potential" have been identified for the site and are shown in Figure 8.4. No infrastructure is planned in this area, as well as in current irrigated fields and this is acceptable from a soils and agricultural potential point of view. The National DAFF has been consulted in this regard.

The overall impact to farming activities associated with the Zen Wind Energy Facility is quantified in the table below. As a worst-case scenario, the proposed facility will result in a 0.36% production loss of wheat (7.8 tons), and a 1.1% production loss of cattle (9 cattle).

Parameter	Quantity	Unit
Total Area: Roads	9.26	ha
Total Area: Infrastructure & WTG's	4.6 *	ha
Existing Area: Roads	- 3.62	ha
Existing Area: Infrastructure & WTG's	- 1.5 *	ha
Area: TOTAL	3350	ha
Net Additional Area Occupied	***8.74 (0.26% of TOTAL)***	***ha***
Current Agri-Potential:	***2167.75 – 2602.51***	***tons wheat***
	811	***cattle***
Equivalent Agri-Impact (Loss):	***6.24 – 7.8 (0.36% worst case)***	***tons wheat***
	5 – 9 (1.1 % worst case)	***cows***

*** Assumed 1 WTG will occupy a conservative 0.1 ha during operation**

As a mitigation measure, the developer proposes the installation of at least one additional centre pivot on the site in order to intensify production on portions of the site which are unaffected by the facility. The landowner has expressed serious intent to commit to such intensification activity.

8.4.2 Issued raised by DAFF

During the EIA phase, DAFF commented on the project and raised concerns with the project:

a) The layout of the wind energy facility will impact negatively on the agricultural nature and production potential of the site.
b) The change of land use will result in the loss of agricultural land that is used for food production.
c) Amendment of the layout to move turbines to areas not under cultivation in order to allow the Department to reconsider the application.

The agricultural potential specialists evaluated the concerns as follows:

a) The layout has been adapted to minimise surface impacts and the surface area impact has a small development footprint. This aspect is especially relevant when considering the large difference in biological productivity between the land near Gouda and the high potential areas currently mined for coal on the Eastern Highveld. South Africa's food security is under a much larger threat from coal mining than from diffuse wind energy developments in areas where the wind is adequate for such development.
b) The turbine position layout has been amended to accommodate the following aspects addressed in the addendum to the agricultural potential report (refer to Appendix H).
    a. All turbines are positioned on shallow duplex or shallow rocky soils.
    b. The access routes to these turbine positions are linear and follow existing areas that are suited for such purposes.

c. An agricultural potential sensitivity map was provided in the agricultural potential report. In terms of this map the turbine positions were restricted to areas of lower agricultural potential and the area indicated by the farmer as having a higher potential is excluded from the development.
d. From a satellite image overlay of the layout it is apparent that the layout and associated infrastructure follows existing roads and boundaries between fields. The layout was planned in such a way that existing fields and farming units would not be disaggregated.
e. From the digital elevation model (DEM) of the site and the generated slope map it is evident that the turbines are place predominantly on land with a slope less than 2%. The turbines on the eastern side (low potential soils) are situated on land with a slope between 2% and 5%. No turbines are situated on land with a slope of more than 5%.

The soils and agricultural potential study concluded that:

» The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence.
» The soils on the site are predominantly duplex and shallow rocky soils and as such suffer from large crop production risks in the event where rainfall distribution and quantities are sub-optimal.
» The wind turbines positions have been planned to use existing roads and boundary areas between fields in order to minimise impacts on farming practices and layout.
» There is no potential for the expanding or intensification of agricultural activities through any means other than establishment of irrigation infrastructure and artificial drainage.
» The development of wind energy facility on the site will have a much smaller surface area footprint than coal energy production impacts in high potential agricultural areas of the country if a long-term energy production outlook taken.
» Electricity production on this site will lead to significant savings due to transmission losses when considering that the Western Cape Province is dependent to an extent on electricity generated by coal more than 1500 km away on the Eastern Highveld – in areas of high agricultural potential.
» The development of a wind energy facility on the site will not have a detrimental effect on the farming enterprises or agricultural production if properly managed.
» The development of the wind energy facility will be beneficial to the area and will improve financial security, especially during times of environmental upheaval in the form of droughts.
» The lease fees generated from the wind energy facility can contribute to the improvement of agricultural potential in the areas to be irrigated.

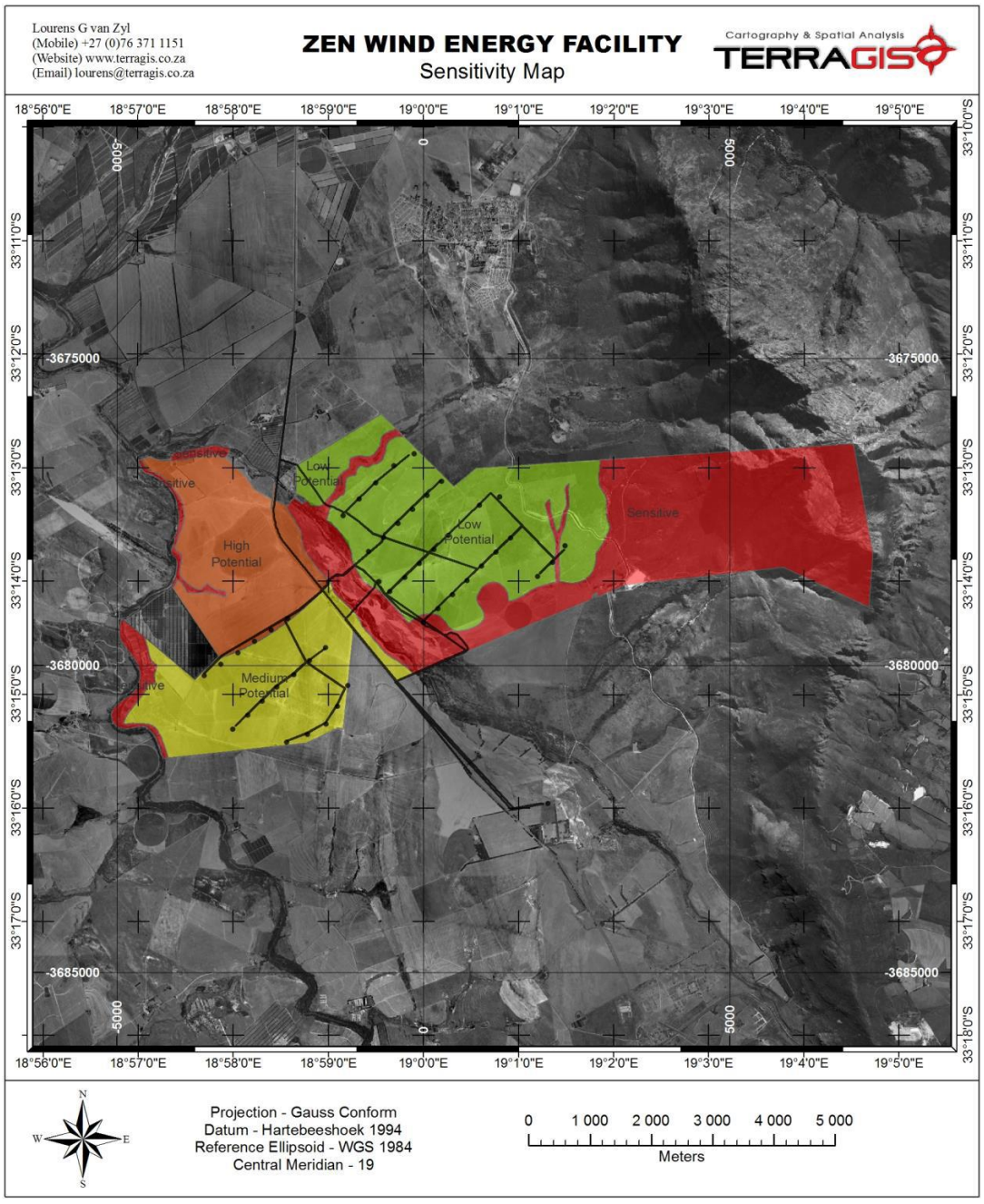

Figure 8.4: Agricultural and soil sensitivity map indicating the position of the turbines

Impact Table – Land Use and 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*	**Low (16)**	**Low (16)**
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: None.		
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 an arid are of low agricultural potential and 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 albeit of a low to negligible significance.		

8.4.3 Soil Erosion / Degradation during Construction

The site contains mostly shallow duplex soils, shallow rocky soils and rock outcrops with some alluvial sandy soils. The area dominated by alluvial sands lies entirely in the stream channel and floodplain of the Klein Berg River. As shown in Figure 8.4, the alluvial soils associated with the floodplain of the Klein Berg River are sensitive to soil erosion. The soils associated with the Mountain Range are classified as sensitive to soil erosion. No wind turbines will be placed along the floodplain of the Klein Berg River or the mountain range. However, the access roads and power line will cross the alluvial soils of the Klein Berg River, therefore potential negative impacts on soils may occur.

Activities / infrastructure that may have an impact on soils include:

» Wind turbines (i.e. construction and positioning of the concrete foundations of the wind turbines, positioning and construction of underground cabling between

the wind turbines, construction and positioning of an on-site substation, construction and positioning of a workshop, office, maintenance and storage area)
» Construction and positioning of internal access roads
» Construction and positioning of the overhead power line/s
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)

Impact Table – Soil erosion / degradation during construction

Nature: Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**High (80)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:
» Care must be taken with the ground cover during and after construction on the site.
» If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. Care should also be taken to control and contain storm water run-off.
» Rehabilitate construction sites by using indigenous grasses.
» Restrict size of authorised disturbance areas.
» Minimise activity on steep slopes / the side of slopes.
» Implement effective erosion control measures.
» 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

8.4.4 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.

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. » Implement measures to avoid /reduce chemical spillages during the operation of the facility (such as spill kits).		
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		

8.4.5 Cumulative impacts

The development of the Zen Wind Energy Facility project and the adjacent Gouda Wind Energy Facility project does have the potential to have negative cumulative impacts on soil. Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures must be implemented. With good soil management, cumulative impacts can be prevented.

8.4.6 Comparative Assessment of Power Line Alternatives

The power line Route 1 traverses areas under centre-pivot irrigation systems adjacent to the Klein Berg River and is therefore not considered a feasible alignment. Both power line routes cross over the Kleinberg River at different points, presenting erosion risk issues at each crossing. Route 2 is identified as the preferred alternative from geology and soils perspective, as it is aligned adjacent to the R44 and is shorter in length than Route 1. In addition, Route 1 would require re-alignment to avoid the centre-pivot irrigation. Therefore the power line Route 2 is nominated as preferred from a soils and agricultural potential perspective.

8.4.7 Conclusions and Recommendations

It is recommended that the development of the wind energy facility be approved conditional to proper planning. The developer should engage constructively with the landowners to co-ordinate activities in order to minimise increased management requirements by the land owners as well to minimise potentially negative impacts (on the short-term) on the agricultural activities during the construction phase.

» The long term impact on the agricultural production and food security by the proposed Zen Wind Energy Facility will be small/ insignificant as long as the development adheres to the environmental management that has been developed. The development of the site as a wind energy facility will only have a short term negative impact on the production of agricultural products from the property. That is during the construction phase of the project when the construction activities may interfere with the normal management practices on the property. Thereafter, the livestock and game farming activities will return to normal and the presence of the wind turbines is not expected to have any negative effect on normal farming and management practices.
» The soils on the site are susceptible to wind and water erosion and the undulating nature of the site could contribute to this. Special measures should therefore be adopted during the construction of infrastructure (i.e. roads, buildings, wind turbine foundations, internal cabling between turbines, etc.) to keep water erosion to a minimum and to be adopted in the EMP. Uncontrolled soil erosion will directly influence the soil and vegetation where the erosion takes place and will also have a cumulative impact on watercourses on the site, as well as downstream from the site.
» The slopes on the site vary from level to steep. There are a few steep slopes on the site that should be regarded as no-go areas in terms of the placement of wind turbines and internal cabling between turbines. Due diligence should be observed in terms of stormwater management from internal roads, specifically on roads on steeper slopes.

» There are in irrigated lands on the site, which are primarily used for the production of fodder for livestock and cereal production. They are all located in or near the watercourses on the site. As long as the irrigated agricultural fields regarded as no-go areas, the development on the site will not impact on these lands.
» As a mitigation measure, the developer proposes the installation of at least one additional centre pivot on the site in order to intensify production on portions of the site which are unaffected by the facility. The landowner has expressed serious intent to commit lease fees to such intensification activity.

8.5 Assessment of Potential Social and/ Economic Impacts

The key social issues associated with the construction phase are the following:
Potential positive impacts:
» Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts:
» Impacts associated with the presence of construction workers on local communities;
» Influx of job seekers;
» Loss of farm labour;
» Increased risks to stock, crops, grazing and farming infrastructure associated with the presence of construction workers;
» Impact of heavy vehicles on local roads;
» Loss of agricultural land associated with construction related activities.

The key social issues affecting the operational phase include:

Potential positive impacts
» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust;
» The establishment of renewable energy infrastructure.

Potential negative impacts
» The visual impacts and associated impact on sense of place;
» Potential impact on tourism;
» Influx of job seekers to the area;
» Loss of farm labour;
» Impact on farming operations.

Both positive and negative social impacts are discussed below.

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

The construction phase is expected to extend over a period of ~ 18 months and create approximately 266 construction related jobs. Of this total approximately 25 % (67) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 35 % (93) to semi-skilled personnel (drivers, equipment operators), and ~ 40% (106) to low skilled personnel (construction labourers, security staff). 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 line. 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 Gouda and Saron and the surrounding 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 majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from Gouda and Saron. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community. Implementation of the enhancement measures listed below can enhance these opportunities. This issue also highlights the importance of implementing a training and skills development programme before the construction phase commences.

The capital expenditure associated with the construction of a 140 MW wind energy facility will be in the region of R 2.5 billion. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and high import content associated with wind energy facilities the opportunities for the local economy and towns of Gouda and Saron are likely to be limited. However, opportunities are likely to exist for local contractors and

engineering companies in Wellington, Malmesbury and Paarl. The implementation of enhancement measures (listed below) can enhance these opportunities.

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. associated with the construction workers on the site. The majority of non-local construction workers are likely to be accommodated in the towns in the Riebeek Valley and Wellington/Paarl. This will create opportunities for local hotels, B&Bs, guest farms and people who want to rent out their houses. Cllr Witbooi and members of Ward 30 (Saron) Ward Committee indicated that the accommodation opportunities in Saron and Gouda were limited.

The total wage bill with the construction of a 140MW wind energy facility (266 employees X 18 months) is estimated to be in the region of R 66 million. This is based on the assumption that the average monthly salary for low, semi and skilled workers is R 5 000, R 12 000 and R 30 000 respectively. The injection of income into the area in the form of wages will represent a significant opportunity for the local economy and businesses in the local area.

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. associated with the construction workers on the site. The benefits to the local economy will be confined to the construction period (18 months).

In terms of local support, the Ward Committee members indicated they supported the opportunity for the project to create local employment opportunities. The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed wind energy facility to support co-operation between the public and private sectors. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Drakenstein Local Municipality.

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

Nature**:** Creation of local employment and business opportunities during the construction phase associated with the wind energy facility.		
	Without Mitigation	**With Enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local communities and	Local – Regional (3) (Rated as 3 due to potential opportunities for local communities and

	businesses)	businesses)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Mitigation: » 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. » Before the construction phase commences the proponent should meet with representatives from the Local 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. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » The proponent, in consultation with the Local 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.		
Cumulative impacts: Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities and limited skills range, this benefit is likely to be limited.		
Residual impacts: Improved pool of skills and experience in the local area. However, due to relatively small number of local employment and skills-transfer opportunities this benefit is likely to be limited.		

8.5.2 Presence of construction workers in the area

The presence of construction workers poses a potential risk to family structures and social networks in the area, specifically local communities in Saron. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect 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;
» An increase in teenage and unwanted pregnancies;
» An increase in prostitution; and
» An increase in sexually transmitted diseases (STDs).

The findings of the SIA indicate that the local farmers in the area are strongly opposed to construction workers being accommodated on the site. In this regard the proponent has indicated that no construction personnel, apart from security, will be accommodated on the site.

Employing members from the local community to fill the semi and low-skilled job categories will reduce the risk posed by construction workers to local communities. These workers will be from the local community and form part of the local family and social network. The proponent has indicated that they are committed to implementing a local employment policy, specifically for the low and semi-skilled employment opportunities associated with the construction phase. The total number of construction workers from outside the area that will need to be accommodated will therefore be in the region of 112, the majority of which (75) will be skilled workers. In addition, there is likely to be suitable accommodation is towns such as Wellington and Paarl. Based on this the overall impact of construction workers on the local community with mitigation is likely to be low. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be lower than anticipated. This is an issue that will need to be addressed during the recruitment process. The findings of the SIA also indicate that Saron is a fairly homogeneous community with shortage of housing and high unemployment levels. The representatives from the Ward 30 committee indicated the accommodation of non-local workers in the town was likely to cause tension within the community.

While the potential threat posed by construction workers to the community as a whole is likely to be low, the impact on individual members who are affected by the behaviour of construction workers has the potential to be high, specifically if they are affected by STDs etc.

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	Medium (3)	Medium (3)
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 (27)**	**Low for the community as a whole (24)**
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;
» The proponent and the contractor should 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 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: None

8.5.3 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 be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged. The local farm owners in the area who were interviewed indicated that stock theft was currently not a major concern, except over the Christmas-New Year period. The directly affected landowners also

indicated that they would be able to reduce the potential risk to their livestock by moving them other parts of the farm during the construction phase. In addition, as indicated above, a number of the farmers have indicated that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

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 developing a Code of Conduct for construction workers. 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**:*
None

8.5.4 Increased risk of fires during construction

The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires that in turn pose a threat to the 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 veld fires is heightened by windy conditions in the area, specifically during the dry, windy summer months.
» The risk of fire related damage is exacerbated by the limited access to fire-fighting vehicles and the mountainous terrain.

