ENVIRONMENTAL IMPACT REPORT:

Specialist ecological study on the potential impacts of the proposed Rheboksfontein Wind Energy Facility Project, Darling, Western Cape

Prepared by

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on behalf of
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20 September 2010

FINAL EIA REPORT

David Hoare Consulting cc
Biodiversity Assessments, Vegetation Description / Mapping, Species Surveys

CONTROL SHEET FOR SPECIALIST REPORT

The table below lists the specific requirements for specialist studies, according to Regulation 33 of Government Notice No. R385 of 1996 EIA Regulations.

Activity	Yes	No	**Comment**
Details of: 1. the person who prepared the report; and	√		
2. the expertise of that person to carry out the specialist study or specialised process	√		
A declaration that the person is independent in a form as may be specified by the competent authority	√		
An indication of the scope of, and the purpose for which, the report was prepared	√		
A description of the methodology adopted in preparing the report or carrying out the specialised process	√		
A description of any assumptions made and any uncertainties or gaps in knowledge	√		
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	√		
Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	√		
A description of any consultation process that was undertaken during the course of carrying out the study	√		
A summary and copies of any comments that were received during any consultation process	√		
Any other information requested by the competent authority	√		

REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 - Specialist reports and reports on specialized processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the "Control sheet for specialist report" given above.

Regulation 33. (1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialized process.

Regulation 33. (2): A specialist report or a report on a specialized process prepared in terms of these Regulations must contain:
(a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialized process;
(b) declaration that the person is independent in a form as may be specified by the competent authority;
(c) indication of the scope of, and the purpose for which, the report was prepared;
(d) description of the methodology adopted in preparing the report or carrying out the specialized process;
(e) description of any assumptions made and any uncertainties or gaps in knowledge;
(f) description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
(h) description of any consultation process that was undertaken during the course of carrying out the study;
(i) summary and copies of any comments that were received during any consultation process;
(j) any other information requested by the competent authority.

Appointment of specialist

Dr David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Rheboksfontein Wind Energy Facility Project near Darling in the Western Province. The consulting services comprise an assessment of potential impacts on the fauna in the study area by the proposed project.

Details of specialist

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Summary of expertise

Dr David Hoare:

- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995.
- Conducted, or co-conducted, over 200 specialist ecological surveys as an ecological consultant.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with Moyeng Energy (Pty) Ltd. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is approximately 0% of turnover.

Scope and purpose of report

The scope and purpose of the report are reflected in the "Terms of reference" section of this report

Conditions relating to this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. David Hoare Consulting cc and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by Moyeng Energy (Pty) Ltd to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed "Rheboksfontein Wind Energy Facility Project." The project involves the establishment of a wind energy facility and associated infrastructure, including wind turbines, undergound cables between turbines, a sub-station and internal access roads. The purpose of the EIA is to identify environmental impacts associated with the project.

In February 2010 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake a fauna assessment of the study area. The specific terms of reference for the ecological study include:

- an indication of the methodology used in determining the significance of potential environmental impacts;
- a description of the environmental issues that were identified during the environmental impact assessment process;
- an assessment of the significance of direct, indirect and cumulative impacts in terms of standard criteria;
- a description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Plan;
- an indication of the extent to which the issue could be addressed by the adoption of achievable mitigation measures;
- a description of any assumptions, uncertainties and gaps in knowledge;
- an environmental impact statement which contains
- a summary of the key findings of the environmental impact assessment,
- an assessment of the positive and negative implications of the proposed activity,
- a comparative assessment of the positive and negative implications of the distribution line alternatives,
- a comparative assessment of the postivie and negative implications of the access road alternatives.

This report provides details of the results of the EIA phase. The findings of the study are based on a combination of a desktop assessment of the study area and fieldwork undertaken on site

Study area

At a regional level the study area falls within the Western Province to the north of the town of Darling. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The project was to be undertaken in two phases, a Scoping phase and an Environmental Impact Assessment phase. The objective of the EIA phase study was to assess the significance of potential impacts on fauna and flora patterns within the study area. This report contains all the descriptive information on flora and fauna that were presented in the Scoping report as well as a comprehensive assessment of potential impacts. The results of the EIA phase study are provided in this report.

Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

- threatened animal species

Ecosystems

- critical biodiversity areas
- areas of high biodiversity
- centres of endemism

Processes

- corridors
- mega-conservancy networks

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

- Environment Conservation Act (Act 73 of 1989)
- National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)
- National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004)

Animal species of concern

The purpose of listing Red Data animal species was to provide information on the potential occurrence of species of special concern in the study area that may be affected by the proposed infrastructure. Species appearing on these lists could then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species of conservation concern previously recorded in the area and any other species with potential conservation value. Lists of threatened animal and bird species that have a geographical range that includes the study area were obtained from literature sources (e.g. Barnes 2000, Branch 1988, 2001, Friedmann & Daly 2004, Mills & Hes 1997). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

For all threatened fauna that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g. fynbos), but detailed microhabitat requirements (e.g. mountain fynbos on shallow soils overlying Table Mountain sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain fynbos on shallow soils overlying Table Mountain sandstone);
- DEFINITE: species found in habitats on site.

Sensitivity assessment

The study site was evaluated in terms of the potential for containing habitat for animal species of conservation concern. Any habitat considered important for species of concern was considered to be sensitive whereas habitat not important for species of conservation concern was considered t be not sensitive.

Table 1: Sensitivity analysis

Sensitivity class	Description
Low Sensitivity	Habitat with no breeding, inhabiting or foraging importance for animal species of conservation concern
Medium Sensitivity	Habitat with breeding, inhabiting or foraging importance for animal species of low conservation concern (Near Threatened, Declining, Rare or Restricted)
High Sensitivity	Habitat with breeding, inhabiting or foraging importance for animal species of high conservation concern (Critically Endangered, Endangered or Vulnerable)

Assessment of impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase were assessed in terms of the following criteria:

- The **nature**, which includes 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) or regional, and a value between 1 and 5 was assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it was 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 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 was estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, was determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which was 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** was calculated by combining the criteria in the following formula:

S=(E+D+M)P

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).

Limitations

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of ommitting any species, but it is always possible that a species that does not occur on a list may be located in an area where it was not previously known to exist.

