Environmental Impact Assessment for the proposed Ubuntu Wind Energy Project near Jeffrey's Bay, Eastern Cape: Final Environmental Impact Assessment Report

Chapter 5: Impact on Fauna and Flora

Contents

5 IMPACT ON FAUNA AND FLORA 5-5

5.1 INTRODUCTION 5-5
5.1.1 Approach to the study 5-5
5.1.2 Terms of Reference 5-5
5.1.2.1 Flora 5-5
5.1.2.2 Fauna 5-5
5.1.3 Assumptions and limitations 5-6
5.1.3.1 Flora 5-6
5.1.3.2 Fauna 5-6
5.1.4 Information sources 5-6
5.1.5 Declaration of Independence 5-7

5.2 DESCRIPTION OF ASPECTS OF THE PROJECT THAT POTENTIALLY COULD CAUSE IMPACTS ON THE FAUNA AND FLORA 5-7
5.2.1 Wind turbines generators 5-7

5.3 DESCRIPTION OF AFFECTED ENVIRONMENT 5-8
5.3.1 Site Location 5-8
5.3.2 Site Topography 5-10
5.3.3 Regional Planning Framework 5-12
5.3.3.1 Vegetation of Southern Africa 5-13
5.3.3.2 Sub tropical Ecosystem Planning 5-16
5.3.3.3 Riparian Zones and Ecological Support Areas 5-16
5.3.4 Description of Vegetation, Flora and Fauna 5-17
5.3.4.1 Perceived Reference State (PRS) 5-17
5.3.4.2 Vegetation Communities - Present Ecological State (PES) 5-19
5.3.4.3 Terrestrial Habitat Vulnerability Assessment Method 5-26
5.3.4.4 Ecological Indicators 5-28
5.3.4.5 Floral diversity 5-30
5.3.4.6 Fauna 5-33

5.4 IDENTIFICATION OF ISSUES AND IMPACTS 5-41
5.4.1 Vegetation and Flora 5-41
5.4.2 Fauna 5-42
5.4.3 Site layout Alternatives 5-45
5.4.3.1 Alternative A: 50 X 2MW Turbines (V90) 5-45
5.4.3.2 Alternative B: 40 X 2.5MW Turbines (V100) 5-47
5.4.3.3 Alternative C: 33 X 3MW Turbines (V112) 5-49

5.5 PERMIT REQUIREMENTS 5-51
5.5.1 Obtaining permission for the destruction, relocation and/or removal of protected plant species 5-51

5.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS 5-51

5.6.1 General Impact Rating Scale for Specialists/ Baseline data *5-51*
5.6.1.1 Methodology for rating significance of impacts: 5-51

5.7 CONCLUSIONS 5-67
5.7.1 Vegetation and Flora *5-67*
5.7.2 Fauna *5-67*
5.7.3 Summary of Risks and Impacts *5-68*
5.7.3.1 Direct loss of habitat 5-68
5.7.3.2 Loss of Species of special concern and habitat 5-68
5.7.3.3 Changes to species composition and changes to ecological processes 5-69
5.7.3.4 Increased fire risk and alien plant invasion resulting from vehicles 5-69
5.7.4 Recommendations *5-69*
5.7.4.1 Vegetation 5-69
5.7.4.2 Drainage Lines, Seeps, Wetlands, Pans and Dams 5-70
5.7.4.3 Environmental Management Programme Recommendations 5-70
5.7.5 Fauna *5-72*

5.8 APPENDICES 5-74

Appendices

Appendix 5.1. Plant Species List 5-74
Appendix 5.2. Fauna Species List 5-80
Appendix 5.3 Indemnity and conditions relating to this project 5-84

Tables

Table 5.1: Mucina & Rutherford (2006; SAVeg) vegetation classification and Conservation Status. 5-16
Table 5.2: STEP vegetation units and conservation status. 5-16
Table 5.3: Present Ecological State indicators of the study area. 5-28
Table 5.4: Indigenous Species of Special Concern. 5-31
Table 5.5: Alien Invasive plants and common weeds present and CARA classification. 5-32
Table 5.6. Impact assessment 5-54
Table 5.7. Monitoring programme 5-64

Figures

Figure 5-1: Site locality, north-east of Jeffrey's Bay. 5-9
Figure 5-2: Aerial photo of the site, indicating 5 m contours and key topographical features. 5-11
Figure 5-3: VegSA (Mucina & Rutherford) vegetation units and conservation status. 5-14
Figure 5-4: STEP vegetation units and conservation status 5-15
Figure 5-5: Mapped Vegetation communities with respective ecological sensitivity indicated. 5-20
Figure 5-6: Typical regenerating Renosterveld 5-21
Figure 5-7: Typical Renosterveld 5-21
Figure 5-8: Typical Pasture with re-establishment of Renosterveld elements 5-21
Figure 5-9: Typical Pasture with return of Renosterveld elements 5-21
Figure 5-10: Typical Conglomerate Fynbos (northern site). 5-22
Figure 5-11: Typical Conglomerate Fynbos (northern site). 5-22
Figure 5-12: Typical Conglomerate Fynbos (southern site). 5-23
Figure 5-13: Typical Conglomerate Fynbos (close-up). 5-23
Figure 5-14: Typical Gamtoos Thicket 5-24
Figure 5-15: Typical Gamtoos Thicket 5-24
Figure 5-16: Typical Riparian Seep along a drainage line with short seasonal grasses 5-25
Figure 5-17: Seasonal Wetland with typical seasonal grasses dominating 5-25
Figure 5-18: Seasonal Wetland situated in the middle of the site with isolated bushclumps around its periphery 5-25
Figure 5-19: Excavated dam within a large wetland situated in the middle of the site 5-25
Figure 5-20: Transformed area around homesteads with some trees (regenerating thicket clumps and introduced species). 5-26
Figure 5-21: Cultivated land with some regeneration of shrub elements 5-26
Figure 5-22: Typical pastures dominating the majority of the site 5-26
Figure 5-23: Extensive transformed pastures throughout the site 5-26
Figure 5-24: Cape grass lizard (*Chamaesaura anguina anguina*) Near threatened. 5-36
Figure 5-25: Delalandes sandveld lizard (*Nucras lalandii*) 5-36
Figure 5-26: Yellow bellied house snake(*Lamprophis fuscus*); Near threatened 5-36
Figure 5-27: Elandsberg Dwarf Chameleon (critically endangered) 5-36
Figure 5-28: Puff adder (*Bitis arientans*) common species 5-38
Figure 5-29: Red sided skink (*Tetradactylus homalocephala*) 5-38
Figure 5-30: Cape girdled lizard (*Cordylus cordylus*) 5-38
Figure 5-31: Mountain tortoise (*Geochelone pardalis*) 5-38
Figure 5-32: Herald snake (*Crotaphopeltis hotamboeia)* 5-40
Figure 5-33: Rinkhals *(Hemachatus haemachatus)* 5-40
Figure 5-34: Painted reed frog(*Hyperolius marmoratus*) 5-40
Figure 5-35: Eastern leopard toad (*Amietophrynus pardalis*) 5-40

Figure 5-36: Example of typical wind turbine footprint lay down area (Coega IDZ). 5-43
Figure 5-37: Example of typical wind turbine footprint (including lay down area and turbine footprint). 5-43
Figure 5-38: Example of Puff adder (*Bitis arietans*), killed on road 5-44
Figure 5-39: Example of Marsh terrapin killed by vehicle on road. 5-44
Figure 5-40: Example of water monitor electrocuted in fence 5-45
Figure 5-41: Example of fence-line near a proposed development site 5-45
Figure 5.42: Mapped Vegetation communities with alternative A layout overlain (V90). 5-46
Figure 5.43: Mapped Vegetation communities with alternative B layout overlain (V100). 5-48
Figure 5.44: Mapped Vegetation communities with alternative C layout overlain (V112). 5-50

5 IMPACT ON FAUNA AND FLORA

5.1 INTRODUCTION

5.1.1 Approach to the study

Mr Jamie Pote was sub-contracted by the CSIR to undertake a terrestrial ecological assessment of the proposed Ubuntu Wind Energy Project near Jeffrey's Bay. Site visits were conducted during January 2011 and May 2011. Mr Mark Marshall of Sandula Conservation assisted with the faunal survey and assessment (Terrestrial Mammals, Reptiles and Amphibians).

5.1.2 Terms of Reference

5.1.2.1 Flora

The TOR for ecological studies are to:

- Carry out fieldwork to locate and describe the vegetation on the study area, the key focus being on determining the impact footprint(s) for the site;
- Determine the species present and localities within each vegetation types;
- Determine whether the study area falls wholly or partially within the distribution range of species listed as Vulnerable, Endangered or Critically Endangered and Protected;
- Provide a description of the current state of the vegetation on site supported by relevant photographs;
- Identify and describe the conservation value and conservation planning frameworks relevant to this site (Regional Planning) for the represented vegetation units;
- Describe the areas where indigenous vegetation has been transformed;
- Determine which alien species are present, their distribution within the study area, and recommended management actions;
- Note and record the position of unusually large specimens of trees;
- Provide a detailed vegetation sensitivity map of the site, including mapping of disturbance and transformation on the site;
- Intergrate the faunal assessment (terrestrial mammals, reptiles and amphibians) into the Ecological (Biodiversity) Assessment Report;
- Identify and rate potential impacts, outline mitigatory measures, and outline additional management guidelines; and
- Provide an Environmental Management Plan (EMP), including generic rehabilitation and revegetation guidelines.

5.1.2.2 Fauna

This specialist report describes, and assesses the potential impact on, the terrestrial fauna present in the area that will be affected by the proposed development. It also addresses the existing impacts resulting from the current land use as it affects the fauna. Most of the faunal diversity was assessed on the basis of the presence of suitable habitat, tracks, signs (droppings, feathers, tracks, etc.) as well as documented distributions. A site visit was undertaken in May

2011 but no specific faunal collections were made. The presence of alien and extra-limital species in the region has also been noted. It should be noted that birds and bats are addressed separately in Chapters 6 and 7 of this report respectively.
The following faunal groupings have been investigated:

- Amphibians;
- Reptiles; and
- Mammals (excluding bats).

For amphibian species, the A Complete guide to the frogs of Southern Africa (Du Preez & Carruthers 2009) and Atlas and Red data book of the frogs of South Africa, Lesotho and Swaziland (Minter et al 2004) were used to identify potentially-occurring frogs. Potentially-occurring reptiles were identified by using Branch (1998), Marais (2004) and Alexander and Marais (2007) and using the online resources of the ADU (http://sarca.adu.org.za/). Field Guide to Mammals of Southern Africa (Stuart & Stuart 2007) and A Field Guide to the Tracks and Signs of Southern and East African Wildlife (Stuart & Stuart 2000) were used for the identification of potentially-occurring mammals. Because of their large numbers in terms of taxa, invertebrates are rarely considered in detailed environmental management plans. South African Red Data Lists of Threatened Species (using IUCN categories) are available for: amphibians (Minter et al. 2004), reptiles (Branch 1988b, 2002, and updates), and mammals (Friedmann and Daly 2004).
To clarify, species of special concern (SSC) are animals that are known to be:

- endemic to the region;
- that are considered to be of conservational concern;
- that are in commercial trade (CITES or ToPS listed species); or,
- are of cultural significance.

5.1.3 Assumptions and limitations

A number of limitations apply to this study.

5.1.3.1 Flora

- Botanical surveys based upon a limited sampling time period may not reflect the actual species composition of the site because of seasonal variations in flowering times.
- While all reasonable attempts were made, the author cannot guarantee that all plant species were recorded during the assessment because of the rapid sampling and assessment techniques employed.

5.1.3.2 Fauna

- Faunal surveys may not reflect the actual species composition of the site because of seasonal variations.
- An amphibian survey was conducted in the autumn thus actual presence/absence of species could not necessarily be verified and reliance on literature sources was necessary.

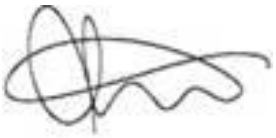
5.1.4 Information sources

Information was obtained from literature sources for the desktop component of the study. Fieldwork was conducted to obtain site-specific information and local expert knowledge was also obtained where pertinent and available.

5.1.5 Declaration of Independence

BOX 5.1: DECLARATION OF INDEPENDENCE FOR BOTANICAL ASSESSMENT

I, **Jamie Pote**, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed WKN-Windcurrent SA (Pty) Ltd Ubuntu Wind Energy Project, application or appeal in respect of which I 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 my performing such work.



