EIA REPORT:

Specialist ecological study on the potential impacts of the proposed Happy Valley Wind Energy Facility Project, Eastern Cape

Prepared by

David Hoare
(Ph.D., Pr.Sci.Nat.)

David Hoare Consulting cc
Postnet Suite no. 116
Private Bag X025
Lynnwood Ridge, 0040

for

Savannah Environmental (Pty) Ltd
PO Box 148,
Sunninghill,
2197

on behalf of
Renewable Energy Investments South Africa

26 July 2011

DRAFT EIA REPORT: 2nd Draft

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

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 Happy Valley Wind Energy Facility in the Eastern Cape Province. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

Dr David Hoare
David Hoare Consulting cc
Postnet Suite no. 116
Private Bag X025
Lynnwood Ridge, 0040

Telephone: 012 804 2281
Cell: 083 284 5111
Fax: 086 550 2053
Email: dhoare@lantic.net

Summary of expertise

Dr David Hoare:

- PhD in ecology
- 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 250 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 Renewable Energy Investments South Africa. 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 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 Renewable Energy Investments South Africa to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed "Happy Valley Wind Energy Facility." The project involves the establishment of a wind energy facility and associated infrastructure, including up to 20 wind turbines, an on-site sub-station, a 66 kV - 132 kV powerline linking to Eskom's Melkhout sub-station, underground cables linking the turbines to the sub-station, workshop area and internal access roads to each turbine. The purpose of the EIA is to identify environmental impacts associated with the project.

In April 2010 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological EIA 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.

This report provides details of the results of the EIA phase. The findings of the study are based on a desktop assessment of the study area, detailed mapping from aerial imagery and a field survey of the site.

Study area

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

METHODOLOGY

The environmental study is 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 flora, fauna and ecology 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

1. threatened plant species
2. protected trees
3. threatened animal species

Ecosystems

1. threatened ecosystems
2. protected ecosystems
3. critical biodiversity areas
4. areas of high biodiversity
5. centres of endemism

Processes

1. corridors
2. mega-conservancy networks
3. rivers and wetlands
4. important topographical features

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:

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

Plant and animal species of concern

The purpose of listing Red Data plant and 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. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute for the quarter degree squares within which the study area is situated.

Regulations published for the National Forests Act provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area.

Lists of threatened animal and bird species that have a geographical range that includes the study area were obtained from literature sources (Alexander & Marais 2007, Barnes 2000, Branch 1988, 2001, du Preez & Carruthers 2009, 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 organisms (flora and 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.

Vegetation habitats of concern

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA), Northern Cape Biodiversity Conservation Plan (NCBCP). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

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 unexpectedly located in an area.

Exclusions

The avifaunal and bat assessment is excluded from this study and will be undertaken by separate specialist consultants.

DESCRIPTION OF STUDY AREA

Location

The study site is situated approximately 7 km north-west of Humansdorp in the Eastern Province and falls within the quarter degree grid 3324DC (Figure 1). The closest settlement is Kruisfontein, 2 km to the south-east of the site.

The farm portions on which the proposed wind energy facility would occur include the following: Portion 1 and 2 of Farm 810.

No alternative site is currently being considered for the proposed wind energy facility.

The study area is located directly to the north of the N2 that links Port Elizabeth to George / Knysna. This road runs from east to west past the south-eastern corner of the study site. Access to the site is via Kruisfontein through Humansdorp. The site is therefore well-connected to a major route in this region. There is a road from Kruisfontein into the mountains north of the site that crosses the western part of the site. There are also limited local access roads on site.

The Melkhout substation is located off site near Humansdorp. This is a minimum of 5 km from the site.

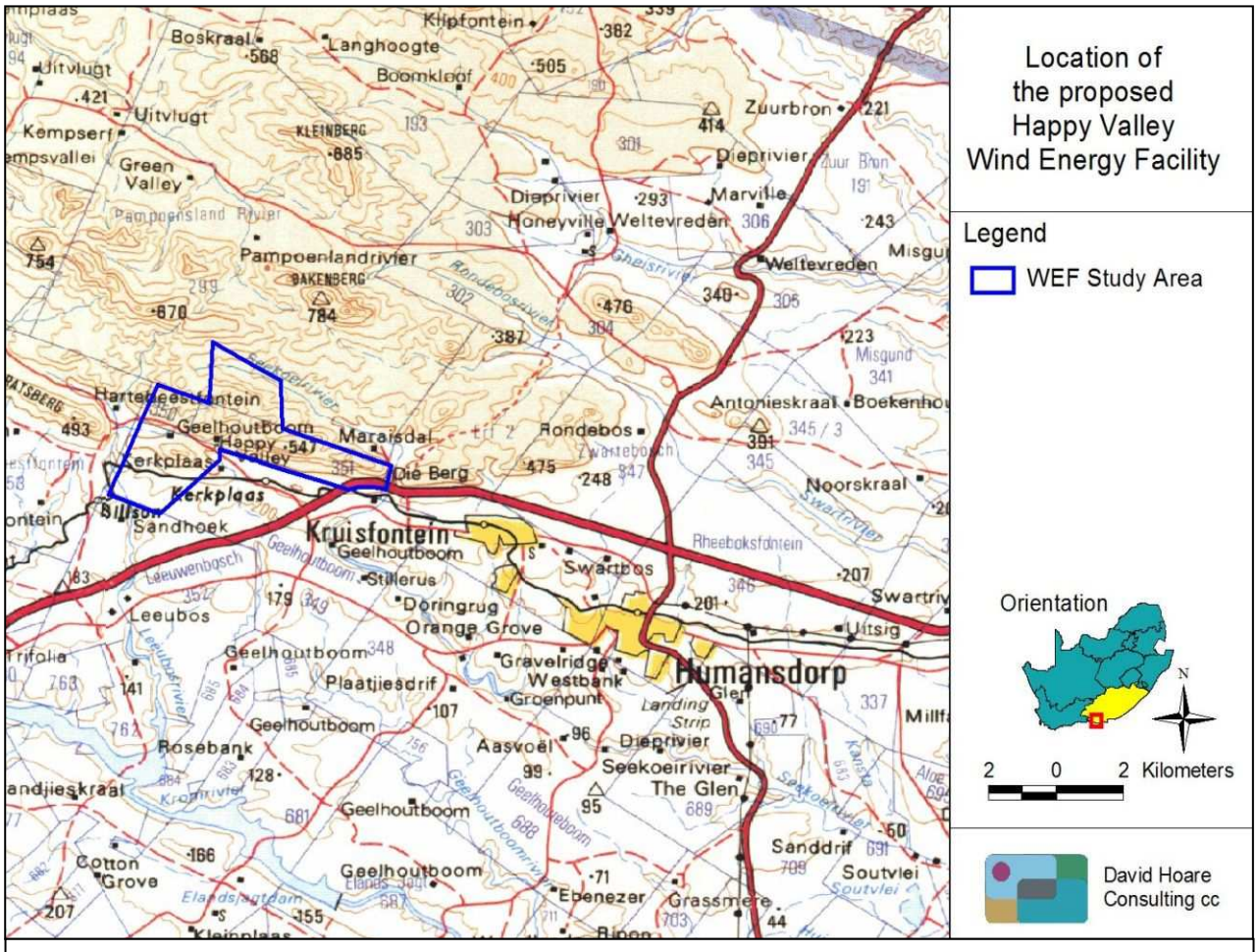

Figure 1: Location of the proposed Happy Valley Wind Energy Facility.

Topography

A general view of the topography of the study area is given in Figure 2. The study site is located on the southernmost ridge of the Cape Fold mountains. South of the mountains are plains that stretch southwards to the coast-line. The ridge dominates the study area, running in an east-west direction through the site.

The study area is moderately to steeply sloping. The elevation varies from 240 to 547 m above sea level. The site slopes towards the coast, but with a raised area running through the central part of the site parallel to the coast.

There are a number of small streams dissecting the landscape, all draining into the Seekoei River and flowing towards the coastline.

Geology and soils

According to a course-scale geology map (SACS 1980), the major geological formation occurring in the study area is Peninsula Formation of the Table Mountain Group, consisting of arenite. Arenite is a fine- to medium-grained sedimentary rock. The outcrop in the south-western part of the site is Nardouw Subgroup, also of the Table Mountain Group, consisting of arenite, shale and tillite.

Detailed soil information is not available for broad areas of the Eastern Cape. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There are two landtypes in the

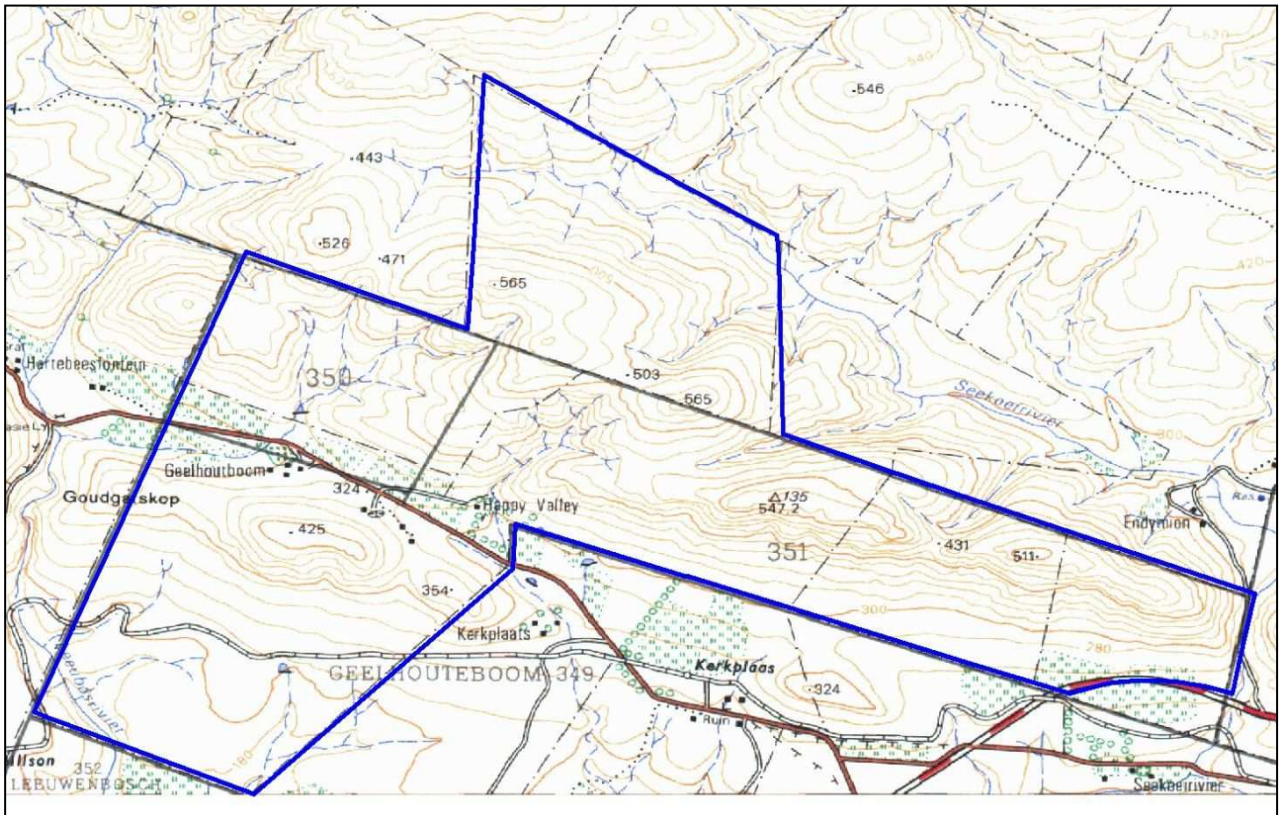

Figure 2: Contour lines giving a general indication of the topography of the study area and surrounding landscapes.

study area, the Fa and Bb landtypes (Land Type Survey Staff, 1987). The Fa land type indicates pedologically young landscapes that are not predominantly rock and nor predominantly alluvial or aeolian and in which the dominant soil-forming processes have been rock weathering, the formation of orthic topsoil horizons and, commonly, clay illuviation, giving rise typically to lithocutanic horizons (MacVicar et al. 1974). The soil forms that epitomise these processes are Glenrosa and Mispah. Fa refers to land in which lime in the soil is not encountered regularly in any part of the landscape. Most of the site falls within this land type.

The Bb land type indicates land in which red and/or yellow apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene forms) that are dystrophic and/or mesotrophic predominate over red and/or yellow apedal soils that are eutrophic, and in which red soils (mainly Hutton and Bainsvlei) are not widespread (MacVicar et al. 1974). Small parts of the site in the south-eastern and south-western corners belong to this land type.

Very little of the site is considered to be suitable for cultivation.

Climate

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

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

Landuse and landcover of the study area

The majority of the study area is natural, although small parts may be degraded to varying degrees through land-use practices. The landscape consists primarily of low grassy fynbos on low mountain ridges. Landcover data for the area (Fairbanks et al. 2000) indicates that the site consists of a mixture of cultivation low shrubland.

There are a small number of cultivated lands on site. According to land type information, most of the soils on site are considered to be marginal for cultivation, despite the adequate rainfall. The cultivated lands are concentrated in two places, at the south-eastern border of the site and within the western part of the site closest to the main road passing through the site.

Broad vegetation types

Vegetation may be described at various hierarchical levels from Biome, to broad Vegetation Type and down to Plant Community level associated with local habitat conditions. There are three general descriptions of the vegetation in the study area. Acocks (1953) published the first comprehensive description of the vegetation of South Africa, which was updated in 1988. This was followed by an attempted improvement (Low & Rebelo 1998) which became widely used due to the inclusion of conservation evaluations for each vegetation type, but is often

less rigorous than Acocks's original publication. More recently, a detailed map of the country was produced (Mucina *et al.*, 2005). A companion guide to this map (Mucina & Rutherford 2006), containing up-to-date species information and a comprehensive conservation assessment of all vegetation types, has just been published. The classification of the vegetation according to all three of these publications is given below, but only the most recent publication is currently used by conservation authorities.

Acocks (1953) classified this area as falling within False Fynbos, a fynbos veld type which Acocks considered to be transitional to sour grassland.

According to Low and Rebelo (1998), the study area is situated within South & South-west Coast Renosterveld on the mountain ridge and Grassy Fynbos on the lower-lying areas. This publication and that of Acocks do not provide much useful information about vegetation patterns in this region that can be used for conservation planning.

The publication by Low and Rebelo is now considered to be outdated and has been superseded by the description by Mucina *et al*. (2006). According to this most recent vegetation map of the country (Figure 3), the study area falls primarily within one main vegetation type, ***Kouga Grassy Sandstone Fynbos***, which falls into the Fynbos Biome. The site is on the boundary with another vegetation type, ***Humansdorp Shale Renosterveld***, and it is likely that the site could contain floristic elements derived from either of these vegetation types.

Kouga Grassy Sandstone Fynbos is found along the lower flanks of the Kouga Mountains in the Langkloof north of Joubertina and the northern and lower slopes of Suuranysberge to the low mountains and flats north of Humansdorp (Rebelo et al. 2006). It is a low shrubland with

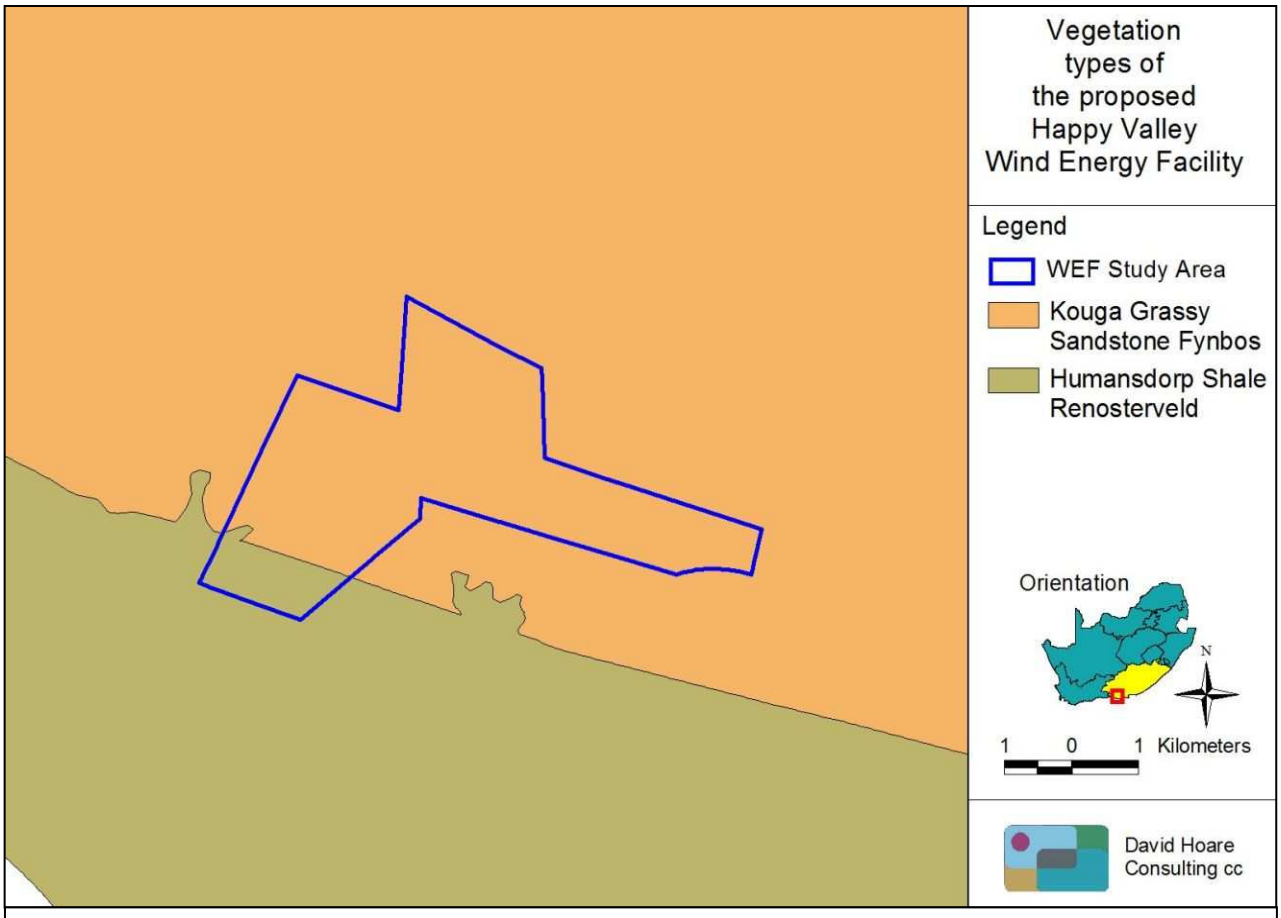

Figure 3: Vegetation types of the study site and surrounding areas.

sparse, emergent tall shrubs and dominated by grasses in the undergrowth or grassland with scattered ericoid shrubs (Rebelo et al. 2006). This vegetation type occurs throughout the site under assessment (Figure 3).