DESCRIPTION OF STUDY AREA

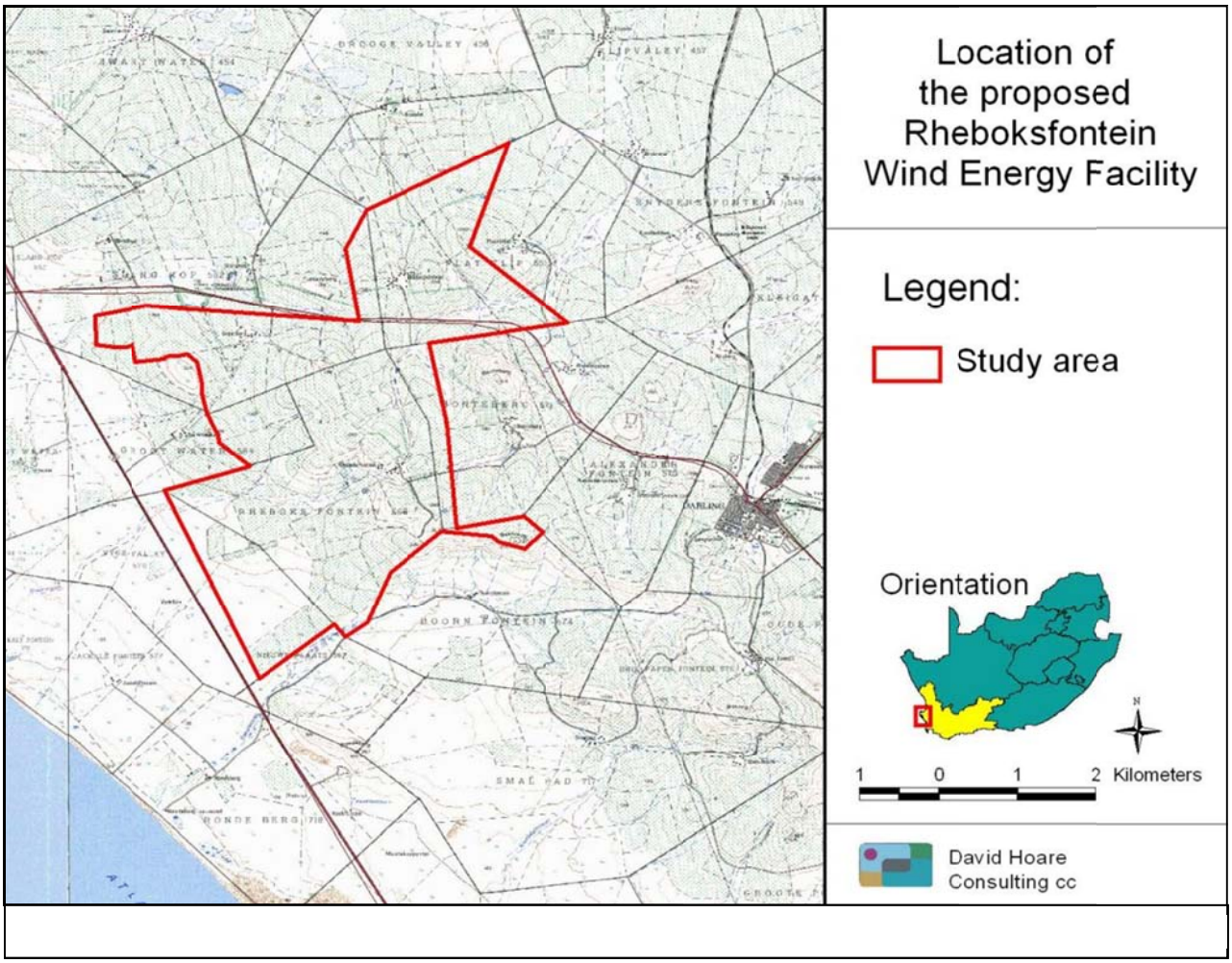
Location

The study site is situated west of Darling in the Western Cape Province and falls within the quarter degree grid 3318AD (Figure 1). The farm portions on which the proposed wind energy facility would occur include the following: Remaining extent of Farm 568 (Rheboksfontein), Farm 567 (Nieuwe Plaats), Remaining extent of Farm 571 (Bonteberg), Portion 1 of Farm 574 (Doornfontein), Portion 1 of Farm 551 (Plat Klip), Farm 1199 (Groot Berg) and Portion 2 of Farm 552 (Slang Kop). No alternative site is currently being considered for the proposed wind energy facility.

The study area is to the east of the R27 coastal road from the Cape (Melkbossttrand) to Velddrift. The R315 from Darling to Yzerfontein passes through the site. The site is therefore well-connected to regional routes.

Landuse / landcover and vegetation

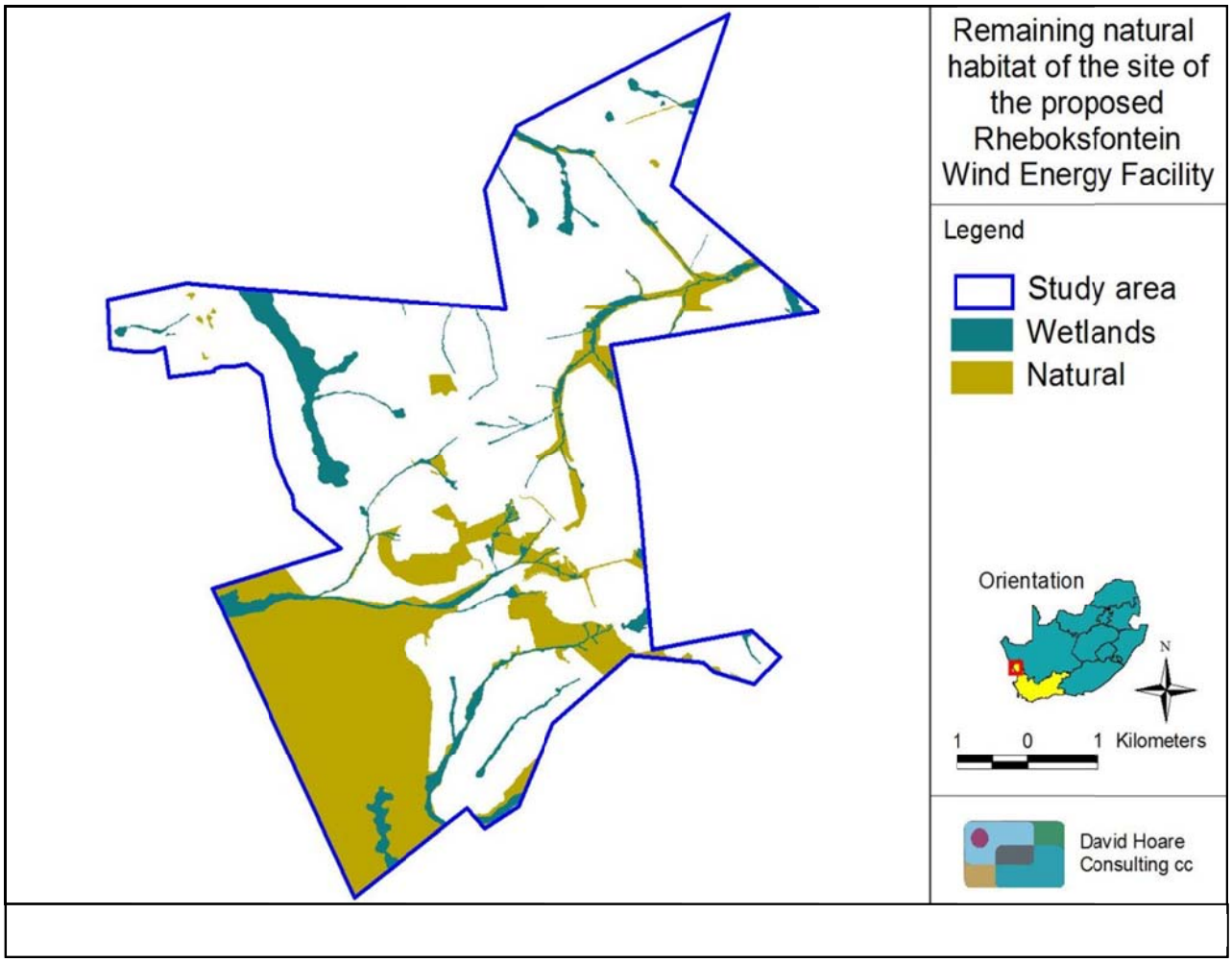
A landcover map of the study area (Fairbanks *et al*. 2000) indicates that a large proportion of the site consists of cultivation, degraded shrubland / low fynbos and grassland (both considered to be secondary vegetation on old lands) with a few small patches of shrubland / low fynbos (natural). The Surveyor General's 1:50 000 topocadastral maps for the study area