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. » Use of fire prevention and fire management strategies for the wind energy facility. » The landowners and developer should ensure that they join the local fire protection agency.
Cumulative impacts: None, provided losses are compensated for.
Residual impacts: None

8.5.5 . Impact due to increase in traffic during construction

The turbine components are likely to be transported to the site via the N7 and R311 from Cape Town or Saldanha. The movement of large, heavy loads during the construction phase has the potential to create delays and safety impacts for other road users travelling along the N7 and R 311. These roads are important access and tourist routes. However, the potential impacts can be mitigated by timing the trips to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc. Measures should also be taken to avoid times of the year that would impact on farming operations, specifically harvesting time.

Several abnormal loads using large trucks will be associated with the construction phase. In addition, crawler cranes (~ 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. If required, the developer will consider the upgrade of the farm gravel roads to the site for the transportation of the wind turbine components during construction. Zen Wind Farm (Pty) Ltd will have to apply for a permit to transport abnormal loads on public roads. In order to avoid traffic congestion and road safety during construction, various mitigation measures and road safety measures can be used.

The findings of the SIA indicate that the impact of traffic on the local roads that link the site to the port in Cape Town would be low. The social impacts associated with the movement of construction related traffic along these roads are therefore likely to be low.

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		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
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:

None

8.5.6 . Damage to and loss of farmland during construction

The activities associated with the construction phase have the potential to result in the loss of land available for grazing. However, the affected owners indicated that the project would not affect their farming activities. In addition, the loss of productive farmland would therefore be offset by the income from the lease agreement.

The final disturbance footprint can also be reduced by careful site design and placement of components. 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. Recommended mitigation measures are outlined below.

The landowner is compensated for leasing of the land by Zephan Trading. 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.

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 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 effectively rehabilitated or compensation is not paid (5)	Medium Term if damaged areas are rehabilitated (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (28)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided
Mitigation: • The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised; • An Environmental Control Officer (ECO) should be appointed to monitor the construction phase;		

• All areas disturbed by construction related activities, such as access roads on the site, 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. The specifications for the rehabilitation programme should be drawn up a suitably qualified ecologist; • The implementation of the Rehabilitation Programme should be monitored by the ECO.
Cumulative impacts: Overall loss of farmland could affect the livelihoods of the affected farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated.
Residual impacts: None

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

Based on information from other proposed wind energy facilities, the establishment of a 140MW wind energy facility will create approximately 7 permanent and 9 temporary employment opportunities. The operational phase is expected to last 20 years. The employment opportunities are therefore limited. 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 social benefit. The remainder of the semi-skilled and majority of the skilled employment opportunities are likely to be associated with people from outside the area.

The proponent has also indicated that they are committed to implementing a training and skills development programme during the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the DLM IDP.

Given the location of the proposed facility the majority of permanent staff is likely to reside in local towns in the area. In terms of accommodation options, a percentage of the non-local 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 monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the operational lifespan of the project.

The local hospitality industry in the area 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. The establishment of a Community Trust, as required in terms of the Request for Proposal Document prepared by the Department of Energy, will also create potential benefits for the local community.

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 (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The establishment of a Community Trust should be discussed with the 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.		
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: None		

8.5.8 Benefits associated with the establishment of a community trust

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy. The proponent has indicated that they are committed to establishment of a Community Trust.

A Community trust provides an opportunity to generate a reliable and steady revenue stream over a 20 -25 year operational lifespan of the wind energy facility. This revenue can be used to fund development initiatives in the area and support local economic and community development. The 20 year timeframe also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed Zen wind energy facility will be used to support a number of social and economic initiatives in the area, including:

» Land Reform;
» Enterprise Development;
» Energy;
» Education; and
» Healthcare.

Impact Table Summarising impacts of establishment of a community trust

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development		
	Without Mitigation	**With Enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent in consultation with the DLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; » The proponent in consultation with the DLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the wind energy facility are managed for benefit of the community as a whole and not individuals within the community.		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: None		

8.5.9 . 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. 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 overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively moderate. However, the 140 MW produced will help to offset 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 an important contribution.

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

Nature: Development of renewable energy infrastructure in the Western Cape, South Africa.		
	Without Mitigation	**With Mitigation**
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement: n/a		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: None		

8.5.10. Potential Impact of the wind energy facility on tourism in the region

A review of the impact of wind energy facilities on tourism covering 40 studies undertaken by Dr van Zyl (2012) found that the instances of serious negative

impacts on tourism are relatively rare and implies the need to ensure that compelling arguments are provided before concluding that a wind farm will have a highly significant negative impact on tourism.

Based on the review the instances where wind energy facilities are most likely to result in negative impacts are those where they are situated in particularly visually sensitive areas such as areas with a clear wilderness quality with little or no signs of 'civilisation' in the form of infrastructure such as power lines, major roads, etc.

The Drakenstein Local Municipality: Planning Division indicated that potential impact on tourism was linked to tourism the development potential of Saron as heritage destination and the R44/ R45. Tourism development is also identified as a key focus area in 2012-2017 IDP. However, the findings of the SIA indicate that the study area is predominately a farming area with limited tourism facilities. In addition the R44/ R45 carries large volumes of freight between the N1 and Saldanha. The site is located ~ 15 km from the Riebeeck Valley which is an important tourist destination. Due to the distance the wind turbines are not likely to be visible from the towns of Riebeek Casteel and Riebeek West.

The findings of the SIA therefore indicate that while the establishment of the Zen energy facility will impact on the visual character of the area and its rural sense of place, this impact will be localised. The potential impact on tourism is also likely to be confined to facilities in the area whose views are affected by the proposed energy facility. The significance of this impact with mitigation is rated to be Medium Negative. The impacts on tourism is the broader, DLM and CWDM region are likely to be negligible. The significance of this impact with mitigation is rated to be Low Negative.

Impact on tourism industry

Nature: Potential impact of the wind energy facility on local tourism		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (27)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement:		

» The proponent should liaise with representatives from the DLM and local tourism representatives to raise awareness of the proposed facility. » The proponent should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.
Cumulative impacts: Potential negative and or positive impact on tourism in the KLM
Residual impacts: None

8.5.11. 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 wind energy facility is of low significance. The potential noise impacts are covered in the specialist Noise Impact Assessment.

8.5.12. Comparative Assessment of Power Line Alternatives

The Visual Impact Assessment notes that both power line options are likely to result in potential visual impact, but Route 2 appears to be shorter, and follows the alignment of the road for a longer percentage of its length. Route 2, therefore, represents the consolidation and concentration of infrastructure, which is preferable from a visual perspective. Route 2 is therefore the preferred option, based on visual (social) impacts. The anticipated visual impact resulting from the overhead power line is likely to be of **moderate significance.** Route 1 would traverse centre-pivot irrigation areas on Kleinberg Rivier and is therefore not ideal.

The overall social impact associated with the both alternatives is likely to be low. However, the land owner has indicated that Route 2 is the preferred option. This is supported by the findings of the VIA and the SIA.

8.5.13. Cumulative Social Impacts

Cumulative impact on sense of place

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 is also likely to be the case in South Africa. 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).

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 facility's on the landscape is therefore likely to be a key issue in South Africa, specifically given South Africans' strong attachment to the land and the growing number of wind farm applications.

The flood of applications and the impact on local planners is also a concern and appears to mirror the experience in Scotland. The research undertaken Warren and Birnie (2009), found that the wind energy 'gold rush' that took place in Scotland took everyone by surprise – politicians, planners, scientists, land managers, conservationists and the public alike. As a result a severe burden was placed in officials and related planning and development control procedures. In addition, officials and planners had very few specific criteria for assessing proposals, notably because of the lack of overall strategic locational guidance. Basic data on most aspects of wind farm development, including environmental impacts, is limited and short term. As a result the debates regarding wind farms often degenerated into exchanges of claims and counter-claims that were typically long on assertion and short on evidence. The potential for a similar situation to develop in South Africa is high.

The potential for cumulative impacts was raised as key concern by the Drakenstein Local Municipality. This concern is linked to the combined size of the Gouda and Zen projects. The establishment of a number of wind projects in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. However, the proposed Zen, Gouda and INCA wind energy facility's are located adjacent to each other and, could, from a visual perspective, be viewed as a single large wind energy facility as opposed to three separate wind energy facilities. While this does not necessarily reduce the overall visual impact of these three facilities on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. The environmental authorities therefore need to take into account the potential positive and negative cumulative impacts before a final decision is taken with regard to the number and location of renewable energy facilities in an area.

In addition to the Gouda and INCA wind projects, a wind energy facility is proposed near Wolseley, which is located ~ 30km east of the Zen site. The site is not visible from the proposed Zen site due to the screening provided by the natural topography (viz. the Obiekwa/ Voëlvlei/ Elandskloof Mountains). In terms of cumulative impacts there would be the potential for sequential visibility (e.g. the effects of seeing two or more wind farms along a single journey, e.g. road or walking trail). This would apply to motorists travelling from Gouda towards Worcester along the R46 and R43.

The findings of the VIA (MetrGIS, November 2012) indicate that consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Impact Table Summarising Cumulative impacts on sense of place and the landscape

Nature: Visual impacts associated with the establishment of more than one wind energy facility and the potential impact on the areas rural sense of place and character of the landscape.		
	Without Mitigation	**With Mitigation**
Extent	Local and Regional (2)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Negative	Negative
Reversibility	Yes. Wind turbines and other infrastructure can be completely removed.	
Irreplaceable	No	

loss of resources?		
Can impact be mitigated?	Yes	
Enhancement: The recommendations of the VIA studies should be implemented and used to inform the location and number of wind turbines associated with the proposed wind projects in the area.		
Cumulative impacts: Potential impact on current rural sense of place and landscape character of the area.		
Residual impacts: None		

Cumulative Impact on the Local Economy

In addition to the potential negative impacts, the establishment of the other renewable energy projects in the area also has the potential to result in significant positive cumulative socio-economic impacts for the DLM and the CWDM. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. As indicated above, three wind energy facilities are proposed in the DLM. In addition a wind energy facility is proposed near Wolseley, in the Witzenberg LM, and a number of solar energy projects are located in the Breede Valley Local Municipality. Both these municipalities are part of the CWDM.

Impact Table Summarising Cumulative impacts on local economy

Nature: The establishment of a number of renewable energy facilities in and around the Swartland region will create employment, skills development and training opportunities, creation of downstream business opportunities and stimulation of the local property market.		
	Without Enhancement	**With Enhancement**
Extent	Local and regional (3)	Local and regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	***Medium (44)***	***High (70)***
Status	Positive	Positive
Reversibility	Yes. Wind energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement:		

The mitigation measures aimed at creating local employment and business opportunities should be implemented. However, the establishment of a number of large renewable energy facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities therefore need to take into account the potential positive and negative cumulative impacts before a final decision is taken with regard to the number and location of renewable energy facilities in an area.
Cumulative impacts: Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy
Residual impacts: None

8.5.14. Conclusions and Recommendations

The findings of the SIA undertaken for the proposed Zen Wind Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also create an opportunity to support local economic development in the area. The development of renewable also 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.

The proposed Zen Wind Energy Facility and establishment of the other renewable energy facilities in the area also have the potential to result in significant positive cumulative socio-economic impacts for the CWDM and WLM. However, the Zen facility will impact on the visual and landscape character of the area. The significance of this is rated as medium negative.

The overall finding of the SIA is that the potential positive socio-economic impacts associated with the proposed Zen Wind Energy Facility outweigh the potential social negative impacts. It is therefore recommended that the facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the report. Cumulative positive and negative social impacts will also be of an acceptable level.

8.6 Assessment of Potential Visual Impacts

The VIA 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.

The greater environment is considered to have distinctive landscape character and a high visual quality. The sense of place is quite distinctive. The towns of Porterville, Saron, Gouda, Tulbach, Wolseley, Riebeeck West and Riebeeck Kasteel account for the highest population concentration within a region, which has an average of 21 people per km^2. Of note is that the town of Saron has some heritage value, in particular the historic core of the town. Most of the farming is dryland agriculture, with large patches of irrigated agriculture in the proximity of the larger towns, and where surface water is available. Wheat and maize farming dominate the land-use character in the western part of the study area. The land use in the eastern part of the study area is primarily conservation, which consists of thicket and bushland on the mountain slopes, giving rise to shrubland and fynbos in the high lying areas. A substantial portion of land cover is allocated to agriculture and forestry. Industrial type infrastructure includes the Riebeeck West PPC Quarry and some major distribution / transmission lines in the far south east of the study area. Several arterial roads traverse the area, namely the R46 from the south east and the south-west, the R311 from the north-west, and the R44, which bisects the area in a north south direction. A number of secondary roads form links between these arterials.

The region has a rural, pastoral character with scattered isolated homesteads occurring within the study area. Large areas, especially within the mountains, have been given over to conservation, or remain in a natural state.

Protected areas and / or important conservation areas include the following:

» The Cape Winelands Biosphere Reserve, of which the core area and buffer areas lie less than 10km to the south east of the site.
» The Cape Floral Region World Heritage Site, situated in the north east of the study area.
» Various important Mountain Catchment areas, also in the north east of the study area.
» The Voelvlei Dam Conservancy located less than 10km to the south east of the site. This conservancy also lies within the Cape Winelands Biosphere Reserve.
» The Kasteelberg Conservancy some 12km to the south west of the site.
» The Elandsberg Private Nature Reserve located about 20km to the south of the site.

The site is located on the eastern edge of the Western Cape coastal plain. The Witsenberge immediately to the east of the site as well as the Kasteelberg in the south west are part of the Western Cape's declared 'scenic mountain ranges', and link with the Cederberg in the north and the Hexriver Mountains in the south.

The area is a popular tourist destination, and is known for its rural pastoral landscapes set against the dramatic backdrop of the mountains. Most of the arterial and secondary roads are therefore assumed to be used as scenic drives by tourists passing through or visiting the region.

Heritage Western Cape (HWC) requested that the Visual Impact Assessment deal specifically with the visual impacts on and from the historical core of Saron and on and from any historical homestead within 5km of the turbines. The Visual Impact Assessment (VIA) assessed the impacts of the project on the town of Saron. In addition, an HIA has been undertaken by ACO Associates (specialists in heritage impact assessment). The HIA report assessed impacts on the town of Saron. Together, these two studies assessed the impact on heritage and cultural resources, related to visual impacts of the proposed Zen Wind Energy Facility. The town of Saron has been assessed as being likely to experience moderate to high visual impact.

In addition, HWC requested that the comment in respect of heritage of parties in Saron be obtained. To date, no objection/ concerns have been raised by the local residents and the Local Municipality regarding negative visual impacts of the project.

8.6.1 Visual Exposure

The result of the initial viewshed analyses for the proposed Zen Wind Energy Facility is shown on **Figure 8.5.** The visibility analysis was undertaken from 46 wind turbine positions at an offset of 110m above average ground level (i.e. the maximum hub height of the proposed turbines).

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.

The viewshed not only indicates areas from which 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 dark orange areas indicate a high frequency (i.e. 42-46 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-5 turbines or parts thereof may be visible).

The following is evident from the analysis:

» The proposed Zen wind energy facility would have a large core area of potential visual exposure within a 5km radius of the development site. This core area, which will experience a high frequency of visual exposure, includes a number of

roads, the historic town of Saron, a number of settlements and homesteads, as well as the larger parts of the adjacent Gouda and INCA wind energy facilities.

» Parts of the Cape Nature Important Mountain Catchment Areas would be visually exposed, specifically on the western slopes of the Witsenberge. Virtually all areas east of the Witsenberge would be visually protected from the proposed Zen Wind Energy Facility.
» Visual exposure would remain high with a high frequency of exposure in the medium distance (i.e. between 5 and 10km), due to the flat undulating nature of the topography west of the mountains.
» Of importance in the 5-10km zone is the town of Gouda in the south east, a number of settlements and homesteads and the northern part of the Cape Winelands Biosphere Reserve buffer area. Parts of the Cape Nature Important Mountain Catchment Areas also lie within this zone.
» In the medium to longer distance (i.e. between 10 and 20km), the extent of visual exposure will be somewhat reduced, although the frequency will remain high. This zone also includes a number of settlements and homesteads, the towns of Riebeeck West and Riebeeck Kasteel and parts of the Riebeeck West PPC Quarry.
» Protected areas would include parts of the Cape Winelands Biosphere Reserve core and buffer areas, the Voëlvlei Dam and the Kasteelberg Conservancies. Again, the western slopes of the Witsenberge would be visually exposed, representing parts of the Cape Nature Important Mountain Catchment Areas.
» Visual exposure beyond the 20km radius is significantly reduced, especially in the south west, where the Kasteelberg acts as a visual shield.
» Long distance views of the facility will be possible from the Elandsberg Private Nature Reserve and parts of the Kasteelberg Conservancy.
» The facility would be visible for substantial sections of the R44 throughout the study area, and also along the eastern section of the R46 until it traverses the Witsenberge. The facility will be visible for only limited parts of the R311 and the western section of the R46.
» Visual exposure of all secondary roads is high in the short and medium distance (i.e. up to 10km), reducing significantly beyond 20km.