JAMIE POTE

5.2 DESCRIPTION OF ASPECTS OF THE PROJECT THAT POTENTIALLY COULD CAUSE IMPACTS ON THE FAUNA AND FLORA

The key components of the project and their respective impacts upon the terrestrial faunal and floral environment are:

5.2.1 Wind turbines generators

Wind farm Component	**Ecological impacts**
Wind turbine generators	
Turbines will be supported on reinforced concrete spread **foundations**	The terrestrial environment will be impacted where vegetation clearing is required for constructing turbine foundations.
Electrical transformers will be placed beside each turbine.	The terrestrial environment will be impacted where vegetation clearing is required for electrical transformers
Gravel surfaced **hard standing areas** (adjacent to each turbine for use by cranes during construction and retained for maintenance use throughout life span of the project.	The terrestrial environment will be impacted where vegetation clearing is required for hard standing areas
Electrical connections	
The wind turbines typically will be connected to each other and to the substation using, in most cases, buried **(1 m deep) medium voltage cables**, except where a technical assessment of the proposed design suggests that overhead lines are appropriate.	The terrestrial environment will be impacted where vegetation clearing is required for cable trenches outside of road reserve
A new **sub-station** and transformer to the 132	The terrestrial environment will be impacted

Wind farm Component	Ecological impacts
kV Eskom grid will be built. Preferably close to the 132 kV line.	where vegetation clearing is required for substation construction
Other potential infrastructure	
Operations and maintenance building:	The terrestrial environment will be impacted where vegetation clearing is required for the warehouse/ workshop (0.5 ha)
Fencing as required.	Dependent on the type and extent of fencing it may act as a barrier to ecological processes and cause mortalities to animals. (especially if the fence is electrified)
Temporary **wind measuring mast** of 100m height.	The terrestrial environment is temporarily affected by mast base footprint
Roads	
Gravel access roads onto the site from the public road	The terrestrial environment will be impacted where vegetation clearing is required for road construction
An **internal road network** to the turbines and other infrastructure (substation and operation and maintenance building). The road network may include turning circles for large trucks, passing points and culverts over gullies and rivers.	The terrestrial environment will be impacted where vegetation clearing is required for road construction Ecological processes may be impacted where linear features impact ecological corridors The road network may result in barriers to faunal movement and result in mortalities
All roads width 6 m plus cabling and drainage.	Road width, extent and final design will affect the overall impact upon the terrestrial environment.
Upgrading of certain **existing roads** may take place.	Upgrading of existing roads, and rehabilitation of old roads will reduce the overall impact on the terrestrial environment
Temporary activities during construction	
Lay down area, besides an access route	The terrestrial environment will be impacted where vegetation clearing is required for hard-standing area (1 ha) if permanent.
The overall **site compound** for all contractors	The terrestrial environment will be impacted where vegetation clearing is required for the site compound.

5.3 DESCRIPTION OF AFFECTED ENVIRONMENT

5.3.1 Site Location

The site is located north-east of Jeffrey's Bay, Eastern Cape (Figure 5-1).

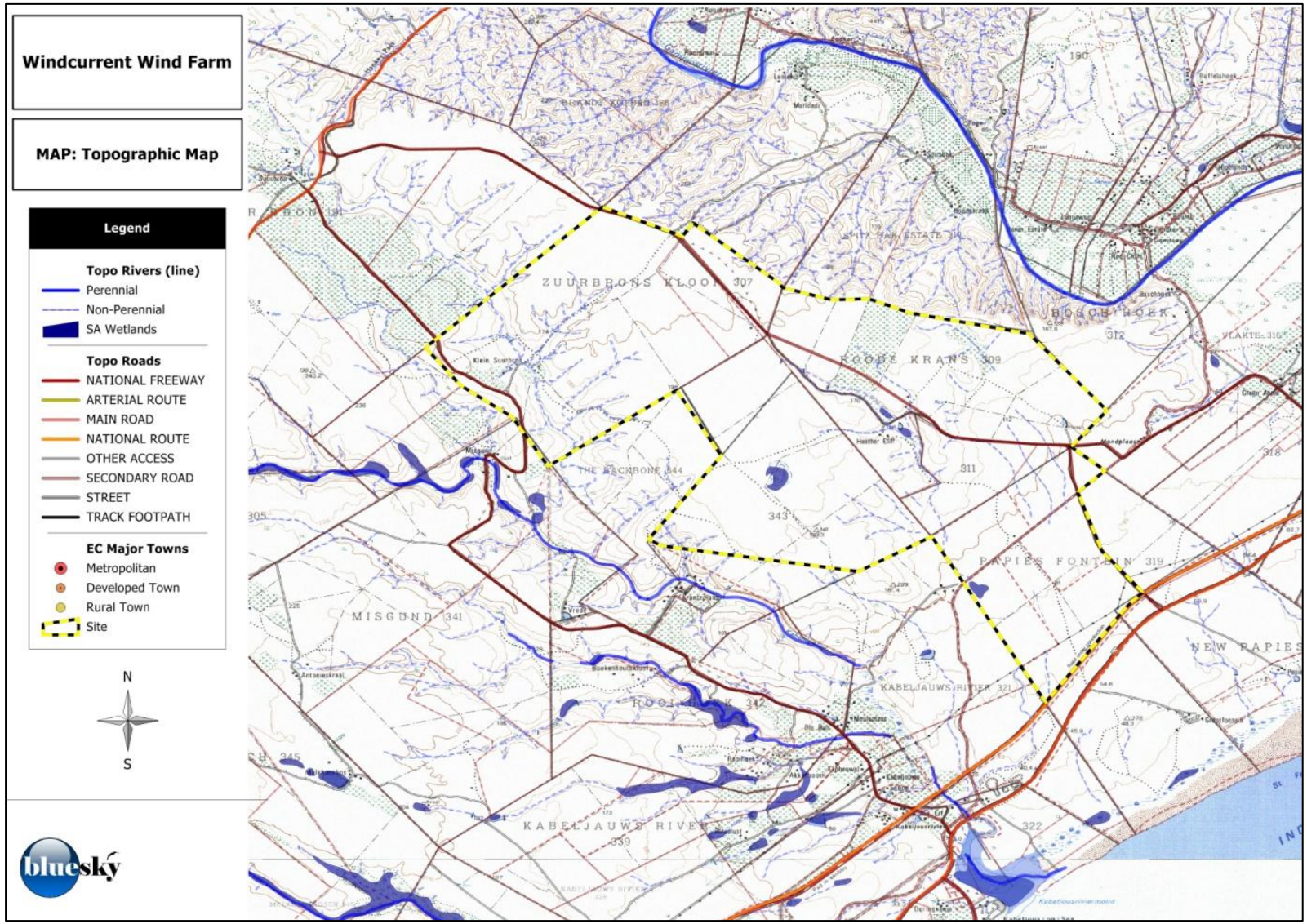


Figure 5-1: Site locality, north-east of Jeffrey's Bay.

5.3.2 Site Topography

In general the site is located in the middle of a slightly undulating plateau with deeply incised river valleys on the east and west and a small seasonal drainage line bisecting the site (Figure 5.1). In general soils on the plateau are well developed with shallower, rocky soils where the topography slopes towards the drainage lines. A seasonal wetland is present in the middle of the site and a number of small dams are present along the drainage lines.

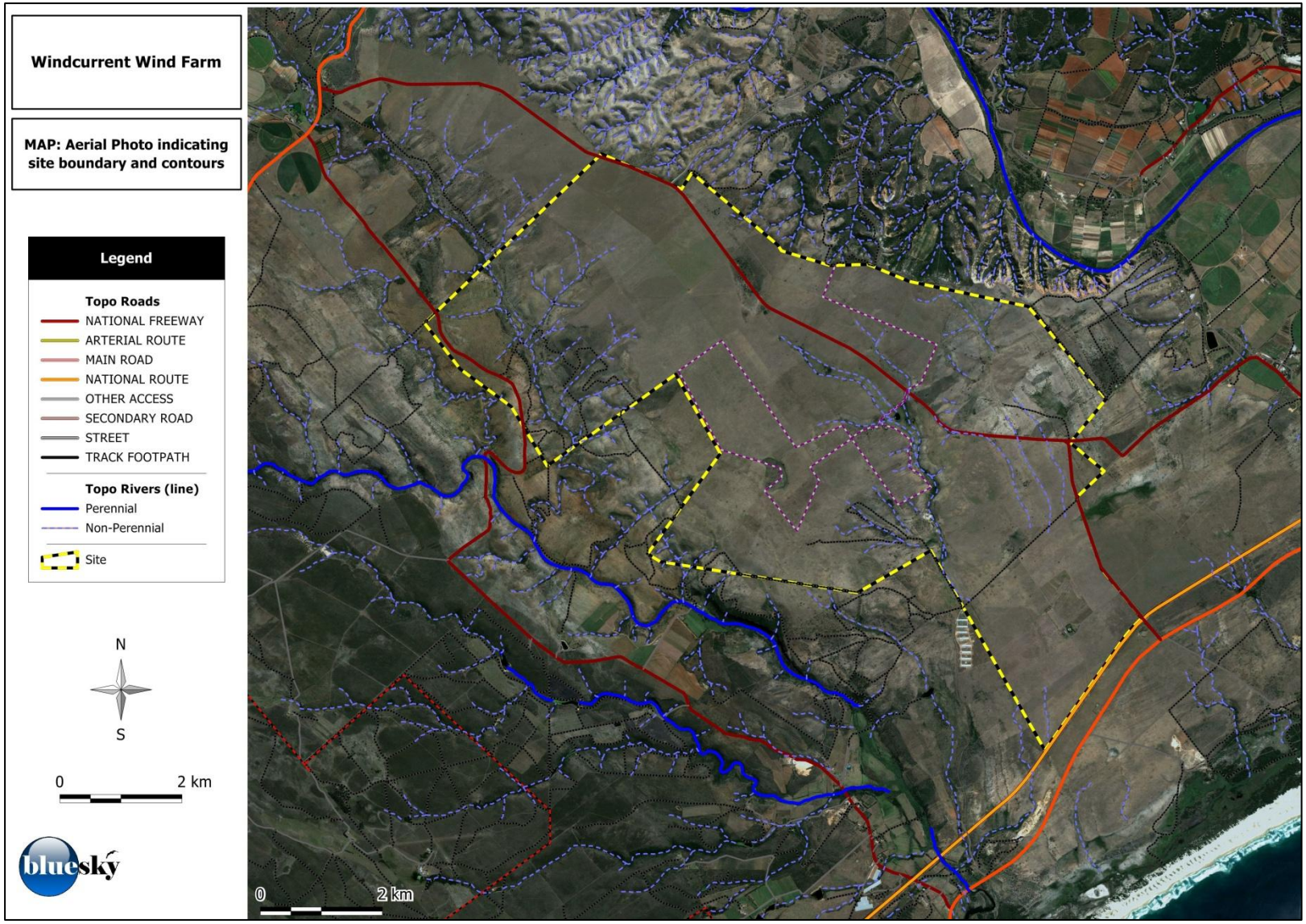


Figure 5-2: Aerial photo of the site, indicating 5 m contours and key topographical features.

5.3.3 Regional Planning Framework

The Eastern Cape Province has highly diverse vegetation since it occupies an area where the biomes of South Africa converge (Rutherford and Westfall, 1994). As a result, the Eastern Cape vegetation is a mosaic of vegetation types, many of which have become severely threatened by development (Lubke *et al.*, 1988, Low and Rebelo, 1996). The vegetation of the region falls in the *Tongoland-Pondoland phytochorion* (White, 1983) that is considered to have originated in Natal and migrated south-westward where it merged with the *Cape Fynbos and arid Succulent Karoo flora*, hence the vegetation is generally highly diverse.

The Cape Floral Kingdom, typically referred to as Fynbos, is generally characterised by three elements: the tough, wiry restioids (Cape Reeds) form the graminoid (grass-like) layer; the heath component is composed of small, narrow-leafed shrubs (the most famous examples are the Ericas); the proteoid component of proteas, cone-bushes and pin-cushions (Campbell & Sigonyela, 2001). Within the study area, the dominant component is a Renosterveld-Thicket mosaic with a Grassy Fynbos component. In Grassy Fynbos, true grasses largely replace the restioids although several species of Restionaceae are still found. The grasses are common widespread species that are fairly drought-hardy (C^4 grasses).