supports this observation and indicates that cultivation has taken place across most of the site. The field assessment confirmed these patterns. Large parts of the site were found to be cultivated and remaining areas of natural habitat were often not in pristine condition. There are, however, areas that could potentially support unique populations of animals, depending on their habitat requirements. The extent of these remaining areas of habitat is shown in Figure 2. This figure can also be considered to be a sensitivity map for fauna for the study area.

The study site is located within the Cape Floristic Region (CFR), which is recognised as one of the principal centres of diversity and endemism in Africa. Fynbos and Renosterveld are considered to be the main vegetation types in the CFR. Fynbos is very species rich, but has been transformed or degraded to a high degree and is therefore considered to be of high conservation value.

The site occurs within two vegetation types: Swartland Granite Renosterveld, classified as Critically Endangered, and Hopefield Sand Fynbos, classified as Endangered (Mucina *et al*. 2005, Mucina & Rutherford 2006). The vegetation-type descriptions provide an indication that vegetation on site consists primarily of fynbos and renosterveld. There are, however, also strips of thicket along drainage lines in the areas of steeper topography and wetland vegetation within the drainage lines. Areas closer to the coast have large proportions of sandy substrates or mobile sand. Despite high levels of transformation on site, there are a number of different habitat types that may provide suitable habitat for a variety of faunal species.



Red List animal species of the study area

All vertebrates (mammals, birds, reptiles, amphibians) of conservation concern that have a geographical distribution that includes the study area are listed in Appendix 1[1]. Based on habitat requirements, there are a number of threatened or near threatened species that were considered to have a possibility of occurring on site or making use of habitats available on site. These are the following:

- White-tailed Rat (EN)
- Cape Caco (VU)
- Namaqua Plated Lizard (NT)
- Fisk's House Snake (VU)
- Yellow-bellied House Snake (NT)
- Gronovi's Dwarf Burrowing Skink (NT)
- Kasner's Dwarf Burrowing Skink (VU)

There were also two threatened bat species that have a geographical distribution that includes the site and there is some possibility that they may be encountered on site, either foraging, nesting or roosting. These include the following:

- Lesueur's Wing-gland bat (NT)
- Schreiber's long-fingered bat (NT)

None of these species are protected according to section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

The remaining species with a geographical range that includes the site were assessed as having a low chance of occurring in available habitats in the study area or the study site is at the margin of their distribution range.

[1] The IUCN conservation status of some species has been updated since the Scoping Report was written. Appendix 1 contains fewer species than in the Scoping Report.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Legislation

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied." ,
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997

The ECA states that:

- Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of inter alia the following factors:
- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.
- The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

In terms of the Biodiversity Act, 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 biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

The Nature and Environmental Conservation Ordinance, 1974 (Ordinance 19 of 1974)

Provides for protection of fauna and flora in the Western Cape Province.

The Western Cape Nature Conservation Laws Amendment Act, 2000 (Ordinance 3 of 2000)

Provides for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board. Also provides updated lists of endangered and protected fauna and flora for the Province.

National Water Act

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

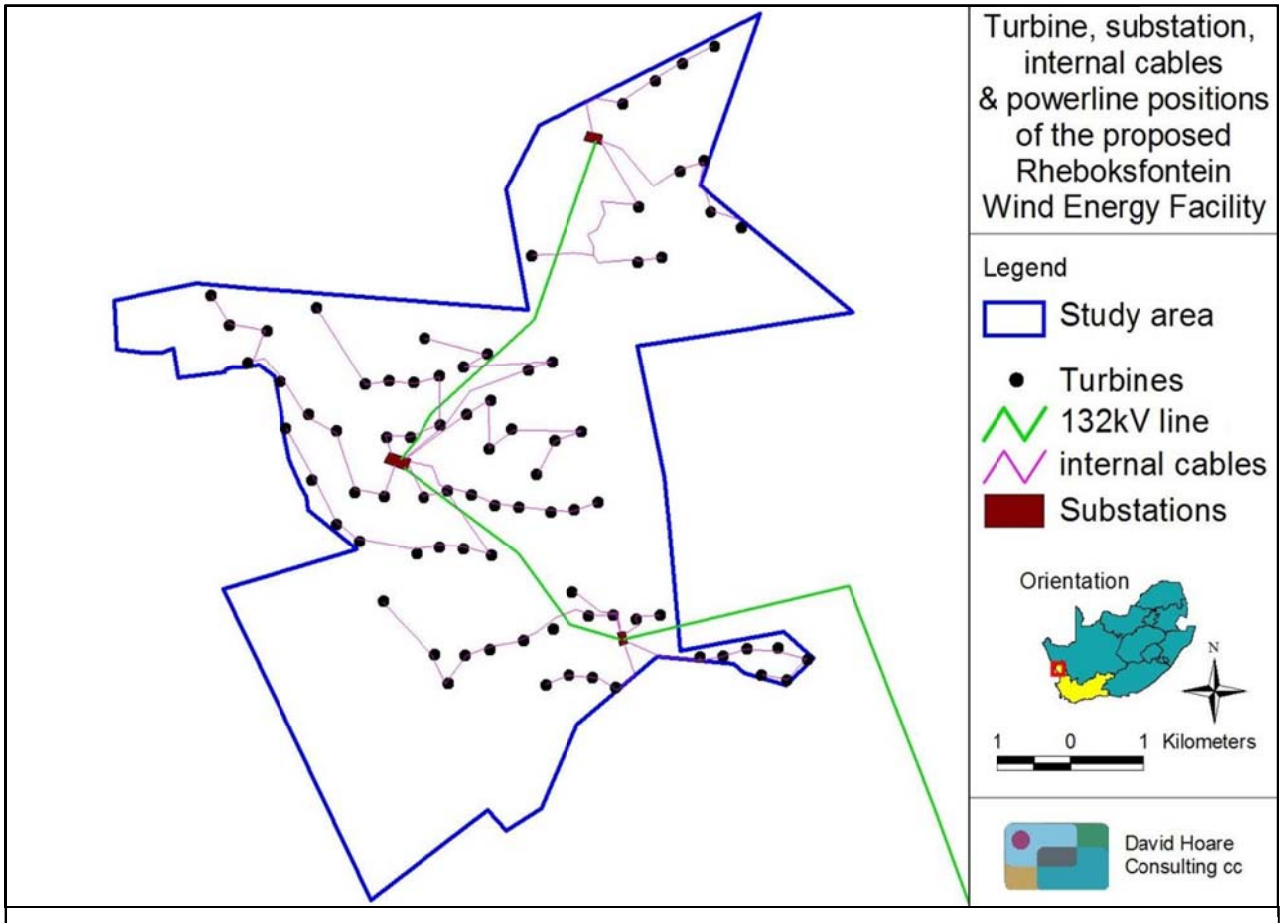
Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

DESCRIPTION OF INFRASTRUCTURE

A total of 80 turbines have been proposed for the site. Each turbine will have a relatively small footprint (i.e. 15 m x 15m). There will be disturbance beyond this during the construction phase since a lay-down area is required prior to raising the turbine to it's final position.