Humansdorp Shale Renosterveld occurs in three swathes, one of which extends from Jeffreys Bay near the coast inland past Humansdorp to the lower reaches of the Dieprivier near Two Streams (Rebelo et al. 2006). The vegetation type occurs on moderately undulating plains and undulating hills. It is a vegetation composed of low, medium dense graminoid, dense cuppressoid-leaved shrubland, dominated by renosterbos (Rebelo et al. 2006). There are both grassland shrubland and grassland forms of the renosterveld. Thicket patches are common on termitaria and fire-safe enclaves. This vegetation type occurs in the extreme southern part of the site (Figure 3).

Conservation status of broad vegetation types

The vegetation types of South Africa have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protected on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the Draft Ecosystem List versus in the scientific literature.

Table 1: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Kouga Grassy Sandstone Fynbos is classified in Mucina *et al*. (2006) as Least Threatened, with 19% conserved of a target of 24% and 10% transformed (Mucina et al. 2006).

Humansdorp Shale Renosterveld occurs is classified in Mucina *et al*. (2006) as Endangered, with none conserved of a target of 29% and 61% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists this vegetation type as Endangered.

The Cape Floristic Region

The study area occurs within the Cape Floristic Region (see Figure 4), which is recognised as one of the principal centres of diversity and endemism in Africa (van Wyk & Smith 2001).

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

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

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

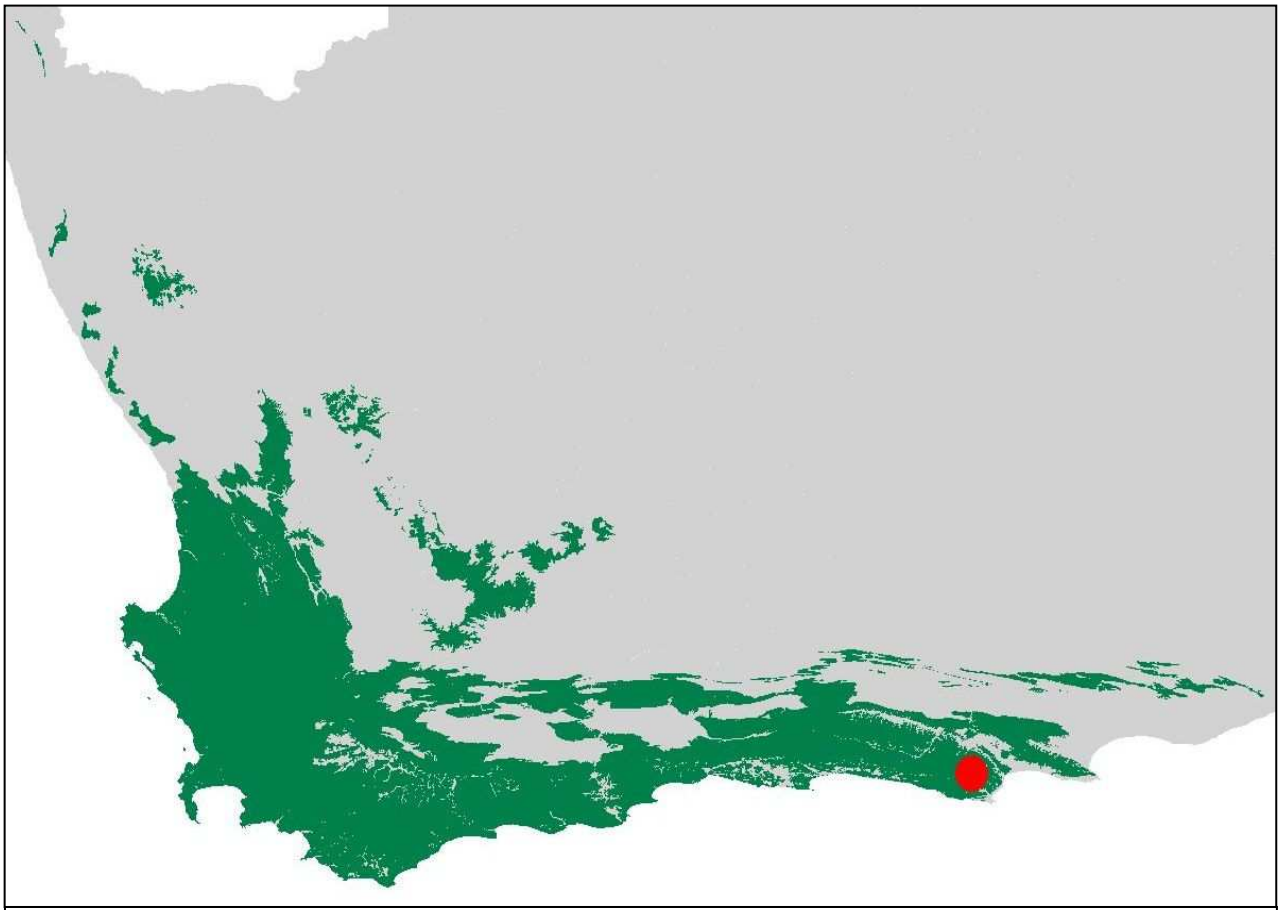

Figure 4: Relationship of the Fynbos Biome to the study area (red circle).

Permanent and complete transformation of habitat has affected 33% of the CFR hotspot. Less than 20% of the total area covered by the CFR hotspot can be considered close to the pristine state in the sense that it is entirely free of alien plants and subjected to appropriate fire and grazing regimes (Cowling & Pierce 2000). The study area is within this hotspot area near its eastern end (see Figure 4) and, although the hotspot contains a wide variety of vegetation types, the study area contains a number of vegetation types that are typical of the areas of concern within the hotspot.

Red List plant species of the study area

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

The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were seven species recorded in the quarter degree grid in which the study area is located that are listed on the Red List that could occur in habitats that are available in the study area. According to IUCN Ver. 3.1 (IUCN, 2001) one of these are listed as Critically Endangered, four as Endangered and two as Near Threatened (see Table 3 for explanation of categories).

Table 3: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

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

The Critically Endagered species, *Erica humansdorpensis*, is highly likely to occur on site; the site is at the locality where the species has been previously recorded. It was found in fynbos on the roadside and occurs in lowland fynbos at the base of the mountain slopes. It occurs in the south-eastern part of the site close to the N2 National road. The current proposed layout indicates that the overhead powerline will be positioned close to this area (see section below).

The Endangered plant species, *Disa lugens* var. *lugens*, has a high likelihood of occurring on site. It is found on coastal lowlands as well as on mountain slopes and plateaus. In the mountains, it is mostly found on cooler, south-facing slopes. The species was not found on site, but requires very specific conditions before it emerges. The site contains ideal habitat for

this species and is within the known geographical distribution of this species. It has been recorded a number of times in areas that are in proximity to the site.

The Near Threatened plant species, *Aloe micracantha*, was recorded on site on the northern side of the main mountain ridge in close proximity to the existing vehicle track. It prefers nutrient-poor, well-drained sandy soils and could anywhere along the northern side of the main mountain ridge on site. It is a very cryptic species, looking like a tuft of grass when not in flower, but clearly visible when in flower (refer to Figure 5).

Another Near Threatened plant species, *Protea coronata*, has a high likelihood of occurring on site. It occurs from Cape Peninsula to Van Stadens, including lower slopes of mountain ranges. It has been recorded at a number of localities to all sides of the site. It prefers heavy clay soils and forms dense stands on the lower or middle slopes, often in tall, moist fynbos on forest margins or in damp, sheltered kloofs. No flowering proteas were found on site, but habitat on site is definitely suitable for this species.

There are three Endangered plant species that were considered to have a moderate probability of occurring on site, *Brachystelma cummingii*, *Haworthia longiana* and *Osteospermum pterigoideum*. In all three cases the habitat on site is not ideal or the closest records of these species, even if close by, is within habitats that are not found on site. The current assessment is therefore that there is a low risk of them occurring on site, but that their occurrence cannot be ruled out completely.

In summary, there are four plant species of concern that occur or have a high likelihood of

Figure 5: Near threatened plant species, *Aloe micracantha*, recorded on site.

occurring in habitats on site and that may be affected by the proposed project. These are as follows:

1. *Erica humansdorpensis* (CR),
2. *Disa lugens* var. *lugens* (EN),
3. *Aloe micracantha* (NT),
4. *Protea coronate* (NT).

Red List animal species of the study area

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

There are a number of mammal species of conservation concern that have a distribution that coincides with the study area. Only two of these are considered to have a possibility of occurring on site, the Brown Hyaena and the Natal Long-fingered Bat, both listed as Near Threatened. There are therefore no threatened (CR, EN or VU) species that have a probability of occurring on site[1].

There are two reptile and no amphibian species of conservation concern that have a distribution that includes the study area and which could occur on site. The two reptile species are the Spotted Rock Snake (Rare) and the Yellow-bellied House Snake (Near Threatened). There are therefore no threatened (CR, EN or VU) reptile or amphibian species that are likely to occur on site (see Table 3 for explanation of conservation categories).

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. Those that have a geographical distribution that includes the study area are *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*.

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

Based on habitat preferences, any of these species could occur on or near the site. *Sideroxylon inerme* subsp. *inerme* has been previously recorded in the grid in which the study site is located, as well as surrounding grids (see Appendix 4). *Boscia albitrunca* is not indicated as occurring in this region, but has been recorded in the quarter degree grid in which the study area is located (see Appendix 4). *Pittosporum viridiflorum*, *Podocarpus falcatus* and *Podocarpus latifolius* have been recorded in the grid to the south of the study area. If any of these species occur in the study area, the most likely places would be in the thicket in the drainage lines or in woodland patches. Some of these areas were searched for these species, but no individuals were found on site. The probability of one or more of them occurring on

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

site, is however, still very high, but in the thicket in drainage lines only, which is where no infrastructure is proposed to be located.

Other features of conservation concern

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

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

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

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

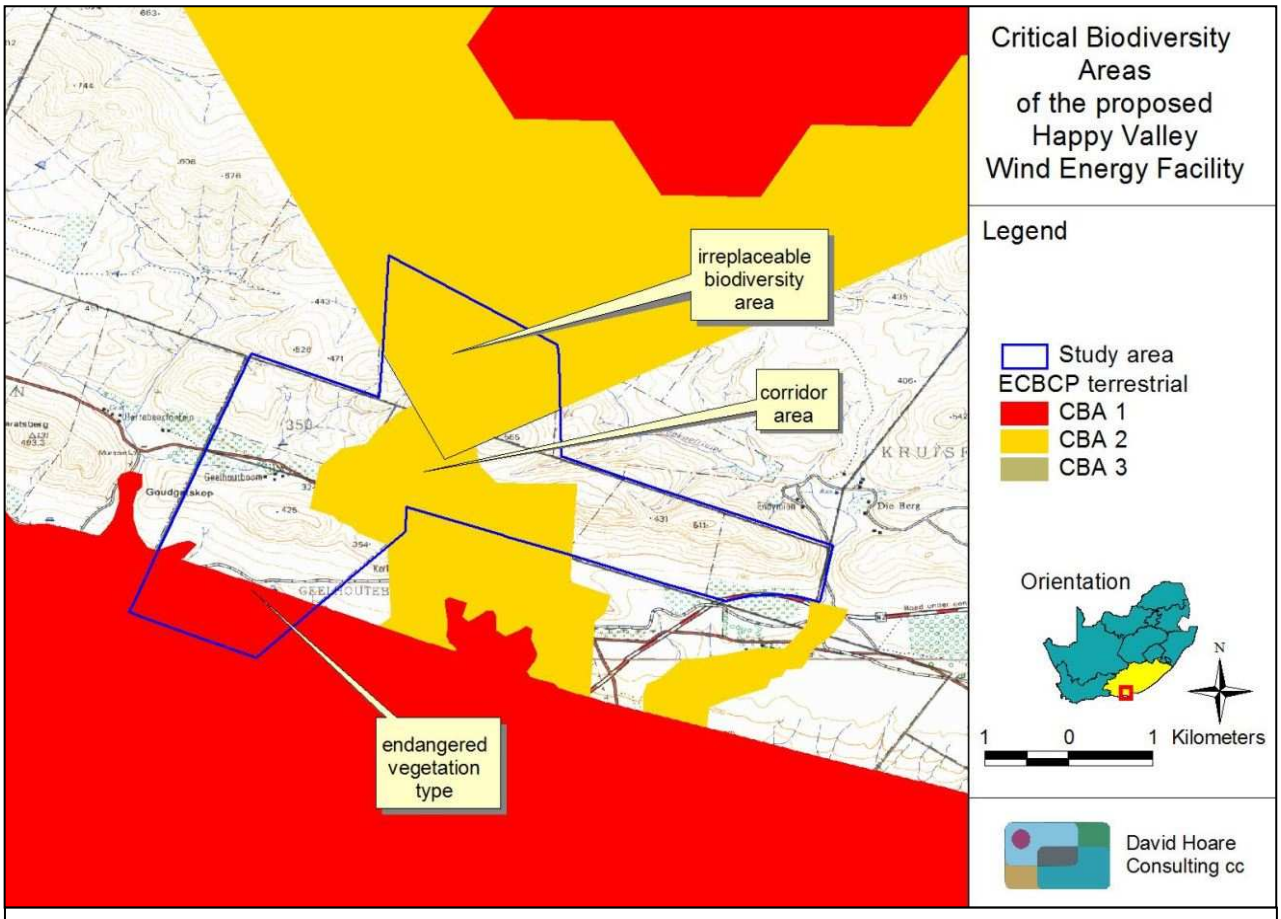

Figure 6: Important biodiversity areas of the study area (from ECBCP).

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

Within and around the study area, the ECBCP identifies CBAs at two levels that occurs within the study area and surroundings (Figure 6). The CBA 2 areas that fall within the study site are corridor areas, which are important for a number of reasons, including the maintenance of ecological processes, and known important sites for biodiversity, labeled as irreplaceable biodiversity areas (see Figure 6 to distinguish different areas).

Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that could (a) possibly have high conservation value or that (b) may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 7. An explanation of the different sensitivity classes is given in Table 4. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

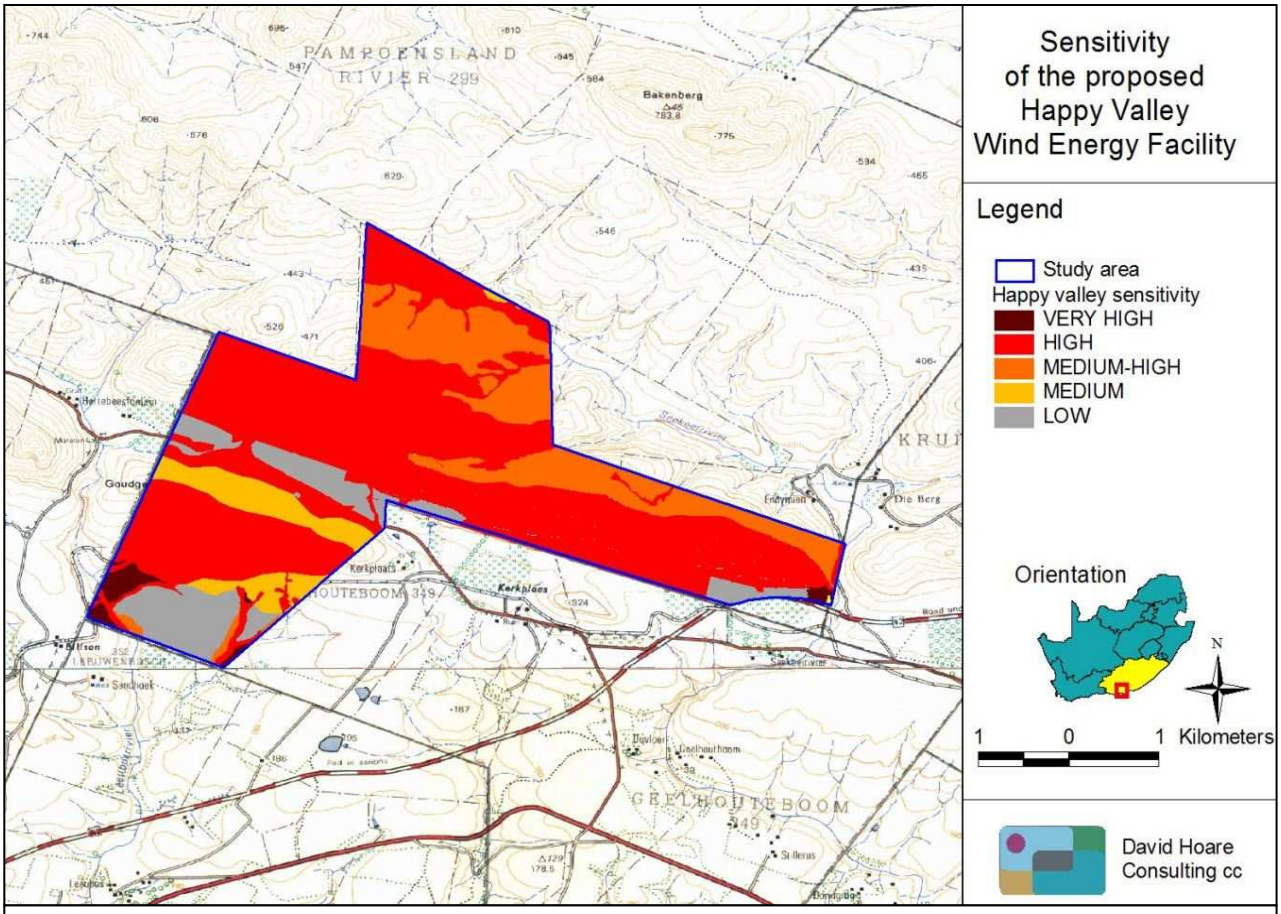

Figure 7: Sensitivity within different parts of the study area.