Cowling (1984) identified Subtropical Transitional Thicket as a vegetation class that extended from the Kei River to the south-western Cape, and defined it as follows: (i) dominance of species of Tongoland-Pondoland affinity with strong links to the Karoo-Namib (drier forms) and Afromontane (wetter forms) Regions; (ii) relatively low regional endemism (at least in comparison with elsewhere in the fynbos biome), comprising mainly succulent species of karroid affinity; (iii) dominated by broad-leaved sclerophyllous shrubs, many of which have spines, and having a conspicuous woody vine and succulent component, especially in drier forms; and (iv) associated with deepish, well-drained and relatively fertile soils. It is not fire-prone and is functionally similar to forest, for example in nutrient-cycling processes and the high incidence of species with vertebrate-dispersed fruits. (Midgley *et al.* 1997). However, thicket differs from forest in that (i) large herbivores (Kerley *et al.* 1995) and not tree falls are the major source of disturbance; (ii) most canopy species regenerate by Ramet (clonal) recruitment (Midgley and Cowling (1993); dominant canopy species are relatively shade-intolerant (Holmes and Cowling (1993); and it grows where annual rainfall may be as low as 200 mm (Acocks 1953).

Systematic Conservation Planning provides a framework that highlights national and regional conservation planning processes. At a national level and regional planning level the Vegetation of Southern Africa (2006) and the Sub Tropical Ecosystem Planning Conservation Assessment (2003) serve to *'assist land-use planners and decision-makers, especially in municipalities, to integrate biodiversity information into land-use planning and decision-making'*. No local planning frameworks currently exist for the site that would identify those areas that are critical for conserving biodiversity and facilitate the integration of biodiversity into decision-making (i.e. mainstreaming biodiversity). In general local conservation frameworks aim to minimise the loss of natural habitat in **Critical Biodiversity Areas** (**CBA**) and prevent the degradation of **Ecological Support Areas** (**ESA**), while encouraging sustainable development in other natural areas. In general the guidelines for local conservation plans designate habitats having an elevated conservation status as being **Critical Biodiversity Areas** with **Ecological Support Areas**, tending to include corridors along drainage lines and rivers. For the purposes of this report important drainage features are designated as **ESAs** and vegetation units deemed to have an elevated conservation status as **CBAs.**

A summary of the affected vegetation units and conservation/ecosystem status as per the various National and Regional Bioregional Plan are provided for Mucina & Rutherford Vegetation of Southern Africa in (Table 5.1; VegSA; **Error! Reference source not found.**) and Sub-Tropical

Ecosystem Planning (Table 5.2; STEP; **Error! Reference source not found.**). These national and regional plans provide the most recent available descriptions of the general floral environment present within the area, as well as the respective conservation status of the respective vegetation units.

5.3.3.1 Vegetation of Southern Africa

At a *national* scale, Mucina & Rutherford (2006; SAVeg) classify vegetation units present within the wind farm sites as indicated in Table 5.1.

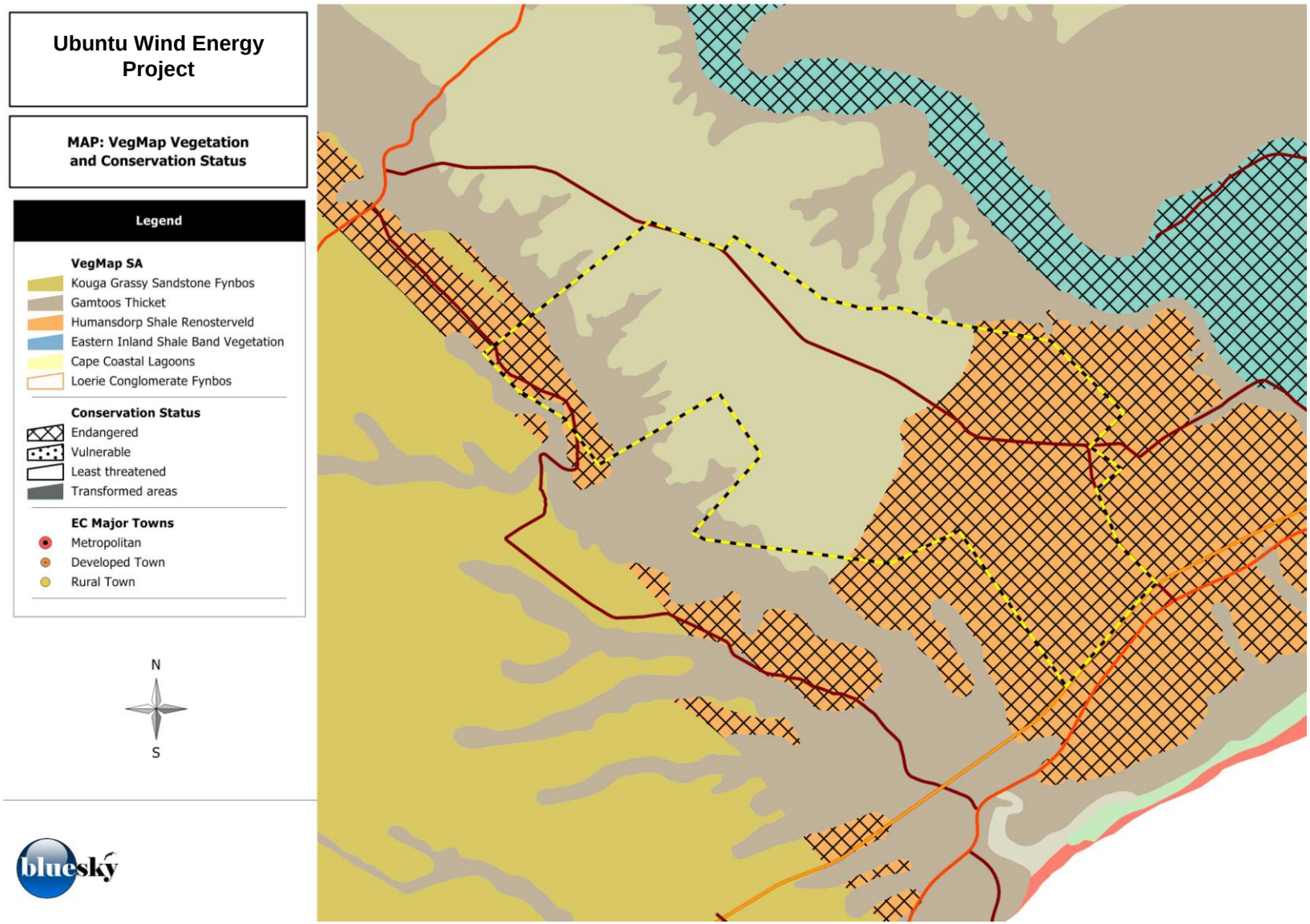


Figure 5-3: VegSA (Mucina & Rutherford) vegetation units and conservation status.

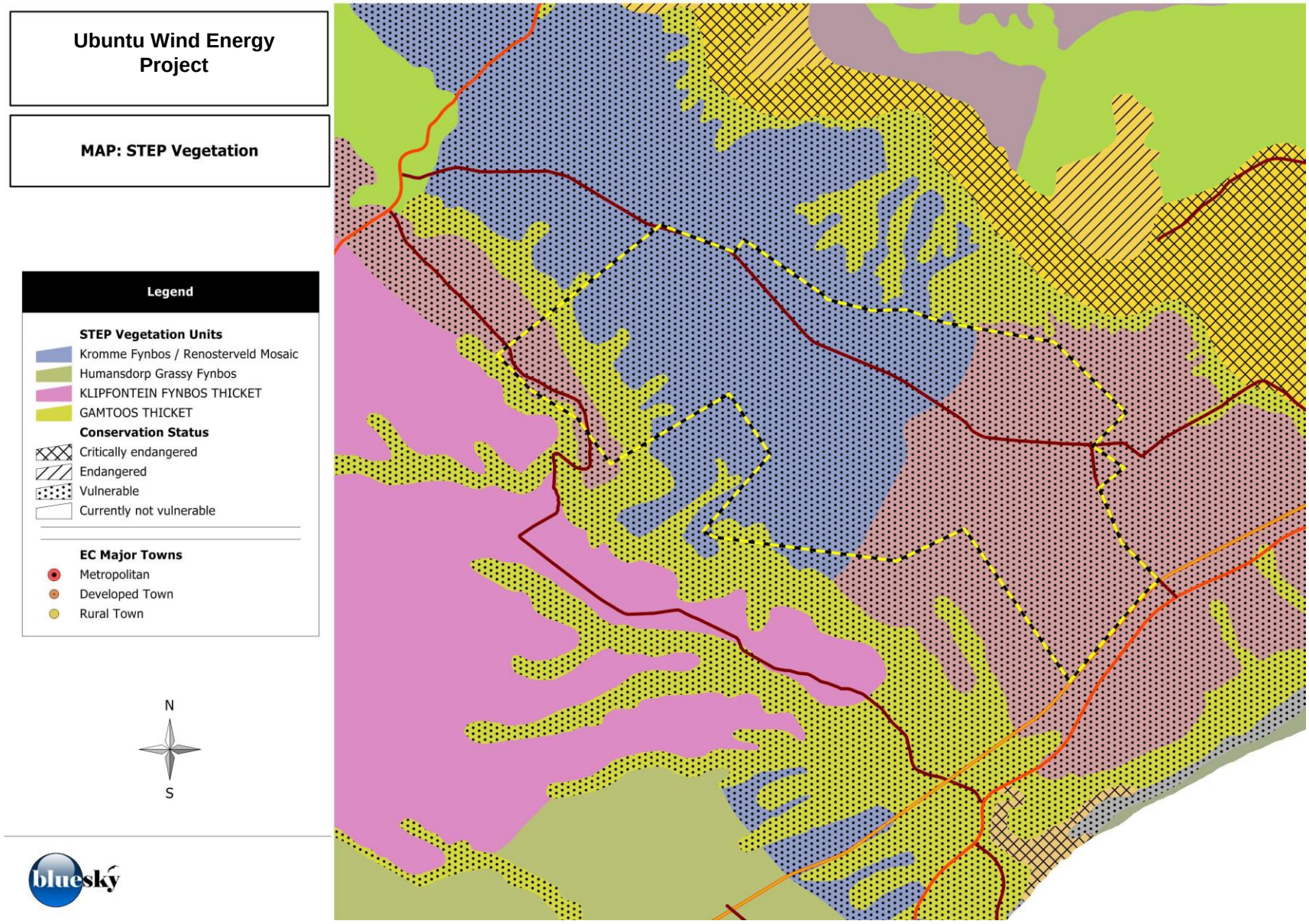


Figure 5-4: STEP vegetation units and conservation status

Table 5.1: Mucina & Rutherford (2006; SAVeg) vegetation classification and Conservation Status.

Vegetation Unit	Conservation Status
Humansdorp Shale Renosterveld	Endangered
Gamtoos Thicket	Least threatened
Loerie Conglomerate Fynbos	Least threatened

Mucina and Rutherford recognise Humansdorp Shale Renosterveld as having an endangered conservation status.

5.3.3.2 Sub tropical Ecosystem Planning

At a *regional* scale STEP provides regional planning guidelines for the Eastern Cape/Western Cape area, where Thicket vegetation occurs. The respective STEP vegetation units and their respective conservation statuses within the proposed wind farm sites are presented in Table 5.2.

Table 5.2: STEP vegetation units and conservation status.

Vegetation Unit	Conservation Status
Gamtoos Thicket	Vulnerable
Kromme Fynbos / Renosterveld Mosaic	Vulnerable
Kabeljous Renoster Thicket	Vulnerable

5.3.3.3 Riparian Zones and Ecological Support Areas

The term "wetland" is a generic term for all the different kinds of habitats where the land is wet for some period of time each year, but not necessarily permanently wet. Water which falls as rain in the catchment and which is not lost to the atmosphere through evaporation or transpiration, moves through the catchment to the sea. Wetlands occur where the landform (topography) or geology slows down or obstructs the movement of water through the catchment (e.g. where it is very flat), or where groundwater surfaces causing the surface soil layers in the area to be temporarily, seasonally or permanently wet. This provides an environment where particular plants (hydrophytes) that are adapted to wet conditions tend to grow in abundance. The plants in turn affect the soil and hydrology (e.g. by further slowing down the movement of water and by producing organic matter that may accumulate in the soil).