It is envisaged that the wind energy facility structures would be visible to observers (i.e. people travelling along roads, residing in towns and at homesteads or visiting the region), especially within a 5-10km radius of the wind energy facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

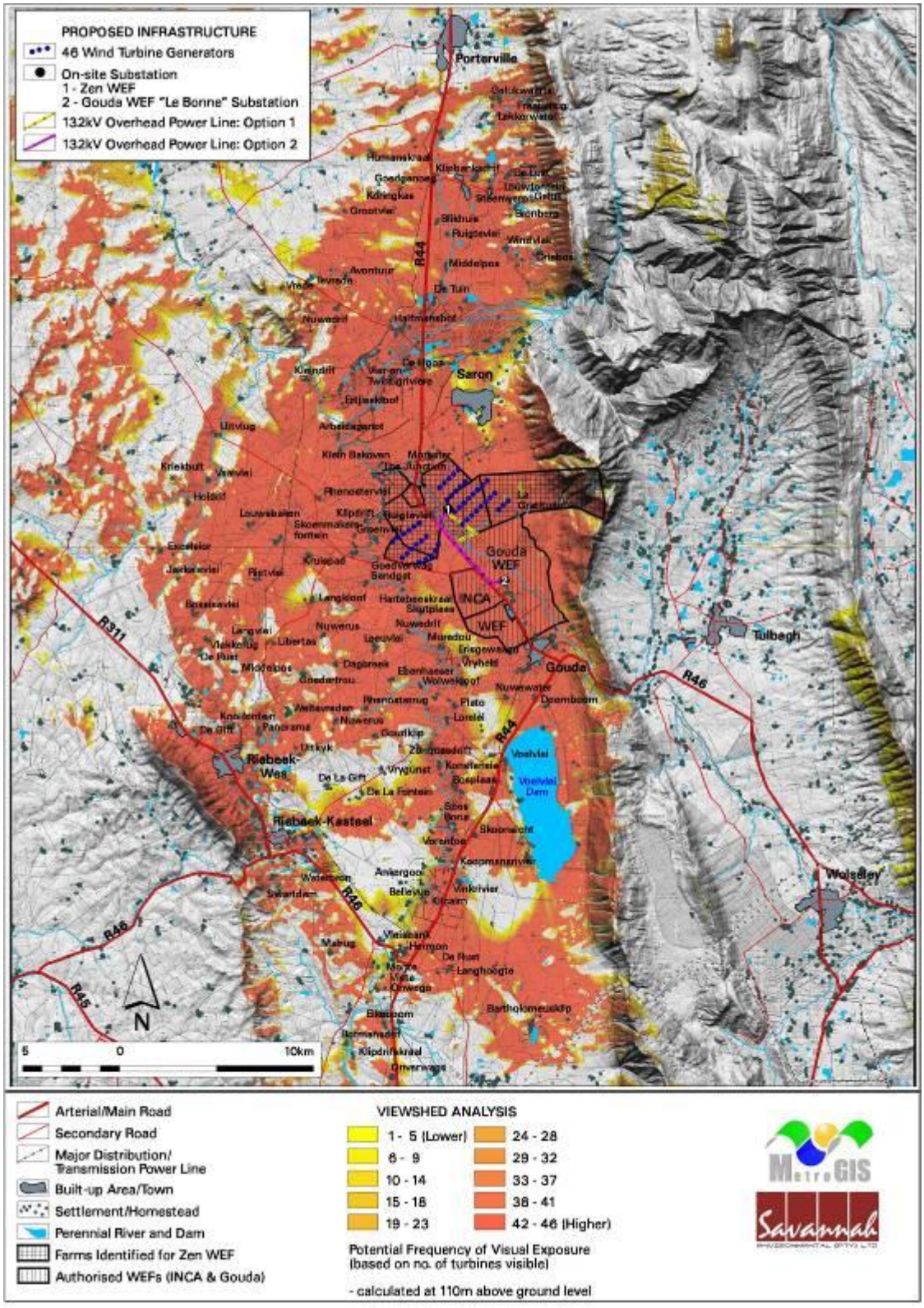

Figure 8.5: Viewer exposure for the Zen Wind Energy Facility

8.6.2 Visual Impact

In terms of viewer sensitivity, the most vulnerable to potential visual impacts include residents of homesteads and settlements (who will be exposed while at home) and tourists visiting and travelling through the area. The scenic nature of the area and the tourism within the region implies that some homesteads may operate as tourist facilities, and that many roads may be used by tourists as scenic drives. This potential elevates the sensitivity of these receptors somewhat.

Eco tourists visiting the multitude of conservation areas within the study area are also considered very sensitive to visual impacts, especially those viewing the facility from elevated vantage points and trails within the mountains. Daily commuters (by road) are also considered to be sensitive receptors, but as this exposure will be of shorter duration that for residents of homesteads, their sensitivity is somewhat lower. The severity of the visual impact on visual receptors decreases with increased distance from the proposed facility.

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed wind energy facility are displayed on **Figure 8.6**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index for the wind energy facility is further described as follows.

» The visual impact index map indicates a core zone of **high** visual impact within a 5 km radius of the proposed facility. Limited areas of **moderate** visual impact occur, where the frequency of exposure is lower.
» Sensitive visual receptors within this zone include users of the R44 and secondary roads as well as residents of the settlements of *Vier-en-Twintigriviere, Morester, The Junction, Klein Bakoven, Rhenostervlei, Klipdrift, Ruigtevlei, Skoenmakersfontein, Groenvlei, Kruispad, Goedverwag, Sandgat, Hartebeeskraal, Skutplaans, Nuwedrif, Moredou* and *Leeuvlei* (amoungst others). These receptors are likely to experience **very high** visual impact.
» The town of Saron also falls within this zone, and is likely to experience **moderate to high** visual impact. The community of Saron have not objected to the

development of the wind turbines and considering the residential land-use at Saron, the visual impact is considered acceptable.

» Similarly, parts of the Cape Nature Important Mountain Catchment Areas will be exposed to potential visual impact of a **moderate to high** magnitude, specifically on the western slopes of the Witsenberge.
» The extent of potential visual impact remains high between the 5 km and 10 km. The mountains to the east of the site effectively screen areas beyond from potential visual impact. Visual impacts within this zone are mostly **moderate**, with limited areas of **low** magnitude where the frequency of exposure is lower.
» Sensitive visual receptors again include users of the R44 and secondary roads as well as residents of a fair number of homesteads and settlements. These receptors are likely to experience **high** visual impact.
» The town of Gouda also falls within this zone, and is likely to experience **moderate** visual impact.
» Parts of the Cape Winelands Biosphere Reserve buffer area and of the Cape Nature Important Mountain Catchment Areas which fall within this zone are likely to be exposed to a **low to moderate** visual impact.
» Between 10 km and 20 km, the extent of potential visual impact is reduced, especially in the west. Visually exposed areas tent to occur mainly in the north and south. Areas in the east beyond the mountains are largely screened from potential visual impact. Visual impacts within this zone are likely to be mostly **low** with limited areas of **very low** magnitude where the frequency of exposure is lower.
» Sensitive visual receptors at this distance include users of the R44, short stretches of the R311 and R46, as well as various secondary roads. A number of homesteads and settlements, especially to the north and south of the facility may also be visually impacted upon. Visual impacts on these sensitive receptors are likely to be **moderate.**
» The towns of Riebeeck West and Riebeeck Kasteel fall within this zone, and are likely to experience **low** visual impacts.
» Protected areas such as parts of the Cape Winelands Biosphere Reserve core and buffer areas, the Voelvlei Dam and the Kasteelberg Conservancies will be similarly exposed to potentially **low to very low** visual impacts.
» Remaining visual impacts beyond the 20 km radius are expected to be **negligible,** where these occur at all.

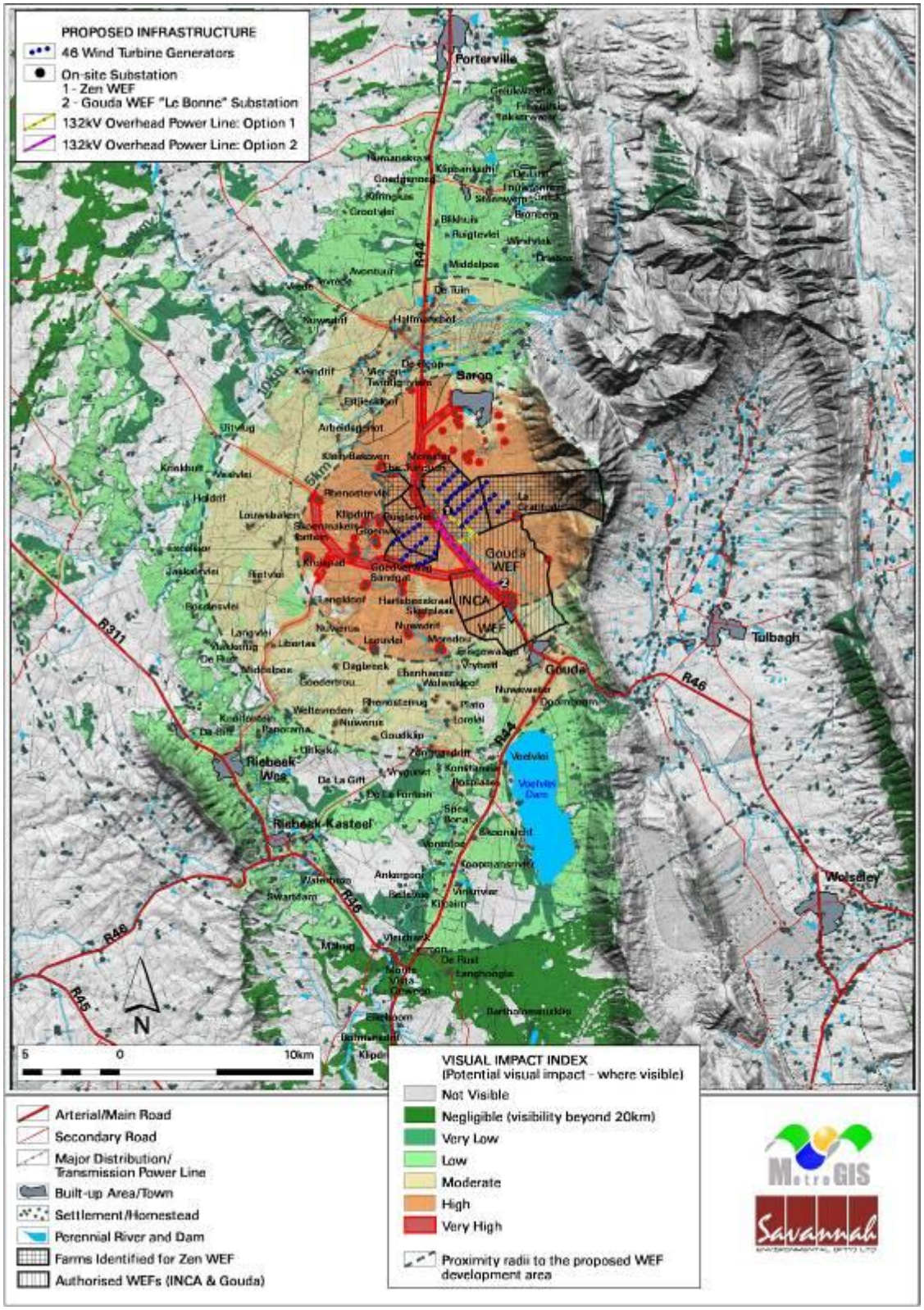

Figure 8.6: Visual Impact Index

8.6.3 Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Zen 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 provided by the developer.

The simulated views show the placement of the wind turbines during the longer-term operational phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken.

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 wind energy facility. 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.

Figure 8.7.: Photo simulation view from the R44 as it passes through the Zen site. The viewpoint looks to the south east and is located approximately 1km from the closest turbine. This viewpoint is indicative of a close range view which will potentially be seen when travelling to the south east from Saron. 12 turbines are fully to partially visible in the landscape.

Figure 8.8.: Photo simulation view from the a secondary road to the west of the Zen site. The point lies approximately 5km from the closest turbine, and is indicative of a medium distance view that visual receptors will have of the facility. The viewing direction is westerly, and 31 turbines are fully to partially visible in the landscape.

Impact Tables - visual impact of the wind energy facility

Nature of Impact: Visual impact on sensitive visual receptors within the region		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (26)**	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?	Yes	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the proposed Zen wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region. This is particularly relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a decided cumulative impact in terms of the concentration, extent and visual exposure of wind energy infrastructure within the region.

On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on users of arterial and secondary roads in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A

Duration	Long term (4)	N/A
Magnitude	Very high (10)	N/A
Probability	High (4)	N/A
Significance	High **(71)**	N/A
Status (positive, neutral or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas, as contained in the EMP.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the proposed Zen wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region. This is particularly relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a decided cumulative impact in terms of the concentration, extent and visual exposure of wind energy infrastructure within the region.

On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on residents of homesteads and settlements in close proximity to the proposed facility

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very high **(10)**	N/a
Probability	High **(4)**	N/a
Significance	High **(71)**	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	
Mitigation / Management: Planning: » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region. This is particularly relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a decided cumulative impact in terms of the concentration, extent and visual exposure of wind energy infrastructure within the region. On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Visual impact of the proposed facility on the town of Saron.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	High **(8)**	N/A
Probability	Probable **(3)**	N/A
Significance	Moderate **(48)**	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	
Mitigation / Management: Planning: » Retain / re-establish and maintain natural vegetation in all areas outside of the		

development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region. This is particularly relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a decided cumulative impact in terms of the concentration, extent and visual exposure of wind energy infrastructure within the region.
On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.6.4 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, 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. An 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.

The site is located on the eastern edge of the Western Cape coastal plain. The Witsenberge immediately to the east of the site as well as the Kasteelberg in the south west are part of the Western Cape's declared 'scenic mountain ranges', and link with the Cederberg in the north and the Hexriver Mountains in the south.

The area is a popular tourist destination, and is known for its rural pastoral landscapes set against the dramatic backdrop of the mountains. Most of the arterial and secondary roads are therefore assumed to be used as scenic drives by tourists passing through or visiting the region.

The region has a rural, pastoral character with scattered isolated homesteads occurring within the study area. Large areas, especially within the mountains, have been given over to conservation, or remain in a natural state. The greater

environment is considered to have distinctive landscape character and a high visual quality. The sense of place is quite distinctive. The anticipated visual impact of the facility on the regional visual quality, and by implication on the sense of place of the region, is expected to be of moderate significance. No mitigation of this impact is possible, but measures are recommended as best practice. The table below illustrates this impact assessment.

Impact Table - Visual Character and Sense of Place

Nature of Impact: Visual impact of the proposed facility on the visual quality of the landscape 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	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region. This is particularly relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a decided cumulative impact in terms of the concentration, extent and visual exposure of wind energy infrastructure within the region.

On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.6.5 Lighting Impacts

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

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 wind energy facility may contribute to the effect of sky glow in an otherwise dark environment. Lighting impacts will be moderate significance both before and after mitigation.

Light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity to the wind turbines.

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.

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

The intensity of light generated by the wind energy facility is expected to be of a low significance.

Impact Table - Significance of visual impact of lighting at night on visual receptors in close proximity to the proposed wind energy facility

Nature: Sky glow from lighting of the facility		
	Without mitigation	**With mitigation**
Extent	(Regional) 3	(Regional) 3
Duration	(Permanent) 5	(Long Term) 4[5]
Magnitude	(Low) 4	(Low) 3
Probability	(Improbable) 2	(Improbable) 2
Significance	**(Low)24**	**(Low)20**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Utilize light sources of minimum intensity necessary to accomplish the light's purpose; » Turning lights off using a timer or occupancy sensor when they are not needed; » Improving lighting fixtures, so that they direct their light more accurately towards where it is needed, and with fewer side effects. » No "architectural uplighting" of structures should be employed i.e. the turbines themselves must not be illuminated. » Only "full cut-off" light fixtures that direct light only below the horizontal plane (must be used. These lights aim light downward and sideways, thereby avoiding uplighting.		
Cumulative impacts: Yes, doe to multiple wind energy facilities in the area.		
Residual Impacts: Residual impacts will be very low once mitigation measures are implemented or once offensive lighting is removed.		

8.6.6 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 site, as well as those within 500m of the property boundary may experience a visual impact of low significance both before and after mitigation.

[5] It is assumed that the turbines will be removed after the 20 year life span of the wind energy facility

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

Impact Table - Significance of visual impact of shadow flicker

Nature: Shadow flicker due to wind turbines		
	Without mitigation	**With mitigation**
Extent	(Local) 2	(Local) 2
Duration	(Short) 1	(Short) 1
Magnitude	(Low) 4	(Low) 4
Probability	(Improbable) 1	(Improbable) 1
Significance	**(Low)7**	**(Low)7**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Should there be complaints about shadow flicker at specific residences, it is recommended that blinds be fitted on windows of residences that are affected.		
Cumulative impacts: Limited.		
Residual Impacts: Very limited residual impacts possible after implementation of mitigation.		

8.6.7 The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the wind turbines is not possible to mitigate. The functional design of the structures 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. Secondary impacts anticipated as a result of the proposed facility (i.e. visual character and sense of place) are also not possible to mitigate.

The following mitigation is, however possible:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. This measure will help to soften the appearance of the facility within its context.
» In terms of ancillary infrastructure, it is recommended that Option 2 be favoured for the overhead power line, as this is the shortest alignment, and one which follows the road (thus representing a consolidation of infrastructure).
» It is possible to limit the overall number of aircraft warning lights to some extent. By fitting warning lights to the turbines on the outer perimeter facility, the facility is demarcated along its perimeter, thereby reducing the requirement for warning lights on each turbine. Should the INCA and Gouda facilities as well as the Zen facility proceed, then this mitigation measure may be extended in include all three facilities.
» Possible mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the Wind Energy Facility and the ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:
    * Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    * Shielding of open luminaries to direct light downward towards the ground;
    * 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 visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

    * Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    * Reduce the construction period through careful logistical 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 (i.e. in already disturbed areas) wherever possible.