Table 4: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act) And may also be positive for the following: • High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) • High value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • Low ability to respond to disturbance (low resilience, dominant species very old).	• CBA 1 areas. • Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.
HIGH	Indigenous natural areas that are positive for any of the following: • High intrinsic biodiversity value (moderate/high species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). • Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain	• CBA 2 "critical biodiversity areas". • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem

	Catchment Areas Act, Lake Areas Development Act)	providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	• CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	
LOW	No natural habitat remaining.	

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

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

There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. vegetation of conservation importance: this is based primarily on the ECBCP assessment (see Figure 6), the Draft Ecosystem List and the fact that the site falls within the Cape Florsitic Region;
2. perennial and non-perennial rivers and streams: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
3. potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a high chance of occurring within remaining natural habitats within the study area.
4. estuaries and estuarine habitats that occur some distance off-site, but which may, under extreme circumstances, be affected by activities on site.

These factors have been taken into account in evaluating sensitivity within the study area (Figure 7). The sensitivity classification for the site is as follows:

1. VERY HIGH: (i) A small area of lowland fynbos in the south-eastern corner of the site is classified as having very high sensitivity (see Table 4 and Figure 7). This patch of vegetation is the site of a previous record of a Critically Endangered plant species, *Erica humansdorpensis*. (ii) Also classified as having very high sensitivity are all remaining areas of lowland fynbos that occur within Humansdorp Shale Renosterveld, which is classified in the scientific literature and according to the Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004) as Endangered, and is protected according to this legislation.
2. HIGH: (i) All of the drainage lines on site are classified as having high sensitivity (see Table 4 and Figure 7). They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide high value ecosystem goods and services. (ii) Also classified as having high sensitivity are all areas of south-facing mountain fynbos on site. These are potential habitat for the Endangered plant species, *Disa lugens* var. *lugens*. They are also considered to have high intrinsic biodiversity value, including high species richness, high habitat variability and high probability of containing species of narrow distribution and/or ecological amplitude. In addition, they are considered to be areas that provide high value ecosystem goods and services in terms of being within a mountain catchment area for a number of streams and wetlands.
3. MEDIUM-HIGH: All of the north-facing mountain fynbos on site is classified as having medium-high sensitivity (see Table 4 and Figure 7). These are areas of natural vegetation that are considered to have high intrinsic biodiversity value, including high species richness, high habitat variability and high probability of containing species of narrow distribution and/or ecological amplitude. In addition, they are considered to be areas that provide high value ecosystem goods and services in terms of being within a mountain catchment area for a number of streams and wetlands.
4. MEDIUM: All remaining areas of natural vegetation on site are classified as having medium sensitivity (see Table 4 and Figure 7).
5. LOW: Areas where no natural vegetation occurs is classified as having low sensitivity (see Table 4 and Figure 7). This includes cultivated lands, previously cultivated areas with secondary vegetation, areas of buildings, roads and bare ground.

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 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 (according to Section 15(1)) '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'. GN 1042 provides a list of protected tree species (amends GN 1012).

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

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.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1477 of 2009: Draft National List of Threatened Ecosystems

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

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.

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.

National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

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

In terms of Section 26 of this Act, "*No person shall without a permit hunt or be in possession of any endangered wild animal or the carcass of any such animal*". Schedule 2 of this Act provides a list of Protected Wild Animals.

Integrated Coastal Zone Management Act (Act No. 24 of 2008)

The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management of the coastal zone and contains a number of Chapters dealing with various components. Those that may affect the current project are as follows:

- A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis.
- Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the factors and criteria which

the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Lake Areas Development Act (Act No. 39 of 1975)
- Mountain Catchment Areas Act (Act No. 63 of 1970)

DESCRIPTION OF INFRASTRUCTURE

The position of the proposed infrastructure within the study area is indicated in Figure 8. This shows 13 turbines. These are linked by a network of internal access roads, which is also the planned position of the underground cables linking the turbines to one another and to the substation. An overhead powerline travels from the substation south-eastwards and then eastwards off the site. The major part of this powerline is adjacent to an existing overhead powerline.

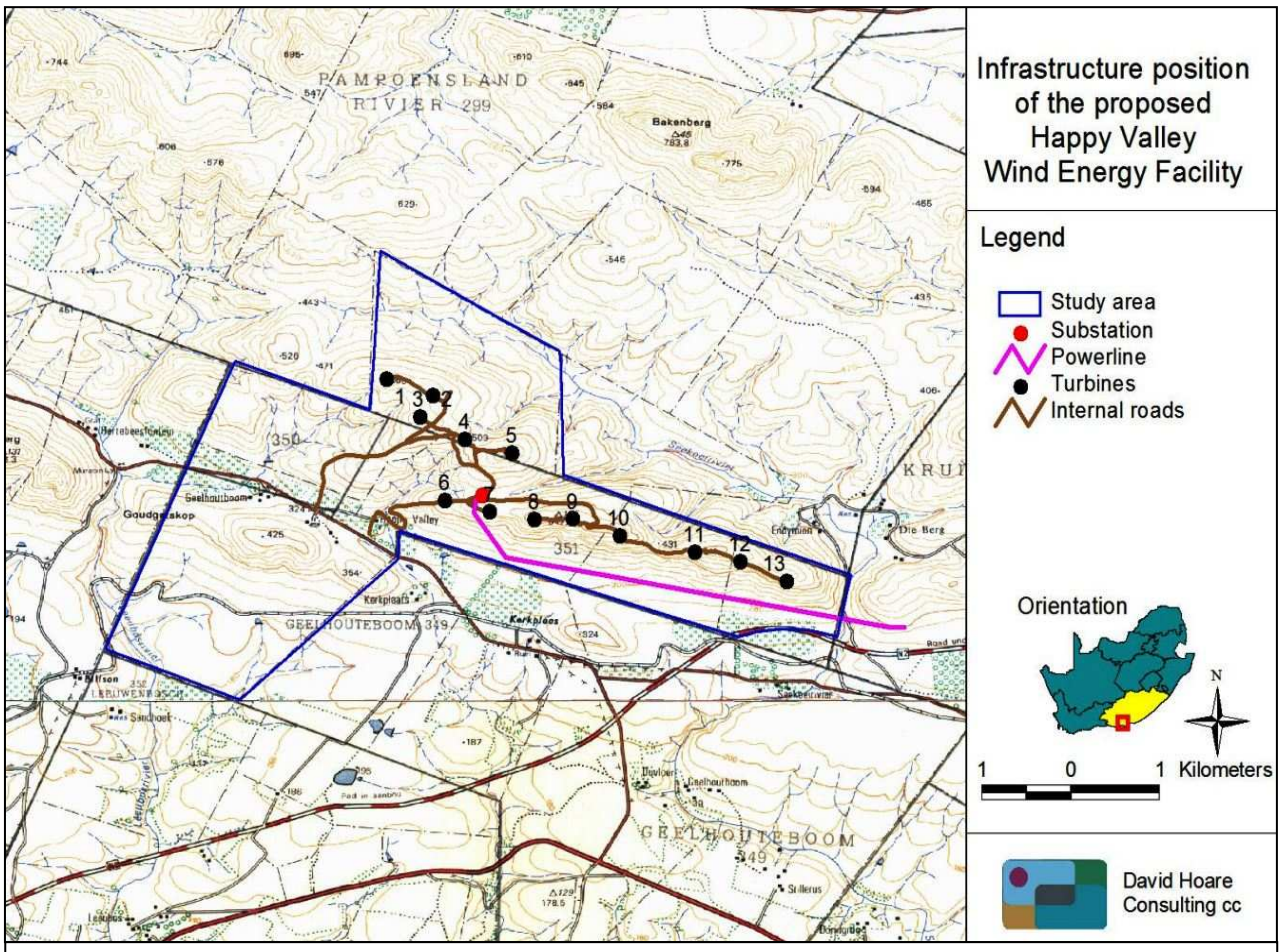

Figure 8: Proposed infrastructure position in the study area.

IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

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

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including, for example, indigenous forest, thicket and wetland vegetation, that leads to direct or indirect loss of such habitat.
- 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 plant communities and ecosystems or loss or change in ecosystem function.
- Secondary and cumulative impacts on ecology: 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.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

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.
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

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. The most important positive environmental impact of a WEF are related to decreased dependency on coal power. Potential impacts are discussed in more detail below:

Impact 1: Impacts on other 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.

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

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. 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 is one mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, the Brown Hyaena, listed as Near Threatened. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, the Yellow-bellied House Snake.

The Brown Hyaena is a mobile animal that is likely to avoid the site during construction and re-appear afterwards. If any populations of the Yellow-bellied House Snake occur on site, they are likely to be restricted to the specific parts of the site and unlikely to be able to move away during the construction phase, or are dependent on habitats on site remaining intact. This species, although listed as Near Threatened, occurs throughout a wide part of South Africa and is very unlikely to be significantly affected by, even in the worst-case scenario, the complete loss of the site, which constitutes a very small fraction of its potential overall range. Overall, this species is therefore unlikely to be affected by construction of the proposed infrastructure.

Impact 2: Impacts on threatened plants
Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

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

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

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

There are four plant species of conservation concern that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Critically Endangered, one as Endangered and two as Near Threatened. The Critically Endangered species has been recorded adjacent to the N2; the locality description is on the site. The remaining species have all been recorded nearby and the habitat on site is potentially suitable for them. One Near Threatened species was recorded on site during fieldwork undertaken for this project. The species are as follows:

1. *Erica humansdorpensis* (CR – previously recorded on site),
2. *Disa lugens* var. *lugens* (EN),
3. *Aloe micracantha* (NT – found on site),
4. *Protea coronate* (NT).

Impact 3: Impacts on protected tree species

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section1 5(1) of the National Forests Act, 1998 "no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated".

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* is considered to be highly likely to occur on site, and the remaining species could occur on site. Potentially suitable habitats were searched, but none of these species were found/positively identified on site. The possibility of them occurring there cannot be ruled out without a detailed search of all potentially suitable habitat for juveniles of these species. There are small woodland patches on site and in some drainage lines that may contain individuals of protected species, but these are not directly affected by the proposed infrastructure. On the basis of the layout information provided and the site visit, it is therefore considered unlikely that protected trees will be affected by the proposed project. This impact is therefore not assessed for individual infrastructure components.

Impact 4: Impacts on indigenous natural vegetation (terrestrial)

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

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

8. loss of ecosystem goods and services.

It has been established that the vegetation on site is classified as Least Threatened. However, the site falls within the Cape Floristic Region, which is an area of global biodiversity significance, and also affects areas classified as important corridors or habitats in the ECBCP. The natural vegetation on site within the mountain area is rich in species and there is a diversity of different habitat types. The vegetation is in very good condition, intact and there is little fragmentation or degradation within the mountain areas.

Impact 5: Impacts on wetlands

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. 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 streams and drainage lines in which wetlands occur. More importantly, one of the major wetland systems on site constitutes part of the catchment for an estuary on the coast downstream of the site, the Seekoei River estuary, which is classified in the ECBCP as of high conservation significance and sensitivity. The wetlands on site form the upper seepage zones and hillslope seepage wetlands that are the source of the water that is found downstream. They are, therefore, highly sensitive to disturbance and any hard modification to vegetation or soil within these areas is likely to seriously compromise the current functioning of these systems.

Impact 6: Change in runoff and drainage patterns

Infrastructure and roads crossing landscapes cause local hydrological and erosion effects resulting in major peak-flow and sediment impacts (Forman & Alexander 1998). This may occur around construction sites, but also in areas where the infiltration rates of the landscape are changed due to an impermeable surface being constructed. Increased runoff associated with infrastructure may increase the rates and extent of erosion, reduce percolation and aquifer recharge rates, alter channel morphology and increase stream discharge rates. Consequences may include:

1. increased loss of soil;
2. loss of or disturbance to indigenous vegetation, especially in wetlands;
3. loss of sensitive habitats, especially in wetlands;
4. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
5. fragmentation of sensitive habitats;
6. impairment of wetland function;

7. change in channel morphology in downstream wetlands, potentially leading to loss of wetland vegetation; and
8. reduction in water quality in wetlands downstream of road.

There are both steep slopes and wetlands occurring on site and an estuary occurring down stream. The soils within the steeply sloping landscapes are not highly erodible, but the natural vegetation plays an important role in regulating the hydrology of the landscape. A number of turbines and the associated internal access roads and underground cables are on very steep slopes that are vulnerable to downslope damage.

Impact 7: Establishment and spread of declared weeds and alien invader plants

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

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. fragmentation of sensitive habitats;
8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

There are a number of different alien plant species that could become established on site, some of which already occur on site. A checklist of species previously recorded in the grid in which the site is located indicates that the following species are likely to invade the site, given the right conditions: *Acacia cyclops*, *Acacia saligna*, *Acacia mearnsii*, *Datura stramonium*, *Hakea sericea* and *Pinus pinaster*. The species, *Acacia cyclops*, *Acacia mearnsii* and *Pinus pinaster* were seen on site. The potential therefore exists for extensive and diverse invasion of the site. The habitats most likely to be affected are watercourses and fynbos, depending on the invasive species.

ASSESSMENT OF IMPACTS

Impacts are assessed for each component of infrastructure for the proposed wind energy facility. There is therefore a seperate assessment for the turbines, substation, overhead power lines and the combination of underground cables between turbines and internal access roads.

Wind turbines

A total of 14 turbines have been proposed for the site. The position of these in the study area is indicated in Figure 8.

Impact 1: Impacts on threatened terrestrial animal species

There are two Near Threatened animal species that may be affected by construction activities on site. One, the Brown Hyaena is mobile and will not be affected by construction or operation of the facility. The other, the Yellow-bellied House Snake, may occur on site, but it is unknown. It has a wide distribution and the conservation status of the species will not be affected by construction on site.

Extent: For the Yellow-bellied House Snake, the impact will be local.

Duration: The impact will occur during construction and will be medium-term (if a population is affected, the duration will be until the population has recovered from any potential impact).

Magnitude: At a local scale, the impact is likely to result in a slight impact on population processes for the affected species, which is scored as low.

Probability: It is improbable that the impact will occur (it is not known whether the species of concern, the Yellow-bellied House Snake, will be affected or not - if they occur it is improbable that they will be affected).

Mitigation measures: None

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (3)	local (3)
Duration	medium-term (3)	medium-term (3)
Magnitude	low (4)	low (4)
Probability	improbable (2)	improbable (2)
Significance	**low (20)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) None		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

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

Impact 2: Impacts on threatened plants

There are two threatened and two near threatened species that could occur on site. One of the Near Threatened species was recorded on site during this study and one threatened species has been previously recorded on site. In terms of legislation, a species listed as Near Threatened is not treated as a threatened species and impacts on these species are not assessed here.

Extent: The impact will occur at the site of the proposed turbines, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site. The impact will therefore be evaluated at a regional scale.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The impact could potentially be of high magnitude and could result in population processes temporarily ceasing.

Probability: The probability of the impact occurring is the same for both of the plant species of concern. For the Critically Endangered species (*Erica humansdorpensis*), the closest turbine is located 800 m away. It is assessed as improbable that impacts will occur on populations of *Erica humansdorpensis* due to construction and/or operation of turbines due to the fact that the species does not occur in the affected zone for the turbines. For the Endangered plant species (*Disa lugens*), it is unknown whether they occur within or near to the footprint of any turbine. It is assessed as improbable that impacts will occur on populations of this species.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of each turbine must be searched for populations of potentially affected plant species of concern.

Nature: Impacts on threatened plants (Erica humansdorpensis, CR)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (28)**	**Low (28)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be low if control measures are effectively applied		

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

Nature: Impacts on threatened plants (Disa lugens, EN)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	High (8)
Probability	Improbable (2)	Highly improbable (1)
Significance	**Medium (32)**	**Low (16)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) Prior to construction, during a suitable season, undertake a targeted survey of the footprint of the turbines to ensure that no populations of *Disa lugens* occur there. If any populations are found, turbines should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Impact 4: Loss or fragmentation of indigenous natural vegetation

All of the turbines are situated within natural vegetation within the mountain region of the site.

Extent: The impact will occur at the site of the proposed turbines. The construction of the turbines potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low. The fragmentation effect may, however, cause ecological processes to continue but in a modified way, which is scored as moderate. This is due to the new nodes of disturbance created within an undisturbed landscape.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbines and laydown areas.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate to low (5)
Probability	definite (5)	definite (5)
Significance	**medium (60)**	**medium (55)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the turbines. (2) Impacts should be contained to within the footprint of the turbines and laydown area.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

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

Impact 5: Damage to wetlands/watercourses

None of the turbines are currently positioned within mapped wetland areas..

Extent: The impact will occur at the site of the proposed turbines, but could have downstream impacts. The extent of the potential impact is therefore on the site and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a permanent effect.

Magnitude: In the long-term, impacts will result in processes continuing but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is improbable that the impact will occur.

Mitigation measures:
None required

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	moderate (6)	moderate (6)
Probability	Improbable (2)	Improbable (2)
Significance	**low (26)**	**low (26)**

Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None required		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

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

Impact 6: Change in runoff and drainage patterns

Turbine numbers 8, 9, 10, 11, 12 and 13 are all in areas where there is a high risk of causing downslope impacts, at the summit of very steep slopes.

Extent: The impact will be local, although downslope areas could be affected.

Magnitude: It is likely to be an impact of moderate magnitude in terms of the degree to which erosion may be caused that damages downslope areas (will result in processes continuing but in a modified way).

Duration: The impact will be of permanent duration.

Probability: Based on the current position of the infrastructure, it is improbable that the impact will occur.

Potential significance: On the basis of this assessment, the impact is likely to be of low significance.

Mitigation measures: A comprehensive stormwater management plan must be compiled, prior to construction, that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces. Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimise the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabions, weirs, rock-packing, etc.

Nature: Change in runoff and drainage leading to increased soil erosion and damage of downslope areas		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Moderate (6)	low (4)
Probability	Improbable (2)	improbable (2)
Significance	**low (24)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Partially	
Mitigation: (1) compile a comprehensive storm-water management plan (2) rehabilitate any disturbed areas immediately to stabilise landscapes (3) water velocity must be reduced and diffused before water is returned to natural systems (4) erosion features must be immediately stabilised, if they develop. (5)		
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat may all lead to additional impacts that will exacerbate this impact.		
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.

Impact 7: Establishment and spread of declared weeds and alien invader plants

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

Extent: The impact will occur at the site of the proposed turbines, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility and could create an invasive plant situation that lasts for more than a human life-span. This is scored as permanent.

Magnitude: Due to the current undisturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate to high (will result in processes continuing but in a modified way or in processes temporarily ceasing, if invasions become uncontrolled).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	permanent (5)	long-term (4)
Magnitude	moderate to high (7)	low (4)
Probability	Highly probable (4)	probable (3)

Significance	**medium (56)**	**medium (30)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Substation

There is a single substation proposed on the site, just north of turbine 7.