The power line from the wind energy facility to the substation and to the grid will be a 132kV line. The substation will be 80 m x 90 m in extent. There are 3 internal substations, internal cables for connecting turbines to one another and internal access roads to turbines. It is proposed that the internal access roads and the internal cables linking turbines will follow the same routes.

The position of the turbines, substations, internal underground cables and overhead power line in the study area is indicated in Figure 3.



IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

Potential issues relevant to potential impacts on the fauna of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern.
- Impacts on sensitive habitats: this includes impacts on any habitats that are important for threatened fauna.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
    - disruption to nutrient-flow dynamics;
    - impedance of movement of material or water;
    - habitat fragmentation;
    - changes to abiotic environmental conditions;
    - changes to disturbance regimes, e.g. increased or decreased incidence of fire;
    - changes to successional processes;
    - effects on pollinators;
    - increased invasion by alien plants.

  Changes to factors such as these may lead to a reduction in the resilience of habitats and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on fauna: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.

A number of direct risks to ecosystems would result from construction of the proposed WEF, as follows:

- Clearing of land for construction.
- Construction of access roads.
- Placement of underground cables linking turbines.
- Chemical contamination of the soil by construction vehicles and machinery.
- Storage of materials required for construction.

There are also risks associated with operation of the proposed WEF, as follows:

- Collisions with flying animals (bats and birds). This may have local impacts on populations as well as cumulative effects on species over wider areas.
- Maintenance of surrounding vegetation as part of management of WEF.

Description of potential impacts

Major potential impacts are described briefly below. These are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of wind energy facilities on the ecological environment. There are two major ways that wind-energy development may influence ecosystem structure and functioning—through direct impacts on individual organisms and through impacts on habitat structure and functioning. The most important potential negative ecological impacts of a WEF are related to bird and bat mortality and loss of habitat.

Impact 1: Impacts on threatened animals

Nature: Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction. Construction of turbines, access roads, transmission lines and other infrastructure associated with the wind energy facility will lead to direct loss of habitat. There are some small patches of natural habitat remaining on site. This vegetation potentially provides habitat for a number of threatened or near threatened species (threatened species include those classified as critically endangered, endangered or vulnerable), including the following: White-tailed Rat (EN), Cape Caco (VU), Namaqua Plated Lizard (NT), Fisk's House Snake (VU), Yellow-bellied House Snake (NT), Gronovi's Dwarf Burrowing Skink (NT) and Kasner's Dwarf Burrowing Skink (VU). The potential value of this natural habitat for these species of conservation concern is affected by the particular requirements of each species and the availability of habitat on site.

For threatened animal species, loss of a population or individuals could lead to:

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

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

Impact 2: Impacts on bats

Nature: Bird and bat deaths are one of the most controversial biological issues related to wind turbines. The deaths of birds and bats at wind farm sites have raised concerns by conservation agencies internationally. In order to address this issue in South Africa, the Endangered Wildlife Trust (EWT) and BirdLife South Africa (BLSA) have combined efforts to lobby for the appropriate consideration of the potential negative effects of wind energy production. Impacts on birds as a result of the proposed WEF are assessed in a separate report.

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

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that co-incides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

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

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

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility. These are Lesueur's Wing-gland bat (NT) and Schreiber's long-fingered bat (NT).

Impact 3: Impacts on watercourses and wetlands

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. This will lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

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

The site contains a number of non-perennial streams, drainage lines and wetlands. These are mapped on Figure 2.

ASSESSMENT OF IMPACTS

Impacts are assessed for each component of infrastructure for the proposed wind energy facility, as follows:

- wind turbines;
- substations;
- overhead power line (132kV);
- underground cables between turbines and linking turbines to internal substations in combination with internal access roads.

Wind turbines

Impact 1: Impacts on threatened animals

It has been evaluated that there are four threatened and two near threatened animal species that could potentially be affected by the proposed wind energy facility. These are White-tailed Rat (EN), Cape Caco (VU), Namaqua Plated Lizard (NT), Fisk's House Snake (VU), Yellow-bellied House Snake (NT), Gronovi's Dwarf Burrowing Skink (NT) and Kasner's Dwarf Burrowing Skink (VU). These species are most likely to be affected by the construction of the wind energy facility to a greater extent than the operation of the wind energy facility.

Extent: The impact will occur at the site of the proposed WEF, specifically at the scale of the individual infrastructure within the site. At it's greatest extent this may affect the entire site, but according to the proposed layout is likely to only affect a small proportion of suitable habitat on site. Only one turbine is within untransformed habitat (number 57) and is close to the edge of such habitat. The impact will occur at the site of the turbine.

Duration: The impact will either be of short-term duration (construction phase only) or of permanent duration if it leads to loss of critical habitat for species.

Magnitude: The scale of the impact is very small (one turbine). The habitat at this point is slightly disturbed and is also not ideal habitat for any of the species of conservation concern. The potential magnitude of the impact could therefore be very low, due to the fact that only one turbine affects these areas and its footprint is relatively small.

Probability: Because of the fact that only one turbine infringes on natural habitat, the probability of the impact occurring is therefore relatively low and is scored as improbable.

Potential significance: The overall significance of the impact is rated as low.

Mitigation measures: Move turbine number 57 to the north-east by about 40 m.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	low (2)	low (1)
Probability	improbable (2)	Highly improbable (1)
Significance	**low (16)**	**low (7)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Move one turbine slightly to avoid natural habitat.		
Cumulative impacts: Any other infrastructure could cause similar impacts.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on bats

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility. These are Lesueur's Wing-gland bat (NT) and Schreiber's long-fingered bat (NT). These species are most likely to be affected by the operation of the WEF to a greater extent than the construction of the WEF.

Extent: The impact will occur at the site of the proposed WEF, but will have an impact at a more regional level, since it affects entire populations of affected species and may affect migration routes of species.

Duration: The impact will be of long-term duration, because it will occur for the entire duration of the operation of the wind energy facility.

Magnitude: If any populations of either species occur in the area, the potential magnitude of the impact could be moderate.

Probability: No known populations of either bat species occur in the grid in which the site is located. The probability of the impact occurring is therefore relatively low and is scored as improbable.

Potential significance: The overall significance of the impact is rated as low.