Three key features can be used to distinguish wetlands:
Abundance of water: the land is covered by water, or has saturated soil at some time when the soil is biologically active. Saturated soil is that which contains sufficient water for long enough for reduction to occur.
Saturated (reduced) soil: the soil is hydric i.e. the soil has been depleted of oxygen through the chemical process of reduction, which in turn results in the presence of redoximorphic features, e.g. features formed by the process of reduction, translocation and oxidation of iron and manganese.
Hydrophytic vegetation: plant life adapted to growing in saturated soils. Some plants have adapted to life in wetlands and are called hydrophytes (this means that they are "water loving", or rather, anoxia tolerant). These specialized plants have adapted to grow in the anaerobic conditions of hydric soils.

A. Potential Vulnerabilities of, and threats to wetlands

Threats to the wetlands as a result of the proposed development potentially include:

- Introduction to the system of:
  - alien and invasive terrestrial vegetation,
  - aquatic alien vegetation
- Pollution sources affecting water quality and water quantity (stormwater runoff and siltation);
- Development that compromises long-term ecosystem functioning;
- Infilling/direct loss of aquatic habitats;
- Drainage of wetlands;
- Separation from up- and downstream wetland systems - e.g. source areas, seepage lines, drainage corridors;
- Changes in water table (increases and decreases in level and changes in quality);
- Removal or degradation of indigenous vegetation in the system;
- Catchment hardening (loss of catchment habitat and ability to absorb flows, and increased stormwater runoff), encroachment, fragmentation/loss of corridors; and
- Insufficient buffering between existing wetlands and developments.

B. Recommended Management Guidelines

The following guidelines should be implemented and adhered to when impacts to wetlands are likely to occur:

- Flow regimes must be able to maintain the wetland at its present extent and habitat quality, as well as downstream ecosystems;
- Hydrological connections between systems should be preserved;
- Existing ecosystem linkages/connectivity must be maintained at an appropriate scale; and
- Buffers (i.e. building setbacks, preferably natural vegetation) should:
  - protect wetland systems from specific identified threats, as relevant to each system;
  - provide sufficient space to allow for future rehabilitation and buffering of that ecosystem;
  - protect the ecosystem health and integrity of receiving ecosystems.

5.3.4 Description of Vegetation, Flora and Fauna

5.3.4.1 Perceived Reference State (PRS)

A. Gamtoos Thicket

Intact thicket vegetation located in kloofs, incised slopes adjacent to perennial and annual streams and watercourses to upper reaches of drainage lines. Most likely to have been of a climax nature, with pioneer species along the fringes, controlled by fire occurrence on the ecotone within the grassy fynbos and renosterveld vegetation.

Distribution: Eastern Cape Province: coastal basin of the Gamtoos River valley, south of the Baviaanskloof Mountains and along some smaller river valleys such as that of the Kromme River. Also found north of the Baviaanskloof Mountains in more xeric conditions on some low ridges south and southeast of Steytlerville.

Altitude: 0–700 m.

Geology and Soils: Mostly restricted to rocky, sandy-loamy soils derived from shale and sandstone of the Bokkeveld Group (Ceres and Tarka Subgroups) and Table Mountain Group (Nardouw Subgroup) as well as the Jurassic Enon conglomerates. Also found are fairly shallow clayey soils derived from the Gamtoos Group limestone, phyllite and arenite of the Kaan and Klein River Formations (Namibian Erathem).

Vegetation and Landscape Features: On low mountain slopes in steeply sloping areas and on low ridges. Tall, dense thicket, where both the trees and shrubs and the succulent components are well represented. Few distinct strata can be differentiated within much of the vegetation as the lower and upper canopies are intertwined often together with a wide variety of liana species linking the understory species with the canopy. Occurs mostly as a fragmented community with large, dense stands restricted to south- and south-west facing slopes that are protected against fires. The structure of the dense stands of Gamtoos Thicket is similar to that of the Sundays thicket, but it differs in the dominant species.
NSBA Conservation status: Least threatened
NSBA Conservation status: Least threatened. Target 19%. A total of 6% of this vegetation unit is protected in statutory conservation areas: Baviaanskloof Conservation Area, Guerna and Berg Plaatz Wilderness Areas as well as Stinkhoutsberg, Kabeljousrivier, Loerie Dam and Seekoeirivier Nature Reserves. Private conservation areas (Hankey Forest Reserve No. 1, Monteaux Game Ranch, Lombardini Game Farm, Kabeljous River Natural Heritage Site, and Kromme River Mouth, Eastcot and Loerie Dam Nature Reserves) also protect some patches of this vegetation type. Some 12% of Gamtoos Thicket has been altered by cultivation and 1% by urbanisation. The alien *Atriplex lindleyi* subsp. *inflata* has invaded many degraded arid thicket areas, especially on soils with a high clay content. Erosion is variable.

B. Humansdorp Shale Renosterveld:

Intact vegetation as per description above located on lower slopes towards the coast. Most likely to have been elements from this vegetation within the southern portions of the site.
NSBA Conservation status: Endangered
Distribution: Eastern Cape Province: Three swathes: from Jeffrey's Bay and Marina Glades near the coast inland past Humansdorp to the lower reaches of the Dieprivier near Two Streams; the Mondplaas/Mondhoek area near the mouth of the Gamtoos River stretching inland in a series of patches south of the Gamtoos River to west of Patensie; between thicket and fynbos types from Burghley Hills to Rocklands and the Dell to Nooitgedacht southwest of Uitenhage. Coastal forelands from Humansdorp to Port Elizabeth.
Altitude: 20–360 m.
Geology & Soils: Clay and loams derived from the Ceres Subgroup of the Bokkeveld Group shales. Plinthic catenas prominent. Land types mainly Ca and Bb.
Vegetation & Landscape Features: Best developed on loamy soils on open flats, mostly derived from sandstone and shale of the Baviaanskloof Formation but also those of the Ceres subgroup of formations. Characteristic is the abundance of Renosterbos (*Elytropappus rhinocerotis*), often with the grass component (*Themeda triandra*) well developed soon after a fire. Soon after a fire *Aspalathus nivea* also tends to be common here, along with other Fynbos elements (e.g. *Erica glandulosa*), but they are never dominant. Some species (e.g. *Cyrtanthus wellandii*, *Delosperma patersoniae*, and *Gasteria nitida* var. *armstrongii*) are endemic to this unit. Some parts of this may be of recent (< 300 years) origin as landowners seem to use fire to remove the Thicket vegetation to favour the palatable grass component. The subsequent frequent burning and heavy grazing of the grass component probably enabled Renosterbos to increase in density, to become the present dominant species in most of the areas. *Aloe africana* is often abundant in this unit, even in the matrix Renosterveld where it may act as a precursor for Thicket clumps, or alternatively be a remnant of the Thicket clumps.
Conservation: Endangered. Target 29%. None conserved in statutory conservation areas and only 6% enjoys protection on private land (Thaba Manzi and Lombardini Game Farms). Some 61% already transformed (cultivation). Erosion very low and low.

C. Loerie Conglomerate Fynbos

Distribution: Eastern Cape Province: Hankey Valley on both sides of the Gamtoos River, from Andrieskraal to Mondplaas on the south-western side, and Patensie to Thornhill on the north-eastern side. Also found in the lower Kwazunga Valley above Springfield and Rooikrans near Uitenhage. Altitude: 80–400 m.
Geology & Soils: Acidic, mostly clay-loam, Glenrosa and Mispah soils and conglomerates associated with shales and conglomerates of the Karroo Uitenhage sequence.
Vegetation & Landscape Features: Moderately undulating plains dissected by major rivers. Vegetation low shrubland or grassland with sparse emergent tall shrubs, and rich in succulents and geophytes. Structurally these are graminoid, asteraceous and proteoid fynbos types.
NSBA Conservation status: Least threatened. Target 23%. Some 11% statutorily conserved in the Groendal Wilderness Area. Small patches are also found in the private Kabeljous River Natural Heritage Site. About 9% transformed (cultivation). Erosion very variable, including significant areas of high and moderate erosion, but also very low in some areas.

5.3.4.2 Vegetation Communities - Present Ecological State (PES)

A number of distinct vegetation communities are present within the site (Figure 5.5):
A. Shale Renosterveld community;
B. Loerie Conglomerate Fynbos
C. Gamtoos Thicket
D. Seeps, Wetlands and Drainage Lines
E. Transformed vegetation.

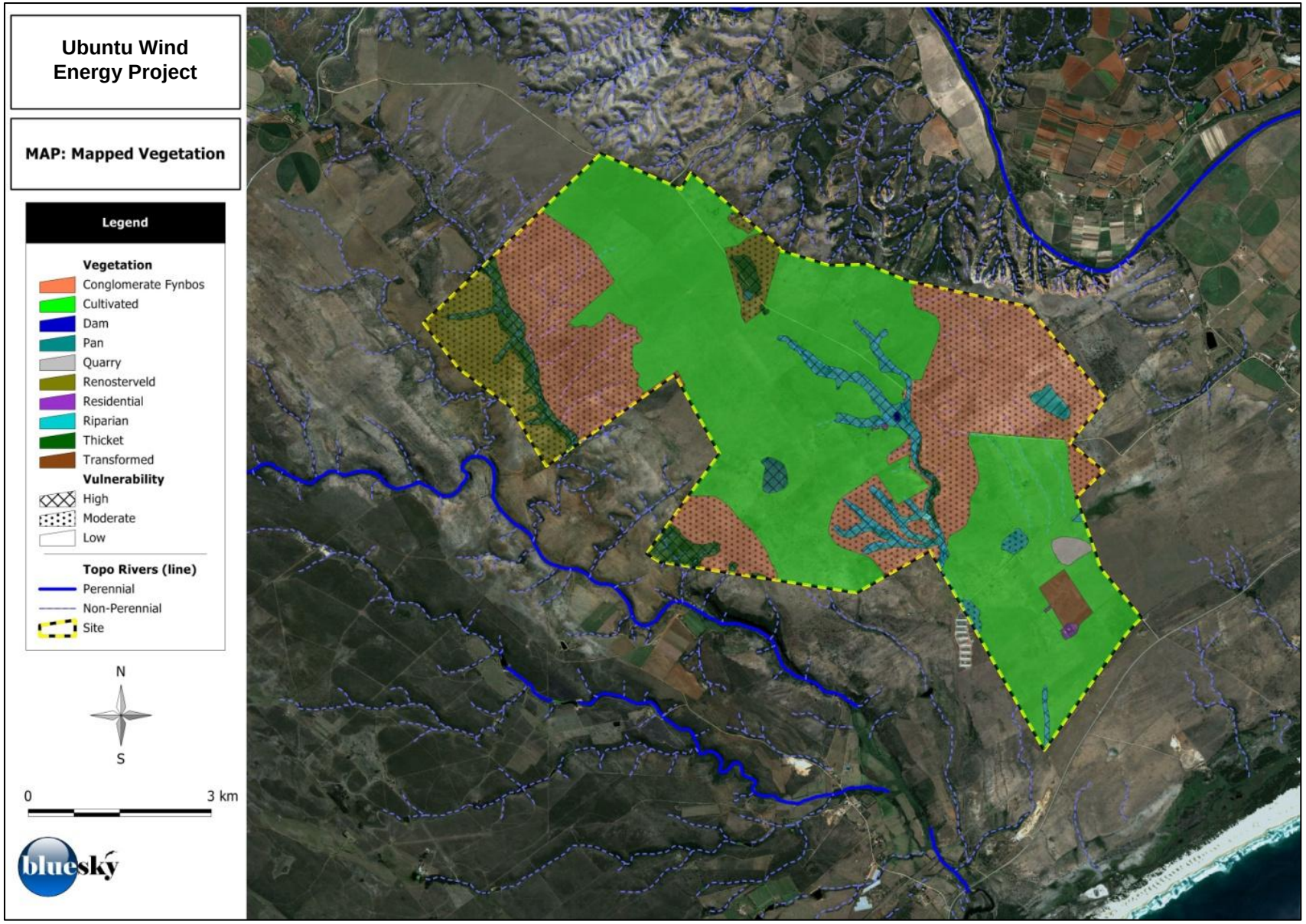


Figure 5-5: Mapped Vegetation communities with respective ecological sensitivity indicated.