- 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 appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

» During operation, the maintenance of the turbines, the internal roads, the power line servitude and other ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.
» Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.
» Once the Wind Energy 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. An ecologist should be consulted to give input into rehabilitation specifications.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» Good practice requires that the mitigation of both primary and secondary visual impacts as listed above be implemented and maintained on an on-going basis.

8.6.8 Cumulative impacts

Two wind energy facility sites are located south of the proposed Zen Wind Energy Facility. These are the Gouda wind energy facility (approximately 46 turbines), bordering the site to the south, and the INCA wind energy facility (approximately 10 turbines), located immediately west of the formerly mentioned. Of note is the fact that the Gouda Energy Wind facility has been awarded preferred bidder status for Round 2 of the IPP Procurement Program.

Figure 8.9 shows the potential cumulative visual impact of the proposed Zen Wind Energy Facility as well as the authorised and preferred bidder Gouda Wind Energy Facility (located to the south). This map shows those areas that will be exposed to both facilities (light orange), those areas that will be exposed only to the approved

Gouda facility (dark red), and those areas that will be exposed only to the proposed Zen facility (green). It is noteworthy that due to the close proximity of these facilities, their respective viewsheds cover largely the same area. Discrepancies exist, especially to the immediate north of the proposed Zen facility, where the taller turbines will be visible to the town of Saron and the areas to the north thereof. Other than this, there are no significant differences in the extent of visual exposure of these two facilities.

In this respect, the potential visual impact of the proposed Zen facility will fall mostly within the zone of potential visual impact of the authorised Gouda facility. Additional receptors that will be impacted upon as a result of the Zen facility include receptors in the town of Saron, and a few homesteads to the north thereof, as well as in the north west of the study area.

Therefore, in terms of cumulative impact, the proposed Zen facility will not result in an increased area of visual impact (i.e. beyond that of the authorised Gouda facility), but will result in an increase in the frequency of exposure within the existing viewshed. In this respect, visual receptors will be exposed to greater numbers of turbines, which would imply a higher intensity of visual intrusion.

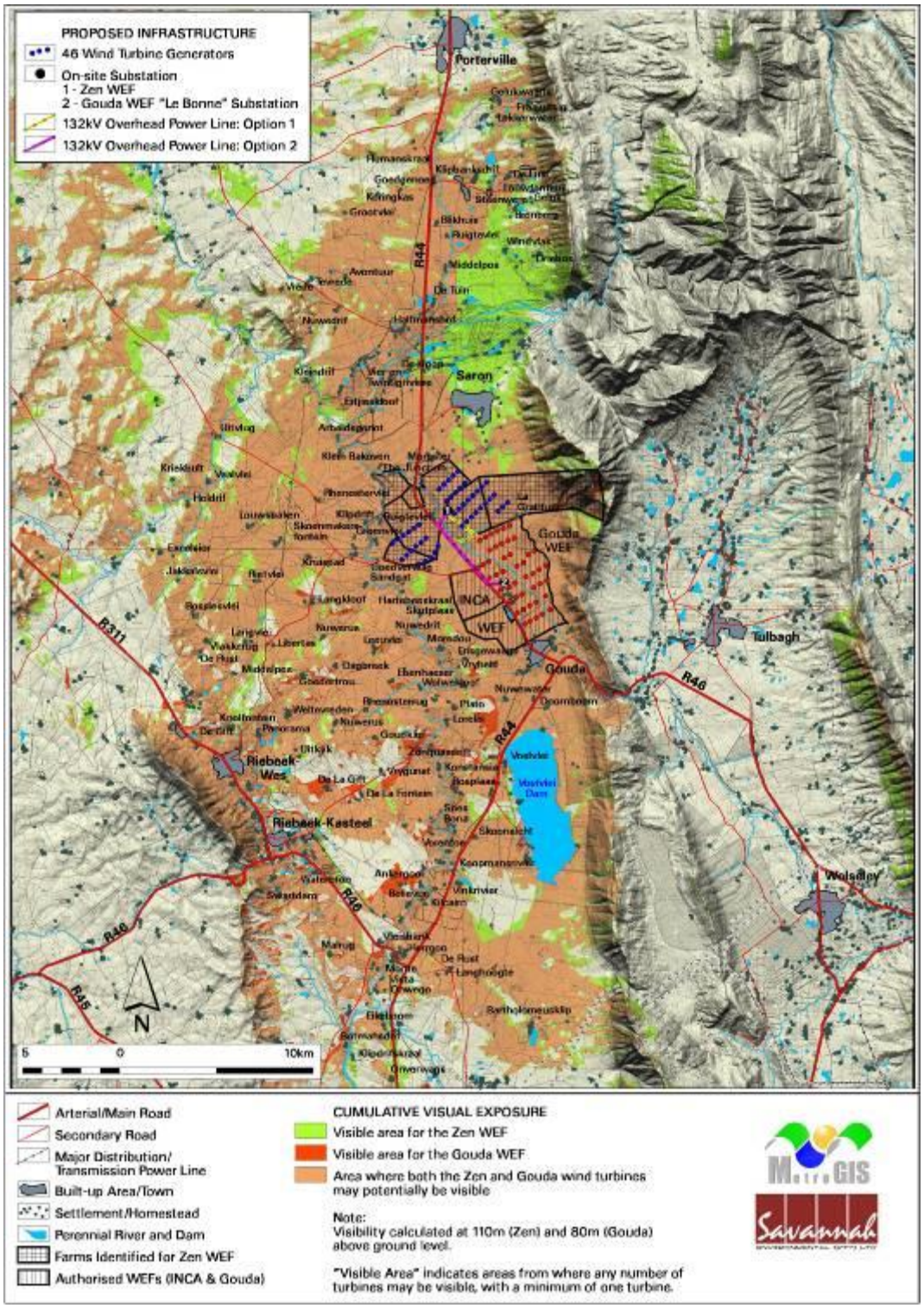

Figure 8.9: Potential cumulative visual exposure of the authorised Gouda wind energy facility and the proposed Zen wind energy facility.

8.6.9 Visual Impact of the Power Line & Comparative Assessment of Power Line Alternatives

The proposed power lines will visible to visual receptors within 2km of the infrastructure. The visibility of the power line lies largely within the view shed of the wind turbines. Both power line options are likely to result in potential visual impact, however Route 2 is 1km shorter than Route 1, and follows the alignment of the R44 road for a longer percentage of its length. This option, therefore, represents the consolidation and concentration of infrastructure, which is preferable from a visual perspective. Route 2 is therefore preferred power line option from a visual perspective, and its impact is assessed hereunder.

Of note is the location of the power line adjacent to the proposed Zen wind energy facility for the northern section, and its location adjacent to the authorised INCA and Gouda facilities in the south. In this respect, the much larger turbines will 'absorb' the visual impact of the power line to some extent, reducing the probability of this impact occurring somewhat.

The anticipated visual impact resulting from the overhead power line is likely to be of **moderate** significance. No mitigation of this impact is possible, but measures are recommended as best practice. The table below illustrates this impact assessment.

Impact Table – Visual Impact of the Power Line

Nature of Impact: Visual impact of the overhead power line on sensitive visual receptors in close proximity thereto		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High (8)	N/A
Probability	Probable (3)	N/A
Significance	Moderate **(48)**	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	
Mitigation / Management: Construction: » Rehabilitation of all construction areas, including the power line servitude. » Ensure that vegetation is not cleared unnecessarily. Operation: » Maintenance of servitude.		

Decommissioning: » Removal of infrastructure not required for post decommissioning use and rehabilitation of the servitude areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the overhead power line will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area. This is also relevant in light of the INCA and the Gouda wind energy facilities to the immediate south east of the proposed Zen facility. The construction of 3 wind energy facilities (Zen, INCA and Gouda) within 5km of each other will have a cumulative impact in terms of the concentration, extent and visual exposure of ancillary (built) infrastructure within the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.6.10 Conclusions and Recommendations

The construction and operation of the proposed Zen Wind Energy Facility and its associated infrastructure, will have a visual impact on the study area, especially within (but not restricted to) a 10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. It is concluded that a significant number of sensitive visual receptors will be impacted upon visually should this facility be developed.

Of relevance, however, is that two wind energy facilities are planned to be located south of the proposed Zen wind energy facility. These are the Gouda wind energy facility (approximately 60 turbines), bordering the site to the south, and the INCA wind energy facility (approximately 10 turbines), located immediately west of the formerly mentioned wind energy facility.

The Gouda facility is planned to be constructed in 2013. In this regard, the potential visual impact of the proposed Zen facility will fall mostly within the zone of potential visual impact of the authorised Gouda facility. Additional receptors that will be impacted upon as a result of the Zen facility include receptors in the town of Saron, and a few homesteads to the north thereof, as well as in the north west of the study area.

Therefore, in terms of cumulative impact, the proposed Zen facility will not result in an increased area of visual impact (i.e. beyond that of the authorised Gouda facility), but will result in an increase in the frequency of exposure within the existing viewshed. In this regard, visual receptors will be exposed to greater numbers of turbines, which would imply a higher intensity of visual intrusion.

On the other hand the consolidation of facilities and the creation of a wind energy hub in his area may contribute to the containment of a potentially scattered proliferation of wind energy facilities within an even greater region. The latter is undesirable from a visual perspective, and the consolidation and concentration of impact is preferred.

Considering all factors, therefore, it is concluded that the significance of anticipated visual impacts are of acceptable levels within this receiving environment. The main considerations include the relatively contained extent of potential visual exposure (due to the mountainous topography) and the understanding the Gouda facility will be constructed in due course.

A number of mitigation measures have been propose. Mitigation will be effective in terms of lighting and construction. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction and operational life span of the proposed facility.

8.7 Assessment of Potential Noise Impacts

Enviro-Acoustic Research (previously M2 Environmental Connections cc) reviewed the revised layout (dated 2013-10-08) for the proposed Zen Wind Energy Facility The addendum to the noise impact assessment report (Appendix K) considered the use of a range of wind turbines proposed by the developer. A number of wind turbines were evaluated that are currently available on the market and their noise emission levels plotted as wind speeds change. The addendum to the noise impact assessment report considered use of a combination of the following turbines:

» ECO-110, hub height 90m, rotor diameter 110m.
» ECO-122, hub height 89m, rotor diameter 122m.
» ECO-110, hub height 100m, rotor diameter 110m.

Noise data (total sound power emission and octave sound power emission levels) for these wind turbines were sourced from documents released by the manufacturer. With the input data as used, this updated assessment indicated that the proposed layout would have an insignificant noise impact on all potentially noise-sensitive receptors. It is likely that the wind turbines would be inaudible at most of the identified receptors. The total noise levels are not projected to exceed the noise level of 45 dBA recommended by the IFC (for residential use), the ETSU-R97 limit or the ambient sound levels measured onsite. The significance of the noise impact remains low and the latest proposed layout as modelled is considered to be acceptable from a potential noise impact aspect. The findings and recommendations of the previous Environmental Noise Impact Assessment will remain valid, which are summarised below.

8.7.1 Relevant Noise Receptors

Considering DEA's Environmental Potential Atlas, with available topographical maps used to identify potential Noise-sensitive developments in the area. The data was then imported into GoogleEarth® to allow a more visual view of the areas where Noise-sensitive developments were identified. The assessment indicated there are 224 such developments that occur in the area. Noise-sensitive developments identified are highlighted in **Figure 8.10** below and considered further in the Noise Impact Assessment (Appendix K). NSD01, NSD02 and NSD03 are located on the Zen site and considered sensitive to noise during construction and operations of the wind turbines.

8.7.2 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.

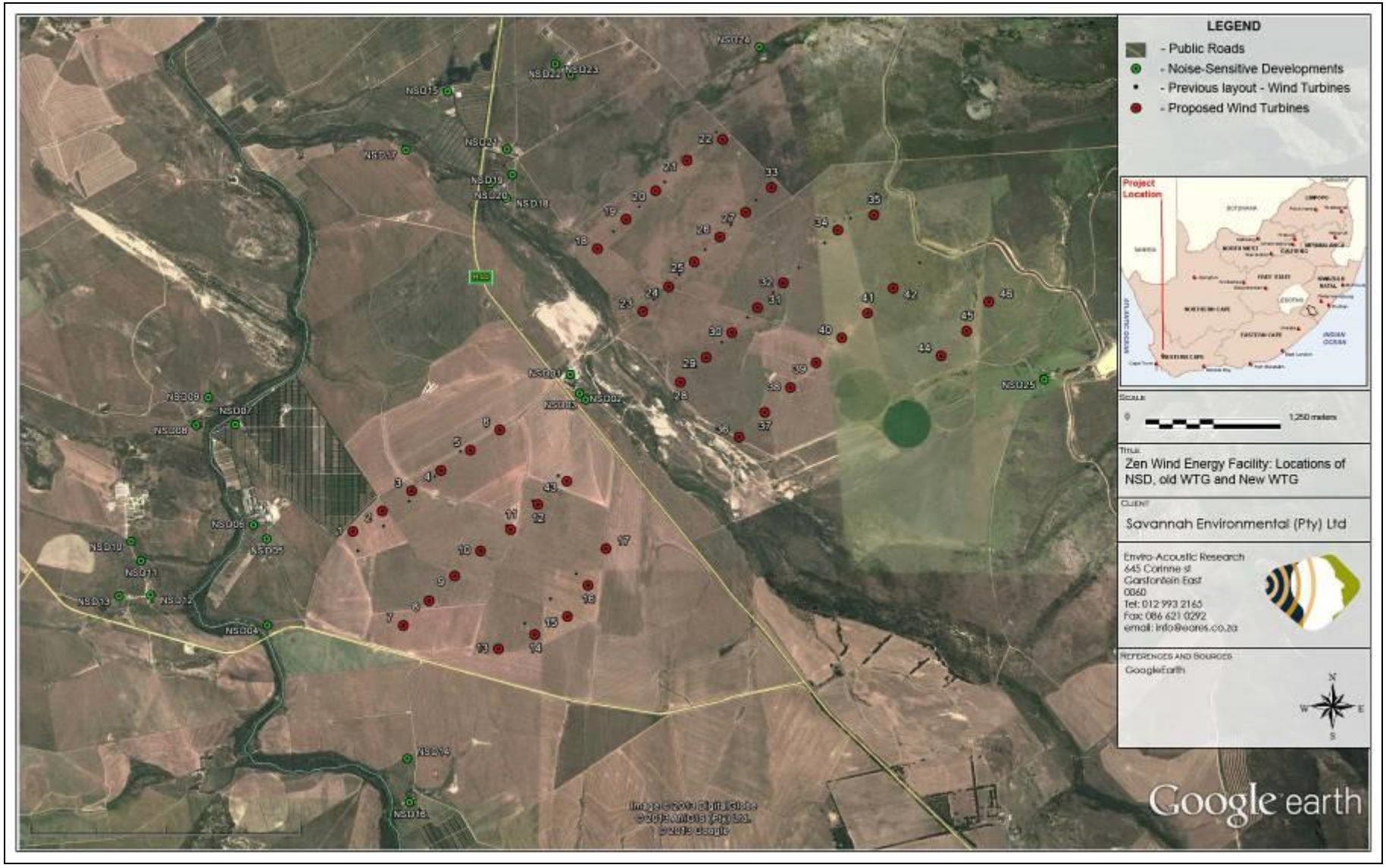

Figure 8.10: Aerial image indicating potential noise sensitive receptors and property boundaries for the Zen Wind Energy Facility

» **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).

Results of Noise Modelling – Construction Noise

Only the calculated daytime 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 all activities taking place simultaneously at each proposed wind turbine location during wind-still conditions, in good sound propagation conditions (20°C and 80% humidity).

Even though construction activities are projected to take place only during day time, it might be required at times that construction activities take place during the night (particularly for a large project). Below is a list (and reasons) of construction activities that might occur during night time:

» Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
» Working late due to time constraints: Weather plays an important role in time management in construction. A spell of bad weather can cause a construction project to fall behind its completion date. Therefore it is hard to judge beforehand if a construction team would be required to work late at night.

As it is unknown where the different activities may take place, it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6 dBA cumulative noise impact) at all locations where wind turbines may be erected, calculating how this may impact on potential noise-sensitive developments as well as mapping this modelled construction activity over distance. Overall, noise impacts during construction will have a low impact on the identified potential noise-sensitive receptors.

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

Nature: Numerous simultaneous construction activities that could cause noise impacts on receptors.	
Acceptable Rating Level	Rural district with little road traffic (excluding construction traffic): 45 dBA outside during day (refer **Error! Reference source not found.**). Use of $L_{Req,D}$ of 45 dBA for rural areas Ambient sound level = 35 - 40 dBA
Extent ($\Delta L_{Aeq,D}$>7dBA)	**Local**– Change in ambient sound levels would not extend further than 1,000 meters from activities **(2).**
Duration	**Temporary**– Noisy activities in the vicinity of the receptors would last a portion of the construction period **(1).**
Magnitude	Low Ambient noise levels <Rating Level **Low (2) – High (8).**
Probability	Due to change in ambient sound levels there is a possibility that NSD01 – 03 may complain. **Possible (2**)**.**
Significance	**Low (22)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Comments	Modelling considered a worse-case scenario with significant activities taking place all around NSD01 – NSD03.
Can impacts be mitigated?	Yes, though mitigation not required.
Mitigation:	Not required.
Effectiveness of mitigation:	Not applicable, mitigation not required
Cumulative impacts:	This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

8.7.3 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 sources[6]**
Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:
- Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge
- Noise due to inflow turbulence (turbulence in the wind interacting with the blades)
- Discrete frequency noise due to trailing edge thickness
- Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade)
- Noise generated by the rotor tips

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

Results of Noise Modelling – Operational Phase

The Noise study focuses on the impacts on the surrounding sound environment during times when a quiet environment is highly desirable. Noise limits are therefore appropriate for the most noise-sensitive activity, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc.). Appropriate Zone Sound Levels are therefore important, yet it has been shown that the SANS recommended (fixed) Night Rating Level ($L_{Req,N}$ = 35dBA) might be inappropriate due to the increased ambient sounds relating to wind action. A more appropriate method to determine the potential noise impact would be to make use of the projected noise levels due to the operation of the wind energy facility as well as the likely ambient sound levels due to wind induced noises.