Mitigation measures: A monitoring programme should be implemented to document the effect of the WEF operation on bats. This should take place before construction (to provide a benchmark), and during operation. If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact, for example, halting operation during low wind conditions when bats are most active.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	regional (3)	regional (3)
Duration	long-term (4)	long-term (4)
Magnitude	medium (5)	Medium low (4)
Probability	improbable (2)	improbable (2)
Significance	**low (24)**	**low (22)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation: (2) A monitoring programme should be implemented to document the effect of wind turbines on bat species.
Cumulative impacts: Any other infrastructure could cause similar impacts.
Residual Impacts: None.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on watercourses

There are a number of watercourses and wetlands on site that could potentially be affected by the proposed construction of turbines. Some of the turbines are currently positioned within or immediately adjacent to mapped wetland areas (turbine numbers 3, 32, 35 and 66). These are all disturbed wetlands in previously cultivated areas.

Extent: The impact will be local and surrounding areas, although downstream areas could be affected.

Duration: The impact will be of medium-term duration (until a perennial cover of vegetation becomes re-established in disturbed areas).

Magnitude: The scale of the impact is very small (four turbines). The potential magnitude of the impact could therefore be low to medium, depending on the degree to which impacts are managed at each turbine site.

Probability: According to the current position of the turbines, it is highly probable that the impact will occur.

Mitigation measures: Stormwater and runoff water must be controlled and managed to avoid impacts on watercourses. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Medium (4)	Low (3)
Probability	highly probable (4)	probable (3)
Significance	**medium (36)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Avoid unnecessary impacts on wetland areas. Impacts should be contained, as much as possible, within the footprint of the turbine and lay-down area. (2) obtain a permit from DWA to impact on any wetland or water resource. (3) rehabilitate any disturbed areas immediately to stabilise landscapes		
Cumulative impacts:		

None.
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Substations

Impact 1: Impacts on threatened animals

It has been evaluated that there are four threatened and two near threatened animal species that could potentially be affected by the proposed wind energy facility. These are White-tailed Rat (EN), Cape Caco (VU), Namaqua Plated Lizard (NT), Fisk's House Snake (VU), Yellow-bellied House Snake (NT), Gronovi's Dwarf Burrowing Skink (NT) and Kasner's Dwarf Burrowing Skink (VU). These species are most likely to be affected by the construction of the wind energy facility and associated infrastructure to a greater extent than the operation of the wind energy facility.

Extent: The impact will occur at the site of the proposed WEF, specifically at the scale of the individual infrastructure within the site. At it's greatest extent this may affect the entire site, but according to the proposed layout is likely to only affect a small proportion of suitable habitat on site. Substation 1 is in the centre of an area of untransformed habitat and includes some wetlands habitat. The impact will occur at the site of the substation.

Duration: The impact will either be of short-term duration (construction phase only) or of permanent duration if it leads to loss of critical habitat for species.

Magnitude: The scale of the impact is very small (one substation). The habitat at this point is in relatively good condition and includes variable sub-habitats. It is potentially suitable habitat for some of the species of conservation concern. The potential magnitude of the impact could therefore be medium.

Probability: Because of the fact that the substation infringes squarely on natural habitat, the probability of the impact occurring is relatively high and is scored as probable.

Potential significance: The overall significance of the impact is rated as medium.

Mitigation measures: Move substation 1 eastwards by about 400 m onto the summit of the hill where it is cultivated.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	medium (5)	low (1)
Probability	probable (3)	Highly improbable (1)
Significance	**medium (33)**	**low (7)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation: (1) Move substation 1 eastwards by about 400 m onto the summit of the hill where it is cultivated.to avoid natural habitat.
Cumulative impacts: Any other infrastructure could cause similar impacts.
Residual Impacts: None.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on bats

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility. These are Lesueur's Wing-gland bat (NT) and Schreiber's long-fingered bat (NT). These species are not likely to be affected by the construction or operation of the substations.

Extent: The impact will occur at the site of the proposed substations.

Duration: The impact will be of long-term duration, because it will occur for the entire duration of the operation of the wind energy facility.

Magnitude: If any populations of either species occur in the area, the potential magnitude of the impact could be very low.

Probability: No known populations of either bat species occur in the grid in which the site is located. The probability of the impact occurring is therefore relatively low. It is also very unlikely that the substation will have any effect on bats. The probability is therefore scored as highly improbable.

Potential significance: The overall significance of the impact is rated as low.

Mitigation measures: None required.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (4)	long-term (4)
Magnitude	Very low (1)	very low (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	**low (6)**	**low (6)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None required		
Cumulative impacts: No other impacts are likely to cause similar effects on bats.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on watercourses

Substation 1 is positioned directly across a small watercourse. The other two substations are further than 50 m away from the edge of any watercourse. The watercourse affected by substation 1 is in an undisturbed part of the landscape.

Extent: The impact will be local and surrounding areas, although downstream areas could be affected.

Duration: The impact will be of permanent duration, because the vegetation will be permanently cleared in order to construct the substation.

Magnitude: The potential magnitude of the impact could be medium to high at a local scale, due to the steepness of the slope and the complete clearing of vegetation required.

Probability: According to the current position of the substation, it is definite that the impact will occur.

Mitigation measures: Stormwater and runoff water must be controlled and managed to avoid impacts on watercourses. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources. The substation position should be moved approximately 400 m to the east, where it will not affect the wetland and will be positioned on flatter terrain.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Medium (6)	Low (1)
Probability	definite (5)	improbable (2)
Significance	**high (65)**	**low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Move substation 1 position by 400 m to the east. (2) Avoid unnecessary impacts on wetland areas. Impacts should be contained, as much as possible, within the footprint of the substation. (3) obtain a permit from DWA to impact on any wetland or water resource. (4) rehabilitate any disturbed areas immediately to stabilise landscapes		
Cumulative impacts: None.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Overhead power line

Impact 1: Impacts on threatened animals

It has been evaluated that there are four threatened and two near threatened animal species that could potentially be affected by the proposed wind energy facility. These are White-tailed Rat (EN), Cape Caco (VU), Namaqua Plated Lizard (NT), Fisk's House Snake (VU), Yellow-bellied House Snake (NT), Gronovi's Dwarf Burrowing Skink (NT) and Kasner's Dwarf Burrowing Skink (VU). These species are most likely to be affected by the construction of the wind energy facility and associated infrastructure to a greater extent than the operation of the wind energy facility.

Extent: The impact will occur at the site of the proposed power line, specifically at the scale of the individual towers. Part of the power line (near substation 1) is within untransformed habitat. The impact will occur at the site of this section of power line. There are also patches of untransformed habitat along the remainder of the alignment to the Dassenburg substation. This part of the power line is adjacent to two existing powerlines. The assumption is made that the towers will be placed next to or close to existing towers. There are therefore a number of places where existing twoers are within untransformed habitat.

Duration: The impact will either be of permanent duration if it leads to loss of habitat for species.

Magnitude: The scale of the impact is small (one section of power line on site and some areas along the remainder of the existing power line route to Dassenburg). The habitat on site at this point is in relatively good condition and includes variable sub-habitats. It is potentially suitable habitat for some of the species of conservation concern. Along the existing servitude and alignment to Dassenburg, the potential impact is ameliorated by the fact that two power lines already exist, access is therefore alrteady in place and there are existing disturbances at the existing towers. The potential magnitude of the impact could therefore be medium.