A. Shale Renosterveld community

Some elements of this unit (Figure 5-6 to Figure 5-9) are present with *Elytropappus rhinocerotis* dominating degraded areas. Mostly transformed as a result of cultivation. The Renosterveld where not invaded and disturbed or transformed, tends to be typical of the vegetation types. Excessive burning is clearly evident for the majority of this unit within the site. Species diversity becomes very poor and is dominated by a few key fire-resistant species (such as *Bobartia sp.,* and *Watsonia sp.).* The unit tends to be most intact in areas having shallow soil, often associated with or surrounding the distinct rocky refugia (*Metalasia aurea* is a good indicator of these areas). Where intact, it is composed of a mix of small shrubs, herbs, grasses and restios typically less than 50 cm in height. Typical and common species include, but are not limited to, *Agathosma gonaquensis, Bobartia orientalis, Boophone disticha, Clutia alaternoides, Disparago ericoides, Elytropappus rhinocerotis, Erica cerinthoides, Euryops munitus, Gerbera ambigua, Helichrysum anomalum, Ischyrolepis sp., Metalasia densa, Montinia caryophyllacea, Passerina falcifolia, Selago corymbosa, Tephrosia capensis, Thamnochortus sp, Themeda triandra* and *Watsonia pillansii.*

Figure 5-6: Typical regenerating Renosterveld

Figure 5-7: Typical Renosterveld

Figure 5-8: Typical Pasture with re-establishment of Renosterveld elements

Figure 5-9: Typical Pasture with return of Renosterveld elements

It provides habitat for a number of protected species. Most of this habitat is likely to be lost to development as per the current development plan. Ecological functioning tends to be disturbed in this habitat, where excessive fire and cultivation/tilling has occurred. The retention of portions

of this within the Open Space Management System is critical to form linkages with outlying areas to the west and east. Disturbance within the area demarcated as intact Grassy Fynbos tends to be minimal, with a few footpaths as well as some light alien infestation being present.

- Community structure varied, dependant on fire and grazing regimes;
- Large areas intact, but degradation evident to varying degrees as a result of historical land-use practices in the area;
- A few severely degraded (non-restorable) portions of this vegetation type are present.

Implications for the proposed windfarm

- Loss of intact vegetation dependant on final layout and limited to footprint of turbines, roads, cables and other infrastructure.
- During micro-siting, intact areas of Fynbos should be retained in favour of more degraded patches or rocky areas, where some fire-protected niches may be present.

B. Loerie Conglomerate Fynbos

The Conglomerate Fynbos (Figure 5-10 to Figure 5-13) where not invaded and disturbed or transformed, tends to be typical of the vegetation types. The unit tends to be most intact in areas having distinctly shallow, stony soils soil. Where intact, it is composed of a mix of small shrubs, herbs, grasses and restios typically less than 50 cm in height. *Metalasia densa* and *Metalasia aurea* are good indicators in this unit, which tends to be adapted to habitats where soils are shallow and fire tends to be excluded. Typical and common species include, but are not limited to *Erica pectinifolia, Leucadendron salignum, Leucospermum cuneiforme, Berkheya heterophylla, Helichrysum spp., Indigofera spp., Hibiscus spp., Hermannia spp., Gerbera spp., Ledebouria ensifolia, Morella serrata, Oedera genistifolia, Selago corymbosa, Senecio spp., Passerina falcifolia. Clutia sp., Disparago ericoides, Elytropappus rhinocerotis, Ischyrolepis sp., Montinia caryophyllacea, Passerina falcifolia, Selago corymbosa, Ledebouria ensifolia* and *Themeda triandra. Some typically thicket elements also occur, including Diospyros dichrophylla, Euclea crispa, Grewia occidentalis* and *Scutia myrtina.*

Figure 5-10: Typical Conglomerate Fynbos (northern site).

Figure 5-11: Typical Conglomerate Fynbos (northern site).

Figure 5-12: Typical Conglomerate Fynbos (southern site).

Figure 5-13: Typical Conglomerate Fynbos (close-up).

It provides habitat for a number of protected species. Minimal loss of this habitat is likely to occur should the current development plan alternatives be implemented. Ecological functioning tends to be largely intact in this habitat where excessive fire and cultivation/tilling has not occurred. The retention of portions of this within the Open Space Management System is critical to form linkages with outlying areas to the west and east. Disturbance within the area demarcated as intact Conglomerate Fynbos tends to be minimal with a few footpaths as well as some light alien infestation being present.

- Community structure varied, dependent on fire and grazing regimes;
- Large areas intact, but degradation evident to varying degrees as a result of historical land-use practices in the area;
- A few severely degraded (non-restorable) portions of this vegetation type are present.

Implications for the proposed windfarm

- Loss of intact vegetation dependant on final layout and limited to footprint of turbines, roads, cables and other infrastructure.
- Loss of Conglomerate Fynbos is restricted to a few sites outside of cultivated areas and the expected loss is unlikely to have any significant impact at a regional level.
- During micro-siting, intact areas of Conglomerate Fynbos should be retained in favour of more degraded patches or rocky areas, where some fire-protected niches may be present..

C. Gamtoos Thicket

Intact thicket vegetation (see Section 5.3.4.1 A) remains in kloofs, incised slopes adjacent to perennial and annual streams and watercourses. This unit is in a largely natural state although infestations by *Acacia mearnsii* are present and the original vegetation has been lost through direct clearing and in areas flooded by dams. The thicket (Figure 5-14 & Figure 5-15) tends to be limited to slopes around drainage lines, with some pockets in fire protected areas within the grassy fynbos mosaic.

Figure 5-14: Typical Gamtoos Thicket

Figure 5-15: Typical Gamtoos Thicket

Typical Gamtoos Thicket elements are common and include: *Abutilon sonneratianum, Allophylus decipiens, Aloe africana, Aloe ferox, Aloe speciosa, Apodytes dimidiata, Aristida congesta, Asparagus spp., Azima tetracantha, Cotyledon orbiculata, Cotyledon campanulata, Cussonia thyrsiflora, Ehretia rigida, Euclea racemosa, Euclea undulata, Euphorbia grandidens, Euphorbia triangularis, Gasteria nitida, Gymnosporia capitata, Gymnosporia spp., Hippobromus pauciflorus, Jasminum angulare, Lauridia tetragona, Maerua cafra, Mystroxylon aethiopicum, Olea europaea subsp africana, Pappea capensis, Pittosporum viridiflorum, Ptaeroxylon obliquum, Pterocelastrus tricuspidatus, Rhus incisa, Sansevieria hyacinthoides, Schotia afra var afra, Scolopia zeyheri, Tarchonanthus camphoratus, Grewia occidentalis, Scutia myrtina and Sporobolus africana*

Implications for the proposed windfarm

- Loss of intact vegetation dependent on the final layout and limited to the footprint of the turbine towers, roads, cables and other infrastructure and likely to be very limited within the site.
- Preferably, since Thicket clumps tend to be sparse and provide a specialised habitat within the grassy matrix, these clumps should be avoided during final micro-siting.

D. Seeps, Wetlands and Drainage Lines

The seasonal wetlands (Figure 5-16 to Figure 5-19) can be distinguished by having a variety of short grasses present. No species of special concern were noted to be present within the pans.

Figure 5-16: Typical Riparian Seep along a drainage line with short seasonal grasses

Figure 5-17: Seasonal Wetland with typical seasonal grasses dominating

Figure 5-18: Seasonal Wetland situated in the middle of the site with isolated bushclumps around its periphery

Figure 5-19: Excavated dam within a large wetland situated in the middle of the site

Typical grass species include: *Cynodon dactylon, Ehrharta calycina, Eragrostis capensis, Ficinia sp., Melinis repens, Panicum maximum, Pennisetum clandestinum, Sporobolus africana, Stenotaphrum secundatum and Themeda triandra.*

Implications for the proposed windfarm

- Loss of intact vegetation dependent on the final layout and limited to the footprint of the turbine towers, roads, cables and other infrastructure.
- Changes to water regimes may alter species composition in the long term.

E. Transformed vegetation.

The transformed areas (Figure 5-20 to Figure 5-23) in the site tend to have a low biodiversity (predominantly grasses and some herbs) often with a moderate to high density of alien species and are thus of limited conservation importance and most suited to be used for development.

Figure 5-20: Transformed area around homesteads with some trees (regenerating thicket clumps and introduced species).

Figure 5-21: Cultivated land with some regeneration of shrub elements

Figure 5-22: Typical pastures dominating the majority of the site

Figure 5-23: Extensive transformed pastures throughout the site

Typical grass species include *Digitaria sp., Pennisetum clandestinum, Stenotaphrum secundatum* and *Themeda triandra. P*rotected species were however noted within the disturbed areas, mostly common widespread species, which are conducive to relocation.

- The areas adjacent to the drainage lines are however important in terms of drainage and the ecological corridor and buffer areas should be retained even if transformed.
- A few severely degraded (non-restorable) and transformed areas are present along associated with pastures and farming infrastructure.

Implications for the proposed windfarm

- Areas where the footprint of the turbine towers, roads, cables and other infrastructure are located within transformed areas will have minimal loss of natural vegetation cover.

5.3.4.3 Terrestrial Habitat Vulnerability Assessment Method

An overall vulnerability assessment incorporating key vegetation and ecological indicators (summarised in Table 5.3) was made and includes the following key criteria:

- Relative levels of *intactness* i.t.o. overall loss of indigenous vegetation cover;
- Presence, diversity and abundance of *species of special concern* (weighted in favour of local endemic species);
- Extent of *infestation* (severity and overall ecological impact), as well as the degree to which successful rehabilitation could take place;
- Overall degradation incorporating above factors; and
- Relative importance of the vegetation communities relative to their regional conservation status - indicated as vulnerability of the area as a result of loss.

Intactness

Three basic classes are differentiated:

- **Low**: < 25 % of original vegetation has been removed/lost; and/or no species of special concern present that are critically endangered, endangered or having highly localised endemicity.
- **Moderate**: 25 - 75 % of original vegetation has been removed/lost; and or species of special concern present but not having high conservation status or high levels of endemicity.
- **High**: > 75 % of original vegetation has been removed/lost; and/or presence of species with a highly endemicity and/or high conservation status (endangered or critically endangered).

Alien Infestation

Three classes are differentiated:

- **Low**: no or a few scattered individuals of alien species;
- **Moderate**: individual clumps of invasive species present, but cover less than 50% or original area;
- **High**: dense, impenetrable stands of invasive species present, or cover > 50 % of area with substantial loss functioning. Rehabilitation will most likely require specialised techniques over an extended period (> 5 years).

Degradation

Overall degradation is determined from the above alien infestation and intactness scores according to the following matrix:

Intactness	**Infestation**		
	Low	**Moderate**	**High**
High	Pristine	Near Pristine	Moderately Degraded
Moderate	Near Pristine	Moderately Degraded	Severely Degraded
Low	Moderately Degraded	Severely Degraded	Transformed

Overall Sensitivity score

Overall sensitivity of the vegetation within the site is calculated according to the following matrix which combines degradation and overall conservation status of the vegetation units of the site.

Degradation	**Conservation Status**			
	Least threatened	**Vulnerable**	**Endangered**	**Critically Endangered**
Severely degraded/ Transformed	Low	Low	Moderate	Moderate - High
Moderately degraded	Low	Moderate	High	High
Ecologically Pristine or near Pristine	Moderate	Moderate - High	High	Very High (No-Go area)

- Areas scoring an overall low sensitivity are those areas that are:
    - highly degraded or transformed and it is unlikely that they could be rehabilitated to a normal functioning state without extreme effort and expense.
    - includes areas that have a low conservation status.

- *This includes the portions of the site that are associated with homesteads and cultivated areas and pastures, or where there is very dense alien infestation. Loss of these areas will furthermore not significantly compromise the current conservation status of the vegetation unit.*

- Areas scoring an overall moderate sensitivity are those areas that:
  - contain a reasonably intact habitat;
  - have moderate, low or no alien infestation,
  - a *Vulnerable* or lower conservation score and with minimal loss of ecological functioning.

  - *On site the intact portions of Humansdorp Shale Renosterveld and Loerie Conglomerate Fynbos tend to have a moderate sensitivity score.*

- Areas scoring an overall high sensitivity are those having:
  - an important ecological function (including ephemeral wetland pans) , having specialized habitats (rocky outcrops with associated specialised flora and/or fauna) or steep slopes;
  - a critically endangered conservation status or an endangered conservation status where ecological processes have not been irreversibly compromised.
  - *High sensitivity areas would include wetlands, seeps and riparian areas, which although have a low regional conservation status provide a specialised habitat that is absent from the surrounding general vegetation units. Intact Thicket clumps have also been scored as having a High Sensitivity as they tend to be isolated islands and have an important ecological function in the general area.*

5.3.4.4 Ecological Indicators

A summary of key Present Ecological State indicators for the area are presented in Table 5.3 below. Since historical data are lacking some assumptions have been made where necessary.