That there exists a low risk of a noise impact developing during the operational phase of the development. Using a worse-case scenario with ambient sound levels more quiet than measured onsite, there exist a likely risk that the sound creased by the wind turbines will be audible at a level that may be annoying. However, considering the ambient sound levels as measured onsite, it is unlikely

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

that the wind turbines will create a noise sufficiently to be audible above the wind-induced noise levels.

Based on the modelling results and preceding figures the risk of a noise impact developing due to the wind turbines is very low. Considering the above, the significance of the noise impact is defined and summarised in the table below.

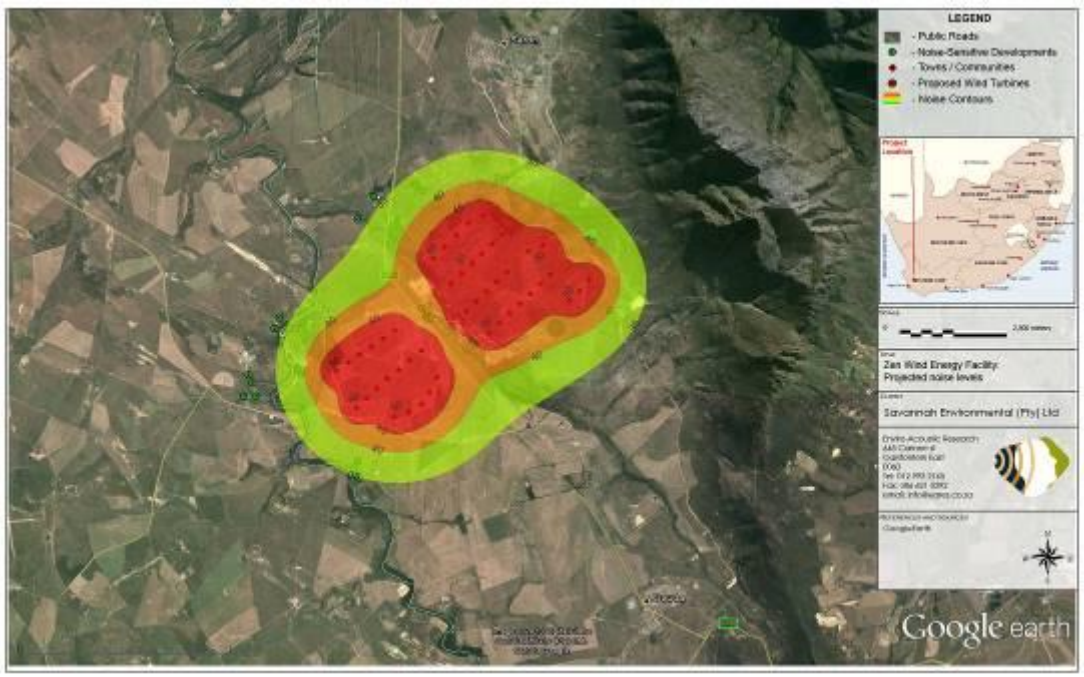

Figure 8.11: Projected Noise Levels (ISO model) from wind turbines; Contours of constant sound levels for a 6 m/s wind

Impact tables summarising the significance of noise impacts (without mitigation) during the operational phase (***Revised layout)***

Nature:	*Numerous turbines operating simultaneously during a period when a quiet environment is desirable.*
Acceptable Rating Level	Rural district with little road traffic. Acceptable noise level of 45 dBA as per ETSU-R97 and IFC.
Extent ($\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact will extend less than 1,000 meters from activity. **(2).**
Duration	**Long** – Facility will operate for a number of years **(4).**
Magnitude	**High (8)** – for NSD01, NSD02 and NSD03. Low for all other NSD
Probability	**Possible (2)** for NSD01, NSD02 and NSD03. Improbable for all other NSD.
Significance	**28 (Low)** for NSD01, NSD02 and NSD03.
Status	Negative.
Reversibility	High.
Irreplaceable loss of	*Not relevant.*

resources?	
Comments	-
Can impacts be mitigated?	Insignificant noise impact, mitigation not required
Mitigation:	*No mitigation required.*
Cumulative impacts:	This impact is cumulative with existing ambient background noises.
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

8.7.4 Comparative Assessment of Power Line Alternatives

Transformer noises (Substation)

Also known as magnetostriction; this is when the sheet steel used in the core of the transformer (substation) tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations are taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" takes place 100 times a second, resulting in a tonal noise at 100Hz. This is normally not an issue if the substation is further than 200 meters from a potentially sensitive receptor. This is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer equipment.

Transmission Line Noise (Corona noise)

Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires of power lines. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions as provided by fog or rain. A minimum line potential of 70 kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and

consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but fortunately it is generally only a feature during fog or rain.

Corona discharges results in:

» Power losses
» Audible noises
» Electromagnetic interference
» A purple glow
» Ozone production
» Insulation damage

In addition this is associated with high voltage transmission lines, and not the lower voltage distribution lines proposed for construction by the developer.

As such, Electrical Service Providers (such as Eskom) goes to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relative short duration compared to other operational noises. At the relative low voltages proposed for this project Corona noises would not be an issue.

There will be no differences in the significance of noise impacts for any of the alternative power line routings. Therefore any of the two proposed alternatives are considered acceptable from a noise perspective.

8.7.5 Cumulative impacts

Because Environmental Authorisation was granted for the neighbour Gouda Wind Energy Facility, and this facility is planned to be constructed in 2013/2014, this noise impact assessment will also investigate the cumulative potential noise impact. The closest wind turbines in the wind energy facility are shown in **Figure 8.11.**

The developer of the neighbour Gouda Wind Energy Facility had indicated that the Enercon E82 wind turbine would be used. Unfortunately the 3rd octave sound power levels for this turbine was not available with the compilation of the report, but based on the total sound power level of the Enercon, the Vestas V90 3.0 MW turbine (operating in mode 0), for which 3rd octave sound power levels are available will be used. While the 3rd octave spectrum characteristics may differ, the total sound power levels are sufficiently close to provide an indication of the potential noise impacts. The octave sound power levels of the Vestas V90 3.0MW turbine (operating in mode 2) is presented in Table 8.3 (in octave sound power levels).

Table 8.3: Octave Sound Power Emission Levels used for modelling: Vestas V90 3.0MW wind turbine operating in Mode 2

Wind Speed (m/s)	**$L_{Aeq,ambient}$ (**Error! Reference source not found.**) dBA**	**31.5 (dB)**	**63 (dB)**	**125 (dB)**	**250 (dB)**	**500 (dB)**	**1000 (dB)**	**2000 (dB)**	**4000 (dB)**	**L_{WA} (dBA)**
5*	30.30	110.3	106.4	101.8	99.1	95.8	96.4	93.2	87.8	100.4
6*	33.33	115.3	112.0	103.7	100.5	97.4	98.6	95.0	89.6	102.4
7*	37.09	117.3	110.7	104.7	101.6	98.1	99.9	95.8	90.2	103.4
8*	41.4	117.9	118.7	105.8	102.1	98.4	99.3	96.0	93.2	103.8
9*	46.16	118.1	120.5	106.8	102.2	98.8	99.6	95.9	93.0	104.0
10*	51.16	118.6	121.4	107.9	102.8	99.6	100.9	96.6	93.2	104.9

*Source: DELTA (2009) for a Vestas V90 3.0MW wind turbine with hub height of 107 m above ground with 90 m rotor diameter. Turbine operating in Mode 2.

Results: Operational Phase – Cumulative potential noise impacts

Projected Cumulative Noise Levels in the area due to the operation of both wind energy facilities are illustrated in the following figures (ISO model for a 7 m/s wind). **Figure 8.12** illustrates the projected cumulative noise levels due to the operation of the Zen and Gouda wind energy facilities, illustrating the potential noise impact if all the wind turbines from the two wind energy facilities are operating at the same time.

The review indicates that NSD04 would be the only potential noise-sensitive receptor that could be influenced by increased cumulative noise levels due to sounds from the wind turbines from both wind energy facilities. The increase however is less than 5 dB and not considered significant. The total noise level (42 dBA) in addition is not significant if considering the ambient sound levels as measured onsite.

It should also be noted that the dwelling is not used constantly, and mainly a holiday / hunting residence rented to holiday makers. The findings of the previous section will therefore remain relevant and the significance of the cumulative noise impact will remain low.

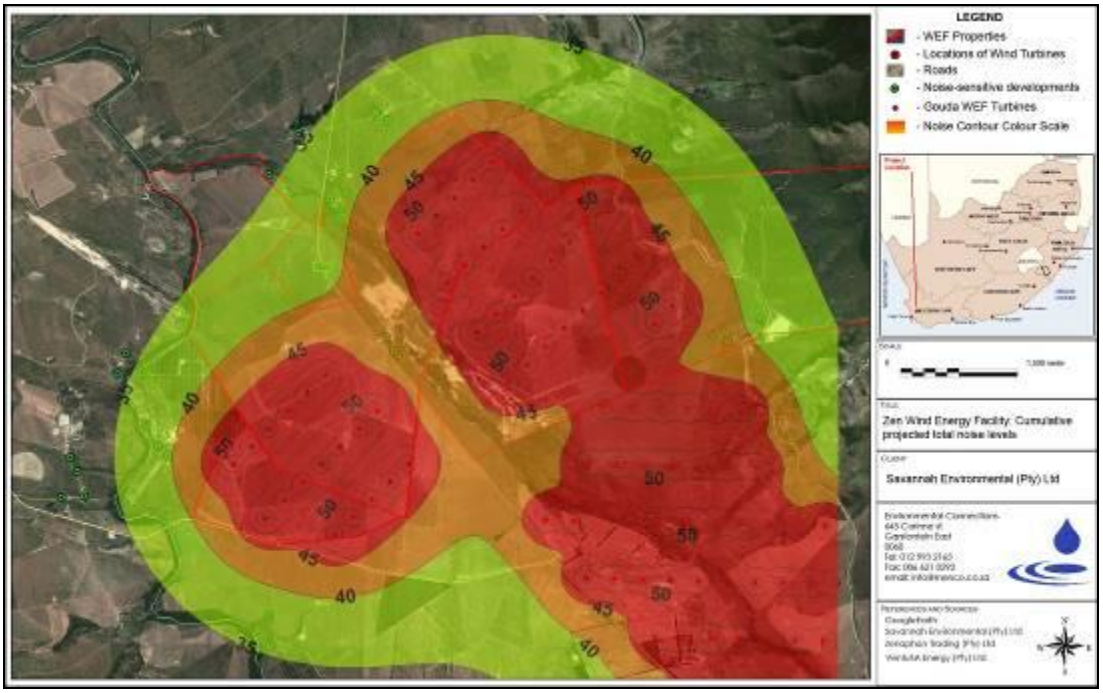

Figure 8.12: Projected Night-time Cumulative Noise Levels (ISO model) when both wind energy facilities operate for a 7 m/s wind

8.7.6 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 3.0MW wind turbine. However, mitigation measures are still proposed to reduce the potential noise impacts and risks to receptors.

With the input data as used, this assessment indicated that the potential noise impact would be insignificant during both the construction and operational phases, considering the singular noise impact of Zen as well as the cumulative noise impact when both of these proposed wind energy facility are operational.

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 could 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. Measurements done onsite show a soundscape significantly impacted by wind-induced noises. No further ambient sound measurements are recommended prior to the development of the wind energy facility. Quarterly noise measurements are recommended for the first year of operation.

Noise measurements are recommended at NSD02/NSD03, NSD04 and NSD19/NSD20 over a period of at least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer. If a valid and reasonable noise complaint is registered relating to the operation of the facility additional noise monitoring should be conducted by an acoustic consultant during the quarterly noise measurements. Noise monitoring must be continued as long as noise complaints are registered.

The developer should re-evaluate the layout if any wind turbines are added within 1 000 meters from any NSD.

The findings of the NIA 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.

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 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.

8.8 Assessment of Potential Impacts on Heritage - Archaeology

No sites of significant heritage potential were identified in the proposed Zen site and broader study area. Although no significant heritage sites could be identified on the surface, the following heritage features were found/ considered in the survey:

» Early Stone Age (ESA) material was common but its density varied considerably according to location. In general, the eastern side of the farm had very few artefacts, while in the west artefacts were present throughout the area but more frequently encountered towards the north than the south. These occurrences are not really 'sites' in the typical sense, since the material is largely in secondary context having been left on the surface after erosion of the overlying deposits.
» Two small LSA scatters were found on the banks of the Berg River in the far west of the site. Neither was dense. Both included flaked artefacts in quartz and one had a small quartzite hammer stone and one quartzite flake present. A small number of isolated quartz flakes were found in sandy ground close to the proposed substation location. They were too dispersed to be able to distinguish any source areas but with the bush present there it is quite likely that an LSA site is present in the immediate vicinity.
» No historical artefacts were seen anywhere in the study area.
» No graves were seen in the study area and the farmer commented that no graves were known to be present on the site.
» Two old structures occur on the Farm Bonne Esperance and those at Die Mond. The structures in Saron will not be given individual consideration here since they are relatively far from the proposed development. However, as a whole they will be considered under historical settlements below.
» The towns of Saron and Gouda: the majority of buildings are quite recent and the town has no significance as a historical settlement.
» Cultural landscape: limited.

Archaeological resources and built environment resources are provisionally graded as shown in Table 8.4. Grading is a means of generalising the degree of heritage significance attached to the resources present. The archaeological resources are of limited significance and do not merit any grading. The farm houses are altered to varying degrees but that at Die Mond appears to contain more original fabric and/or joinery and, upon inspection of its interior, may in fact merit a 3B grading. Furthermore, its context is better with the Kleinbergrivier werf having had modern storage facilities and farm outbuildings added to it. While some individual structures within the historic settlement of Saron likely merit a 3A grading, the majority of its historical structures should probably be 3C or

ungraded. However, the overall context of the historic core of Saron is deemed of reasonable significance and might be considered as a grade 3B heritage resource.

Table 8.4: Provisional grading of heritage resources in the ZEN study area.

Heritage resource	Provisional grading
MD2012/001	ungraded
MD2012/002	ungraded
MD2012/003	ungraded
MD2012/004	ungraded
KB2012/001	ungraded
KB2012/002	ungraded
HK2012/001	ungraded
BE2012/002	ungraded
Kleinbergrivier farmhouse	3C
Kleinbergrivier outbuilding	ungraded
Die Mond farmhouse	3B/C
Die Mond outbuilding	ungraded
Saron historical settlement as a whole	3B

Archaeological mitigation, if required, could be easily carried out under a permit issued to the archaeologist by Heritage Western Cape. Since no other heritage resources will be directly impacted therefore no other permits would be required for implementation of the proposed development.

Impact Tables – Impact of Construction on heritage artefacts

Nature: Destruction and/or disturbance of archaeological sites and/or artefacts.		
	Before mitigation	**After mitigation**
Extent:	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (15)**
Status	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
Mitigation: » *In situ* recording of ESA artefacts and excavation of LSA sites (if ever found to be impacted).		
Cumulative impacts Other similar archaeological material would be impacted by other similar developments in the area but, given the widespread nature of this material, cumulative impacts are not significant.		

8.8.1 Comparative Assessment of Power Line Alternatives

The two power line routes along the R44 to the proposed substation to the south will cross through one of the areas with a high concentration of ESA artefacts as identified by Orton (2010). However, the excavation of power line pylons in that area is not deemed to be of any significance. No preferred option, both are acceptable from a heritage prospective.

8.8.2 Cumulative impacts

Other similar archaeological material would be impacted by other similar developments in the area but, given the widespread nature of this material, cumulative impacts are not significant.

8.8.3 Conclusions and Recommendations

No important heritage sites occur within the development footprint of the proposed for infrastructure for the Zen Wind Energy Facility. Impacts to heritage resources are not likely to be very significant and no "red flag" issues have been identified. Archaeological resources of medium to low significance will be directly impacted, while buildings, cultural landscapes and scenic routes will all receive indirect impacts of medium to low significance. It is concluded that, on heritage issues, the proposed Zen wind energy facility may proceed.

Archaeological mitigation, if required, could be easily carried out under a permit issued to the archaeologist by Heritage Western Cape. Since no other heritage resources will be directly impacted no other permits would be required for implementation of the proposed development.

It is recommended that, subject to the agreement of Heritage Western Cape, the proposed project should be allowed to proceed. However, the following conditions should be adhered to:

» If any change to the layout is made pre-construction then a follow-up inspection of the new layout should be made, particularly for archaeological resources which are point-specific on the landscape.
» Buffers around historical houses should be a minimum of 500 m but preferably as large as possible. The nearest turbine is 960 m from main house and 2.9 km from the other historical house so this is acceptable in terms of the current layout.
» If any burials are encountered during any stage of the development then work in the immediate vicinity should be stopped, the remains protected and the

finds reported to HWC or an archaeologist. Exhumation would be required at the expense of the developer.

» 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 HWC, 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.

8.9 Assessment of Potential Impacts on Palaeontology

8.9.1 Findings or Loss of Fossils during Construction

The study area is underlain by deposits of the Malmesbury Group (low-lying areas) and Cape Supergroup (mountains). According to Almond and Pether (2008) the Malmesbury Group is of low palaeontological significance with no fossils recorded as yet. The Cape Supergroup rocks contain several units with varying palaeontological significance. Generally, the shale units have higher significance than the sandy units but are not well represented in the study area. The lowest rocks, if present, would be Piekenierskloof Formation conglomerates (J. Compton, pers. comm., 2010), while Peninsula Sandstone would overlie them. Norman and Whitfield (2006:fig. 19) show that the more significant Cederberg shale only occurs in the very high reaches of the mountains where turbines would not be constructed. The only shale unit that might be present lower down is the Graafwater Formation, which occurs between the Piekenierskloof and Peninsula Sandstone Formations, but this would be very thin here if present at all.