Probability: Because of the fact that this section of the power line infringes squarely on natural habitat, the probability of the impact occurring is relatively high and is scored as highly probable.

Potential significance: The overall significance of the impact is rated as medium.

Mitigation measures: Move power line east by about 400 m. For the power line from the site to the Dassenburg substation, towers must be placed as close to the existing towers on the existing power lines parallel to the proposed alignment.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	medium (4)	low (1)
Probability	Highly probable (4)	Highly probable (4)
Significance	**medium (40)**	**low (28)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	To some degree	
Mitigation: (1) Move power line eastwards to avoid natural habitat. (2) Place towers next to / near to existing towers along the route to Dassenburg (off-site)		
Cumulative impacts: Any other infrastructure could cause similar impacts.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on bats

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility. These are Lesueur's Wing-gland bat (NT) and Schreiber's long-fingered bat (NT). These species are not likely to be affected by the construction or operation of the overhead power line. At worst, there may be some collisions with cables, but due to the echolocation abilities of bats, is unlikely to occur very often. Bats do, however, occasionally turn off their echolocation and can run into things, but this is very unlikely to cause more than a small number of mortalities for the proposed project.

Extent: The impact will occur at the site of the proposed power line.

Duration: The impact will be of long-term duration, because it will occur for the entire duration of the operation of the wind energy facility.

Magnitude: If any populations of either species occur in the area, the potential magnitude of the impact could be low.

Probability: No known populations of either bat species occur in the grid in which the site is located. The probability of the impact occurring is therefore relatively low. It is also very unlikely that the power line will have any effect on bats. The probability is therefore scored as highly improbable.

Potential significance: The overall significance of the impact is rated as low.

Mitigation measures: None required.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (4)	long-term (4)
Magnitude	Very low (1)	very low (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	**low (6)**	**low (6)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None required		
Cumulative impacts:		

Any other infrastructure could cause similar impacts.
Residual Impacts: None.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on watercourses

The 132kV power line crosses wetlands and watercourses in various places, although it is unlikely that power line towers will be positioned within wetlands. The impact is assessed assuming that towers may be positioned in watercourses, thereby indicating the worst-case scenario. The assessment includes the entire length of the power line to the Dassenburg substation. This latter section of the power line includes a tower that will be placed very close to the permanent wetland part of a small pan between Saxonsea and Mamre.

Extent: The impact will be local and surrounding areas, although downstream areas could be affected.

Duration: The impact will be of permanent duration, because the vegetation will be permanently cleared in order to erect the tower.

Magnitude: The potential magnitude of the impact could be medium at a local scale.

Probability: According to the current position of the power line, it is probable that the impact will occur.

Mitigation measures: Stormwater and runoff water must be controlled and managed to avoid impacts on watercourses. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources. Power line towers must not be positioned in watercourses.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Medium (4)	Low (1)
Probability	probable (3)	improbable (2)
Significance	**medium (33)**	**low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Ensure towers are not positioned in watercourses. (2) Avoid unnecessary impacts on wetland areas. Impacts should be contained, as much as possible, within the power line servitude. (3) obtain a permit from DWA to impact on any wetland or water resource. (4) rehabilitate any disturbed areas immediately to stabilise landscapes		
Cumulative impacts: None.		
Residual Impacts:		

Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Internal cables and access roads

Impact 1: Impacts on threatened animals

It has been evaluated that there are four threatened and two near threatened animal species that could potentially be affected by the proposed wind energy facility. These are White-tailed Rat (EN), Cape Caco (VU), Namaqua Plated Lizard (NT), Fisk's House Snake (VU), Yellow-bellied House Snake (NT), Gronovi's Dwarf Burrowing Skink (NT) and Kasner's Dwarf Burrowing Skink (VU). These species are most likely to be affected by the construction of the wind energy facility and associated infrastrucrure to a greater extent than the operation of the wind energy facility.

There are a number of places where internal access roads and underground cables are proposed to cross untransformed natural habitats. This includes the following: between turbines 55 and 57, between turbines 53 and 56, between turbines 57 and 42, between turbines 62 and 64, between turbine 80 and substation 1.

Extent: The impact will occur at the site of the proposed WEF, specifically at the scale of the individual infrastructure within the site. At it's greatest extent this may affect the entire site, but according to the proposed layout is likely to only affect a relatively moderate proportion of suitable habitat on site. The impact will occur along the alignments within natural habitat.

Duration: The impact will be of permanent duration if it leads to loss of habitat for species.

Magnitude: The scale of the impact is moderately small, but may be significant in terms of preserving habitat integrity on site. The potential magnitude of the impact could therefore be moderate to high.

Probability: Based on the current alignment of internal access roads and underground cables, the probability of the impact occurring is definite.

Potential significance: The overall significance of the impact is rated as medium.

Mitigation measures: Re-align the proposed alignments to follow contours, avoid drainage lines and untransformed natural habitat and follow existing disturbances on site. Suggestions are as follows: between turbines 55 and 57, the alignment should be shifted so that it runs from turbine 57 first towards turbine 42 along an exisitng dirt track and then back towards turbine 55; between turbines 53 and 56, the alignment should be moved northwards from turbine 56 to the edge of the existing cultivated land and then towards turbine 53; between turbines 57 and 42, the alignment should follow the existing track going northwards from turbine 57 then swing about 200 m eastwards of its existing alignment and follow the contour around the hill back to turbine 42; between turbines 62 and 64, the alignment should go north-westwards from turbine 62, past turbine 59 and then down the hill along the existing gravel road; between turbine 80 and substation 1, the substation needs to be moved 400 m eastwards and the underground cable between the substation and turbine 80 needs to follow the existing track up the hill that runs more-or-less where the cable will then go.

Nature: Impacts on individuals of threatened bat species

	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Medium high (6)	low (1)
Probability	definite (5)	improbable (2)
Significance	**medium (60)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Move alignments slightly that currently affect wetlands / watercourses and untransformed natural habitats.		
Cumulative impacts: Any other infrastructure could cause similar impacts.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on bats

It has been evaluated that there are two near threatened bat species that could potentially be affected by the proposed wind energy facility. These are Lesueur's Wing-gland bat (NT) and Schreiber's long-fingered bat (NT). These species are not likely to be affected by the construction or operation of underground cables or access roads, except for a small loss of habitat.

Extent: The impact will occur at the site of the proposed wind energy facility.

Duration: The impact will be of long-term duration, because it will occur for the entire duration of the operation of the wind energy facility.

Magnitude: If any populations of either species occur in the area, the potential magnitude of the impact could be very low.

Probability: No known populations of either bat species occur in the grid in which the site is located. The probability of the impact occurring is therefore relatively low. It is also very unlikely that the infrastructure will have any effect on bats. The probability is therefore scored as highly improbable.

Potential significance: The overall significance of the impact is rated as low.

Mitigation measures: None required.