Table 5.3: Present Ecological State indicators of the study area.

Aspect	Description
Landscape Description	
Aspect, Slope, Topography	Depending on position relative to drainage lines (which run in a southerly direction) the sites are relatively flat to gently undulating plateaux surrounded on the east and west with deeply incised valleys
Substrate	Quartzite and sandstone
Community Description	
Vegetation units	Humansdorp Shale Renosterveld on undulating plateaux and Gamtoos Thicket along slopes of incised drainage lines; Humansdorp Shale Renosterveld varies in composition from a shrubby composition on shallow-soil and rocky hilltops with a grassy component in valleys and seep areas where soils are deeper and wetter. Loerie Conglomerate on slopes where rocky exposed soils are present.
Total Cover (%)	± 95 % (remainder includes dams, excavations and areas where bare soil is present (i.e. outcrops)
Tree Canopy Cover (%)	< 5 % (thicket plus some scattered invasives)
Shrub Cover (%)	± 10 % (within Fynbos and Renosterveld)
Herb Cover (%)	± 20 %
Grass Cover (%)	> 60 % (includes pastures)
Bare soil/rock (%)	< 5 % (includes outcrops, dams and excavated areas)

Aspect	Description
Estimated Tree Height (m)	< 5 m (excluding alien and exotic species around residences)
Disturbances, current land uses and sources of degradation	
Human disturbances/impacts	Cattle grazing and cultivation related disturbances, pastures, excavations, dams, roads, dwellings and other buildings
Habitat fragmentation	Extensive in pasture areas and relating to existing gravel roads and dams along drainage lines and seeps and fenced areas where some constraints on faunal movement may occur.
Invasive Alien Plants	Some isolated clumps present, predominantly *Acacia spp.,* but largely insignificant in extent and proliferation.
Relative remaining intact habitat:	Areas largely transformed, with managed pastures accounting most of the site
Grazing (livestock)	Site used extensively for cattle grazing, but at low density
Hunting	None evident
Conservation (flora)	No formalised conservation within the site, but fenced game farm present.
Wetlands/Seeps	Dominated by grasses and herbaceous species with sedges and other facultative wetland species. Wetlands and seep areas are extensive and will be dealt with in a separate wetland specialist report.
Recreational (sport)	None observed
Sensitivities	
Conservation importance	Moderate to Low for Loerie Conglomerate Fynbos and Humansdorp Shale Renosterveld and Moderate to High for Gamtoos Thicket
Topography	Topography relatively flat to gently undulating, with deeply incised drainage lines running towards the south and east.
Rehabilitation potential	Rehabilitation after disturbance highly possible, where loss of topsoil is not extensive.
Community structure	Excessive fire, cultivated pastures and historical grazing has impacted community structure. Some degradation indicators present.
Flora	Natural indigenous vegetation with some pastures and transformed areas.
Fauna	Some reptiles present in outcrops indicated as being of special concern as per faunal recommendations. Amphibians associated with wetlands and seeps and may migrate during rainfall periods.
Indigenous Species of Special Concern	See Table 5.4 above for list
Alien invasion	Few scattered clumps aliens throughout the area, tending to be non-invasive when occurring.
Ecological Processes	
Coastal dunes	None present on the site
Climatic gradients	None present on the site
Drainage Lines/ Riparian Vegetation	Important from an ecological process perspective within rivers and associated drainage lines. Riparian vegetation present in seeps and wetlands and associated with dams.
Refugia	Distinct rocky outcrops present and abundant on hilltops and along ridges along incised drainage lines. Provides habitat for floral and faunal species of special concern. Whilst relatively abundant on site the total refugia habitat is limited in extent and distribution.
Fire	The frequency of fires has probably changed significantly in relation to the PRS. The frequency of fires in the study area is unknown, but expected to be relatively frequent in grassland and grassy fynbos vegetation. Changes to community structure are evident due to excessive fire, with indicators of excessive fire evident throughout the site and extensive in places.
Ecotones/Tension zones	Habitat fragmentation (pastures and roads) has increased the area covered by ecotones in relation to the PRS
Erosion	Serious erosion largely absent due to levelness of the site, some surface erosion evident around severely disturbed areas especially dams
Carbon storage	Grassland and Fynbos/Renosterveld is a moderate to low carbon accumulator; Thicket is a moderate to High carbon accumulator
Medicinal plants	No medicinal species were noted in abundance, but some species occurring have been recorded for medicinal uses.

Aspect	Description
Food	The value of the study area as a source of food is expected to be insignificant, with food plants being limited to a few tree species. Extensive loss of indigenous vegetation cover would have been accompanied by loss of indigenous food plants
Fuelwood (availability)	No collection observed, although bush clearing would have generated wood which may have been used historically
Building materials	None evident, trees largely confined to ravines
Grazing	Cattle present with a history of sheep farming (Stocking density moderate to high so grazing impact tends to be significant)
Barriers to gene dispersal	The erection of fences and roads will prevent the movement of some fauna (terrestrial) and hence plant propagules (i.e. as their agents of dispersal)
Corridors for gene dispersal	Fences and utility structures (e.g. transmission lines, telephone lines) that act as perches for birds may be viewed as corridors for bird mediated seed dispersal. These may not follow the dispersal routes in the PRS (e.g. ridges, drainage lines) and increase dispersal of certain species (bird dispersed thicket pioneers)
Conservation importance	
Current Distribution (extent)	Loerie Conglomerate Fynbos is relatively widespread in the region, Gamtoos Thicket is also widespread, but restricted to kloofs and river valleys. Humansdorp Shale Renosterveld tend to be transformed and degraded through agricultural activities.
Relative Conservation importance	Loerie Conglomerate Fynbos and Humansdorp Shale Renosterveld vegetation has a low local conservation importance where intact, Gamtoos Thicket has a moderate to high local conservation importance. tend to be transformed and degraded through agricultural activities.
Overall Intactness	Excessive runaway fire and land management (cultivation, grazing and burning) have altered the unit from the PRS, and besides localised areas and specialised habitats, the general vegetation is transformed and degraded rather than intact.

5.3.4.5 Floral diversity

A total of **218** plant species was recorded within the site (for complete species list see Appendix 5.1). Field sampling was undertaken in the late summer and autumn (January and May 2011), but it was completed at the end of a particularly dry spell and may not be comprehensive in that certain plants are only visible for short periods of time during the year. This, however, is unlikely to be a significant issue since sites should be surveyed before construction and micro-sited should it be necessary to avoid any populations of SSC found to occur that could be deemed to be of significant conservation importance.

A. Protected Flora

Thirty six protected plant species occurred within the site (Table 5.4). Most of the species are widely distributed and it is unlikely that the proposed development would have any significant impact on populations. It is however strongly recommended that individuals of *Cyrtanthus obliquus*, *Delosperma ecklonis, Erepsia aristata* and *Gasteria pulchra* be rescued and relocated before construction commences.

Table 5.4: Indigenous Species of Special Concern.

Botanical Name*	Family	Status**	Regional Distribution/ Endemism+	Distribution within the site
Aloe africana	Asphodelaceae	PNCO	Regionally Widespread and Common	Fynbos/ Renosterveld, Thicket
Aloe speciosa	Asphodelaceae	PNCO	WC, EC	Thicket
Asparagus aethiopicus	Asparagaceae	PNCO	Namaqualand to Transkei	Thicket
Asparagus capensis	Asparagaceae	PNCO	Namibia to Transkei	Fynbos/ Renosterveld
Asparagus racemosus	Asparagaceae	PNCO	Widespread	Thicket
Asparagus striatus	Asparagaceae	PNCO	WC, EC, FS	Thicket
Bobartia orientalis	Iridaceae	PNCO	Widespread	Fynbos/ Renosterveld
Boophone disticha	Amaryllidaceae	PNCO	Southern Africa, East Africa	Widespread and common in intact outcrops
Bulbine frutescens	Hyacinthaceae	PNCO	Widespread	Fynbos/ Renosterveld
Chasmanthe aethiopica	Iridaceae	PNCO	EC, WC	Fynbos/ Renosterveld
Cyrtanthus obliquus	Amaryllidaceae	PNCO	Humansdorp, PE	Fynbos/ Renosterveld, outcrops
Delosperma ecklonis	Mesembryanthemaceae	PNCO	Humansdorp, Uitenhage	Fynbos/ Renosterveld, outcrops
Disa sp.	Orchidaceae	PNCO		Fynbos/Renosterveld, outcrops
Erepsia aristata	Mesembryanthemaceae	PNCO	Humansdorp, Baviaanskloof, endemic	Fynbos/Renosterveld,
Erica cerinthoides	Ericaceae	PNCO	Widespread, EC, WC	Fynbos
Erica pectinifolia	Ericaceae	PNCO	Widespread, EC, WC	Fynbos
Gasteria pulchra	Asphodelaceae	PNCO	Hankey, Humansdorp	Fynbos/ Thicket, outcrops
Gladiolus longicollis	Iridaceae	PNCO	Widespread	Fynbos/ Thicket, outcrops
Haemanthus sp.	Amaryllidaceae	PNCO		Fynbos/ Thicket, outcrops
Hypoxis angustifolia	Hypoxidaceae	PNCO	Widespread	Fynbos/ Thicket, outcrops
Ischyrolepis sp	Restionaceae	PNCO	Widespread	Fynbos/ Thicket
Ledebouria ensifolia	Hyacinthaceae	PNCO	Widespread	Fynbos/ Thicket
Leucadendron salignum	Proteaceae	PNCO	Widespread	
Ornithogalum longibracteatum	Hyacinthaceae	PNCO	Widespread	Fynbos/ Thicket
Pelargonium reniforme	Geraniaceae	PNCO	Widespread	Thicket, Fynbos
Pittosporum viridiflorum	Pittosporaceae	NFA	Widespread	Thicket
Protasparagus densiflorus	Asparagaceae	PNCO	Widespread	Fynbos/ Renosterveld
Protea neriifolia	Proteaceae	PNCO	EC, WC	Fynbos
Romulea minutiflora	Iridaceae	PNCO	WC, EC	Fynbos/ Thicket
Satyrium membranaceum	Orchidaceae	PNCO	Widespread	Fynbos/ Thicket, outcrops
Schotia afra var afra	Fabaceae	NFA	Widespread	Thicket
Sideroxylon inerme	Sapotaceae	NFA	Widespread	Thicket
Thamnochortus sp	Restionaceae	PNCO	Widespread	Fynbos/ Renosterveld

Botanical Name*	Family	Status**	Regional Distribution/ Endemism+	Distribution within the site
Watsonia pillansii	Iridaceae	PNCO	Widespread	Fynbos/Renosterveld
Watsonia pillansii	Iridaceae	PNCO	Widespread, EC, WC	Fynbos/ Renosterveld, outcrops

*Highlighted Species are cited as being endemic to the vegetation unit; ** PNCO Protected by the Provincial Nature Conservation Ordinance; NFA Protected by the National Forests Act of 1998; +EC - Eastern Cape, WC - Western Cape, KZN - Kwazulu-Natal

B. Removal of plants on site for rehabilitation purposes

Conservation worthy/ horticulturally valuable plant species within areas to be cleared that are able to survive translocation, and as indicated by a suitably qualified and trained botanical specialist, must be removed prior to site clearing for later use for rehabilitation purposes. The person or organisation responsible for the relocation of these species must work in advance of the vegetation clearing team, and locate as well as relocate individual plant specimens. Removed plants must be excavated by hand in such a way that the plants, especially the roots are not damaged. Plants can be planted out temporarily either in plastic bags or in-situ in an area that is not affected by the proposed development. Should bags be used, they must be large enough to contain the entire plant's root system. Bags must be filled with local top soil material. Plants should be watered regularly, protected from damage and otherwise maintained to ensure healthy growth. On completion of the civil work plants should be re-planted out in scattered clumps at areas on the site to be rehabilitated as directed by the Environmental Control Officer (ECO).

Individuals of all removed species will need to be housed in a nursery until such time as relocation areas have been identified.