Impact 1: Impacts on threatened terrestrial animal species

There are two Near Threatened animal species that may be affected by construction activities on site. One, the Brown Hyaena is mobile and will not be affected by construction or operation of the facility. The other, the Yellow-bellied House Snake, may occur on site, but it is unknown. It has a wide distribution and the conservation status of the species will not be affected by construction on site. Construction of the substation will cause the loss of a very small area of habitat relative to the overall range of potentially affected species.

Extent: For the Yellow-bellied House Snake, the impact will be local.

Duration: The impact will occur during construction and will be medium-term (if a population is affected, the duration will be until the population has recovered from any potential impact).

Magnitude: At a local scale, the impact is likely to result in a small impact on population processes for the affected species, if any.

Probability: It is improbable that the impact will occur (it is not known whether the species of concern, the Yellow-bellied House Snake, will be affected or not - if they occur it is improbable that they will be affected).

Mitigation measures: None

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (3)	local (3)
Duration	medium-term (3)	medium-term (3)
Magnitude	small (1)	small (1)
Probability	improbable (2)	improbable (2)
Significance	**low (14)**	**low (14)**

Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (2) None		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

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

Impact 2: Impacts on threatened plants

There are two threatened and two near threatened species that could occur on site. One of the Near Threatened species was recorded on site during this study and one threatened species has been previously recorded on site. In terms of legislation, a species listed as Near Threatened is not treated as a threatened species and impacts on these species are not assessed here.

Extent: The impact will occur at the site of the proposed turbines, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site. The impact will therefore be evaluated at a regional scale.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact depends on the species. The known location of the Critically Endangered species is far from the substation site and this species will not be affected. For the Endangered species, the impact could potentially be of high magnitude and could result in population processes temporarily ceasing.

Probability: For the Critically Endangered species (*Erica humansdorpensis*), the substation is located 3 400 m away – no impact will therefore occur on this species due to construction of the substation. For the Endangered plant species (*Disa lugens*), it is unknown whether they occur within or near to the footprint of the substation. It is assessed as improbable that impacts will occur on populations of this species.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the substation must be searched for populations of potentially affected plant species of concern.

Nature: Impacts on threatened plants (Disa lugens)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	High (8)
Probability	Improbable (2)	Highly improbable (1)
Significance	**Medium (32)**	**Low (16)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) Prior to construction, undertake a targeted survey of the footprint of the substation to ensure that no populations of *Disa lugens* occur there. If any populations are found, the substation should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Impact 4: Loss or fragmentation of indigenous natural vegetation

The substation is situated within natural vegetation within the mountain region of the site.

Extent: The impact will occur at the site of the proposed substation. The construction of the substation potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low. The fragmentation effect may, however, cause ecological processes to continue but in a modified way, which is scored as moderate. This is due to a new node of disturbance created within an undisturbed landscape.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbines and laydown areas.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate to low (5)
Probability	definite (5)	definite (5)
Significance	**medium (60)**	**medium (55)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	

Mitigation: 1. Avoid unnecessary impacts on natural vegetation surrounding the substation.
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will definitely occur.

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

Impact 5: Damage to wetlands/watercourses

The substation is positioned within a short distance of a mapped wetland area, but is in a flat area at the summit of the slopes.

Extent: The impact will occur at the site of the proposed substation, but could have downstream impacts. The extent of the potential impact is therefore on the site and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a long-term to permanent effect.

Magnitude: In the long-term, impacts will result in processes continuing but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is probable that the impact will occur.

Mitigation measures:

1. Stormwater and runoff water must be controlled for all infrastructure and managed to avoid siltation and surface hydrological impacts on wetlands.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Long-term (4)
Magnitude	moderate (6)	Low (4)
Probability	probable (3)	probable (3)
Significance	**medium (39)**	**medium (30)**
Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) control stormwater and runoff water and inhibit erosion. (2)		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

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

Impact 6: Change in runoff and drainage patterns

The substation is not positioned within a very steep part of the landscape, but erosion could affect surrounding sensitive areas, especially drainage lines and wetlands.

Extent: The impact will be local, although downslope areas could be affected.

Magnitude: It is likely to be an impact of moderate magnitude in terms of the degree to which erosion may be caused that damages downslope areas (will result in processes continuing but in a modified way).

Duration: The impact will be of permanent duration.

Probability: Based on the current position of the infrastructure, it is probable that the impact will occur.

Potential significance: On the basis of this assessment, the impact is likely to be of medium significance.

Mitigation measures: A comprehensive stormwater management plan must be compiled, prior to construction, that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces. Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimise the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabions, weirs, rock-packing, etc.

Nature: Change in runoff and drainage leading to increased soil erosion and damage of downslope areas		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Moderate (6)	low (4)
Probability	probable (3)	improbable (2)
Significance	**medium (36)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Partially	
Mitigation: (1) compile a comprehensive storm-water management plan (2) rehabilitate any disturbed areas immediately to stabilise landscapes (3) water velocity must be reduced and diffused before water is returned to natural systems (4) erosion features must be immediately stabilised, if they develop.		
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat may all lead to additional impacts that will exacerbate this impact.		
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.

Impact 7: Establishment and spread of declared weeds and alien invader plants
The substation will create new node of disturbance within an otherwise pristine landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be enhanced.

Extent: The impact will occur at the site of the proposed substation, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility and could create an invasive plant situation that lasts for more than a human life-span. This is scored as permanent.

Magnitude: Due to the current undisturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	permanent (5)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	probable (3)
Significance	**medium (52)**	**medium (30)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (6) keep disturbance of indigenous vegetation to a minimum (7) rehabilitate disturbed areas as quickly as possible (8) do not translocate soil stockpiles from areas with alien plants (9) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (10) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		

Residual Impacts: Will probably be very low if control measures are effectively applied

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

Overhead powerline/s

The overhead power line from the wind energy facility to the substation and to the grid will be a 132kV line. The alignment proposed exits the proposed substation, travels down the mountainside and then runs parallel to an existing line all the way to the Eskom substation.

Impact 1: Impacts on threatened terrestrial animal species
There are two Near Threatened animal species that may be affected by construction activities on site. One, the Brown Hyaena is mobile and will not be affected by construction or operation of the facility. The other, the Yellow-bellied House Snake, may occur on site, but it is unknown. It has a wide distribution and the conservation status of the species will not be affected by construction on site. Construction of the powerline will affect a relatively insignificant proportion of the overall habitat of these species.

Extent: The impact will be local.

Duration: The impact will occur during construction and will be medium-term (if a population is affected, the duration will be until the population has recovered from any potential impact).

Magnitude: At a local scale, the impact is likely to result in a small impact on population processes for the affected species, if any.

Probability: It is improbable that the impact will occur (it is not known whether the species of concern, the Yellow-bellied House Snake, will be affected or not - if they occur it is improbable that they will be affected).

Mitigation measures: None

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (3)	local (3)
Duration	medium-term (3)	medium-term (3)
Magnitude	small (1)	small (1)
Probability	improbable (2)	improbable (2)
Significance	**low (14)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (3) None		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

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

Impact 2: Impacts on threatened plants

There are two threatened and two near threatened species that could occur on site. One of the Near Threatened species was recorded on site during this study and one threatened species has been previously recorded on site. In terms of legislation, a species listed as Near Threatened is not treated as a threatened species and impacts on these species are not assessed here.

Extent: The impact will occur at the site of the proposed powerline servitude and towers, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site (especially for species listed as Endangered or Critically Endangered). The impact will therefore be evaluated at a regional scale.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact depends on the species. The known location of the Critically Endangered species (*Erica humansdorpensis*) is directly adjacent to a section of the powerline servitude and this species is very likely to be affected. The potential impact could therefore be very high (could result in complete destruction of patterns and permanent cessation of processes) if this population is destroyed. For the Endangered species (*Disa lugens*), the impact could potentially be of moderate magnitude and could result in population processes continuing but in a modified way.

Probability: The probability of the impact occurring is highly probable for the Critically Endangered species (*Erica humansdorpensis*) due to the fact that the powerline servitude is directly adjacent to the area where this species has been previously recorded. Any impacts on known habitat for this species would affect the chances of survival for this species. For the Endangered plant species (*Disa lugens*), it is unknown whether they occur within or near to the footprint of the powerline servitude. It is assessed as improbable that impacts will occur on populations of *Disa lugens*.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the powerline servitude and the towers must be searched for populations of potentially affected plant species of concern. Suitable habitat for *Erica humansdorpensis* in the vicinity where it was previously recorded must be treated as a "no go" area (areas indicated as having VERY HIGH sensitivity in Figure 7).

Nature: Impacts on threatened plants (Erica humansdorpensis, CR)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	**High (72)**	**Low (28)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation: (2) keep disturbance of indigenous vegetation to a minimum (3) rehabilitate disturbed areas as quickly as possible (4) Prior to construction, undertake a targeted survey of the servitude of the powerline and immediately adjacent areas to ensure that no populations of *Erica humansdorpensis* occur there. (5) Suitable habitat for *Erica humansdorpensis* in the vicinity where it was previously recorded must be treated as a "no go" area. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Will probably be low if control measures are effectively applied

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

Nature: Impacts on threatened plants (Disa lugens, EN)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Improbable (2)	Highly improbable (1)
Significance	**Low (28)**	**Low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (4) keep disturbance of indigenous vegetation to a minimum (5) rehabilitate disturbed areas as quickly as possible (6) Prior to construction, during a suitable season, undertake a targeted survey of the footprint of the powerline towers to ensure that no populations of *Disa lugens* occur there. If any populations are found, tower structures should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Impact 4: Loss or fragmentation of indigenous natural vegetation

Powerlines are situated primarily in previously disturbed parts of the landscape. It is not expected that powerline towers will have a major effect on natural vegetation on site, due to the small footprint of each tower structure.

Extent: The impact will occur at the site of the proposed powerline tower structures. The construction of the tower structures potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be long-term. Effective revegetation could reduce this to a medium-term impact.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low.

Probability: According to the provided layout, it is highly likely that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the servitude of the powerline.
2. Disturbed areas must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	low (4)	low to small (3)
Probability	Highly probable (4)	probable (3)
Significance	**medium (36)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the powerline.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

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

Impact 5: Damage to wetlands/watercourses

The overhead powerline crosses three wetlands on site and five off-site.

Extent: The impact will occur at the site of the proposed powerline tower structures. The extent of the potential impact is therefore on the local scale.

Duration: The impact will occur during construction, but will probably result in impacts that have a long-term effect.

Magnitude: In the long-term, impacts will result in a slight impact on processes, which is scored as low.

Probability: According to the provided layout, it is highly probable that the impact will occur.

Mitigation measures:

1. Tower structures must be placed outside wetland boundaries. It should be possible for all powerlines to span any wetlands or watercourse.
2. There is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	low (4)	Small (2)
Probability	Highly probable (4)	probable (3)
Significance	**medium (36)**	**low (21)**
Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Place powerline tower structures outside wetland boundaries, OR (2) obtain a permit from DWA to impact on any wetland or water resource.		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

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

Impact 6: Change in runoff and drainage patterns

The power line will descend one part of the mountain slope and then be situated adjacent to an existing powerline. It is not expected that powerline towers will have a major effect on runoff and drainage patterns on site, due to the small footprint of each tower structure.

Extent: The impact will be local, although downslope areas could be affected.

Magnitude: It is likely to be an impact of low magnitude in terms of the degree to which erosion may be caused that damages downslope areas (will cause a slight impact on processes).

Duration: The impact will be of medium-term duration (until disturbed areas have become properly revegetated).

Probability: Based on the current position of the infrastructure, it is probable that the impact will occur.

Potential significance: On the basis of this assessment, the impact is likely to be of medium significance.

Mitigation measures: Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimise the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabions, weirs, rock-packing, etc.

Nature: Change in runoff and drainage leading to increased soil erosion and damage of downslope areas		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Small to low (3)
Probability	Probable (3)	Improbable (2)
Significance	**low (24)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Partially	
Mitigation: (1) rehabilitate any disturbed areas immediately to stabilise landscapes (2) water velocity must be reduced and diffused before water is returned to natural systems (3) erosion features must be immediately stabilised, if they develop.		
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat may all lead to additional impacts that will exacerbate this impact.		
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.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Powerlines are situated primarily in previously disturbed parts of the landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be moderately enhanced.

Extent: The impact will occur at the site of the proposed powerline, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will be of long-term duration.

Magnitude: Due to the current partially disturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme

should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (48)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Access roads and underground cables between turbines

Road infrastructure and the proposed location of underground cables associated with the wind turbines are shown in Figure 8. Underground cables between turbines will be situated beneath the internal access roads.

Impact 1: Impacts on threatened terrestrial animal species

There are two Near Threatened animal species that may be affected by construction activities on site. One, the Brown Hyaena is mobile and will not be affected by construction or operation of the facility. The other, the Yellow-bellied House Snake, may occur on site, but it is unknown. It has a wide distribution and the conservation status of the species will not be affected by construction on site. Construction of internal access roads will lead to some loss of habitat for these species

Extent: The impact will be local.

Duration: The impact will occur during construction and will be permanent (loss of habitat on site will be of a scale that will probably inhibit re-population of affected areas. Habitat loss will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on population processes for the affected species, which is scored as low.

Probability: It is improbable that the impact will occur (it is not known whether the species of concern, the Yellow-bellied House Snake, will be affected or not - if they occur it is probable that they will be affected).

Mitigation measures: Impacts must be contained to within the footprint of the proposed internal access road. Surrounding vegetation must not be affected. The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road.

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (3)	local (3)
Duration	medium-term (3)	medium-term (3)
Magnitude	low (4)	Small to low (3)
Probability	probable (3)	probable (3)
Significance	**medium (30)**	**low (27)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) Impacts must be contained to within the footprint of the proposed internal access road. Surrounding vegetation must not be affected. (2) The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road.		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

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

Impact 2: Impacts on threatened plants

There are two threatened and two near threatened species that could occur on site. One of the Near Threatened species was recorded on site during this study and one threatened species has been previously recorded on site. In terms of legislation, a species listed as Near Threatened is not treated as a threatened species and impacts on these species are not assessed here.

Extent: The impact will occur at the site of the proposed access roads and underground cables, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site (especially for species listed as Endangered or Critically Endangered). The impact will therefore be evaluated at a regional scale.

Duration: The impact will permanent, because habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact depends on the species. The known location of the Critically Endangered species (*Erica humansdorpensis*) is not directly affected by planned

internal access roads and underground cables and this species is unlikely to be affected. The potential impact is therefore likely to be minor (will not result in an impact on processes). For the Endangered species (*Disa lugens*), the impact could potentially be of high magnitude and could result in population processes being altered to the extent that they temporarily cease.

Probability: The probability of the impact occurring is highly improbable for the Critically Endangered species (*Erica humansdorpensis*). For the Endangered plant species (*Disa lugens*), it is unknown whether they occur within or near to the footprint of the proposed internal access roads and underground cables. It is assessed as probable that impacts will occur on populations of this species primarily due to the fact that suitable habitat will definitely be affected.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the internal access roads and underground cables must be searched for populations of potentially affected plant species of concern. If the road alignment cannot be adjusted to miss such populations then a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

Nature: Impacts on threatened plants (Erica humansdorpensis, CR)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (4)	Minor (4)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (12)**	**Low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be low if control measures are effectively applied		

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

Nature: Impacts on threatened plants (Disa lugens, EN)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (48)**	**Low (24)**

Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) Prior to construction, during a suitable season, undertake a targeted survey of the footprint of the internal access roads and underground cables to ensure that no populations of *Disa lugens* occur there. If any populations are found, the road alignment should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

Impact 4: Loss or fragmentation of indigenous natural vegetation

Most of the internal access roads and underground cable alignments are situated within natural vegetation within the mountain region of the site. There are existing tracks up the mountain for a portion of this and it is indicated that these alignments will be used, but these are inadequate for construction and maintenance of the wind energy facility and will have to be properly constructed as new roads.

Extent: The impact will occur at the site of the proposed internal access roads. The construction of the turbines potentially directly affects a moderate proportion of natural vegetation on site. However, fragmentation of vegetation on site may affect the integrity of surrounding areas. The impact is therefore scored as local and surroundings.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact will result in processes continuing but in a modified way, which is scored as moderate. The fragmentation effect will also cause ecological processes to continue but in a modified way

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures: The only effective way to reduce impacts on natural vegetation is to modify the position of infrastructure to avoid the pristine mountain areas. Given the layout proposed, it does not appear that this is a feasible option. The following measures may reduce the impacts marginally:

1. Unnecessary impacts on surrounding natural vegetation must be avoided.
2. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
3. The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road. Only a

single road up the mountain should be constructed, rather than the two shown in the current proposed layout.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	Local & surroundings (2)	Local & surroundings (2)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	moderate (5)
Probability	definite (5)	definite (5)
Significance	**high (65)**	**medium (60)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the turbines. (2) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. (3) The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road and only a single road up the mountain should be constructed.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

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

Impact 5: Damage to wetlands/watercourses

Internal access roads and underground cable alignments cross wetlands to the north of the substation site.

Extent: The impact will occur at the site of the proposed internal access roads, but could have downstream impacts. The extent of the potential impact is therefore local and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a permanent effect.

Magnitude: In the long-term, impacts will result in processes being altered to the extent that they temporarily cease, which is scored as high.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures: The only effective was to reduce impacts on these wetlands is to modify the position of infrastructure to avoid wetlands. The internal access roads just south of turbine 4 should be re-aligned. Stormwater and runoff water must be controlled for all infrastructure and managed to avoid siltation and surface hydrological impacts on wetlands. Disturbed areas must be rehabilitated as soon as possible. If this is not feasible from an engineering

perspective and impacts on wetlands cannot be avoided, the following measures may reduce the impacts marginally:

1. There is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.
2.
3. Cross watercourses close to existing disturbances.
4. Cross watercourses perpendicularly, where possible, to minimize the construction footprint.
5. Adequate culvert and/or bridge structures are required at crossings.
6. Construction must not cause the width of the watercourse to be narrowed.
7.