Nature: Impacts on individuals of threatened bat species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (4)	long-term (4)
Magnitude	Very low (1)	very low (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	**low (6)**	**low (6)**

Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None required		
Cumulative impacts: Any other infrastructure could cause similar impacts.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on watercourses

There are a number of watercourses on site that could potentially be affected by the proposed construction of underground cables and internal access roads. Access to turbines and thus construction of roads will probably require disturbance to a number of watercourses. It is considered likely that watercourses are highly likely to be affected by construction of internal access roads and underground cables.

Extent: The impact will be local and surrounding areas, although downstream areas could be affected.

Duration: The impact will be of permanent duration, because the vegetation will be permanently cleared in order to construct the infrastructure.

Magnitude: The potential magnitude of the impact could be medium to high at a local scale, due to the complete clearing of vegetation required.

Probability: According to the current position of the underground cables and internal access roads, it is definite that the impact will occur.

Mitigation measures: Stormwater and runoff water must be controlled and managed to avoid impacts on watercourses. A permit from DWA is required if there are expected to be any impacts on any wetland or water resources. Some alignments must be adjusted to co-incide with existing disturbances on site and, in some cases, to go around the top of a wetland rather than through the middle near the top. Turbine 58 should be moved to the south-eastern side of the watercourse next to which it stands in order to avoid impacts from underground cables and access roads.

Nature: Damage to wetland areas.		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	definite (5)	probable (3)
Significance	**medium (60)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	Reversible with effective rehabilitation	Reversible

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Align the cable alignment as much as possible along existing linear disturbances, e.g. roads on site. (2) Cross wetlands perpendicularly. (3) Avoid unnecessary impacts on natural vegetation. Impacts should be contained, as much as possible, within the footprint of the proposed cable alignment. (4) obtain a permit from DWA to impact on any wetland or water resource. (5) rehabilitate any disturbed areas immediately to stabilise landscapes (6) Proper culvert and bridge structures are required for permanent roads.		
Cumulative impacts: None.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

DISCUSSION AND CONCLUSIONS

A large proportion of the study area is in a transformed state and consists primarily of agricultural lands. There are, however, areas of remaining natural vegetation as well as areas within cultivated lands that may provide habitat for threatened fauna. The current layout of infrastructure avoids remaining natural habitat to a large degree.

There are a number of animal species of conservation concern that may occur in habitats within the study area. Those of concern are the following:

- Lesueur's Wing-gland bat (NT)
- Schreiber's long-fingered bat (NT)
- White-tailed Rat (EN)
- Cape Caco (VU)
- Namaqua Plated Lizard (NT)
- Fisk's House Snake (VU)
- Yellow-bellied House Snake (NT)
- Gronovi's Dwarf Burrowing Skink (NT)
- Kasner's Dwarf Burrowing Skink (VU)

A risk assessment was undertaken which identified three main potential negative impacts on fauna, as follows:

- Impacts on habitats of non-flying threatened fauna;
- Impacts due to collision of bats with infrastructure (primarily turbine blades);
- Impacts of construction on wetlands / watercourses.

Impacts were assessed and it emerged that substation 1 is currently positioned within an untransformed area of habitat and could potentially have impacts of high significance on wetlands and watercourses and of medium significance on habitat for threatened animal species. Similar impacts may occur due to construction of internal access roads and underground cables. Impacts on wetlands may occur due to construction of some wind turbines. All impacts can be reduced to having low significance by adjusting the position of components of the infrastructure.

Recommendations

The following recommendations are made to reduce impacts or provide additional information that can lead to reduction or control of impacts:

- A monitoring programme should be implemented to document the effect of the WEF operation on bats. This should take place before construction (to provide a benchmark), during construction and during operation. This will provide information to quantify the impacts of the present project.
- Final planning of infrastructure position needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure should 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. Road infrastructure and underground cable alignments should co-incide. One turbine (number 57), substation 1 and part of the overhead powerline needs to be moved in order to avoid impacts on untransformed habitats or watercourses on site. The underground cables and internal access roads need to be re-aligned to avoid wetlands and watercourses, where possible.

Conclusions

The overall impacts of the proposed project have been assessed as largely being of medium to low significance (see Table 3 below). If mitigation measures are put in place to manage impacts, then all potential impacts can be reduced to having low significance. The proposed project is therefore considered to be acceptable in terms of potential impacts on fauna and wetlands / watercourses and it is recommended that it should be permitted to go ahead.

Table 3: Summary of the significance of impacts for different infrastructure components before and after mitigation.

	Wind turbines		Substations		Overhead powerline		Internal cables & access roads	
Impacts on:	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
1. threatened animals	low (16)	low (7)	medium (33)	low (7)	medium (40)	low (28)	medium (60)	low (14)
2. bats	low (24)	low (22)	low (6)	low (6)	low (6)	low (6)	low (6)	low (6)
3. watercourses & wetlands	medium (36)	low (24)	high (65)	low (12)	medium (33)	low (12)	medium (60)	low (24)

MANAGEMENT PLAN

Control measures are only proposed for those impacts where mitigation measures are proposed to reduce the significance of impacts, i.e. some impacts are of low significance and thus no mitigation measures are proposed or no mitigation measures are possible or required.

OBJECTIVE: Monitor impacts on bats due to turbine blade collisions	
Project component/s	Turbines
Potential Impact	Loss of individuals of the threatened bat species
Activity/risk source	Operation
Mitigation: Target/Objective	Target: low mortalities within project control area Time period: implement pre-construction; continue throughout operation

Mitigation: Action/control	Responsibility	Timeframe
(1) establish an ongoing monitoring programme to detect and quantify any mortalities of individuals of threatened bat species	Management (environmental officer),	Estabish and implement pre-construction; continue throughout operation

Performance Indicator	Number of individuals killed by turbine blades within project area
Monitoring	• Determine densities of affected bat species within the area occupied by the wind energy facility before and after construction. • Document patterns of bat movement in the vicinity of the wind energy facility before and after construction. • Record bat mortalities and, as far as possible, the circumstances surrounding collisions. Standard protocols should be used when undertaking such surveys.

OBJECTIVE: Limit impacts on untransformed habitat due to construction of infrastructure	
Project component/s	Substation 1, some turbines and some internal access road / underground cable alignments
Potential Impact	Loss of untransformed natural habitat
Activity/risk source	Planning / construction
Mitigation: Target/Objective	Target: no loss of natural habitat within project control area Time period: planning , construction

Mitigation: Action/control	Responsibility	Timeframe
(1) Move some infrastructure and adjust some alignments, as per mitigation measures given in sections of this report.	Management (environmental officer),	Planning, construction

Performance Indicator	Area of untrasnformed natural habitat lost within project area
Monitoring	• Determine area of natural habitat remaining before and after construction.

OBJECTIVE: Limit damage to watercourses / wetlands	
Project component/s	Any infrastructure or activity that will result in disturbance to watercourses
Potential Impact	Damage to wetland areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the watercourse as a natural system
Activity/risk source	Construction, operation
Mitigation: Target/Objective	Target: no damage to watercourses within project area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) align underground cables and internal access roads as much as possible along existing infrastructure. (2) for any new construction, cross watercourses perpendicularly to minimise disturbance footprints (3) rehabilitate any disturbed areas as quickly as possible (4) control stormwater and runoff water (5) appoint an independent environmental control officer during construction and an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats (6) obtain a permit from DWA to impact on any wetland or water resource.	Planning team; construction team, management, environmental control officer	Planning, construction, operation

Performance Indicator	No impacts on water quality, water quantity, wetland vegetation, natural status of watercourses
Monitoring	• Water quality monitoring to take place on a regular basis. This should include the water quality and quantity leaving the project area through the watercourses (should be monitored within main drainage systems that exit site). • Habitat loss in watercourses should be monitored before and after construction. • The environmental manager should be responsible for driving this process. • Reporting frequency depends on legal compliance framework.