C. Invasive Flora

Three invasive alien plant species were present within the sites (Table 5.5), but not in great abundance. It is recommended that they are removed and/or poisoned to prevent spread into adjacent areas. For a complete species list see Appendix 5.1

D. Eradication protocol

Specific eradication and management procedures must be stipulated in the EMP as to the methods to be implemented to remove and control the various alien invasive plant species as they tend to require species-specific techniques. Introduced weed species do not require removal but management is advised to prevent proliferation as a result of disturbance (i.e. on road verges, etc).

Table 5.5: Alien Invasive plants and common weeds present and CARA classification.

Botanical Name	Common name	Family	Category*	Extent
Acacia cyclops	Rooikrantz	Mimosoideae	CARA 2	Scattered individuals/clumps
Acacia mearnsii	Black Wattle	Mimosoideae	CARA 2	Scattered individuals/clumps
Pinus spp.	Pine	Pinaceae	CARA 2	Homesteads

* **CARA 1**: Declared Weed; **CARA 2:** Declared Invader; see Appendix B.1 in EMP, Section B of this EIA Report for removal requirements.

5.3.4.6 Fauna

The faunal diversity of the central and western regions of the Eastern Cape, including Humansdorp and Jeffrey's Bay, is relatively well-known. However, this diversity has been affected by the long history of human impact in the region and the currently degraded state of much of the area surrounding the study sites. The proposed development involves actions that will compound this transformation.

The faunal assessment provides a review of the surviving terrestrial fauna and its diversity, the presence of threatened species and those of special concern, and the habitat associations of the species

A. Amphibians

Amphibians are an important and often neglected component of terrestrial vertebrate faunas. They are well represented in sub-Saharan Africa, from which approximately 600 species have been recorded (Frost 1985). Currently amphibians are of increasing scientific concern as global reports of declining amphibian populations continue to appear (Mccallum, M.L. 2007) ; and references therein). Although there is no consensus on a single cause for this phenomenon, there is general agreement that the declines in many areas, even in pristine protected parks, are significant and do not represent simple cyclic events. Frogs have been aptly called bio-indicator species whose abundance and diversity is a reflection of the general health and well-being of aquatic ecosystems. They are important components of wetland systems, particularly ephemeral systems from which fish are either excluded or of minor importance. In these habitats significantly, they are dominant predators of invertebrates, many of which may affect humans (e.g. as vectors of disease).
Diversity: Amphibians are the least diverse or species-rich group of terrestrial vertebrates in the region, where 15 species may occur.
Conservation status: No threatened amphibians or SSC have been recorded on the development site.
Alien and extralimital species: No alien or extralimital amphibian species are known in the region.
Habitat associations: The species are mostly associated with temporary and permanent water bodies and only the Bushveld Rain Frog (*Breviceps adspersus*), a terrestrial breeder independent of standing water for reproduction, is probably widely distributed throughout the fynbos habitat.

B. Reptiles

Of 421 reptiles recorded from South Africa, at least 144 occur in the Eastern Cape (Branch, 1998, plus subsequent studies). This diversity is greater than that of Western Europe, and reptiles form an important component of vertebrate diversity within the Province. They also have low mobility and high habitat specificity, particularly lizards and tortoises.
Diversity: Reptile diversity in the region is high, with 61 species known or likely to occur (Branch, 1988a; Branch 1998). This includes 28 snakes, 28 lizards, and 4 chelonians (Appendix 5.2 for a detailed list). They represent almost a third of all reptiles recorded from the Eastern Cape. The recent discovery of new populations of the critically endangered Elandsberg Chameleon (*Bradypodion teaniabronchum*) from the Zandriver Conservation area near Thyspunt (Burger per. comm.), emphasizes the need for more surveys in the area and to understand the ecology of these species. Commonly occurring reptiles are likely to include Puff Adders (*Bites arientans*), Brown House Snake (*Lamprophis capensis*), Cross Marked Sand snake (*Psammophis crucifer*), Cape Girdled lizard (*Cordylus cordylus*) and Red-sided Skink (*Tetradactylus homalocephala*)

Conservation status: Two species (nl. *Scelotes anguineus, Tetradactylus fitzsimonsi*) are endemic to the Eastern Cape Province and of potential conservation concern, have ranges that extend into the coastal region. The only species of major concern for the area is FitzSimons Long-Tailed Seps (*Tetradactylus fitzsimonsi*), an elongate, almost legless terrestrial gerrosaurid that is endemic to coastal fynbos habitats from Oyster Bay to Bridgemead. Its conservation status is Vulnerable.
Seven reptile species are also listed in CITES Appendix II, including monitors (*Varanus albigularis* and *V. niloticus*), one girdled lizard (*Cordylus cordylus*), three tortoises (*Stigmochelys pardalis, Homopus areolatus,* and *Chersina angulata*), and a chameleon (*Bradypodion ventrale*). All are common throughout much of the region, and/or further afield, and all are well protected in existing conserved areas with no evidence of illegal or unsustainable exploitation in the region. Their inclusion on CITES Appendix II is a precautionary measure covering all members of groups that are regularly involved in the international skin (monitor lizards) or pet trade (tortoises, chameleons and girdled lizards).

Alien and extralimital species: A number of reptiles have extended their ranges into the Eastern Cape, probably as a result of being transported during household removals and plant nursery deliveries. These include:
The nocturnal tropical house gecko (*Hemidactylus mabouia*) which is well established in numerous coastal towns (Port Elizabeth, Port Alfred, East London, etc), having expanded its range southwards from northern KwaZulu-Natal since 1960 (Bourquin 1987).
The diurnal Cape dwarf day gecko (*Lygodactylus capensis*) which is also expanding its range in the region, and established populations are known in Port Elizabeth and Grahamstown. It has also recently been observed in the Addo Elephant National Park (Branch unpubl. obs.), as well as in George. It was previously restricted to the Lowveld region and northern KwaZulu-Natal.

Habitat associations: The majority of reptiles within the region are associated with the the fynbos habitat, although some (e.g. the burrowing skinks) are particularly associated with sandy patches. No reptile is linked solely to wooded habitats, although a number of arboreal species (e.g. Southern dwarf chameleon, Tasman's girdled lizard, and boomslang) may utilize forest edges or clearings.

C. Mammals

Despite the emphasis placed on large mammals in the conservation literature they make up less than 15 percent of the total mammal diversity in South Africa. The majority of mammals are small or medium-sized, with rodents being the most successful of all living mammals. Swanepoel (1988) noted that of 292 terrestrial mammal species in southern Africa, 128 (44%) were recorded from the Eastern Cape. Although these figures are now out of date they do demonstrate the mammalian diversity of the Province. Few of the large and medium-sized mammals that previously occurred in the region now occur naturally in the wild. Most are locally extinct or occur in small, fragmented populations usually in forest reserves or in protected areas. Species that have been extirpated within historical times in the Eastern Cape include the cheetah, hunting dog, hippopotamus, lion, red hartebeest and warthog. Most have been extensively re-introduced into provincial and private game reserves. The warthog has escaped from many reserves and threatens to become a problem animal in some areas. Among the medium- to large-sized mammals, buffalo are restricted to reserves, whilst reedbuck, brown hyena, spotted hyena, leopard and serval are extremely rare in the wild.

Diversity: A number of the species formerly recorded or expected to have occurred in the area are now extinct regionally but have been re-introduced to nearby reserves, viz. African Elephant (*Loxodonta africana*), Brown Hyena (*Hyaena brunnea*), Eland (*Taurotragus oryx*), Hippopotamus (*Hippopotamus amphibius)* and Lion (*Panthera leo*).

Over 39 mammal species are known from, or may possibly occur, in the region (Appendix 5.2). This does not include all the bats species, of which approximately another 6/7 species could occur in the region.
Conservation status: The SA Red Data Book Mammals (Friedmann & Daly 2004) revealed that of 295 mammal taxa assessed only 57 (19.3%) were considered threatened. The most sensitive groups were the Insectivores where 42.4% of all taxa (33) were threatened. Moreover, a further four were Near Threatened and no less that 14 were Data deficient. Thus over half (54.4%) of the insectivores were of conservation concern and only one was considered of Least Concern. This contrasts with the more visible large mammal fauna where only 28.9% of 38 carnivore species and only 24% of 33 antelope species were of conservation concern. The significance of these findings is that directed conservation effort is less needed for large mammals (antelope and carnivores) that are either locally extinct or already conserved in protected areas. Of more concern are small neglected groups, such as bats, insectivores and primates.
Few mammal species surviving in the immediate region of the development are now considered of conservation concern. The African wildcat, aardvark, and honey badger were all previously considered Vulnerable (Smithers 1986). However, the African wildcat and aardvark are now considered non-threatened (Least Concern, Friedmann & Daly 2004), whilst the honey badger has been downgraded to Near Threatened (Friedmann & Daly 2004). A number of mammals are considered Data Deficient and may thus be of conservation concern. They include two shrews, the Hottentot golden mole and the woodland mouse (Friedmann & Daly 2004).

Alien and extralimital species: The only alien mammals in the region include feral domestic cats, dogs, cows and donkeys, and introduced urban rodent pests such as the house mouse (*Mus musculus*), house rat (*Rattus rattus*). The African wildcat (*Felis silvestris*) is a local endangered species, threatened by hybridization with the introduced and closely related domestic cat.

Habitat associations: Most remaining herbivores (grysbok, steenbok and bushbuck) are nocturnal browsers sheltering during the day in thicket clumps and feeding at night or dusk in the grassland-fynbos-thicket mosaic. The striped mouse is an important pollinator of some proteas (Cowling and Richardson 1995).

The distribution/occurrence of the reptiles, mammals and amphibians rests largely on the presence of habitat within the study area. There are four distinct habitat types which have or can have the potential for reptiles, mammals and amphibians:
A. Intact Renosterveld-Fynbos occurring on a rocky substrate;
B. Degraded overgrazed veld with scattered Renosterveld;
C. Cultivated pastures; and
D. Wetlands, streams and drainage lines

A. Intact Renosterveld-Fynbos occurring on a rocky substrate

This habitat type comprises fynbos growing amongst small to medium sized rocks. There is a lack of grass in this habitat. This habitat offers many different habitats and micro habitats for various animal species.

Reptiles (Figure 5-24 to Figure 5-27)
The indigenous vegetation together with the gentle slope of the land provides habitat for snakes such as the puff adder (*Bitis arientans*) and the crossed-marked sand snake (*Psammophis crucifer).* The thicker vegetation provides habitat for snakes such as boomslang (*Dispholidus typus*).The numerous lizards provide a large food source for snakes which specialise in feeding on lizards such as rhombic skaapstekers (*Psammophylax rhombeatus*) and grass snakes such as crossed marked sand snake. The Yellow-bellied house snake (*Lamprophis fuscus*), which is near threatened, may occur within this area. Geckos are limited to the Spotted thick-toed gecko

(*Pachydactylus maculatus*) which is confined to rocky areas and micro habitats under rotting logs etc. One gecko, possibly introduced into the area is the Cape dwarf gecko (*Lygodactylus capensis*). This gecko formerly occurred in Northern Natal but has spread as far as Mossel Bay. If it occurs in the area it will be found on tree trunks, farm fence post and grounded logs. This gecko is diurnal and is preyed upon by snakes such as, sand snakes, skaapstekers and boomslang. Tasman's girdled lizard (*Cordylus tasmani*), which is noted as Vulnerable, may occur within the area, on aloes. FitzSimon's long-tailed seps (*Tetradactylus fitzsimonsi*) is listed as vulnerable. This species occurs under rotting logs or rocks. The Cape grass lizard (*Chamaesaura anguina anguina*), a near threatened species, occurs in grassy areas, which is also occupied by the Red Sided Skink (*Tetradactylus homalocephala*) and Cape Skink(*Tetradactylus capensis*). All the lizards are diurnal. Due to the lack of large rocky outcrops within the proposed development site, reptiles such as Southern Rock Agamas (*Agama atra*) and Cape Girdled Lizards (*Cordylus cordylus*) may be absent. However, these two species occur on rocky areas in the coastal zone east of the site (Port Elizabeth) and they may occur south of the development site. Although not recorded, the Elandsberg Dwarf Chameleon (*Bradypodion taeniabronchum)* which is listed as endangered, has been found in the Ladies Slipper Mountain area. It is possible that this species may also occur within the proposed development site.

Figure 5-24: Cape grass lizard (*Chamaesaura anguina anguina*) Near threatened.