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	high (8)	low (4)
Probability	Definite (5)	Probable (3)
Significance	**high (75)**	**low (27)**
Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) control stormwater and runoff water and inhibit erosion. (2) Disturbed areas must be rehabilitated as soon as possible. (3) Re-align internal access roads currently planned to be positioned just south of turbine number 4. If not possible, then the following measures must also be applied: a. obtain a permit from DWAF to impact on any wetland or water resource. b. Cross watercourses close to existing disturbances. c. Cross watercourses perpendicularly, where possible, to minimize the construction footprint. d. Adequate culvert and/or bridge structures are required at crossings. e. Construction must not cause the width of the watercourse to be narrowed. (4)		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

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

Impact 6: Change in runoff and drainage patterns

A large proportion of internal access roads and underground cable alignments are in areas where there is a high risk of causing downslope impacts, often at the summit of very steep slopes.

Extent: The impact will be local, although downslope areas could be affected.

Magnitude: It is likely to be an impact of high magnitude in terms of the degree to which erosion may be caused that damages downslope areas and causes secondary vegetation loss (will cause processes to be altered to the extent that they temporarily cease).

Duration: The impact will be of permanent duration.

Probability: Based on the current position of the infrastructure, it is probable that the impact will occur.

Potential significance: On the basis of this assessment, the impact is likely to be of medium significance.

Mitigation measures: A comprehensive stormwater management plan must be compiled, prior to construction, that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces. Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimise the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabions, weirs, rock-packing, etc.

Nature: Change in runoff and drainage leading to increased soil erosion and damage of downslope areas		
	Without mitigation	**With mitigation**
Extent	Local & surroundings (2)	Local & surroundings (2)
Duration	permanent (5)	permanent (5)
Magnitude	High (8)	moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**medium (45)**	**medium (39)**
Status (positive or negative)	negative	negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Partially	
Mitigation: (1) compile a comprehensive storm-water management plan (2) rehabilitate any disturbed areas immediately to stabilise landscapes (3) water velocity must be reduced and diffused before water is returned to natural systems (4) erosion features must be immediately stabilised, if they develop. (5)		
Cumulative impacts: Alien invasions, damage to wetlands, loss of habitat may all lead to additional impacts that will exacerbate this impact.		
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.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Internal access roads will create new areas of disturbance within an otherwise pristine landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be greatly enhanced.

Extent: The impact will occur at the site of the proposed turbines, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will create an invasive plant situation that lasts for more than a human life-span. This is scored as permanent.

Magnitude: Due to the current undisturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate to high (will result in processes continuing but in a modified way or in processes temporarily ceasing, if invasions become uncontrolled).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	permanent (5)	long-term (4)
Magnitude	moderate to high (7)	low (4)
Probability	Highly probable (4)	probable (3)
Significance	**medium (56)**	**medium (30)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

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

DISCUSSION AND CONCLUSIONS

There are two vegetation type that occurs on site, namely *Kouga Grassy Sandstone Fynbos* (classified as Least Threatened) and *Humansdorp Shale Renosterveld* (classified as Endangered). The vegetation on site has been classified at a Provincial level, through the Eastern Cape Biodiversity Conservation Plan (ECBCP), as having elevated conservation value. The areas of concern in the ECBCP are remaining areas of lowland fynbos in the southern part of the site that fall within the Endangered vegetation type, known important areas for biodiversity in the northern part of the site (around the upper reaches of the Seekoei River) and a corridor area linking these two. The area is also within the Cape Floristic Region, one of the earth's 25 hotspots. There are, therefore, biodiversity planning constraints to development of the site that affect features identified at a Provincial and National level as being sensitive and of high value.

Most of the study area is still in natural condition or considered to be natural vegetation in relatively good condition. Along the main mountain ridge, the vegetation is in excellent condition and contains a high diversity of habitats and plant species. The mountain ridge divides the vegetation into dryer north-facing slopes and more moist south-facing slopes, each with its own species composition. In addition, rocky areas contain a different species composition to more open vegetation with no rocks. Drainage lines and moist areas on site contain species more typical of these habitats than terrestrial habitats. There are gradients in species composition between all these different environmental variations and species that are more commonly found only in these interfaces. The mountain ridge therefore contains high species richness and turnover, including a number of species of rare occurrence and/or of conservation concern. In the lower-lying areas, agricultural activities have affected the vegetation to a great extent. Cultivated lands and infrastructure contain no natural vegetation and areas adjacent to these tend to be disturbed. There are, however, small patches of lowland vegetation that are in moderately good condition and characterized by high richness of species typical of fynbos and/or renosterveld vegetation.

In general, mountains and ridges are characterized by high spatial heterogeneity due to the range of differing aspects, slopes and altitudes all resulting in differing soil, temperature, elevation, light and hydrological conditions. This variation is an especially important predictor of biodiversity. Mountains and ridges in general are characterized by a particularly high biodiversity and it follows that their protection will contribute significantly to the conservation of biodiversity in the landscape. These areas are vital habitat for many threatened plant and animal species and provide important refugia for species vulnerable to the effects of climate change.

The mountain areas on site also constitute an important mountain catchment area for the streams that emanate from the site or pass through the site. Natural vegetation on site acts as a natural hydrological regulator that contributes towards providing a regular and very clean source of water for downstream areas. The site, in combination with similar surrounding areas therefore acts as an important regional provider of so-called ecosystem goods and services, especially for areas located between the mountains and the coastline.

Site-specific factors that may lead to parts of the study area having high ecological sensitivity are the potential presence of wetlands within the drainage lines on site, potential presence of steep slopes, the presence and potential presence of various plant and animal species of conservation concern, and protected trees.

Drainage lines (wetlands) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as

biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches (Rosenberg *et al.*, 1997). Wetlands are protected under national legislation (National Water Act). Any impacts on these areas would require a permit from the relevant National Department.

The drainage lines on site drain into one main stream that leads to the sea via the Seekoei River. The site constitutes part of the catchment for this river. The mouth of the Seekoei River has an estuary, which is considered to be very sensitive and is shown as having high conservation value and sensitivity in the Eastern Cape Biodiversity Conservation Plan (ECBCP). The value and condition of this estuary is dierectly affected by activities that occur within the catchment of the waterways that feed the estuary. The potential impacts of activities on site on these river systems may therefore have an effect on an ecosystem downstream of the site. It is especially important that the sensitive Seekoei River estuary is not affected by activities on site.

The site is characterised by the presence of steep mountain slopes. A view of the main ridge upon which turbines are proposed to be placed is shown in Figure 9 and a more detailed view in Figure 10. Steep slopes can be problematic in constructing infrastructure due to the fact that any impact can have an effect downslope from that point. Depending on the steepness and the length of the slope, particular areas may be more sensitive to disturbance than others. Any steep slopes are therefore considered to have elevated sensitivity from an ecological perspective. This applies to most of the mountain ridge that constitutes the main topographic feature on site. Potential issues that may arise from development of these areas

Figure 9: View of main ridge from south-west of site.

includes erosion of substrates downslope and the impacts of stormwater runoff.

There are eight tree species that are protected under the National Forests Act that have a geographic distribution that includes this area (*Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius*, *Prunus africana and Sideroxylon inerme* subsp. *inerme*) (Appendix 3), all of which have a moderate likelihood of occurring on site and one, *Sideroxylon inerme* (white milkwood), has a high likelihood of occurring on site. Any impacts on individuals of any of these species requires a permit from the National Department. None of these species were found on site, but this does not preclude the possibility of them occurring there.

There are two threatened plant species that could occur in available habitats in the study area. This includes one species classified as Critically Endangered (*Erica humansdorpensis*) and one as Endangered (*Disa lugens* var. *lugens*). The Critically Endangered species has been previously recorded in the south-eastern corner of the site adjacent to the N2 National road. The Endangered species has not been previously recorded on site, but based on geographical range, habitat preference and previous collection records in the near vicinity, it is considered highly possible that it occurs on site.

There are three Endangered plant species that were considered to have a moderate probability of occurring on site, *Brachystelma cummingii*, *Haworthia longiana* and *Osteospermum pterigoideum*. In all three cases the habitat on site is not ideal or the closest records of these species, even if close by, is within habitats that are not found on site. The current assessment is therefore that there is a low risk of them occurring on site, but that their occurrence cannot

Figure 10: View of main ridge upon which infrastructure is proposed to be placed.

be ruled out completely.

The Near Threatened plant species, *Aloe micracantha*, was recorded on site on the northern side of the main mountain ridge in close proximity to the existing vehicle track. It prefers nutrient-poor, well-drained sandy soils and could occur anywhere along the northern side of the main mountain ridge on site. Although this species occurs on site, it is not legally protected nor considered to be threatened (near threatened is a lesser category than any of the threatened categories). However, the presence of this species on site is an indication of the fact that the site has the potential to support populations of unique and/or rare species. This is upported by the probability of other species of concern possibly occurring on site. Another near threatened plant species, *Protea coronata*, also has a high probability of occurring on site, although it was not observed on site during the field survey. It has been recorded in a number of localities in close proximity to the site and suitable habitat occurs on site. The declining plant species, *Prionium serratum*, is another species of concern that could also occur in any large bottomland wetland systems on site.

There are no threatened (CR, EN or VU) mammal, reptile or amphibian species that are likely to occur on site. There are two animal species of lower conservation concern that may occur in habitats within the study area or that may be affected by the proposed WEF. Both species are classified as Near Threatened. They are the Brown Hyaena and the Yellow-bellied House Snake, neither of which are known to occur on site for certain.

A risk assessment was undertaken which identified seven main potential impacts on the ecological receiving environment. A summary of the potential significance of impacts (before and after mitigation) for different infrastructure components is given in Table 5. This shows that the wind energy facility (including all infrastructure components) could have an impact of medium significance on indigenous vegetation and wetlands and may cause damage due to changes in runoff and drainage patterns that could have a host of consequences. Of greatest concern is the potentially high significance of impacts associated with the construction of internal access roads on site, especially on natural vegetation and wetlands (see Table 5).

The overhead powerlines may have an impact of high significance on a threatened (critically endangered) plant species (*Erica humansdorpensis*). An evaluation of potentially affected habitat for this species will determine whether this is of major concern or not and could reduce the significance of this impact to low.

The potential spread of alien plants on site is a concern, primarily because most of the infrastructure is proposed to be situated within an undisturbed part of the landscape. The infrastructure will therefore create new nodes and regions of disturbance that will enhance the potential for invasion of the site. The potential significance of this impact is therefore medium for all infrastructure components.

Conclusion

The primary concerns related to this proposed project are due to impacts caused by the linear infrastructure, specifically the internal access roads, and not to the turbines and/or substation. A number of impacts associated with this project are due to the fact that the infrastructure is proposed to be positioned within a part of the landscape that is currently in a relatively pristine condition (see Figure 11), and within vegetation that, although not considered a high conservation priority nationally (Kouga Grassy Sandstone Fynbos is classified as Least Threatened), has a high biodiversity value[2] and contributes valuable ecosystem goods and services to the surrounding landscape, primarily with respect to being a water catchment area. The site contains a number of seepage areas that constitute the water source for all the drainage lines that emanate on site. One of the beneficiaries of this hydrological functioning is the Seekoei River estuary, the conservation of which is considered to be a Provincial priority. This estuary is, however, far off-site.

A significant proportion of the proposed infrastructure is positioned within a steeply sloping part of the landscape at the summit of the highest part of the mountain ridge (Figure 9 and 10). This will result in some degree of fragmentation of a currently undisturbed landscape. This will potentially compromise the ecological integrity of this area and lead to long-term negative impacts on the ecology of this site.

Figure 11: Unspoilt fynbos in mountain area with high habitat variability, high species richness and high vegetation structural diversity.

[2] Fynbos as a whole has a high conservation value. The site occurs within the Cape Floristic Region, which is recognised as one of the principal centres of diversity and endemism in Africa (van Wyk & Smith 2001). Moreover, it is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier et al. 2000). The site must therefore be considered to have a high conservation value.

Recommendations

The following recommendations can lead to reduction or control of impacts:

- Impacts associated with turbines 1, 8, 9, 10, 11, 12 and 13 must be very carefully controlled in order to minimize impacts on habitat within the mountain area where there are steep slopes and undisturbed vegetation.
- The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road. Also, only a single access road up the mountain should be constructed and not two, as currently indicated.
- Either proposed powerline route is acceptable. The potential impacts are identical for both routes.
- A comprehensive search for threatened and near-threatened plant populations must be undertaken within the footprint of the proposed infrastructure prior to construction. This must take place during an appropriate season to maximise the likelihood of detecting these plants. If any plants are found, localised modifications in the position of infrastructure must be made to avoid such populations and a suitable buffer zone around them.

Table 5: Summary of the significance of impacts for different infrastructure components before and after mitigation.

Impact	Wind turbines		Substation		Overhead powerline		Underground cables & access roads	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
1. threatened animals	low (20)	low (20)	low (14)	low (14)	low (14)	low (14)	medium (30)	low (27)
2. threatened plants: (*Erica humansdorpensis*, CR)	low (28)	low (28)	zero (0)	zero (0)	high (72)	low (28)	low (12)	low (12)
(*Disa lugens*, EN)	medium (32)	low (16)	medium (32)	low (16)	low (28)	low (12)	medium (48)	low (24)
3. protected trees	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)	zero (0)
4. natural vegetation	medium (60)	medium (55)	medium (60)	medium (55)	medium (36)	low (24)	high (65)	medium (60)
5. wetlands	low (26)	low (26)	medium (39)	medium (30)	medium (36)	low (21)	high (75)	low (27)
6. runoff/drainage	low (24)	low (20)	medium (36)	low (20)	low (24)	low (14)	medium (45)	medium (39)
7. alien plants	medium (56)	medium (30)	medium (52)	medium (30)	medium (48)	low (20)	medium (56)	medium (30)

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

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.

Impacts on threatened plants

OBJECTIVE: Limit impacts on threatened plants	
Project component/s	Any infrastructure or activity that will result in disturbance to habitat suitable for threatened plant species or to populations of threatened plant species
Potential Impact	Loss of habitat suitable for or populations of threatened plant species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no significant impacts on identified suitable habitat or populations of threatened plant species within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid impacts on habitat identified as being suitable for threatened plant species or on populations of threatened plant species. (2) keep disturbance of indigenous vegetation to a minimum (3) rehabilitate disturbed areas as quickly as possible (4) Prior to construction, undertake a targeted survey of the footprint of the substation and internal access roads to ensure that no populations of *Disa lugens* occur there. If any populations are found, the substation / road should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species. (5) Suitable habitat for *Erica humansdorpensis* in the vicinity where it was previously recorded must be treated as a "no go" area. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.	Construction team, management (environmental officer),	construction, operation

Performance Indicator	No loss of habitat suitable for or populations of threatened plant species
Monitoring	• Determine population numbers of affected species • After construction, evaluate loss of habitat suitable for or populations of threatened plant species and whether any individuals of affected species were lost to construction activities.

Impacts due to alien invasive plants

OBJECTIVE: Control alien invasive plants

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no alien plants within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid creating conditions in which alien plants may become established: a. keep disturbance of indigenous vegetation to a minimum b. rehabilitate disturbed areas as quickly as possible c. do not import soil from areas with alien plants (2) establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act) (3) immediately control any alien plants that become established using registered control methods	Construction team, management (environmental officer),	construction, operation

Performance Indicator	For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	• Ongoing monitoring of area by environmental control officer during construction • Ongoing monitoring of area by environmental manager during operation • Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework.

Impacts on indigenous natural vegetation

OBJECTIVE: Control loss of indigenous natural vegetation

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Loss of indigenous natural vegetation due to construction activities
Activity/risk source	Construction
Mitigation: Target/Objective	Target: minimal loss of natural vegetation Time period: construction

Mitigation: Action/control	Responsibility	Timeframe
(1) The construction impacts must be contained to the footprint of the infrastructure. (2) Unnecessary impacts on surrounding natural vegetation must be avoided. (3) Rehabilitate any disturbed areas immediately to stabilize landscapes. (4) The number of internal access roads needs to be rationalised to reduce the overall impact. The current layout proposes a network of roads, which should be reduced to single connections between turbines. For example, between turbines 3, 4 and 5, the internal access roads are doubled up and should be reduced to a single road.	Construction team, management (environmental officer),	construction

Performance Indicator	No loss of natural vegetation within "no-go" areas. Loss of other natural vegetation only within designated footprint of infrastructure. No significant fragmentation of untransformed areas of natural vegetation.
Monitoring	• None

Impacts on wetlands

OBJECTIVE: Limit damage to wetlands & watercourses

Project component/s	Any infrastructure or activity that will result in disturbance to wetlands
Potential Impact	Damage to watercourses 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) rehabilitate any disturbed areas as quickly as possible (2) control stormwater and runoff water (3) Powerline tower structures must be placed outside wetland boundaries (a minimum of 50 m away). (4) 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 (5) (6) for any new construction where direct impacts on wetlands are unavoidable, the following measures must also be applied: (7) cross watercourses perpendicularly to minimize disturbance footprints (8) obtain a permit from DWA to impact on any wetland or water resource. (9) Infrastructure (including culverts and/or bridges) should not be placed within drainage line channels but should span them completely. (10) Construction must not cause the width of the watercourse to be narrowed.	Construction team, management, environmental control officer	Construction, operation

Performance Indicator	No impacts on water quality, water quantity, wetland vegetation, natural status of watercourses
Monitoring	• Habitat loss in watercourses should be monitored before and after construction. • The presence and development of erosion features downstream of any construction through wetlands must be monitored. • The environmental manager should be responsible for driving this process. • Reporting frequency depends on legal compliance framework.

Impacts due to changed runoff and drainage patterns

OBJECTIVE: Inhibit changes to runoff and drainage, especially on steep slopes

Project component/s	Any infrastructure or activity that will result in conditions favouring erosion or increased runoff, sedimentation or increased silt loads in water, and any effects that will change the hydrological functioning of surfaces on site, including loss of indigenous vegetation.
Potential Impact	Increased soil erosion, silt loads or sedimentation, loss of vegetation cover, loss of water infiltration and release
Activity/risk source	Construction, operation
Mitigation: Target/Objective	Target: no erosion or secondary vegetation loss emanating from project activities Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) rehabilitate any disturbed areas immediately after construction in that area is complete in order to stabilise landscapes (2) water velocity from precipitation and runoff must be reduced and diffused before water is returned to natural systems (3) compile a comprehensive stormwater management plan as part of the final design of the project (4) Erosion features must be immediately stabilised with erosion control measures, if they develop (5) The position of some of the proposed infrastructure on very steep slopes must be reconsidered and these components moved to more appropriate positions (turbine numbers 1, 8, 9, 10, 11, 12 and 13 and roads servicing these).	Construction team, management, environmental control officer	Construction, operation

Performance Indicator	No erosion features within project control area and immediate surroundings
Monitoring	• Regular audit of project area and immediate surroundings by geomorphologist/soil specialist to identify erosion features associated with infrastructure. • Regular monitoring to determine whether secondary loss of vegetation is occurring or not • Monitoring of water quality emanating from the site.