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, 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 overall impact significance of the construction phase of the proposed wind farm project is assessed as low (negative) without mitigation. 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 (HWC and/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 palaeontological under-recorded region would constitute a useful addition to our scientific understanding of the fossil heritage here.

The intent of mitigation and lessening of impact is to identify fossil localities for future avoidance or to recover in situ fossils before possible damage or destruction.

Care should be given however to constructions such as access routes, construction facilities, substations, pylons and buildings which would not be limited to dolerite. It is recommended that a palaeontological surface survey of the site is conducted in all the non-doleritic areas prior to construction where construction is planned.

In addition the ECO should photograph and record the position of fossiliferous material when exposed during construction. If the fossiliferous material is going to be damaged during construction, the ECO could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, palaeontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist. A palaeontologist should be appointed to salvage and collect fossiliferous material from the site which may exposed during construction.

The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from HWC and/or SAHRA. A letter stating that no further paleontological studies is required for the project, is attached to Appendix R).

Impact Table – Impact on fossil heritage resources during the construction phase

Nature: Potential paleontological heritage identified in the affected area could be negatively affected during the construction phase (excavations) of the development.		
	Without mitigation	**With mitigation**
Extent	Local High (5)	Local Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	improbable (2)
Significance	**Medium (50)**	**(Low) 24**
Status (positive or negative)	Negative	Positive
Reversibility	Improbable	Possibility
Irreplaceable loss of resources?	High	High
Can impacts be mitigated?	Yes	

Mitigation:

» Care should be given however to constructions such as access routes, construction facilities, substations, pylons and buildings which would not be limited to dolerite. It is recommended that a palaeontological surface survey of the site is conducted in all the non-doleritic areas prior to construction where construction is planned.

» An ECO should photograph and record the position of fossiliferous material when exposed during construction. If the fossiliferous material is going to be damaged during construction, the ECO could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, palaeontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist. A professional palaeontologist should be appointed to salvage and collect fossiliferous material from the site which may exposed during construction.

» The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from the Heritage Western Cape.

8.9.2 Comparative Assessment of Power Line Alternatives

There will be no differences in the significance of fossil heritage impacts for any of the alternative power line routings or construction compound. Therefore any of the proposed alternatives are considered acceptable from a paleontological impact perspective.

8.9.3 Cumulative impacts

The cumulative impact on fossils from the Zen wind energy facility and other projects will not have a significant impact on palaeontological resources.

8.9.4 Conclusions and Recommendations

The study area is underlain by deposits of the Malmesbury Group (low-lying areas) and Cape Supergroup (mountains). According to Almond and Pether (2008) the Malmesbury Group is of low palaeontological significance with no fossils recorded as to date. A letter stating that no further paleontological studies is required for the project, is attached to Appendix R).

8.10 Summary of Impacts associated with the Proposed Power line

A power line will be required from the Zen on-site substation to connect into the proposed LeBonne Substation which is planned to be constructed on a Farm LeBonne Esperance (which is located on a farm that is adjacent to the Zen site, located on the Gouda wind energy facility site).

Two power line alignments/alternatives are proposed in order to link the proposed Zen Substation to the La Bonne Substation, which is located ~4.5 km to the south of the Zen site. Both alternative alignments follow a corridor aligned along, and to the north of the R44, with the final ~3.5km of the two alignments along the same alignment/corridor. Route 1 (~6.5 km in length) is planned to run inland across Farm Bonne Esperance, then turn towards the R44 and run along the R44. Route 2 runs along the R44 to the LeBonne Substation and is ~5.5 km in length. Both power line routes cross over the Klein Berg River at different points. These two routes were considered and assessed in this EIA.

The impacts of the power line have been assessed under each section in this Chapter. In summary, the impacts of the power line include:

» Negative impact on vegetation and soil structure during construction of the power line and associated access roads (low significance rating).
» Disturbance (intrusion impacts) to residents / farmers living in close proximity to where the power line is being constructed (low significance rating).
» Operational impact: Bird mortality due to the power line (low significance rating).
» Operational impact: Visual impact on surrounding area (low significance rating).

Regarding the grid connection options, the following conclusions can be drawn:

» Route 2 is 1km shorter than Route 1, which reduces the footprint of the power line.
» Visual impacts will be reduced for Route 2 due to a shorter length of power line.
» Route 2 is aligned adjacent to the R44 road, and so the impacts associated with linear infrastructure are consolidated.
» Potential impacts on avifauna will be reduced for Route 2 due to a shorter length of power line.
» Route 2 is aligned adjacent to the R44, which will serve to reduce its potential ecological impact as compared to the Route 1.
» Route 1 would traverse centre-pivot irrigation areas on Klein Berg River and is therefore not feasible or preferred from a land-use perspective.

Therefore Route 2 is the preferred option from an environmental perspective due to the reduced degree of disturbance compared to Route 1.

8.11 The No Go Option

As indicated above, 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. As discussed in 5.2.1, both national and the Western Cape provincial governments have set targets for renewables substitution.

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost.

In addition, the No-Development option would compromise the objectives of the WLM IDP and LED to create employment and support economic development.

However, at a provincial and national level, it should be noted that the Zen wind energy facility is not unique. In that regard, a significant number of wind energy facility developments are currently proposed in the Western and Eastern Cape Provinces. Foregoing the proposed Zen wind energy facility would therefore not necessarily compromise the development of renewable energy facilities in the Western Cape or South Africa. However, the benefits to the DLM and the Saron and Gouda communities would be lost should the facility not be developed.

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning "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".

There has been a steady increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. The Department of Energy has, under the REIPPP Programme released requests for proposals to contribute towards Government's renewable energy target of 3725 MW and to stimulate the industry in South Africa. To date, a total of 64 projects have been awarded to the private sector (with a generating capacity of 3922 MW), and the first projects are already on line.

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. Cumulative impacts of the Zen Wind Energy Facility with other known or proposed renewable energy facility projects within the region are assessed in this chapter.

9.1 Approach Taken to Assess Cumulative Impacts

Significant cumulative impacts that could occur due to the development of the wind energy facility and its associated infrastructure in proximity to other similar developments include impacts such as:

- Loss of vegetation and impacts on ecology;
- Impacts on avifauna and bats;
- Soil and agricultural potential impacts;
- Heritage impacts;
- Noise impacts;
- Visual impacts; and
- Social impacts.

A number of wind energy facilities have either been proposed or are under construction within 30km of the proposed for the Zen Wind Energy Facility in the

Western Cape Province. These are described in Table 9.1 and indicated on Figure 9.1.

Table 9.1: Renewable energy facilities within the broader region based on (information available at the time of compiling this report)

Project Name	**Distance from the proposed site**
Gouda Wind Energy Facility	Adjacent (to the south)
30MW INCA Wind Energy Facility	<5km
Renewable Energy Facility near Wolseley	30km
Moorreesburg Wind Farm	30km
Solar Energy Facility at Porterville	25km
Solar Energy Facility at Riebeek Kasteel	15km

As there is uncertainty as to whether all the above-mentioned developments will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. It is, however, important to explore the potential cumulative impacts qualitatively as this will lead to a better understanding of these impacts and the possible mitigation that may be required. As these cumulative impacts are explored in more detail the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions – a national interest) versus the local and regional environmental and social impacts and benefits (i.e. landscape, ecology, tourism, employment etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

It is important to note that it is unlikely that all proposed renewable energy facilities indicated in Table 9.1 will be constructed in the short- to medium-term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Zen Wind Energy Facility.

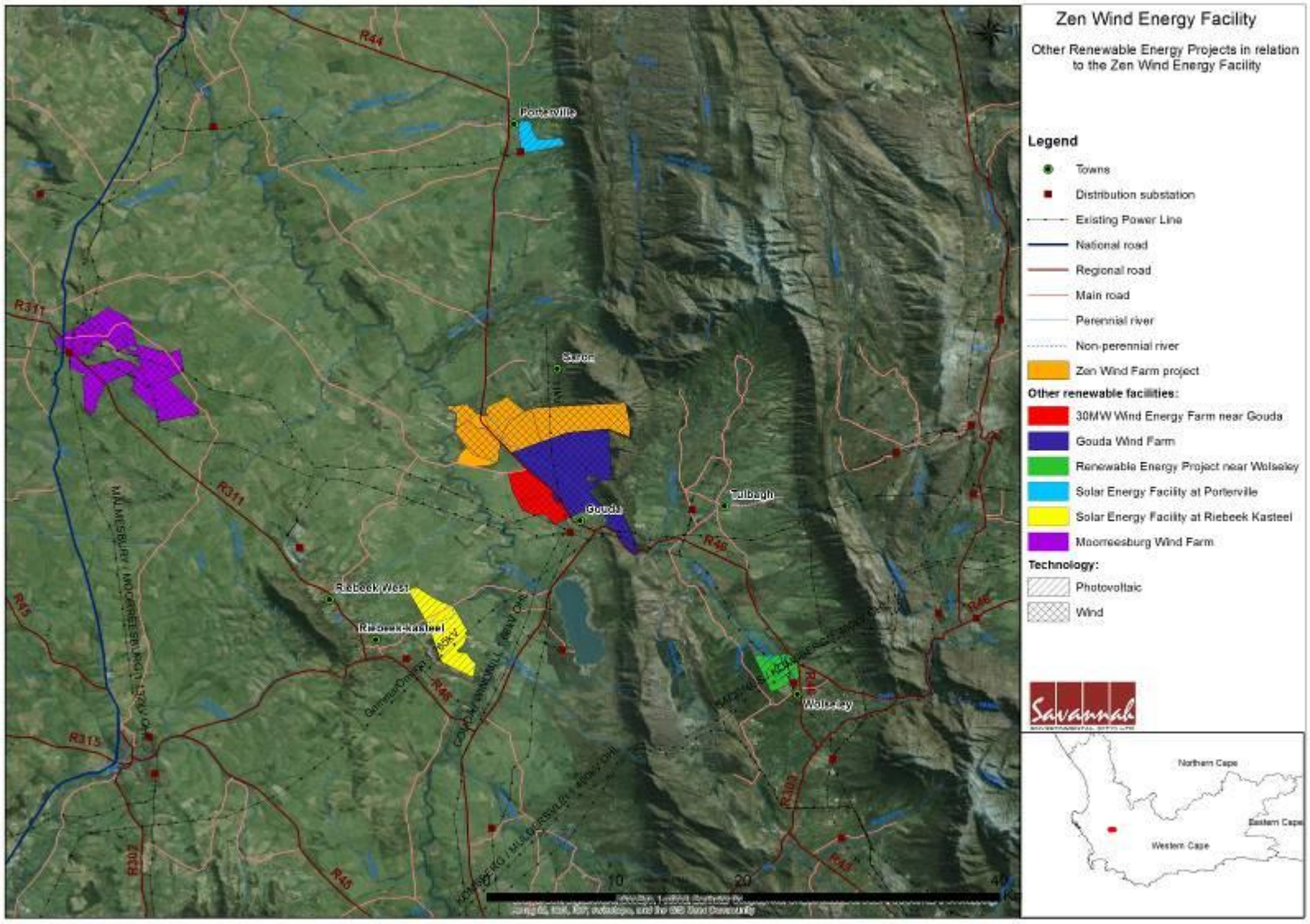

Figure 9.2: Map showing proposed renewable energy projects in the region

Based on the information available at the time of undertaking this EIA, two other wind energy facilities are planned on adjacent farm portions to the Zen Wind Energy Facility site (shown in **Figure 9.2**). These two facilities include:

» The Gouda Wind Energy Facility (approximately 46 turbines), bordering the site to the south of the Zen Wind Energy Facility site. The Gouda Wind Energy Facility is a preferred bidder for Round 2 of the REIPPP Program and construction of the project commenced in 2013.
» The iNca wind energy facility (approximately 10 turbines), located south of the Zen Wind Energy Facility site. The project has been authorised by National DEA.

Potential cumulative impacts of these and other proposed facilities in the region are summarised below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F – M and Chapter 8):

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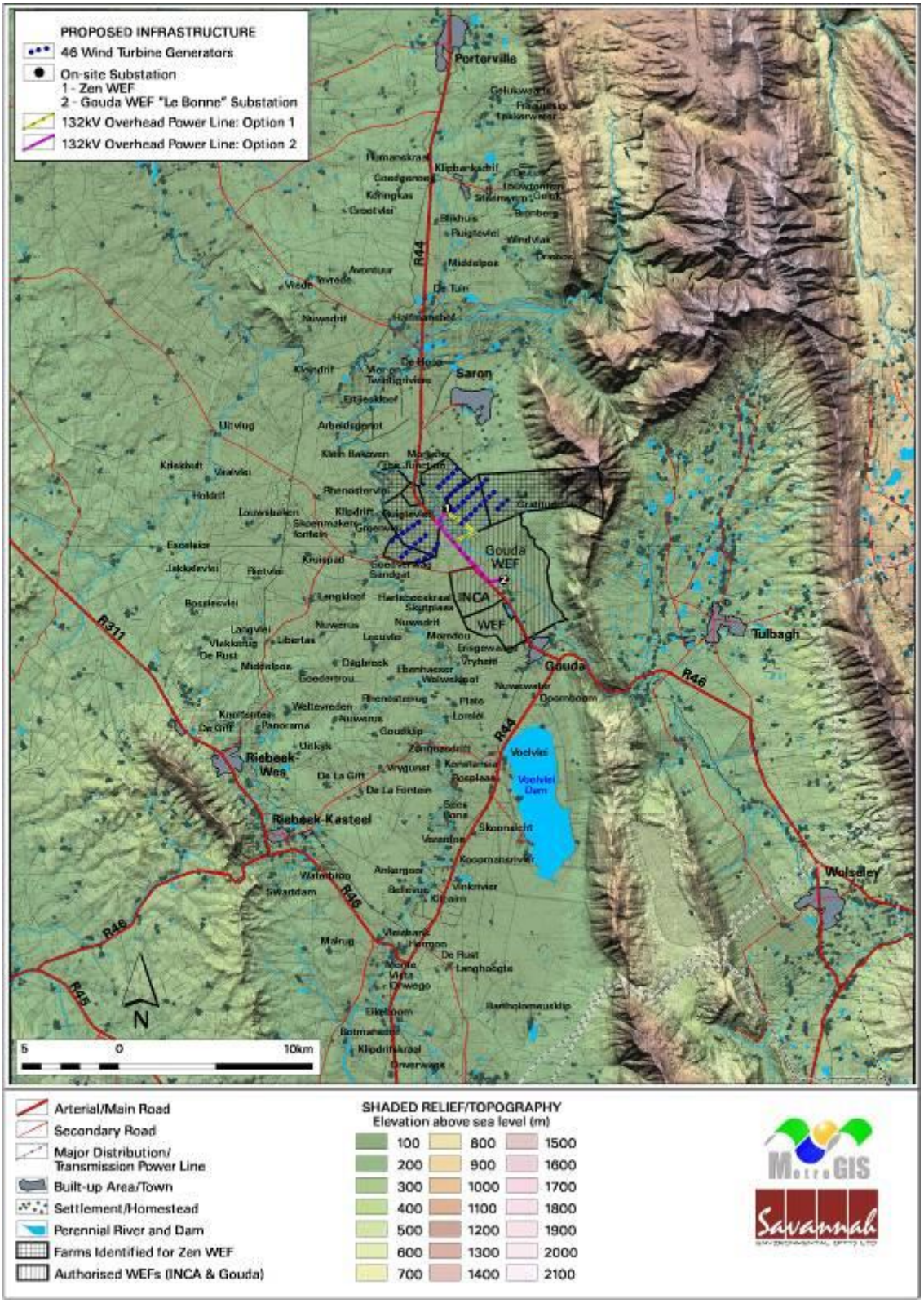

Figure 9.2: Shaded relief map showing the location of the Zen site and the two other wind energy facilities in the immediate area

9.1.1. Cumulative Visual Impacts

This impact will be sequential and additive, due to the visibility of wind turbines from two or more projects within 1-2km of each other. From a visual perspective, the overlapping viewsheds can be considered favourable, as it represents the consolidation and concentration of potential visual impacts within a clustered region (i.e. the development of a wind energy facility node/ hub rather than dispersing the impact to other areas).

Figure 9.3 shows the potential cumulative visual impact of the proposed Zen Wind Energy Facility as well as the Gouda Wind Energy Facility currently under construction (located to the south). This map shows those areas that will be exposed to both facilities (light orange), those areas that will be exposed only to the approved Gouda facility (dark red), and those areas that will be exposed only to the proposed Zen facility (green). It is noteworthy that due to the close proximity of these facilities, their respective viewsheds cover largely the same area. Discrepancies exist to the immediate north of the proposed Zen facility, where the taller turbines will be visible to the town of Saron and the areas to the north thereof. Other than this, there are no significant differences in the extent of visual exposure of these two facilities.

In this respect, the potential visual impact of the proposed Zen facility will fall mostly within the zone of potential visual impact of the authorised Gouda facility. Additional receptors that will be impacted upon as a result of the Zen facility include receptors in the town of Saron, and a few homesteads to the north thereof, as well as in the north west of the study area.