REFERENCES:

BARNES, K.N. (ed.) (2000) The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

BRANCH, W.R. (1988) South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.

CONSTANZA, R., D'ARGE, R., DE GROOT, R, FARBER, S., GRASSO, M., HANNON, B., LIMBURG, K., NAEEM, S., O'NEILL, R.V., PARUELO, J., RASKIN, R.G., SUTTON, P. and VAN DEN BELT, M. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253–260.

DRIVER, A., MAZE, K., ROUGET, M., LOMBARD, A.T., NEL, J., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K and STRAUSS, T. 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

FAIRBANKS, D.H.K., THOMPSON, M.W., VINK, D.E., NEWBY, T.S., VAN DEN BERG, H.M & EVERARD, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. *S.Afr.J.Science* 96: 69-82.

FORMAN, R.T.T. & ALEXANDER, L.E. 1998. Roads and their major ecological effects. *Annual Review of Ecology and Systematics* 29: 207-231.

FRIEDMANN, Y. & DALY, B. (eds.) 2004. The Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

GROOMBRIDGE, B. (ed.) 1994. *1994 IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book - Butterflies. *South African National Scientific Programmes* No. 158, Foundation for Research Development, CSIR, Pretoria.

IUCN (2001). *IUCN Red Data List categories and criteria: Version 3.1*. IUCN Species Survival Commission: Gland, Switzerland.

MILLS, G. & HES, L. 1997. The complete book of southern African mammals. Struik Publishers, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. and KLOEPFER, D. (eds.) 2004. Atlas and Red Data Bookof the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

MUCINA, L. AND RUTHERFORD, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C. AND POWRIE, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.

PASSMORE, N.I. & CARRUTHERS, V.C. (1995) South African Frogs; a complete guide. Southern Book Publishers and Witwatersrand University Press. Johannesburg.

SAUNDERS, D.A., HOBBS, R.J. & MARGULES, C.R. (1991). Biological consequences of ecosystem fragmentation: a review. Conservation biology 5: 19-30

Appendix 1: Threatened vertebrate species with a geographical distribution that includes the current study area.

MAMMALS

Common name	Taxon	Habitat	Status[2]	Likelihood of occurrence
Lesueur's Wing-gland bat	Cistugo lisueuri	Rock crevices in fynbos.	NT (Friedmann & Daly 2004, no record at www.iucnredlist.org)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area; no suitable roosting habitat on site, but there may be nearby
Schreiber's long-fingered bat	Miniopterus schreibersii	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area; no suitable roosting habitat on site, but there may be nearby
White-tailed rat	Mystromus albicaudatus	Highveld and montane grassland, requires sandy soils with good cover. Found throughout South Africa except Northern Cape and Limpopo	EN (Friedmann & Daly 2004, no record at www.iucnredlist.org)	**HIGH**, previously recorded in neighbouring grid, presence of suitable substrate (sandy soils present)
Grant's golden mole	Eremitalpa granti	Strandveld Succulent Karoo, Namib Desert, in subterranean habitats in shifting sands	LC Listed as VU in Friedmann & Daly 2004	**HIGH**, previously recorded in neighbouring grid, substrate properties on site are suitable for this species.

[1]Distribution according to Friedmann & Daly 2004.

[2]Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 September 2010.

AMPHIBIANS

Common name	Species	Habitat	Status[2]	Likelihood of occurrence
Cape Caco	Cacosternum capense	Lowlands west of the Cape Fold mountains, from the Cape Flats northwards to Graafwater. Vredenburg (3217DD) is at the western limit of its distribution range. Inhabits flat or gently undulating low-lying areas with poorly drained loamy to clay soil, where it breeds in shallow, temporary, rain-filled pools and pans that form during the winter months. Also occurs in more sandy habitats. About 90% of recorded breeding sites occur in modified habitat, particularly agricultural lands.	VU	**HIGH**, previously recorded in grid and suitable habitat available on site.

[2]Status according to Minter et al. 2004 and IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 September 2010..

REPTILES

Common name	Species	Habitat	Status[3]	Likelihood of occurrence
Cape sand snake	Psammophis leightoni leightoni	Coastal renosterveld, coastal fynbos and transitional strandveld in the extreme south-western Cape.	VU[4] (no record at www.iucnredlist.org)	**LOW**, just outside known distribution range, but suitable habitat on site.
Armadillo girdled lizard	Cordylus cataphractus	Rock cracks and crevices. Diet consists mainly of termites, beetles and grasshoppers	VU[4]	**LOW**, just outside known distribution range.
Namaqua plated lizard	Gerrhosaurus typicus	Dry sandy areas and bare rocky hillsides	RARE[3], NT[4]	**HIGH**, overall geographical distribution includes this area; suitable habitat on site
Southern	Homopus	Rocky outcrops and ridges	NT[4]	**LOW**, just outside known

Common name	Species	Habitat	Status[3]	Likelihood of occurrence
speckled padloper	signatus cafer	in regions of relatively low rainfall. Occurs west of Cedarberg to the coast.		distribution range. Small amount of suitable habitat may occur on site.
Geometric tortoise	Psammobates geometricus	Flat, low-lying renosterveld of the south-western Cape. Tortoises prefer relatively open habitat.	EN[4]	**LOW**, outside known distribution range. Suitable habitat may occur on site.
Fisk's house snake	Lamprophis fiskii	Karoo, fynbos and succulent karoo.	VU[4]	**MEDIUM**, overall geographical distribution includes this area; suitable habitat on site
Yellowbellied house snake	Lamprophis fuscus	Old termitaria and under stones, underground. Found throughout more mesic parts of South Africa (Cape, east coast, Highveld).	NT[4]	**MEDIUM**, not previously recorded in neighbouring grids, but within overall distribution range and habitats are available on site.
Black spitting cobra	Naja nigricollis woodi	Favours rocky terrain, dry rocky watercourses. Known from Cedarberg.	RARE[3] (no record at www.iucnredlist.org)	**LOW**, overall geographical distribution includes this area; no ideally suitable habitat on site
Gronovi's dwarf burrowing skink	Scelotes gronovii	West Coast from Vredendal to Robben Island. Under flat rocks or litter in sandy areas.	NT[4]	**HIGH**, within geographical distribution range, previously recorded nearby and suitable habitat occurs on site.
Kasner's dwarf burrowing skink	Scelotes kasneri	Coastal dune areas from Lambert's Bay to Vredenburg. Coastal dunes under flat stones or under litter.	VU[4]	**HIGH**, within geographical distribution range, previously recorded nearby and suitable habitat occurs on site.

[3]Status according to Branch 1988.

[4]Status according to Groombridge 1994.\