REFERENCES:

ACOCKS, J.P.H. 1988. Veld types of South Africa (3rd edn.). *Mem. Bot. Surv. S. Afr.* No 28. Government printer, Pretoria.

ALEXANDER, G. & MARAIS, J. 2007. A guide to the reptiles of southern Africa. Struik, Cape Town.

BERLINER, D. & DESMET, P. 2007. Eastern Cape Biodiversity Conservation Plan Technical Report. Department of Water Affairs and Forestry Project No. 2005 -012, Pretoria.

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

DENT, M.C., LYNCH, S.D. & SCHULZE, R.E. 1989. Mapping mean annual and other rainfall statistics in southern Africa. Department of Agricultural Engineering, University of Natal. ACRU Report No. 27. Massachusetts: Clark University.

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.

DU PREEZ, L. & CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Random House Struik (Pty) Ltd, Cape Town.

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.

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.

GERMISHUIZEN, G., MEYER, N.L., STEENKAMP, Y and KEITH, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.

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.

HOARE, D.B., MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets.* in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

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

KOPKE, D. 1988. The climate of the Eastern Cape. In: M.N. Bruton & F.W. Gess. (ed.) *Towards an environmental plan for the Eastern Cape.* Rhodes University, Grahamstown.

LOW, A.B. & REBELO, A.G. (1998) Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria.

MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. S. Afr. J. Agric. Extension, 3(3): 1-4.

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.

MITTERMEIER, R.A., GIL, P.R., HOFFMANN, M., PILGRIM, J., BROOKS, T., MITTERMEIER, C.G., LAMOREUX, J. & FONSECA, G.A.B. DA (eds.) *Hotspots revisited.* CEMEX, pp.218–229. ISBN 968-6397-77-9

MONADJEM, A., TAYLOR, P.J., COTTERILL, E.P.D. & SCHOEMAN, M.C. 2010. Bats of southern and central Africa. Wits University Press, Johannesburg.

MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1–2.

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

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.

MUCINA, L., RUTHERFORD, M.C., **HOARE, D.B**. & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.

MUELLER-DOMBOIS, D. AND ELLENBERG, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.

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

REBELO, A.G., BOUCHER, C., HELME, N., MUCINA, L. & RUTHERFORD, M.C. 2006. Fynbos Biome. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

RUTHERFORD, M.C. & WESTFALL, R.H. (1994). Biomes of southern Africa: an objective categorization. *Memoirs of the Botanical Survey of South Africa* No. 63.

SCHULZE, B.R. 1984. Climate of South Africa, Part 8, General Survey, WB 28. *South African Weather Bureau* 60. Government Printer, Pretoria.

SKELTON, P. 2001. A complete guide to the freshwater fishes of southern Africa. Struik Publishers, Cape Town.

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited.* CEMEX, pp.218–229. ISBN 968-6397-77-9

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. http://www.biodiversityhotspots.org/xp/hotspots/maputaland/.

STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2004. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited.* CEMEX, pp.218–229. ISBN 968-6397-77-9

VAN WYK, A.E. & SMITH, G.F. 2001. Regions of floristic endemism in southern Africa. Umdaus press, Hatfield.

WEATHER BUREAU 1996. *Climate data for stations from the Eastern Cape*.

WESTHOFF, V. AND VAN DER MAAREL, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.

WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNISO vegetation map of Africa. Natural Resources Research 20. Unesco, Paris.

Appendix 1: Plant species of conservation importance that have historically been recorded in the study area.

*IUCN (3.1) Categories:
VU = Vulnerable
EN = Endangered
CR = Critically Endangered
NT = Near Threatened

Table A: Threatened, Near Threatened and Declining plant species that have been previously recorded in the study area

Taxon	Family	Distribution relevant to study area	Global IUCN (3.1) category *	Likelihood of occurrence
Disa lugens var. nigrescens	ORCHIDACEAE	Known only from Oyster Bay near Humansdorp.	CR	LOW
Erica humansdorpensis	ERICACEAE	Humansdorp. Previously recorded 8km W of Humansdorp turnoff from the N2 in fynbos on roadside. Also at Clarkson and Witelsbos. Locality information indicates that species probably occurs in lowland fynbos at base of mountains.	CR	**VERY HIGH**
Gasteria nitida var. armstrongii	ASPHODOL-ACEAE	In the lower Gamtoos Valley, in floodplain, old riverbed. Coastal renosterveld.	CR	LOW
Brachystelma cummingii	APOCYNACEAE	Holrivier, in gravelly ground amongst short bushes. Also recorded from 3324BD and Coega	EN	MEDIUM, upland parts of site
Disa lugens var. lugens	ORCHIDACEAE	Cape Peninsula to Albertinia, Groot-Swartberge, Kammanassie and Kouga Mountains, Coldstream, Humansdorp, Suurberg Mountains, Grahamstown, Somerset East and Cathcart. Very variable. Found in acidic as well as alkaline sands as well as sandstone in mountains. Sea level to 1450 m. Found on coastal lowlands as well as mountain slopes and plateaus. In mountains, mostly found on cooler slopes (S-facing). Near coast often found growing in association with Restionaceae.	EN	**HIGH**
Erica glandulosa subsp. breviflora	ERICACEAE	Northwest of Humansdorp between Gamtoos River and Leuwenbosch River (just south of site). Only herbarium record is from grid 3324DC. Near Bakenberg. Alt. approx. 400 m. Sandy flats alongside road. Short fynbos. (prob. near E 24.69 S 33.94 approx 5 km north of site associated with Gamtoos River valley)	EN	LOW
Haworthia longiana	ASPHODOL-ACEAE	Sundays and Gamtoos River valleys. Valley bottoms and lower slopes of hills in rocky, loamy soils. Previously recorded in grid 3324DC and 3 neighbouring grids to north and east.	EN	MEDIUM
Osteospermum pterigoideum	ASTERACEAE	George and Humansdorp. Low sandstone slopes. 3424BA: 18miles W of Humansdorp.	EN	MEDIUM
Rapanea gilliana	MYRSINACEAE	St. Francis Bay to Port Alfred. Areas close to coast.	EN	LOW
Erica glandulosa subsp. fourcadei	ERICACEAE	Wilderness to Storms River in coastal fynbos.	VU	LOW
Erica glumiflora	ERICAEAE	Wilderness to East London. St. Francis Bay Industrial Area, Eastern Cape; Calcrete hilltop approximately 1.016km WNW of spot height 42m. Known to occur in dune fynbos and coastal limestone fynbos.	VU	LOW

Erica zeyheriana	ERICAEAE	Oyster Bay to Alexandria. Remnant lowland grassy fynbos on sand.	VU	LOW
Satyrium princeps	ORCHIDACEAE	Restricted coastal distribution between Wilderness in the southern Cape to Port Alfred in the Eastern Cape, seldom above altitudes of 150 m. 3424BB - around Seal Point, Cape St Francis.	VU	LOW
Selago rotundifolia	SCROPHULARI-ACEAE	Knysna to Port Elizabeth. Grassy fynbos flats and possibly also forest margins. Previously recorded on flats around Humansdorp.	VU	MEDIUM, lowland parts of site
Aloe micracantha	ASPHODOL-ACEAE	Joubertina to Grahamstown. Grassy fynbos and is also found inland in hilly and mountainous areas. Prefers poor, well-drained sandy soils. Altitude: 50-700 m.	NT	**DEFINITE**, found on site
Pauridia minuta	HYPOXIDACEAE	Langebaan to Riversdale. Damp clay flats	NT	LOW
Protea coronata	PROTEACEAE	Western and Eastern Cape from Cape Peninsula to Van Stadens near Port Elizabeth, including lower slopes of mountain ranges. 200-800 m. Prefers heavy clay soils and fairly high rainfall. Forms dense stands on the lower or middle slopes, often in tall, moist fynbos on forest margins or in damp, sheltered kloofs.	NT	**HIGH**
Psoralea repens	FABACEAE	Cape Peninsula to Eastern Cape. Coastal fynbos, below 50 m elevation.	NT	LOW
Crassula brachystachya	CRASSULACEAE	Known only from a few localitites in the north-eastern Witteberg and north Swartberg. Moist shaded crevices on rock faces in ravines	Rare	LOW
Dioscorea elephantipes	DIOSCORE-ACEAE	Springbok to Clanwilliam to Grahamstown, including many parts of the southern Karoo. 3424BA Humansdorp Div. In wooded kloof, Duineveld, Slang River (coastal).	Declining	LOW
Loxostylis alata	ANACARDI-ACEAE	Van Staden's mountains in the Western Cape to KwaZulu-Natal. Forest margins.	Declining	LOW
Prionium serratum	PRIONIACEAE	Western and Eastern Cape as far as Grahamstown. Also in Podoland from Port St Johns to southern KwaZulu-Natal. Marshy coastal areas. An aquatic or semi-aquatic plant growing in and along rivers, mostly near the coast. Alt. up to 830 m.	Declining	**HIGH**

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria

Appendix 2: Vertebrate species of conservation concern with a geographical distribution that includes the current study area.
(included are species previously listed, but currently considered to be Least Concern)

MAMMALS

Common name	Order/ Family	Taxon	Habitat[1]	Status[2]	Likelihood of occurrence
ARTIODACTYLA / PERISSODACTYLA					
Black rhinoceros	Perissodactyla / Rhinocerotidae	*Diceros bicornis minor*	Browser, occurring in bushveld/savanna habitats, requires dense cover, sufficient browse and permanent water	VU	**NONE**, only occurs in game reserves
Oribi	Artiodactyla / Bovidae	*Ourebia ourebi*	Open grasslands with gentle topography at lower altitudes. Mosaic of tall and short grasses required to meet resting and feeding requirements.	LC, (was EN)	**MEDIUM**, previously recorded in grid to south-east
Blue duiker	Artiodactyla / Bovidae	*Philantomba monticola*	Coastal and afromontane forests as well as coastal thickets, selective forager in litter and fruits	LC, (was VU)	**MEDIUM**, previously recorded in grid to south
CARNIVORA					
Brown hyena	Carnivora / Hyaenidae	*Hyaena brunnea*	Savanna, urban areas, scavenger	NT	**MEDIUM**, previously recorded in neighbouring grid.
Honey badger	Carnivora / Mustelidae	*Mellivora capensis*	Wide variety of habitats. Probably only in natural habitats.	LC, (was NT)	**HIGH**, previously recorded in 3 neighbouring grids
African weasel	Carnivora / Mustelidae	*Poecilogale albinucha*	Moist grassland or woodland with more than 700 mm rainfall per year and where flourishing populations of small rodents occur. Grassland, scrub woodland. The distribution range of this animal covers the west coast of South Africa from Garies southward into the western Cape coastal belt, east and north-east Northern Cape, and all other provinces	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
INSECTIVORA					
Fynbos golden mole	Insectivora / Chrysochloridae	*Amblysomus corriae*	Lowland fynbos and Knysna forest, also in urban areas. Prefers sandy soils with deep litter layer.	NT	**LOW**, at eastern edge of distribution, not previously recorded in grid or neighbouring grid, substrate properties on site not considered to be suitable for this species.
Hottentott's Golden Mole	Insectivora / Chrysochloridae	*Amblysomus hottentotus*	Subterranean habitats; mainly Eastern Cape and KwaZulu-Natal; savanna, grassland and fynbos.	LC, (was DD)	**MEDIUM**, at western edge of distribution, previously recorded in neighbouring grid (to east)
Reddish-grey musk shrew	Insectivora / Soricidae	*Crocidura cyanea*	Wide variety of habitats. Nocturnal, terrestrial.	LC, (was DD)	**MEDIUM**, not previously

					recorded in grids, but overall geographical distribution includes this area.
Greater musk shrew	Insectivora / Soricidae	*Crocidura flavescens*	Wide variety of habitats, but favours some cover. Also urban areas, disturbed areas.	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Forest shrew	Insectivora / Soricidae	*Myosorex varius*	Wide variety of vegetation types, usually primary. Terrestrial habitats adjacent to wetlands; forest	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Least dwarf shrew	Insectivora / Soricidae	*Suncus infinitesimus*	Terrestrial, nocturnal	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Woodland mouse	Insectivora / Soricidae	*Grammomys dolichurus*	Riverine forest, thickets and woodland, terrestrial, arboreal	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.

[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 November 2010.

AMPHIBIANS

Common name	Species	Habitat	Status[2]	Likelihood of occurrence
Eastern Leopard Toad	*Amietophrynus pardalis*	Thornveld and open savanna in the Eastern Cape. Breed in open water and forage some distance from the water.	Declining	**LOW**, within distribution range, but habitats on site not suitable.

[2]Status according to du Preez & Carruthers 2009.

REPTILES

Common name	Species	Habitat[3]	Status	Likelihood of occurrence
Spotted rock snake	*Lamprophis guttatus*	Rocky habitats under exfoliating rock flakes and in narrow rock crevices.	Rare[3]	**MEDIUM**, within overall distribution range and habitats available 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**, previously recorded in neighbouring grid, within overall distribution range and habitats available on site.

[3]Status according to Branch 1988.
[4]Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 November 2010.

Appendix 3: List of protected tree species (National Forests Act).

Acacia erioloba	*Acacia haematoxylon*
Adansonia digitata	*Afzelia quanzensis*
Balanites subsp. *maughamii*	*Barringtonia racemosa*
Boscia albitrunca	*Brachystegia spiciformis*
Breonadia salicina	*Bruguiera gymnhorrhiza*
Cassipourea swaziensis	*Catha edulis*
Ceriops tagal	*Cleistanthus schlectheri* var. *schlechteri*
Colubrina nicholsonii	*Combretum imberbe*
Curtisia dentata	*Elaedendron transvaalensis*
Erythrophysa transvaalensis	*Euclea pseudebenus*
Ficus trichopoda	*Leucadendron argenteum*
Lumnitzera racemosa var. *racemosa*	*Lydenburgia abottii*
Lydenburgia cassinoides	*Mimusops caffra*
Newtonia hildebrandtii var. *hildebrandtii*	*Ocotea bullata*
Ozoroa namaquensis	*Philenoptera violacea* (*Lonchocarpus capassa*)
Pittosporum viridiflorum	*Podocarpus elongatus*
Podocarpus falcatus	*Podocarpus henkelii*
Podocarpus latifolius	*Protea comptonii*
Protea curvata	*Prunus africana*
Pterocarpus angolensis	*Rhizophora mucronata*
Sclerocarya birrea subsp. *caffra*	*Securidaca longependunculata*
Sideroxylon inerme subsp. *inerme*	*Tephrosia pondoensis*
Warburgia salutaris	*Widdringtonia cedarbergensis*
Widdringtonia schwarzii	

Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme subsp. *inerme* have a geographical distribution that coincides with the study area.

Appendix 4: Checklist of plant species recorded during previous botanical surveys in the quarter degree in which the study area is located and the immediately adjacent grid to the south.

Family	Scientific Name
FABACEAE	Acacia cyclops
FABACEAE	Acacia karroo
FABACEAE	Acacia saligna
EUPHORBIACEAE	Acalypha capensis
AMARANTHACEAE	Achyranthes aspera var. sicula
POACEAE	Acroceras macrum
ORCHIDACEAE	Acrolophia micrantha
ORCHIDACEAE	Acrolophia micrantha
EUPHORBIACEAE	Adenocline acuta
EUPHORBIACEAE	Adenocline pauciflora
CRASSULACEAE	Adromischus sphenophyllus
AGAPANTHACEAE	Agapanthus praecox subsp. praecox
RUTACEAE	Agathosma apiculata
RUTACEAE	Agathosma capensis
RUTACEAE	Agathosma dielsiana
RUTACEAE	Agathosma hirta
RUTACEAE	Agathosma martiana
RUTACEAE	Agathosma ovata
POACEAE	Agrostis lachnantha var. lachnantha
POACEAE	Aira cupaniana
AIZOACEAE	Aizoon glinoides
AIZOACEAE	Aizoon rigidum
HYACINTHACEAE	Albuca nelsonii
ASPHODELACEAE	Aloe ferox
ASPHODELACEAE	Aloe maculata
ASPHODELACEAE	Aloe micracantha
ASPHODELACEAE	Aloe pictifolia
ASPHODELACEAE	Aloe pluridens
ASPHODELACEAE	Aloe striata subsp. karasbergensis
ASPHODELACEAE	Aloe striata subsp. striata
POACEAE	Ammophila arenaria
PRIMULACEAE	Anagallis arvensis subsp. arvensis
BORAGINACEAE	Anchusa capensis
COLCHICACEAE	Androcymbium eucomoides
POACEAE	Andropogon eucomus
APIACEAE	Anginon difforme
MALVACEAE	Anisodontea scabrosa
RUBIACEAE	Anthospermum aethiopicum
RUBIACEAE	Anthospermum herbaceum
RUBIACEAE	Anthospermum prostratum
RUBIACEAE	Anthospermum spathulatum subsp. uitenhagense
APIACEAE	Apium graveolens
ICACINACEAE	Apodytes dimidiata subsp. dimidiata
APONOGETONACEAE	Aponogeton distachyos
APIACEAE	Arctopus echinatus
ASTERACEAE	Arctotheca calendula
ASTERACEAE	Arctotheca populifolia
ASTERACEAE	Arctotis acaulis
ASTERACEAE	Arctotis discolor