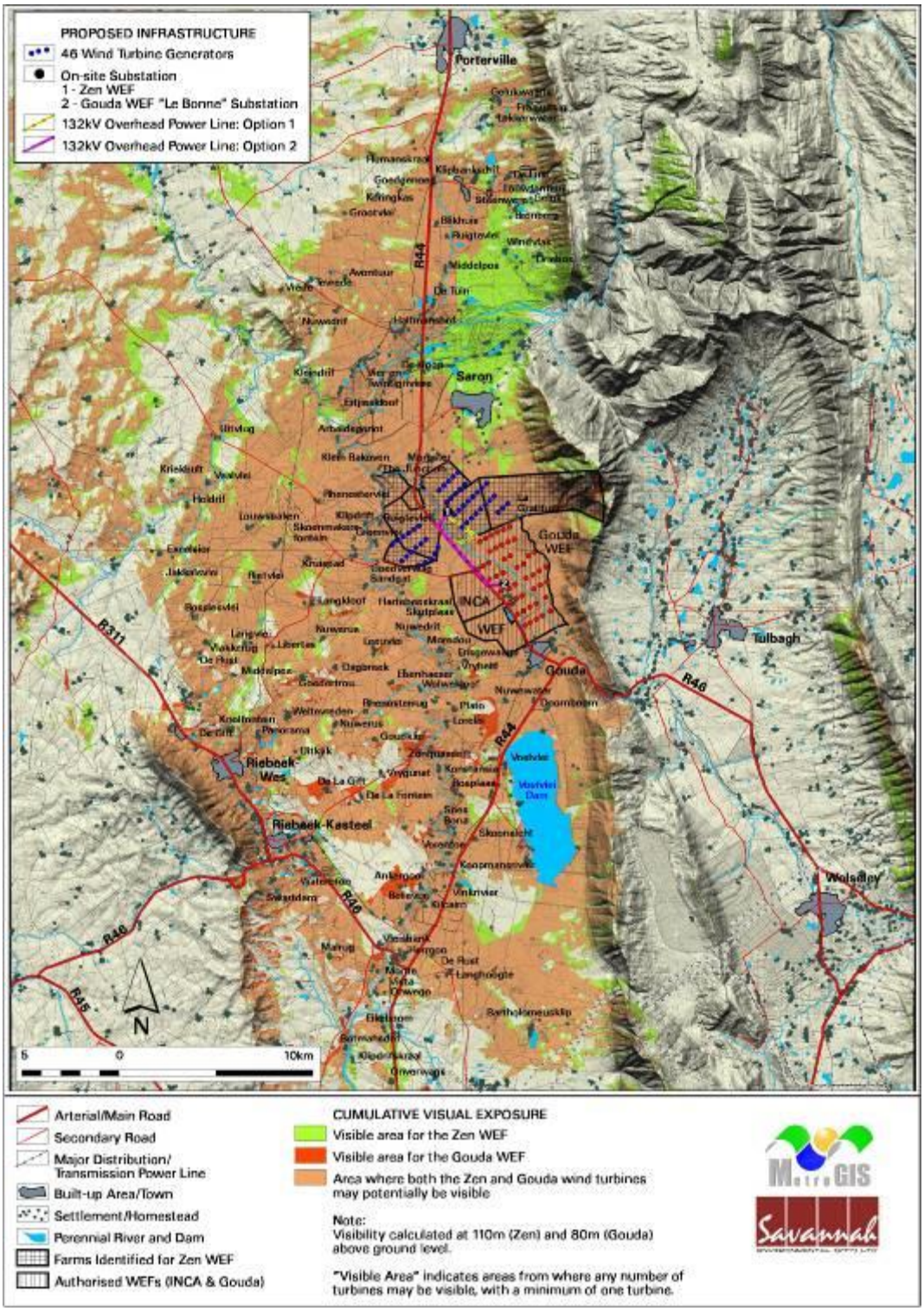

Figure 9.3: Potential cumulative visual exposure of the authorised Gouda wind energy facility and the proposed Zen wind energy facility

Therefore, in terms of cumulative impact, the proposed Zen facility will not result in a significantly increased area of visual impact (i.e. beyond that of the authorised Gouda facility), but will result in an increase in the frequency of exposure within the existing viewshed. In this respect, visual receptors will be

exposed to greater numbers of turbines, which would imply a higher intensity of visual intrusion. Cumulative visual impacts as a result of the construction of the project are of an acceptable level.

9.1.2. Cumulative Social Impacts

Cumulative negative social impacts are linked to the visual impact, as discussed above. The establishment 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 will, however, be of moderate significance due to the relatively low incidence of visual receptors in the region. Cumulative social and visual impacts as a result of the construction of the project are of an acceptable level.

Cumulative positive socio-economic impacts from three or more 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, may be significant. Spin-off cumulative impacts will be benficial in nature.

9.1.3. Cumulative Ecological Impacts

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 and habitat loss may become cumulative with the development of other wind energy facilities (and other developments) in the region. Given the anthropogenic influence on the landscape, and the development footprint which avoids the sensitive features of the site such as Klein Berg River and majority of the remaining natural vegetation, there are not likely to be significant cumulative impacts on ecology. With the implementation of this mitigation, cumulative impacts on ecology as a result of the construction of the project are of an acceptable level.

9.1.4. Cumulative Avifauna Impacts

The cumulative effect of the two or more wind energy facilities in an area on bird species of conservation concern may be moderate to high, without mitigation. It is, therefore, necessary that post-construction monitoring is continued on all sites 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 bird mortalities and displacement may emerge as a significant impact. The cumulative effect of the multiple wind energy facilities in this area on certain birds (Blue Crane and Karoo Shelducks) may be of medium-high significance. Mitigation may be achieved by the limitation of turbine operation at time of risk through the deployment of radar devices that detect approaching birds and temporarily close turbine operation. As the adjoining Gouda Wind Energy Facility is currently under construction, and has similar habitat and bird species, this presents a unique opportunity for the Zen Wind Energy Facility developers to consider actual mortality rates for a wind project in this area.

9.1.5. Cumulative Impacts on Bats

As the Gouda Wind Energy Facility is located adjacent to the Zen site, the two projects could cumulatively result in higher rates of bat mortality due to collision or barotrauma. With development spanning across a larger area (i.e. cumulative land space occupied), more area will be affected and the local bat population will have less suitable area to forage in the proximity of the study area. Therefore, the impacts assessed could potentially increase in duration, magnitude and extent. As the distance that separates these facilities from the Zen Wind Energy Facility is small, it is expected that most of the present and possibly occurring bat species within Zen Wind Energy Facility area will be affected by the resulting cumulative impacts. Bats roosting at the Zen site will possibly travel to the Gouda site to forage, and vice versa. Therefore cumulative impacts of moderate and acceptable limits may result due to the existence of other wind energy facility in close proximity, and in areas that bat species may use frequently.

9.1.6. Cumulative Impacts on geology, soils and agricultural potential

The development of the Zen project and other projects in adjacent areas has the potential to have negative cumulative impacts on soil. Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures must be implemented. With good soil management, cumulative impacts can be prevented. Regarding agricultural potential and impacts on agricultural land use of the site, the long-term impact on the agricultural production and food security by the proposed Zen Wind Energy Facility will be small/ insignificant as long as the development adheres to the environmental management programme. The development of the site as a wind energy facility will only have a short-term negative impact on the production of agricultural products from the property. That is during the construction phase of the project when the construction activities may interfere with the normal management practices on the property. Thereafter, the livestock and game farming activities will return to normal and the presence of the wind turbines is not expected to have any negative effect on normal farming and management practices. The

significance of the cumulative impact on agricultural potential will be low and is of an acceptable level.

9.1.7. Cumulative Noise Impacts

The impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noise as well as other noisy activities conducted in the same area. This is however dependent on two or more facilities being under construction at the same time, which is unlikely.

Noise modelling of the Zen and Gouda wind energy facility revealed that the projected cumulative noise levels due to the operation of the Zen and Gouda wind energy facilities due to the wind turbines is not significant when considering the ambient sound levels as measured on-site. The significance of the cumulative noise impact from the wind turbine will be low and are of an acceptable level.

9.1.8. Cumulative Impacts on Heritage and Palaeontological Resources

Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the area. The potential for the loss or find of heritage artefacts in the region will also increase. The larger area and the Zen site specifically have limited heritage sites, and the significance of the cumulative impact is low and of an acceptable level. There is no cumulative impact on palaeontological resources as the site has a low fossil potential.

9.1.9. Cumulative Impacts on Existing Infrastructure

» Increased pressure on existing roads and other infrastructure may arise if construction of two or more facilities take place at once. Due to the nature of the REIPPP Programme bidding process and Eskom's grid connection constraints, this is considered unlikely and no cumulative impacts are anticipated.

9.3 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in the region. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive at an international level. The economic benefits of renewable energy developments at a local, regional and national level also have the potential to be significant.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Zen Wind Energy Facility have been summarised below:

Cumulative impacts	Significance rating
Visual impact	High
Noise impact	Low
Social impact- positive impact (social and economic value)	High
Social Impact- negative impacts (visual, sense of place, noise and disturbance during construction)	Medium
Ecological impact	Low
Impact on soil and agricultural potential	Low
Impact on Bats	High
Impact on Birds	Medium to high
Heritage impact	Low
Palaeontological impact	No cumulative impacts anticipated

Based on the above, the cumulative impacts associated with the construction and operation of the Zen Wind Energy Facility and other renewable energy facilities in the region are considered to be acceptable (even though considered to be high in some instances) provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for each project. The potential for a cumulative effect on movement of waterbirds must be considered and real data collected during the operation phase of the Gouda Wind to reasonably identify the real potential for the impact, and quantify the extent of the impact. The Zen site is more than 10km north of the Voelvlei Dam, and the Gouda Wind Farm lies between the Zen facility and the waterbody. Therefore due to its location, the Gouda Wind Farm would form the initial obstacle or barrier to waterbirds in this area, typically at night during the months of known waterbird movement. Mitigation may be achieved by deployment of radar devices that detect approaching birds and temporarily close turbine operation. The need for the implementation of such mitigation will be determined by monitoring to be undertaken at the Gouda Wind Farm during operation.

CONCLUSIONS AND RECOMMENDATION CHAPTER 10

Zen Wind Farm (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site near Saron located within the Drakenstein Local Municipality. The site identified for consideration within an Environmental Impact Assessment (EIA) lies approximately 6 km south of Saron, in the Western Cape Province. Up to 46 wind turbines are proposed to be constructed over a broader area of approximately ~35km^2 in extent. The proposed facility would be known as the Zen Wind Energy Facility.

The site is proposed on the following farm portions:

» Portion 1 of the farm Bonne Esperance 83
» Portion 2 of the farm Bonne Esperance 83
» Portion 9 of the farm No. 88
» Remainder of Portion 4 of the farm Kleinbergrivier No.1
» Remainder of the farm Moolenaars Drift No. 85
» Remainder of Portion 1 of the farm Moolenaars Drift No. 85

The project will include the following infrastructure:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity. The capacity of the facility will be up to 140MW.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a tower, a hub (up to 110m above ground level, depending on the turbine size decided upon) and three blades.
» Permanent internal and access roads (up to 6m in width and including turning circles where required) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised, widened and upgraded where possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Two power line route alternatives were assessed in the EIA.

The environmental impact assessment (EIA) for the proposed Zen Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in

Government Notice 33306, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998) 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.

A draft Environmental Impact Assessment Report was initially released for public review in November 2012 for a 30-day public review period. Following the review of the draft EIA report, the following was undertaken and considered, and so the finalisation of the EIA report was delayed until November 2013. The Final EIA report included:

» The consideration of impacts changes associated with use of wind turbines with a rotor diameter of up to 122m. The turbines considered each have a capacity of approximately 3MW, a hub height of up to 110m, and a rotor diameter of 122m, as the largest potential turbine to be used for this site.
» The avifauna specialist study recommended that a radar survey be undertaken to understand night-time movement of birds across the site. The results of the radar survey were taken into account in the avifauna impact assessment.
» The completion of the bird and bat pre-construction monitoring programmes, and an updated impact assessment based on the results of the bird and bat pre-construction monitoring programme.
» The change in the layout/location of wind turbines to address areas of sensitivity highlighted by the bird and bat monitoring, and consideration of the layout by all relevant specialists. Minor changes to two turbine positions (turbines 33 and 43) were made in order to address areas of sensitivity highlighted by EIA findings, habitats and the bird and bat monitoring.
» Addition of an access road within the site development footprint.

10.1 Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies and addendums to these studies as contained within Appendices F - M provide a

detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA Report by providing a summary of the conclusions of the assessment of the proposed wind energy facility and the associated infrastructure (including the substation and overhead power line) on the site near Saron. 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 layout of the turbines and associated infrastructure provided by the developer. This layout includes 46 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMPr)** included within **Appendix N**.

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

10.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 46 turbines and associated infrastructure, Table 9.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 5, 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 10.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Loss or fragmentation of vegetation & protected plant species	Medium	Low
Impacts on watercourses/drainage lines	Medium	Low
Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.	Medium	Low
Impact on threatened animals species/habitat	Medium	Low
Alien vegetation growth due to disturbance	Medium	Low
Loss of habitat within indigenous natural vegetation types, disturbance and soil erosion due to creation of permanent access roads.	Medium	Medium
Impacts on Avifauna		
Bird mortalities due to collisions with wind turbines	High	Medium
Impact on birds due to disturbance of habitat	Low	Low
Loss of avifauna habitat	Low	Low
Electrocution/ collision of birds with the power line	Medium	Low
Impacts on Bats		

Nature	Without mitigation	With mitigation
Disturbance and/or destruction of bat roosts due to construction activities	Medium	Medium
Mortality of bat species through collision with turbines or barotraumas caused by turbines operation.	Medium	Low
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with high agricultural potential and land capability and impact on land-use	Low	Low
Soil erosion / degradation during construction	High	Low
Soil contamination / soil erosion during the operation of the facility	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase (Positive Impact)	Medium	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
Damage to and loss of farmland during construction	Medium	Low
Benefits associated with the establishment of a community trust	Medium	Low
Operational Phase -Creation of Long- Term employment and business opportunities	Low	Medium
Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa	Medium	Medium
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	Low	Low
Health Impacts due to the Operation of the wind energy facility	Low	Low
Visual Impacts		
Visual impact on sensitive visual receptors within the region	Low	N/A

Nature	Without mitigation	With mitigation
Change in visual character and sense of place	Medium	N/A
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	Low	Low
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 Artefacts		
Impact of construction on archaeology	Medium	Low
Potential Impacts on Palaeontology		
Findings or Loss of Fossils during Construction	Medium	Low

10.1.2Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind special energy facility relate to the direct loss of vegetation and species of 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 35km^2 was considered for the facility, of which ~1.3% will be utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed. The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Permanently affected areas comprise 46 turbine footprints (46 foundation areas of 20m x 20m), access roads (up to 6m in width), one 132 kV substation footprint (200m x 200m), power line servitude (36m) and an operations and service building area (100m x 100m). It should be noted that the site currently has several access roads which are used for farming activities. The layout of the facility has, in agreement with the Department of Agriculture, utilised these existing roads in the facility layout to reduce the need for new roadways. It is planned that where existing access roads are able to be utilised within the development footprint, these are utilised, widened and upgraded where possible. The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
46 turbine footprints (each 20m x 20m)	18400
Permanent access roads within the site (6m width and 65km in length)	390000
One on-substation footprint (200m x 200m)	40000
Operations and service building area (100m x 100m)	10000
TOTAL	458400m^2 (of a total area of 35420000m^2) **i.e. 1.3%of site**

Approximately 1.3% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation of the Zen Wind Energy Facility. In addition to this, the power line for grid connection will have a minor linear servitude of up to 36m wide.

Temporarily affected areas during the construction phase comprise 46 laydown areas for turbines (each laydown area assumed to have a footprint of 60m x 60m) and a temporary crane travel track and construction access roads utilising the same route as the permanent access road (an additional 4m in width to the permanent road of 6 m (i.e. taking the total roadway to be used during construction to 10m in width). The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
46 turbine laydown areas (60m x 60m per turbine)	165600
Temporary crane travel track and construction access roads utilising the same route as the permanent access road (additional 4m in width) and 65km in length	390000
TOTAL	555600 (of a total area of 35420000m^2) = **~1.6% of site**

Therefore, ~1.6% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Zen Wind Energy Facility. Considering permanent and temporary footprints, up to 3% of the total extent of 35km^2 will be disturbed by the construction and operation phases of the project.

10.2 Comparative Assessment of Grid Connection Alternatives (Substations & Power Lines)

A power line will be required from the on-site Zen Substation to connect into the LeBonne Substation which is under construction on a Farm LeBonne Esperance for the Gouda Wind Energy Facility (which is located on a farm that is adjacent to the Zen site).

Two power line alignments are proposed as alternatives in order to link the proposed Zen Substation to the La Bonne Substation which is located ~4.5 km to the south of the Zen site. Both alternatives are aligned along and to the north of the R44, and the final ~3.5km of the alignments is essentially identical. Route 1 (~6.5 km in length) is planned to run inland across Farm Bonne Esperance, then turn towards the R44 and run along the R44. Route 2 runs along the R44 to the LeBonne substation and is ~5.5 km in length. Both power line routes cross over the Kleinberg River at different points. These two routes were considered and assessed in this EIA. Each power line could have a direct connection to an open bay of the LeBonne Substation, or a loop in and loop out connection directly to the LeBonne-Gouda power line at a point adjacent to the Substation.

The impacts of the power line have been assessed in Chapter 8. In summary, the impacts of the power line include:

» Route 2 is 1km shorter than Route 1, which reduces the footprint of the power line.
» Visual impacts will be reduced for Route 2 due to a shorter length of power line.
» Route 2 is aligned adjacent to the R44 road, and so the impacts associated with linear infrastructure are consolidated.
» Potential impacts on avifauna will be reduced for Route 2 due to a shorter length of power line.
» Route 2 is aligned adjacent to the R44, which will serve to reduce its potential ecological impact as compared to Route 1.
» Route 1 would traverse centre-pivot irrigation areas on Klein Berg River and is therefore not feasible or preferred from a land-use perspective.