ASTERACEAE	Arctotis stoechadifolia
FABACEAE	Argyrolobium polyphyllum
IRIDACEAE	Aristea anceps
IRIDACEAE	Aristea bakeri
IRIDACEAE	Aristea ensifolia
POACEAE	Aristida junciformis subsp. galpinii
APOCYNACEAE	Asclepias crispa var. crispa
FABACEAE	Aspalathus angustifolia subsp. angustifolia
FABACEAE	Aspalathus biflora subsp. biflora
FABACEAE	Aspalathus cerrhantha
FABACEAE	Aspalathus chortophila
FABACEAE	Aspalathus ciliaris
FABACEAE	Aspalathus collina subsp. collina
FABACEAE	Aspalathus hispida subsp. hispida
FABACEAE	Aspalathus nigra
FABACEAE	Aspalathus setacea
FABACEAE	Aspalathus spinosa subsp. flavispina
FABACEAE	Aspalathus spinosa subsp. spinosa
FABACEAE	Aspalathus subtingens
ASPARAGACEAE	Asparagus aethiopicus
ASPARAGACEAE	Asparagus crassicladus
ASPARAGACEAE	Asparagus multiflorus
ASPARAGACEAE	Asparagus racemosus
ASPARAGACEAE	Asparagus striatus
ASPARAGACEAE	Asparagus subulatus
ASPARAGACEAE	Asparagus virgatus
ASPLENIACEAE	Asplenium aethiopicum subsp. aethiopicum
APOCYNACEAE	Astephanus marginatus
APOCYNACEAE	Astephanus zeyheri
ASTERACEAE	Aster squamatus
ASTERACEAE	Athanasia dentata
ASTERACEAE	Athanasia trifurcata
CHENOPODIACEAE	Atriplex lindleyi subsp. inflata
POACEAE	Avena fatua
POACEAE	Avena sativa
SALVADORACEAE	Azima tetracantha
IRIDACEAE	Babiana patersoniae
AIZOACEAE	Bergeranthus multiceps
ASTERACEAE	Berkheya heterophylla var. radiata
BRUNIACEAE	Berzelia abrotanoides
ASTERACEAE	Bidens pilosa
ACANTHACEAE	Blepharis capensis
IRIDACEAE	Bobartia orientalis subsp. orientalis
ORCHIDACEAE	Bonatea speciosa
CAPPARACEAE	Boscia albitrunca
POACEAE	Brachiaria serrata
ASTERACEAE	Brachylaena ilicifolia
POACEAE	Brachypodium flexum
APOCYNACEAE	Brachystelma cummingii
POACEAE	Briza maxima
POACEAE	Briza minor
POACEAE	Bromus catharticus
AMARYLLIDACEAE	Brunsvigia striata
BUDDLEJACEAE	Buddleja salviifolia

ASPHODELACEAE	Bulbine frutescens
ASPHODELACEAE	Bulbine latifolia
RUBIACEAE	Burchellia bubalina
CAPPARACEAE	Cadaba aphylla
RESTIONACEAE	Cannomois virgata
RUBIACEAE	Canthium spinosum
CAPPARACEAE	Capparis sepiaria var. citrifolia
CYPERACEAE	Carex clavata
APOCYNACEAE	Carissa bispinosa
APOCYNACEAE	Carissa macrocarpa
CYPERACEAE	Carpha capitellata
MESEMBRYANTHEMACEAE	Carpobrotus edulis subsp. edulis
CELASTRACEAE	Cassine parvifolia
CELASTRACEAE	Cassine peragua subsp. peragua
LAURACEAE	Cassytha ciliolata
ASTERACEAE	Cenia sp.
APIACEAE	Centella asiatica
APIACEAE	Centella cochlearia
CARYOPHYLLACEAE	Cerastium capense
ORCHIDACEAE	Ceratandra grandiflora
SOLANACEAE	Cestrum laevigatum
SCROPHULARIACEAE	Chaenostoma cordatum
SCROPHULARIACEAE	Chaenostoma polyanthum
ACANTHACEAE	Chaetacanthus setiger
VERBENACEAE	Chascanum cuneifolium
IRIDACEAE	Chasmanthe aethiopica
PTERIDACEAE	Cheilanthes bergiana
PTERIDACEAE	Cheilanthes multifida
CHENOPODIACEAE	Chenopodium ambrosioides
OLEACEAE	Chionanthus
GENTIANACEAE	Chironia baccifera
GENTIANACEAE	Chironia melampyrifolia
ASTERACEAE	Chrysanthemoides monilifera subsp. canescens
ASTERACEAE	Chrysocoma ciliata
ASTERACEAE	Cineraria geifolia
MENISPERMACEAE	Cissampelos capensis
CYPERACEAE	Cladium mariscus
RANUNCULACEAE	Clematis brachiata
ROSACEAE	Cliffortia burchellii
ROSACEAE	Cliffortia ferruginea
ROSACEAE	Cliffortia filicaulis var. filicaulis
ROSACEAE	Cliffortia ilicifolia var. cordifolia
ROSACEAE	Cliffortia linearifolia
ROSACEAE	Cliffortia odorata
ROSACEAE	Cliffortia pterocarpa
ROSACEAE	Cliffortia stricta
ROSACEAE	Cliffortia strobilifera
EUPHORBIACEAE	Clutia affinis
EUPHORBIACEAE	Clutia daphnoides
EUPHORBIACEAE	Clutia polifolia
EUPHORBIACEAE	Clutia pulchella var. pulchella
EUPHORBIACEAE	Clutia rubricaulis
RUTACEAE	Coleonema calycinum
RUTACEAE	Coleonema pulchellum

COMMELINACEAE	Commelina africana var. africana
MESEMBRYANTHEMACEAE	Conicosia pugioniformis subsp. muiri
ASTERACEAE	Conyza bonariensis
ASTERACEAE	Conyza scabrida
ASTERACEAE	Cotula coronopifolia
ASTERACEAE	Cotula sericea
CRASSULACEAE	Cotyledon orbiculata var. dactylopsis
CRASSULACEAE	Crassula brachystachya
CRASSULACEAE	Crassula ciliata
CRASSULACEAE	Crassula cultrata
CRASSULACEAE	Crassula ericoides subsp. ericoides
CRASSULACEAE	Crassula expansa subsp. expansa
CRASSULACEAE	Crassula expansa subsp. filicaulis
CRASSULACEAE	Crassula lanceolata subsp. lanceolata
CRASSULACEAE	Crassula muscosa var. muscosa
CRASSULACEAE	Crassula nudicaulis var. nudicaulis
CRASSULACEAE	Crassula orbicularis
CRASSULACEAE	Crassula ovata
CRASSULACEAE	Crassula pellucida subsp. marginalis
CRASSULACEAE	Crassula perforata
CRASSULACEAE	Crassula spathulata
CRASSULACEAE	Crassula tetragona subsp. lignescens
CRASSULACEAE	Crassula tetragona subsp. robusta
ASTERACEAE	Cullumia decurrens
ARALIACEAE	Cussonia spicata
ARALIACEAE	Cussonia thyrsiflora
TECOPHILAEACEAE	Cyanella lutea
POACEAE	Cymbopogon marginatus
APOCYNACEAE	Cynanchum africanum
APOCYNACEAE	Cynanchum obtusifolium
POACEAE	Cynodon dactylon
BORAGINACEAE	Cynoglossum hispidum
CYPERACEAE	Cyperus congestus
CYPERACEAE	Cyperus longus var. longus
CYPERACEAE	Cyperus sphaerospermus
CYPERACEAE	Cyperus textilis
CYPERACEAE	Cyperus thunbergii
LOBELIACEAE	Cyphia sylvatica var. salicifolia
LOBELIACEAE	Cyphia sylvatica var. sylvatica
VITACEAE	Cyphostemma cirrhosum subsp. cirrhosum
AMARYLLIDACEAE	Cyrtanthus clavatus
AMARYLLIDACEAE	Cyrtanthus loddigesianus
APIACEAE	Dasispermum suffruticosum
SOLANACEAE	Datura stramonium
MESEMBRYANTHEMACEAE	Delosperma prasinum
ASTERACEAE	Dicerothamnus rhinocerotis
ASTERACEAE	Dicerothamnus rhinocerotis
CONVOLVULACEAE	Dichondra repens
ACANTHACEAE	Dicliptera extenta
IRIDACEAE	Dierama pendulum
IRIDACEAE	Dietes iridioides
POACEAE	Digitaria eriantha
POACEAE	Digitaria natalensis
ASTERACEAE	Dimorphotheca ecklonis

ASTERACEAE	Dimorphotheca nudicaulis var. graminifolia
DIOSCOREACEAE	Dioscorea elephantipes
RUTACEAE	Diosma hirsuta
ORCHIDACEAE	Disa chrysostachya
ORCHIDACEAE	Disa cornuta
ORCHIDACEAE	Disa hians
ORCHIDACEAE	Disa lugens var. lugens
ORCHIDACEAE	Disa lugens var. nigrescens
ORCHIDACEAE	Disa racemosa
ASTERACEAE	Disparago ericoides
ASTERACEAE	Disparago kraussii
SAPINDACEAE	Dodonaea angustifolia
SAPINDACEAE	Dodonaea viscosa var. angustifolia
URTICACEAE	Droguetia iners subsp. burchellii
MESEMBRYANTHEMACEAE	Drosanthemum candens
BORAGINACEAE	Ehretia rigida subsp. rigida
POACEAE	Ehrharta calycina
POACEAE	Ehrharta erecta var. erecta
POACEAE	Ehrharta rupestris subsp. tricostata
POACEAE	Ehrharta villosa var. maxima
RESTIONACEAE	Elegia asperiflora
RESTIONACEAE	Elegia filacea
RESTIONACEAE	Elegia fistulosa
CYPERACEAE	Eleocharis limosa
POACEAE	Elionurus muticus
POLYGONACEAE	Emex australis
HYPOXIDACEAE	Empodium gloriosum
ONAGRACEAE	Epilobium hirsutum
CYPERACEAE	Epischoenus quadrangularis
POACEAE	Eragrostis capensis
POACEAE	Eragrostis chloromelas
POACEAE	Eragrostis curvula
POACEAE	Eragrostis plana
POACEAE	Eragrostis planiculmis
POACEAE	Eragrostis sarmentosa
ERICACEAE	Erica cerinthoides var. cerinthoides
ERICACEAE	Erica chloroloma
ERICACEAE	Erica cristata
ERICACEAE	Erica curviflora
ERICACEAE	Erica curviflora var. curviflora
ERICACEAE	Erica deliciosa
ERICACEAE	Erica diaphana
ERICACEAE	Erica discolor var. discolor
ERICACEAE	Erica glandulosa subsp. breviflora
ERICACEAE	Erica glandulosa subsp. fourcadei
ERICACEAE	Erica glandulosa subsp. glandulosa
ERICACEAE	Erica glandulosa var. bondiae
ERICACEAE	Erica gracilis
ERICACEAE	Erica humansdorpensis
ERICACEAE	Erica maesta var. maesta
ERICACEAE	Erica nutans
ERICACEAE	Erica pectinifolia
ERICACEAE	Erica pectinifolia var. pectinifolia
ERICACEAE	Erica scabriuscula

ERICACEAE	Erica seriphiifolia
ERICACEAE	Erica simulans var. simulans
ERICACEAE	Erica sparrmanii
ERICACEAE	Erica sparsa var. sparsa
ERICACEAE	Erica speciosa
ERICACEAE	Erica tenella var. tenella
ERICACEAE	Erica thamnoides
ERICACEAE	Erica unilateralis
ERICACEAE	Erica wendlandiana
ERICACEAE	Erica zeyheriana
ASTERACEAE	Eriocephalus africanus var. africanus
ASTERACEAE	Eriocephalus africanus var. paniculatus
FABACEAE	Eriosema squarrosum
ERIOSPERMACEAE	Eriospermum dielsianum subsp. molle
EBENACEAE	Euclea crispa subsp. crispa
EBENACEAE	Euclea polyandra
EBENACEAE	Euclea racemosa subsp. macrophylla
EBENACEAE	Euclea racemosa subsp. racemosa
EBENACEAE	Euclea undulata
EUPHORBIACEAE	Euphorbia albertensis
EUPHORBIACEAE	Euphorbia kraussiana var. erubescens
EUPHORBIACEAE	Euphorbia kraussiana var. kraussiana
EUPHORBIACEAE	Euphorbia mauritanica var. corallothamnus
EUPHORBIACEAE	Euphorbia pentagona
EUPHORBIACEAE	Euphorbia rectirama
EUPHORBIACEAE	Euphorbia silenifolia
EUPHORBIACEAE	Euphorbia sp.
ASTERACEAE	Euryops euryopoides
ASTERACEAE	Euryops spathaceus
POACEAE	Eustachys paspaloides
CHENOPODIACEAE	Exomis microphylla var. axyrioides
ASTERACEAE	Facelis retusa
ASTERACEAE	Felicia
ASTERACEAE	Felicia amelloides
ASTERACEAE	Felicia echinata
ASTERACEAE	Felicia filifolia subsp. filifolia
ASTERACEAE	Felicia muricata subsp. cinerascens
POACEAE	Festuca scabra
CYPERACEAE	Ficinia acuminata
CYPERACEAE	Ficinia bulbosa
CYPERACEAE	Ficinia deusta
CYPERACEAE	Ficinia fascicularis
CYPERACEAE	Ficinia gracilis
CYPERACEAE	Ficinia indica
CYPERACEAE	Ficinia lateralis
CYPERACEAE	Ficinia nigrescens
CYPERACEAE	Ficinia nodosa
CYPERACEAE	Ficinia ramosissima
MORACEAE	Ficus sur
PHYLLANTHACEAE	Flueggea verrucosa
APOCYNACEAE	Fockea edulis
CYPERACEAE	Fuirena hirsuta
FUMARIACEAE	Fumaria muralis subsp. muralis
AIZOACEAE	Galenia secunda

RUBIACEAE	Galium tomentosum
RUBIACEAE	Galopina circaeoides
RUBIACEAE	Gardenia thunbergia
ASPHODELACEAE	Gasteria acinacifolia
ASPHODELACEAE	Gasteria bicolor var. bicolor
ASPHODELACEAE	Gasteria nitida var. armstrongii
ASTERACEAE	Gazania jurineifolia subsp. scabra
ASTERACEAE	Gazania rigens var. uniflora
IRIDACEAE	Geissorhiza heterostyla
GERANIACEAE	Geranium incanum var. incanum
GERANIACEAE	Geranium ornithopodon
ASTERACEAE	Gerbera cordata
ASTERACEAE	Gerbera piloselloides
IRIDACEAE	Gladiolus involutus
IRIDACEAE	Gladiolus liliaceus
IRIDACEAE	Gladiolus permeabilis subsp. permeabilis
IRIDACEAE	Gladiolus rogersii
THYMELAEACEAE	Gnidia oppositifolia
THYMELAEACEAE	Gnidia styphelioides
APOCYNACEAE	Gomphocarpus fruticosus subsp. fruticosus
MALVACEAE	Grewia occidentalis var. occidentalis
MALVACEAE	Grewia robusta
CELASTRACEAE	Gymnosporia capitata
CELASTRACEAE	Gymnosporia nemorosa
AMARYLLIDACEAE	Haemanthus albiflos
AMARYLLIDACEAE	Haemanthus coccineus
AMARYLLIDACEAE	Haemanthus sanguineus
PROTEACEAE	Hakea sericea
PROTEACEAE	Hakea sericea
SCROPHULARIACEAE	Halleria lucida
POACEAE	Harpochloa falx
OROBANCHACEAE	Harveya capensis
OROBANCHACEAE	Harveya purpurea subsp. purpurea
ASPHODELACEAE	Haworthia cooperi var. gordoniana
ASPHODELACEAE	Haworthia longiana
SCROPHULARIACEAE	Hebenstretia dentata
SCROPHULARIACEAE	Hebenstretia robusta
ASTERACEAE	Helichrysum appendiculatum
ASTERACEAE	Helichrysum asperum var. albidulum
ASTERACEAE	Helichrysum asperum var. comosum
ASTERACEAE	Helichrysum aureum var. monocephalum
ASTERACEAE	Helichrysum crispum
ASTERACEAE	Helichrysum cymosum subsp. cymosum
ASTERACEAE	Helichrysum gymnocomum
ASTERACEAE	Helichrysum herbaceum
ASTERACEAE	Helichrysum litorale
ASTERACEAE	Helichrysum nudifolium var. nudifolium
ASTERACEAE	Helichrysum odoratissimum var. odoratissimum
ASTERACEAE	Helichrysum panduratum var. panduratum
ASTERACEAE	Helichrysum rosum var. arcuatum
ASTERACEAE	Helichrysum rosum var. rosum
ASTERACEAE	Helichrysum spiralepis
ASTERACEAE	Helichrysum teretifolium
ASTERACEAE	Helichrysum tinctum

BRASSICACEAE	Heliophila glauca
BRASSICACEAE	Heliophila pendula
BRASSICACEAE	Heliophila rivalis
BRASSICACEAE	Heliophila suavissima
MALVACEAE	Hermannia althaeoides
MALVACEAE	Hermannia flammea
MALVACEAE	Hermannia gracilis
MALVACEAE	Hermannia lavandulifolia
MALVACEAE	Hermannia sp.
MALVACEAE	Hermannia stipulacea
MALVACEAE	Hermannia velutina
IRIDACEAE	Hesperantha falcata
APIACEAE	Heteromorpha arborescens var. arborescens
POACEAE	Heteropogon contortus
MALVACEAE	Hibiscus aethiopicus var. aethiopicus
MALVACEAE	Hibiscus diversifolius subsp. diversifolius
MALVACEAE	Hibiscus pusillus
MALVACEAE	Hibiscus trionum
ASTERACEAE	Hippia frutescens
SAPINDACEAE	Hippobromus pauciflorus
ORCHIDACEAE	Holothrix parviflora
POACEAE	Hordeum murinum subsp. glaucum
ARALIACEAE	Hydrocotyle verticillata
POACEAE	Hyparrhenia poecilotricha
HYPERICACEAE	Hypericum revolutum subsp. revolutum
ASTERACEAE	Hypochaeris radicata
ACANTHACEAE	Hypoestes aristata var. aristata
HYPOXIDACEAE	Hypoxis sobolifera
POACEAE	Imperata cylindrica
FABACEAE	Indigastrum costatum subsp. macrum
FABACEAE	Indigofera denudata
FABACEAE	Indigofera disticha
FABACEAE	Indigofera erecta
FABACEAE	Indigofera flabellata
FABACEAE	Indigofera hedyantha
FABACEAE	Indigofera heterophylla
FABACEAE	Indigofera nigromontana
FABACEAE	Indigofera poliotes
FABACEAE	Indigofera stricta
FABACEAE	Indigofera verrucosa
RESTIONACEAE	Ischyrolepis capensis
RESTIONACEAE	Ischyrolepis eleocharis
ACANTHACEAE	Isoglossa prolixa
CYPERACEAE	Isolepis antarctica
CYPERACEAE	Isolepis ludwigii
CYPERACEAE	Isolepis marginata
CYPERACEAE	Isolepis natans
CYPERACEAE	Isolepis prolifera
CYPERACEAE	Isolepis striata
SCROPHULARIACEAE	Jamesbrittenia burkeana
SCROPHULARIACEAE	Jamesbrittenia microphylla
SCROPHULARIACEAE	Jamesbrittenia sp.
OLEACEAE	Jasminum angulare
JUNCACEAE	Juncus capensis

JUNCACEAE	Juncus dregeanus subsp. dregeanus
JUNCACEAE	Juncus kraussii subsp. kraussii
JUNCACEAE	Juncus lomatophyllus
JUNCACEAE	Juncus rigidus
POACEAE	Karroochloa curva
CUCURBITACEAE	Kedrostis capensis
CUCURBITACEAE	Kedrostis nana var. nana
RANUNCULACEAE	Knowltonia vesicatoria subsp. grossa
POACEAE	Koeleria capensis
THYMELAEACEAE	Lachnaea glomerata
PHYLLANTHACEAE	Lachnostylis hirta
AIZOACEAE	Lampranthus blandus
AIZOACEAE	Lampranthus haworthii
AIZOACEAE	Lampranthus lavisii
MESEMBRYANTHEMACEAE	Lampranthus sp.
AIZOACEAE	Lampranthus spectabilis
AIZOACEAE	Lampranthus stipulaceus
LANARIACEAE	Lanaria lanata
URTICACEAE	Laportea peduncularis subsp. peduncularis
HALORAGACEAE	Laurembergia repens subsp. brachypoda
CELASTRACEAE	Lauridia tetragona
ANACARDIACEAE	Laurophyllus capensis
LAMIACEAE	Leonotis leonurus
BRASSICACEAE	Lepidium africanum subsp. africanum
BRASSICACEAE	Lepidium ecklonii
FABACEAE	Lessertia depressa
FABACEAE	Lessertia kensitii
PROTEACEAE	Leucadendron eucalyptifolium
PROTEACEAE	Leucadendron salignum
PROTEACEAE	Leucospermum cuneiforme
PLUMBAGINACEAE	Limonium scabrum var. avenaceum
PLUMBAGINACEAE	Limonium scabrum var. corymbulosum
PLUMBAGINACEAE	Limonium scabrum var. scabrum
LINACEAE	Linum aethiopicum
LOBELIACEAE	Lobelia erinus
LOBELIACEAE	Lobelia patula
LOBELIACEAE	Lobelia tomentosa
BORAGINACEAE	Lobostemon echioides
POACEAE	Lolium multiflorum
POACEAE	Lolium temulentum
FABACEAE	Lotononis azurea
FABACEAE	Lotononis pungens
ANACARDIACEAE	Loxostylis alata
LYTHRACEAE	Lythrum hyssopifolia
CAPPARACEAE	Maerua cafra
MALVACEAE	Malva parviflora var. parviflora
SCROPHULARIACEAE	Manulea leiostachys
SCROPHULARIACEAE	Manulea obovata
HYACINTHACEAE	Massonia echinata
CELASTRACEAE	Maytenus heterophylla subsp. heterophylla
FABACEAE	Medicago laciniata var. laciniata
FABACEAE	Medicago polymorpha
POACEAE	Melica racemosa
POACEAE	Merxmuellera cincta subsp. cincta

AIZOACEAE	Mesembryanthemum aitonis
AIZOACEAE	Mesembryanthemum granulicaule
ASTERACEAE	Metalasia muricata
IRIDACEAE	Micranthus alopecuroides
ASTERACEAE	Microglossa mespilifolia
POACEAE	Miscanthus capensis
ANEMIACEAE	Mohria caffrorum
LOBELIACEAE	Monopsis acrodon
LOBELIACEAE	Monopsis scabra
LOBELIACEAE	Monopsis simplex
GERANIACEAE	Monsonia emarginata
MONTINIACEAE	Montinia caryophyllacea
IRIDACEAE	Moraea algoensis
IRIDACEAE	Moraea tricuspidata
MYRICACEAE	Morella cordifolia
MYRICACEAE	Morella quercifolia
MYRICACEAE	Morella serrata
POLYGALACEAE	Muraltia alopecuroides
POLYGALACEAE	Muraltia ericaefolia
POLYGALACEAE	Muraltia juniperifolia
POLYGALACEAE	Muraltia squarrosa
MYRSINACEAE	Myrsine africana
CELASTRACEAE	Mystroxylon aethiopicum subsp. aethiopicum
SCROPHULARIACEAE	Nemesia sp.
POLYGALACEAE	Nylandtia spinosa
MELIACEAE	Nymania capensis
NYMPHAEACEAE	Nymphaea nouchali var. caerulea
NYMPHAEACEAE	Nymphaea nouchali var. zanzibariensis
OCHNACEAE	Ochna serrulata
ASTERACEAE	Oedera capensis
ASTERACEAE	Oedera genistifolia
ASTERACEAE	Oedera hirta
ASTERACEAE	Oedera laevis
OLEACEAE	Olea capensis subsp. capensis
OLEACEAE	Olea europaea subsp. africana
OLEACEAE	Olea exasperata
OLINIACEAE	Olinia ventosa
POACEAE	Oplismenus hirtellus
POACEAE	Oplismenus undulatifolius
HYACINTHACEAE	Ornithogalum longibracteatum
HYACINTHACEAE	Ornithogalum tenuifolium subsp. tenuifolium
COLCHICACEAE	Ornithoglossum undulatum
ASTERACEAE	Osteospermum polygaloides var. polygaloides
ASTERACEAE	Osteospermum pterigoideum
SANTALACEAE	Osyris compressa
FABACEAE	Otholobium bracteolatum
FABACEAE	Otholobium sericeum
FABACEAE	Otholobium stachyerum
ASTERACEAE	Othonna carnosa var. carnosa
ASTERACEAE	Othonna quinquedentata
OXALIDACEAE	Oxalis imbricata var. violacea
OXALIDACEAE	Oxalis obtusa
APOCYNACEAE	Pachypodium succulentum
POACEAE	Panicum aequinerve

POACEAE	Panicum deustum
POACEAE	Panicum proliferum
SAPINDACEAE	Pappea capensis
CARYOPHYLLACEAE	Paronychia brasiliana var. brasiliana
POACEAE	Paspalum dilatatum
THYMELAEACEAE	Passerina corymbosa
THYMELAEACEAE	Passerina montivaga
THYMELAEACEAE	Passerina obtusifolia
THYMELAEACEAE	Passerina rigida
HYPOXIDACEAE	Pauridia minuta
MALVACEAE	Pavonia burchellii
GERANIACEAE	Pelargonium alchemilloides
GERANIACEAE	Pelargonium auritum var. carneum
GERANIACEAE	Pelargonium candicans
GERANIACEAE	Pelargonium capitatum
GERANIACEAE	Pelargonium laevigatum subsp. oxyphyllum
GERANIACEAE	Pelargonium ovale subsp. veronicifolium
GERANIACEAE	Pelargonium peltatum
GERANIACEAE	Pelargonium pulverulentum
GERANIACEAE	Pelargonium radulifolium
GERANIACEAE	Pelargonium sidoides
PENAEACEAE	Penaea cneorum subsp. gigantea
PENAEACEAE	Penaea cneorum subsp. lanceolata
PENAEACEAE	Penaea cneorum subsp. ovata
POACEAE	Pennisetum clandestinum
POACEAE	Pennisetum macrourum
POACEAE	Pentaschistis ampla
POACEAE	Pentaschistis heptamera
POACEAE	Pentaschistis pallida
POACEAE	Pentaschistis sp.
PIPERACEAE	Peperomia retusa var. retusa
PIPERACEAE	Peperomia tetraphylla
POLYGONACEAE	Persicaria attenuata subsp. africana
POLYGONACEAE	Persicaria decipiens
APIACEAE	Peucedanum caffrum
MOLLUGINACEAE	Pharnaceum dichotomum
MOLLUGINACEAE	Pharnaceum thunbergii
POACEAE	Phragmites australis
RHAMNACEAE	Phylica abietina
RHAMNACEAE	Phylica axillaris
RHAMNACEAE	Phylica axillaris var. microphylla
RHAMNACEAE	Phylica gnidioides
RHAMNACEAE	Phylica litoralis
PHYLLANTHACEAE	Phyllanthus maderaspatensis
SCROPHULARIACEAE	Phyllopodium sp.
RUBIACEAE	Phylohydrax carnosa
APIACEAE	Pimpinella sp.
PITTOSPORACEAE	Pittosporum viridiflorum
AYTONIACEAE	Plagiochasma rupestre var. rupestre
PLANTAGINACEAE	Plantago lanceolata
ASTERACEAE	Plecostachys polifolia
ASTERACEAE	Plecostachys serpyllifolia
LAMIACEAE	Plectranthus fruticosus
LAMIACEAE	Plectranthus laxiflorus

POACEAE	Poa annua
FABACEAE	Podalyria burchellii
FABACEAE	Podalyria cuneifolia
PODOCARPACEAE	Podocarpus falcatus
PODOCARPACEAE	Podocarpus latifolius
CARYOPHYLLACEAE	Polycarpon tetraphyllum
POLYGALACEAE	Polygala
POLYGALACEAE	Polygala ericaefolia
POLYGALACEAE	Polygala leptophylla var. leptophylla
POLYGALACEAE	Polygala levynsiana
POLYGALACEAE	Polygala myrtifolia var. myrtifolia
POLYGALACEAE	Polygala refracta
POLYGALACEAE	Polygala umbellata
POLYGALACEAE	Polygala wittebergensis
HYACINTHACEAE	Polyxena ensifolia
PORTULACACEAE	Portulacaria afra
PRIONIACEAE	Prionium serratum
CAMPANULACEAE	Prismatocarpus campanuloides var. campanuloides
PROTEACEAE	Protea coronata
PROTEACEAE	Protea cynaroides
PROTEACEAE	Protea eximia
PROTEACEAE	Protea mundii
PROTEACEAE	Protea neriifolia
PROTEACEAE	Protea nitida
PROTEACEAE	Protea repens
PROTEACEAE	Protea scolymocephala
PROTEACEAE	Protea tenax
FABACEAE	Psoralea affinis
FABACEAE	Psoralea arborea
FABACEAE	Psoralea ensifolia
FABACEAE	Psoralea muirii
FABACEAE	Psoralea pinnata var. pinnata
FABACEAE	Psoralea repens
RUBIACEAE	Psydrax obovata subsp. obovata
DENNSTAEDTIACEAE	Pteridium aquilinum subsp. centrali-africanum
CELASTRACEAE	Pterocelastrus tricuspidatus
ASTERACEAE	Pteronia incana
ORCHIDACEAE	Pterygodium alatum
ORCHIDACEAE	Pterygodium volucris
ASTERACEAE	Pulicaria scabra
CELASTRACEAE	Putterlickia pyracantha
CELASTRACEAE	Putterlickia verrucosa
CYPERACEAE	Pycreus polystachyos var. laxiflorus
RANUNCULACEAE	Ranunculus multifidus
MYRSINACEAE	Rapanea gilliana
RESTIONACEAE	Restio tetragonus
RESTIONACEAE	Restio triticeus
RHAMNACEAE	Rhamnus prinoides
RESTIONACEAE	Rhodocoma fruticosa
SANTALACEAE	Rhoiacarpos capensis
VITACEAE	Rhoicissus digitata
VITACEAE	Rhoicissus tridentata subsp. cuneifolia
VITACEAE	Rhoicissus tridentata subsp. tridentata
ANACARDIACEAE	Rhus crenata

ANACARDIACEAE	Rhus dentata
ANACARDIACEAE	Rhus glauca
ANACARDIACEAE	Rhus incisa var. effusa
ANACARDIACEAE	Rhus laevigata var. laevigata forma laevigata
ANACARDIACEAE	Rhus longispina
ANACARDIACEAE	Rhus lucida forma lucida
ANACARDIACEAE	Rhus lucida forma lucida
ANACARDIACEAE	Rhus pallens
ANACARDIACEAE	Rhus pyroides var. gracilis
ANACARDIACEAE	Rhus refracta
ANACARDIACEAE	Rhus tomentosa
FABACEAE	Rhynchosia caribaea
CAMPANULACEAE	Roella spicata var. burchellii
IRIDACEAE	Romulea atrandra var. lewisiae
IRIDACEAE	Romulea dichotoma
RUBIACEAE	Rubia cordifolia subsp. conotricha
ROSACEAE	Rubus fruticosus
POLYGONACEAE	Rumex acetosella subsp. angiocarpus
POLYGONACEAE	Rumex cordatus
POLYGONACEAE	Rumex crispus
POLYGONACEAE	Rumex sagittatus
AIZOACEAE	Ruschia knysnana
MESEMBRYANTHEMACEAE	Ruschia sp.
MESEMBRYANTHEMACEAE	Ruschia staminodiosa
LAMIACEAE	Salvia africana-lutea
THEOPHRASTACEAE	Samolus porosus
DRACAENACEAE	Sansevieria hyacinthoides
APOCYNACEAE	Sarcostemma viminale subsp. viminale
ORCHIDACEAE	Satyrium acuminatum
ORCHIDACEAE	Satyrium parviflorum
ORCHIDACEAE	Satyrium princeps
DIPSACACEAE	Scabiosa albanensis
DIPSACACEAE	Scabiosa columbaria
AMARYLLIDACEAE	Scadoxus puniceus
GOODENIACEAE	Scaevola plumieri
ASTERACEAE	Schistostephium umbellatum
CYPERACEAE	Schoenoxiphium sparteum
FABACEAE	Schotia afra var. afra
FABACEAE	Schotia latifolia
CYPERACEAE	Scirpoides thunbergii
SALICACEAE	Scolopia zeyheri
RHAMNACEAE	Scutia myrtina
ANACARDIACEAE	Searsia fastigata
ANACARDIACEAE	Searsia glauca
ANACARDIACEAE	Searsia laevigata var. laevigata forma laevigata
ANACARDIACEAE	Searsia lucida forma scoparia
ANACARDIACEAE	Searsia pentheri
GENTIANACEAE	Sebaea zeyheri subsp. acutiloba
APOCYNACEAE	Secamone alpini
SCROPHULARIACEAE	Selago canescens
SCROPHULARIACEAE	Selago corymbosa
SCROPHULARIACEAE	Selago myrtifolia
SCROPHULARIACEAE	Selago rotundifolia
ASTERACEAE	Senecio affinis

ASTERACEAE	Senecio arenarius
ASTERACEAE	Senecio burchellii
ASTERACEAE	Senecio carnosus
ASTERACEAE	Senecio crassulaefolius
ASTERACEAE	Senecio deltoideus
ASTERACEAE	Senecio glastifolius
ASTERACEAE	Senecio halimifolius
ASTERACEAE	Senecio linifolius
ASTERACEAE	Senecio madagascariensis
ASTERACEAE	Senecio oederiifolius
ASTERACEAE	Senecio oxyodontus
ASTERACEAE	Senecio pterophorus
ASTERACEAE	Senecio purpureus
ASTERACEAE	Senecio sp.
AMARANTHACEAE	Sericocoma avolans
ASTERACEAE	Seriphium plumosum
POACEAE	Setaria nigrirostris
POACEAE	Setaria sphacelata var. sphacelata
POACEAE	Setaria sphacelata var. torta
SAPOTACEAE	Sideroxylon inerme subsp. inerme
CARYOPHYLLACEAE	Silene
CARYOPHYLLACEAE	Silene gallica
CARYOPHYLLACEAE	Silene primuliflora var. primuliflora
SOLANACEAE	Solanum aggerum
SOLANACEAE	Solanum guineense
SOLANACEAE	Solanum nigrum
SOLANACEAE	Solanum rigescens
SOLANACEAE	Solanum sodomaeodes
ASTERACEAE	Sonchus oleraceus
HYPOXIDACEAE	Spiloxene serrata var. serrata
POACEAE	Sporobolus africanus
POACEAE	Sporobolus pectinatus
POACEAE	Sporobolus virginicus
LAMIACEAE	Stachys aethiopica
CARYOPHYLLACEAE	Stellaria media
POACEAE	Stenotaphrum secundatum
POACEAE	Stipa dregeana var. dregeana
ASTERACEAE	Stoebe plumosa
THYMELAEACEAE	Struthiola argentea
THYMELAEACEAE	Struthiola macowanii
THYMELAEACEAE	Struthiola parviflora
SCROPHULARIACEAE	Sutera hispida
FABACEAE	Sutherlandia frutescens
ASTERACEAE	Syncarpha argentea
ASTERACEAE	Syncarpha milleflora
ASTERACEAE	Syncarpha striata
ASTERACEAE	Tarchonanthus camphoratus
FABACEAE	Tephrosia capensis var. acutifolia
FABACEAE	Tephrosia capensis var. capensis
FABACEAE	Tephrosia grandiflora
AIZOACEAE	Tetragonia decumbens
CYPERACEAE	Tetraria cuspidata
CYPERACEAE	Tetraria cuspidata var. cuspidata
CYPERACEAE	Tetraria sp.

LAMIACEAE	Teucrium africanum
RESTIONACEAE	Thamnochortus cinereus
RESTIONACEAE	Thamnochortus sp.
POACEAE	Themeda triandra
SANTALACEAE	Thesium ericaefolium
SANTALACEAE	Thesium penicillatum
SANTALACEAE	Thesium scandens
SANTALACEAE	Thesium virgatum
POACEAE	Thinopyrum distichum
ASPHODELACEAE	Trachyandra affinis
POACEAE	Trachypogon spicatus
POACEAE	Tribolium hispidum
POACEAE	Tribolium uniolae
FABACEAE	Trifolium burchellianum subsp. burchellianum
SALICACEAE	Trimeria grandifolia subsp. grandifolia
POACEAE	Tristachya leucothrix
TYPHACEAE	Typha capensis
ASTERACEAE	Ursinia scariosa subsp. scariosa
ASTERACEAE	Vellereophyton dealbatum
ASTERACEAE	Vernonia capensis
FABACEAE	Vicia sativa subsp. nigra
MENYANTHACEAE	Villarsia capensis
FABACEAE	Virgilia divaricata
FABACEAE	Virgilia oroboides subsp. oroboides
VISCACEAE	Viscum capense
VISCACEAE	Viscum capense subsp. hoolei
VISCACEAE	Viscum obscurum
POACEAE	Vulpia myuros
HAEMODORACEAE	Wachendorfia paniculata
HAEMODORACEAE	Wachendorfia thyrsiflora
CAMPANULACEAE	Wahlenbergia cinerea
IRIDACEAE	Watsonia pillansii
IRIDACEAE	Watsonia sp.
CUPRESSACEAE	Widdringtonia nodiflora
SCROPHULARIACEAE	Zaluzianskya maritima
ARACEAE	Zantedeschia aethiopica
RUTACEAE	Zanthoxylum capense
CUCURBITACEAE	Zehneria scabra subsp. scabra
ZYGOPHYLLACEAE	Zygophyllum debile
ZYGOPHYLLACEAE	Zygophyllum foetidum