Therefore Route 2 is the preferred option from an environmental perspective due to the reduced degree of disturbance compared to Route 1. Either the direct connection or the loop in and out connection are feasible options, and have no difference in environmental impact.

10.3 Cumulative Impacts

Cumulative impacts of a development project consider impacts resulting from incremental actions from the development, in addition to other past, present or future impacts resulting from other developments/actions/projects. This assumes the knowledge of other developments or actions whose effects could be cumulative to the ones resulting from the project being assessed. Based on the above, the cumulative impacts associated with the construction and operation of the Zen Wind Energy Facility and other renewable energy facilities in the region are considered to be high in some instances, but are expected to be acceptable provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for each project. The detail of cumulative impacts associated with the facilities in the Gouda area are considered in Chapter 9.

10.4 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Zen Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 10.2 and A3 map in Appendix O**). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» ***The Klein Berg River*** which bisects the site: There are no turbines located within the floodplain of the river and the Klein Berg River would not be directly impacted by the development. A buffer of 200m has been used along the Klein Berg River. An upgrade to the current farm bridge may be required for access to the site, but as this area is already disturbed, it is not likely to generate significant impact.
» ***Remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld:*** This vegetation occurs on the eastern section of the site. These are Critically Endangered vegetation types and despite their disturbed nature, the presence of some species of conservation concern was confirmed for these areas. No turbines are located within the intact patches of remaining natural vegetation under the current layout. The access road and presumably the cable trench from Turbine 35 to Turbine 45 traverse one of these intact patches.
» The ***soils with high agricultural potential*** have been identified for the site and are shown in Figure 9.2. No infrastructure is planned in this area of high agricultural potential, as well as in current irrigated fields. This is acceptable from a soils and agricultural potential perspective. It has been agreed with the Department of Agriculture that wherever feasible that existing access routes should be utilised to minimise the need for new route establishment.

The power line Route 1 would traverse centre-pivot irrigation areas on Kleinberg River and is therefore not ideal. Route 1 would require re-alignment to avoid the centre-pivot irrigation.

» ***Bats sensitive areas*** include the Berg and the Klein Berg River (and a 200m buffer has been used where no wind turbines should be constructed) as well as bat roosts sites. Roosts were observed on the site and in the broader study area. No turbines are proposed to be located in the vicinity of the bat roosts site on/within 200m of the Klein Berg River. The Saronsberg mountain range is also a bat sensitive habitat. No development of wind turbines are proposed on the elevated topography.

» ***Bird Habitat and Sensitive Areas -*** The impacts of displacement and habitat loss are considered of minimal importance to birds in the Zen area. The turbines are sited more than 200 m from the rivers, which is bird-sensitive habitat on the site. Birds in agricultural land already tolerate major seasonal changes in micro-habitat and periods of major human disturbance (ploughing, harvesting etc.) so for most species displacement is unlikely to be severe. There is ample alternative habitat available so the loss caused by the footprint of the development is considered unimportant. The potential impacts of electrocution and of collision with power lines can be minimised through straightforward mitigation measures. During operation of the facility, the threat of fatalities of avifauna is also considered a potentially significant impact. The main area of concern for avifauna is mortality through collisions with rotor blades. Of the bird species that may be affected, many have large populations across the Swartland and most of the others occur in the Zen area in very small numbers so that a low level of collision mortality will have no marked effect. Of the 21 identified priority species, two local resident species – Blue Crane and Karoo Shelducks - are at highest risk of mortality through collision and potentially also through displacement from breeding or foraging areas. Most of the other priority species e.g. Greater Flamingo and Martial Eagle, occur in the Zen area in far smaller or negligible numbers, and/or too infrequently, to be a source of concern. Mitigation may be achieved by the limitation of turbine operation at time of risk through the deployment of radar devices that detect approaching birds and temporarily close turbine operation.

Bird sensitive areas in indicated in Figure 10.2 below. These areas should not be regarded as exclusion areas.

As the adjoining Gouda Wind Energy Facility is currently under construction, and has similar habitat and bird species, this presents a unique opportunity for the Zen Wind Energy Facility developers to consider actual mortality rates for a wind project in this area.

- ***Heritage artefacts*** (albeit of no important heritage significance) were found on the site. These include stone scatters and old buildings.
  - Figure 10.3 shows two old structures /buildings which occur on the Farm Bonne Esperance and those at Die Mond. If they require demolishing, a permit must be obtained from Heritage Western Cape. The nearest turbine is 960m from main house and 2.9km from the other historical house, and this is considered to be acceptable in terms of the current layout.
  - Early Stone Age (ESA) material is common on the site, but its density varies considerably according to location. In general, the eastern side of the farm has very few artefacts, while in the west artefacts were present throughout the area but more frequently encountered towards the north than the south. These occurrences are not really 'sites' in the typical sense, since the material is largely in secondary context having been left on the surface after erosion of the overlying deposits.
  - Two small LSA scatters were found on the banks of the Berg River in the far west of the site. Neither was dense, and the find was too dispersed to be able to distinguish any source areas.
  - No graves were observed in the study area.
- ***Noise sensitive receptors*** do occur in and around the site. NSD01, NSD02 and NSD03 are located on the Zen site and considered sensitive to noise during construction and operations of the wind turbines. Noise modelling revealed that noise from the wind turbines will be of a low significance.
- ***Visual receptors*** occur in the study area including farm homesteads and the town of Saron. The visual impacts of the wind energy facility will be of a medium- high significance.

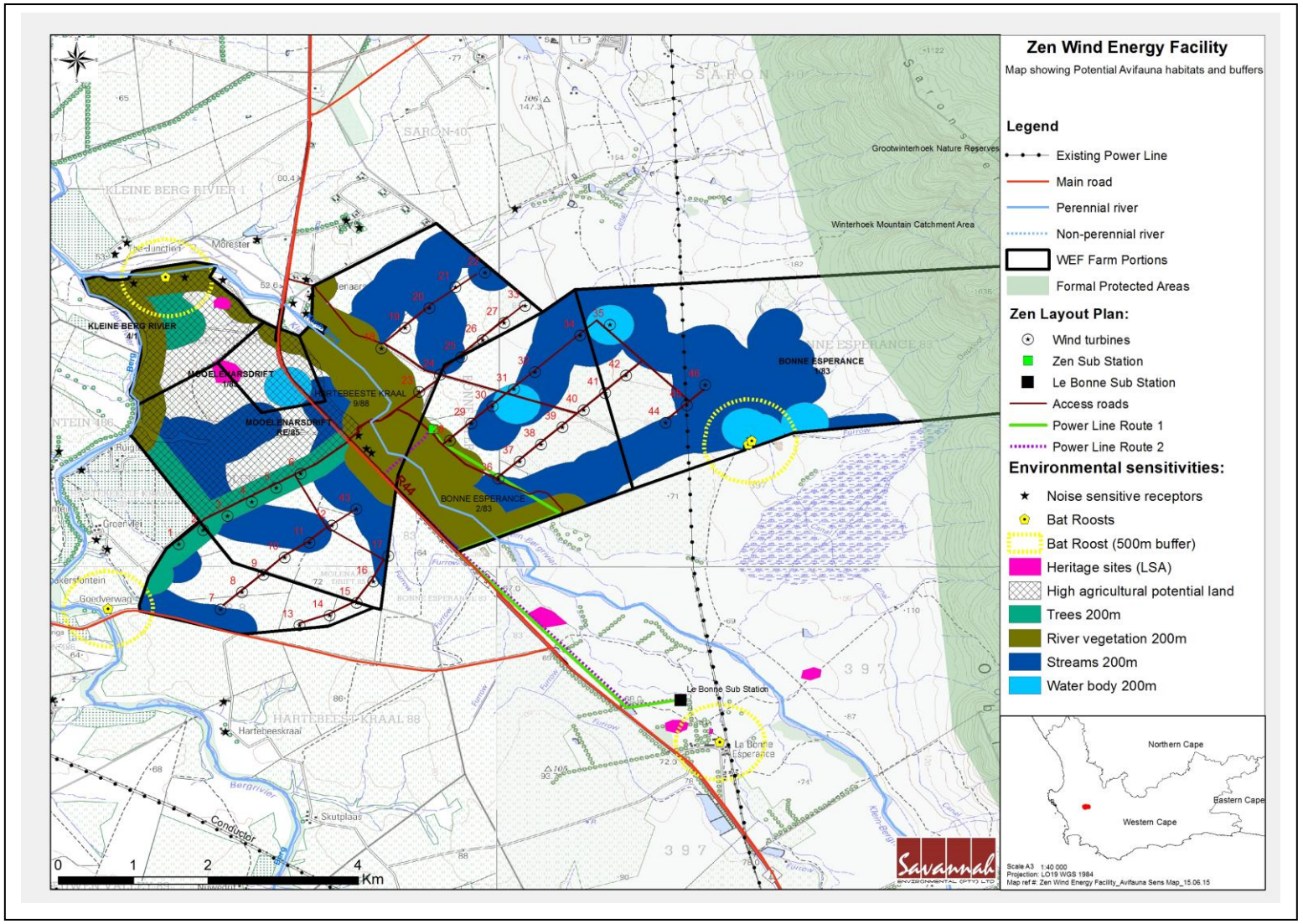

Figure 10.2: Potential avifaunal habitat areas.

Turbine positioning should take cognisance of sensitive areas (as indicated on Figure 10.3). Should mitigation measures in the EMPr be adhered to, impacts on the identified sensitive areas can be adequately managed.

Planning of infrastructure location on the site needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure is planned to be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and underground cable alignments should coincide as much as possible.

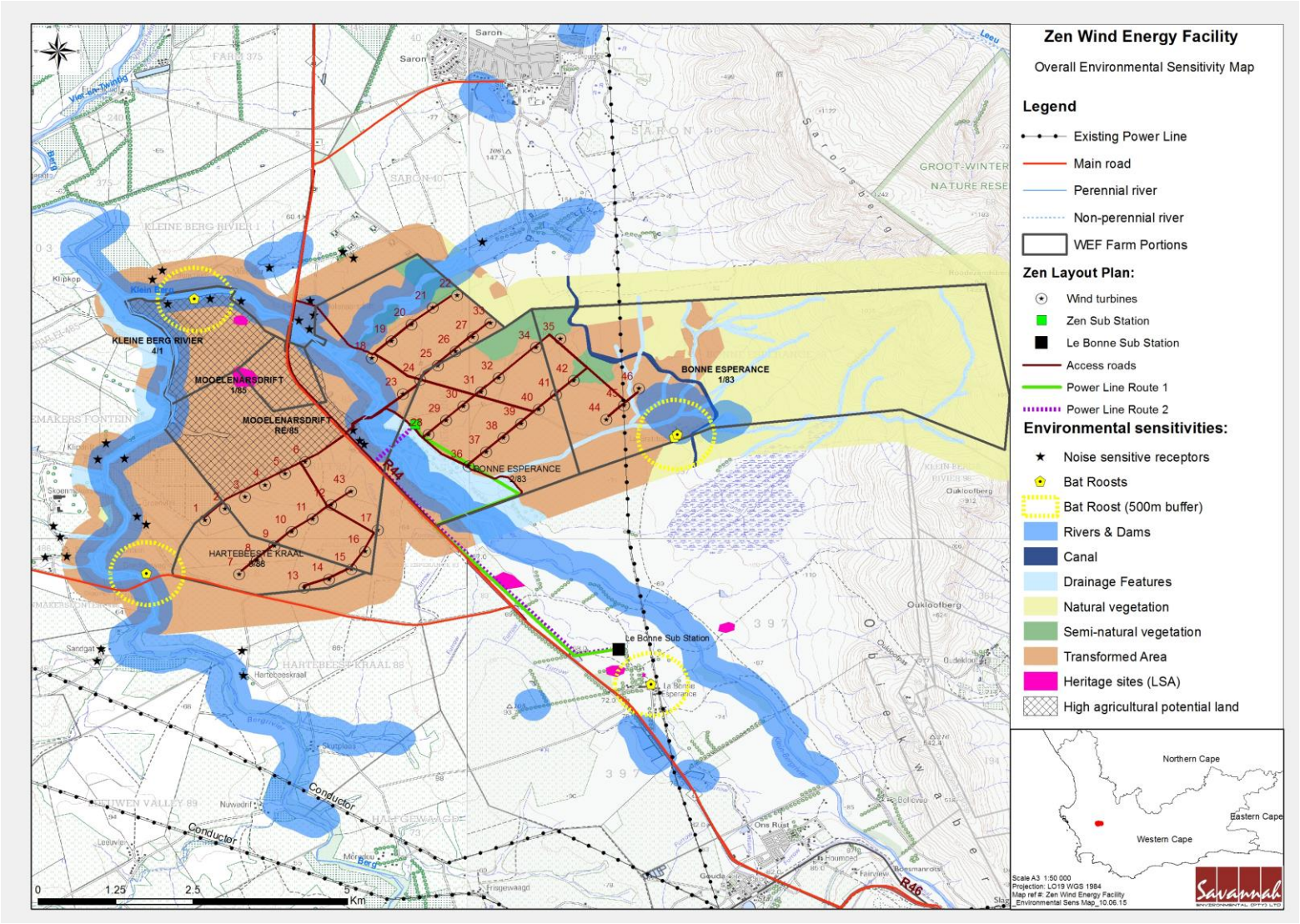

Figure 10.3: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Zen wind energy facility **(Appendix O contains an A3 map)**

10.4.1 Micro-siting of turbines

The only areas which can be considered as a 'no go' areas for the construction of infrastructure (including turbines) are:

» The eastern portion of the site with the Remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld vegetation.
» The Berg and the Klein Berg River and associated tributaries (and an associated 200m buffer where no wind turbines should be constructed), as well as bat roosts sites.
» Soils of high agricultural potential, and areas irrigated by centre pivot systems.
» Heritage sites.

No turbines are located within the environmental sensitive areas listed above, as the layout presented in this Final EIA report was revised by taking into account the areas of sensitivity highlighted by the draft EIA report (i.e. minor changes to two turbine positions (turbines 33 and 43) in order to address areas of sensitivity highlighted by EIA findings, habitats and the bird and bat monitoring).

10.5 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 the Zen Wind Energy Facility in the Western Cape has been established by Zen Wind Farm (Pty) Ltd. The positive implications of establishing the Zen Wind Energy Facility on the demarcated site 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 Western 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.
» 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 Zen Wind Energy Facility site is located directly adjacent to the Gouda Wind Energy Facility, which is currently under construction. This proximity of the two facilities (plus a third which is authorised, but not yet preferred bidder) could be considered as a renewable energy development zone, and consolidates impacts in a single node with a proven wind resource. The development of facilities in viable nodes presents some benefits to the environment through minimisation of the extent of impacts.

The significance levels of the majority of identified negative impacts can generally be reduced to acceptable levels by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the confidence in the environmental assessment undertaken is regarded as acceptable.

The identified 'no go' areas for the construction of infrastructure (including turbines) to be observed during construction and operation include:

» The eastern portion of the site with the Remnants of Swartland Alluvium Fynbos and Swartland Shale Renosterveld vegetation.
» The Berg and the Klein Berg River and associated tributaries (and an associated 200m buffer where no wind turbines should be constructed).
» Identified bat roost sites.
» Soils of high agricultural potential, and areas irrigated by centre pivot systems.
» Heritage sites.

10.6 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 Zen Wind Energy Facility 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 of the project.

The following infrastructure would be included within an authorisation issued for the project:

» The site is proposed to accommodate up to 46 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity. The capacity of the facility will be up to 140MW.
» Each wind turbine is expected to consist of a concrete foundation (20m x 20m x 4m), a tower, a hub (up to 110m above ground level, depending on the turbine size decided upon) and three blades.
» Permanent internal and access roads (up to 6 m in width and including turning circles where required) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised, widened and upgraded where possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (200 m x 200 m) to facilitate grid connection.
» A new 132 kV power line (up to 6.5 km in length) via a direct connection to the LeBonne Substation or a loop in and loop out connection to the LeBonne-Gouda power line which is located on the Farm LeBonne Esperance (adjacent to the Zen Wind Farm site). Route 2 is nominated as the preferred option from an environmental perspective.

Mitigation of land use loss associated with the construction of the project includes the following:

» The minimisation of loss of productive land: The developer has proposed the installation of at least one additional centre pivot on the site in order to intensify crop production on portions of the site which are unaffected by the facility. The landowner has expressed serious intent to commit lease fees to such intensification activity. The benefits of this off-set would be the minimisation of impacts to loss of agricultural potential as a result of the area impacted by the proposed facility.

The following conditions would be required to be included within an environmental authorisation issued for the project:

- All mitigation measures detailed within this report and the specialist reports contained within Appendices F to M must be implemented.
- The draft Environmental Management Programme (EMPr) as contained within Appendix N 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 EMPr 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.
- Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is 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 to carry out a restricted activity involving a specimen of a listed threatened or protected species. Should TOPS species be identified during the final ecological survey, in terms of the NEM:BA a permit (a TOPS permit) will be required for any activities/ removal of TOPS listed species. Plucking, relocation, or destruction of provincially protected species will require a permit in terms of the Nature and Environmental Conservation Ordinance of 1974 and the Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000).
- Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
- The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
- Additional pre-construction monitoring in line with the latest version of the South African best practice bird and bat monitoring guidelines and with due consideration of Bird Life South Africa's comments and requirements, should be commissioned.
- Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.

- Bird diverters must be utilised on the new power line where required, and specifically where the power line traverses the Klein Berg River.
- Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
- No infrastructure to be placed on current/future irrigated fields.
- Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
- Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
- Quarterly noise measurements are recommended for the first year of operation of the wind energy facility.
- Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

REFERENCES CHAPTER 11

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