Figure 5-25: Delalandes sandveld lizard (*Nucras lalandii*)

Figure 5-26: Yellow bellied house snake(*Lamprophis fuscus*); Near threatened

Figure 5-27: Elandsberg Dwarf Chameleon (critically endangered)

Amphibians

The amphibians in the proposed development site are only dependent on water for breeding. The lack of permanent water does not exclude frogs and toads from this habitat. Amphibians present include, Leopard Toad (*Amietophrynus pardalis*) and Raucous Toad (*Amietophrynus rangeri*). During rainfall they will spread into seeps, pans etc. Frogs, such as Common Cacos (*Cacosternum boettgeri*) will gather under stones and fallen logs during dry spells and emerge during rainy periods. The two toads namely the raucous and leopard toads will be found underground during dry spells and emerge during rainy periods, usually after dark. Platannas (*Xenopus laevis*) occur in the area. All the amphibians within the proposed development site are listed as Least Concern in terms of their conservation status.

Mammals

The vegetation provides habitat for mammals such the Four-striped mouse (*Rhabdomys pumilio*), and Scrub hare (*Lepus saxatilis*). The fynbos Golden mole (*Amblysomus corriae*), is listed as near threatened, is limited to the grassy areas with soft sandy soils. Small predators such as the Small-spotted genet (*Genetta genetta*) are not habitat specific and their occurrence is subject to the availability of prey items, including rodents. The Blue duiker (*Philantomba monticola*), listed as vulnerable may also occur within the area. It is restricted to the wooded areas adjacent to the site. These mammals may traverse through the proposed development site. Medium-sized mammals such as grysbok (*Raphicerus melanotis*), Common duiker (*Sylvicapra grimmia*) and porcupine (*Hystrix africaeaustralis*) may occupy the site as well. Medium-sized predators, such as the (*Felis caracal*) are known to occur in this habitat. Their movements are limited to heavily vegetated area during the day from where they emerge at night to hunt in exposed areas such as the grassed areas within the site. Few caracal are present, as they are perceived to be in conflict with livestock farming and are shot and trapped indiscriminately. Large mammals such as Bushbuck (*Tragelaphus scriptus*) are known to occur within the area. The distribution of leopards (*Panthera pardus*) covers the proposed development site, but it is highly unlikely that leopard are still present in the area as they are perceived to be a major threat to livestock farming and have probably all been eradicated from the area. Although not habitat specific, the Honey Badger (*Mellivora capensis*), with Near Threatened conservation status, may occur within the area.

B. Degraded overgrazed veld with scattered Renosterveld (and rockpiles)

This habitat consists mainly of overgrazed grasses together with scattered renosterveld

Reptiles (Figure 5-28 to Figure 5-31)

Although degraded veld, the remaining vegetation supports reptiles such as puff adders(*Bitis arietans*). The grasses provide habitat for snakes such as Rhombic Skaapstekers (*Psammophylax rhombeatus*) and grass snakes such as Crossed-Marked Sand Snake(*Psammophis crucifer*). This habitat has scattered small rocks together with manmade rockpiles; these rock piles offer shelter etc for reptiles and act as sanctuaries and hibernation get-aways for many reptiles. The Yellow Bellied House Snake (*Lamprophis fuscus*) which is near threatened occurs he presence of rocks and the man made rock piles offer habitat for the Spotted Thick Toed Gecko (*Pachydactylus maculatus*) and Tasman's Girdled Lizard (*Cordylus tasmani*), which is noted as having a Vulnerable conservation status. FitzSimon's Long-Tailed Seps (*Tetradactylus fitzsimonsi*) is listed as vulnerable and occurs within this area. The Cape Grass Lizard (*Chamaesaura anguina anguina*), a near threatened species, will occur in the grassy areas between the rocky outcrops. This habitat is also occupied by lizards such as the Red Sided Skink (*Tetradactylus homalocephala*) and Cape Skink (*Tetradactylus capensis*). All the lizards are diurnal such as the Southern Rock Agama (*Agama atra*) and Cape Girdled Lizard

(*Cordylus cordylus*). These species use the rocks as territory display points and for basking and shelter.

Figure 5-28: Puff adder (*Bitis arientans*) common species

Figure 5-29: Red sided skink (*Tetradactylus homalocephala*)

Figure 5-30: Cape girdled lizard (*Cordylus cordylus*)

Figure 5-31: Mountain tortoise (*Geochelone pardalis*)

Amphibians

The amphibians in the proposed development site include, Leopard Toad (*Amietophrynus pardalis*) and Raucous Toad (*Amietophrynus regius*). As is the case with most frog species they are water dependent and if present, will be limited to times of heavy rainfall. They enter into now wet seeps, pans etc. Frogs, such as Common Cacos (*Cacosternum boettgeri*) will gather under stones and fallen logs during dry spells and emerge during rainy periods. The two toads, namely the raucous and leopard toads burrow underground during dry spells and also emerge during rainy periods, usually after dark. All the amphibians within the proposed development site are listed as Least Concern in terms of their conservation status.

Mammals

The vegetation provides habitats such as grassy areas, wooded areas and rocky outcrops. mammals such the Four Striped Mouse, Vlei Rat, and Scrub Hare .The Fynbos Golden Mole (*Amblysomus corriae*), is listed as Near Threatened, will be limited to the grassy soft-soil areas. Small predators such as Small Spotted Genet are not habitat specific and their occurrence is subject to the availability of prey items, such as rodents. The Blue Duiker (*Philantomba monticola*), is listed as vulnerable in terms of its conservation status will occur within the area, it

is highly unlikely that it occurs within the study area. Medium mammals such as grysbok, common duiker and porcupine occupy habitats ranging from grassland/fynbos to shrubby areas; all which occur within the proposed development sites. Few caracal are present, as they are perceived to be in conflict with livestock farming and are shot and trapped indiscriminately. Although not habitat specific, the Honey Badger (*Mellivora capensis*), with Near Threatened conservation status, will occur within the area.

C. Cultivated pastures (transformed areas)

Most of the site consists of transformed cultivated agricultural land, which is presently used for cattle grazing.

Reptiles
Common reptiles are Puff Adders (*Bitis arietans*). Even though the land consists mainly of grasses, it nevertheless offers a passage way for reptiles to traverse through. Open grassy areas may be occupied by snakes such as Rhombic Skaapstekers (*Psammophylax rhombeatus*) and grass snakes such as Crossed Marked Sand Snake (*Psammophis crucifer*). FitzSimon's Long-Tailed Seps (*Tetradactylus fitzsimonsi*), is listed as vulnerable and occurs within this area.

Amphibians
The amphibians in the proposed development site include Clicking Stream Frog (*Strongylopus grayii*) which may be limited to the cattle watering points, Leopard Toad *(Amietophrynus pardalis*) and Raucous Toad (*Amietophrynus regius*). During times of rainfall, they will spread in distribution and enter into now watered seeps, pans etc. Frogs, for example, Common Cacos (*Cacosternum boettgeri*) will gather under accessible stones and grounded logs during dry spells and emerge during rainfall periods. The two occurring toads, namely: raucous toad and leopard toads will be fund underground during dry spells and will also emerge during times of rain fall, this is usually after dark. All the amphibians within the proposed development site are listed as least concern in terms of their conservation status.

Mammals
The vegetation provides habitats for mammals such as the four-striped mouse, vlei rat, and scrub hare. The Fynbos Golden Mole (*Amblysomus corriae*), is listed as Near Threatened, will be limited to the grassy soft-soil areas. Small predators such as small spotted genet are not habitat specific and their occurrence is subject to the availability of prey items, such as rodents. The Blue Duiker (*Philantomba monticola*), is listed as vulnerable in terms of its conservation status occur within the area, but only in terms of it using the pasture lands to cross to other more suitable habitats, the same will be in terms of larger mammals such as grysbok and common duiker. Medium predators, for example Caracal occur in this habitat. Few caracal are present, as they are perceived to be in conflict with livestock farming and are shot and trapped indiscriminately. The distribution of leopards covers the proposed development site. It is highly unlikely that leopard are still present in the area as they are a large threat to livestock farming and are probably all eradicated from the area. Although not habitat specific, the honey badger (*Mellivora capensis*), with near threatened conservation status, will occur within the area. Bush pig may be attracted to this area in search of grass roots etc for feeding purposes.

D. Wetland, Seeps and Drainage Lines

Reptiles (Figure 5-32 & Figure 5-33)
Certain reptiles are attracted to water bodies in search of food, such as frogs and toads. These reptiles are snakes such as Rinkhals (*Hemachatus haemachatus*) and red lipped herald snakes (C*rotaphopeltis hotamboeia*). Even though the pan seldom contains permanent water, it still provides habitat for reptiles. Open grassy areas surrounding the wetland may be occupied by

snakes such as rhombic skaapstekers (*Psammophylax rhombeatus*) and grass snakes such as the crossed-marked sand snake (*Psammophis crucifer*) and puff adders (*Bitis arietans*) FitzSimon's long-tailed seps (*Tetradactylus fitzsimonsi*), is listed as Vulnerable and occurs within this area. The mud/marsh terrapin (*Pelomedusa subrufa)* will be limited to this pan.

Figure 5-32: Herald snake (*Crotaphopeltis hotamboeia)*

Figure 5-33: Rinkhals *(Hemachatus haemachatus)*

Amphibians (Figure 5-34 & Figure 5-35)

The amphibians on the proposed development site include clicking stream frog (*Strongylopus grayii*),Painted reed frog (*Hyperolius marmoratus*) leopard toad *(Amietophrynus pardalis*) and raucous toad (*Amietophrynus regius*). They will emerge during heavy rainfall when they enter into now into wet seeps, pans etc.. The two occurring toads, namely: raucous toad and leopard toads will be fund underground during dry spells and will also emerge during times of rain fall, this is usually after dark. In times of rainfall, this pan provides the main breeding ground for many of the amphibians throughout the entire proposed development site. It is a vital asset to the habitat of amphibians and therefore to the reptiles which depend on them for food. All the amphibians within the proposed development site are listed as least concern in terms of their conservation status.

Figure 5-34: Painted reed frog(*Hyperolius marmoratus*)

Figure 5-35: Eastern leopard toad (*Amietophrynus pardalis*)

Mammals

The vegetation provides habitats for mammals such the four striped mouse, vlei rat, and scrub hare. The fynbos golden mole (*Amblysomus corriae*), is listed as near threatened, will be limited to the grassy soft soiled areas. Small predators such as small spotted genet are not habitat specific and their occurrence is subject to the availability of prey items, such as rodents. The blue duiker (*Philantomba monticola*), is listed as vulnerable in terms of its conservation status occur within the area, but only in terms of it using the pasture lands to cross to other more suitable habitats, the same will be in terms of larger mammals such as grysbok and common duiker. Medium predators, for example occur in this habitat. Few caracal are present, as they are perceived to be in conflict with livestock farming and are shot and trapped indiscriminately. The distribution of leopards covers the proposed development site. It is highly unlikely that leopard are still present in the area as they are a large threat to livestock farming and are probably all eradicated from the area. Although not habitat specific, the honey badger (*Mellivora capensis*), with near threatened conservation status, will occur within the area. Bush forage in this pan; as seen from evidence left from them during the site visit. They are attracted to this area in search of grass roots, tubers, bulbs, etc for feeding purposes.

5.4 IDENTIFICATION OF ISSUES AND IMPACTS

5.4.1 Vegetation and Flora

The proposed development is likely to have a number of impacts on the plants and plant communities within the site. During the drafting of the proposed site development plan, a number of processes were followed to reduce potential impacts during initial design stages. A draft sensitivity and buffer map was compiled during an initial site visit and project specialist workshop to indicate most sensitive areas that preferably should be avoided. Furthermore comments were made throughout the process regarding specific issues as they arose during the initial during layout design. The proposed site development plans have thus sought to avoid the most sensitive areas as far as possible. In this manner many potential impacts have been mitigated in the design phase rather than implementation of mitigation measures during construction and operation. The main impacts are: (a) loss of habitat; (b) reduction or changes to ecological processes/functioning; and (c) loss of species of special concern or SSC habitat.

A. Loss of habitat

Since the majority of the turbine sites and access roads have been positioned in old pastures and previously cultivated areas loss of habitat is unlikely to be significant in extent. Loss of Loerie Conglomerate Fynbos and Humansdorp Shale Renosterveld will be restricted to a few peripheral locations within the site. Loss of habitat will only occur during construction but will persist for the duration of the project. During the project design phase wetland and riparian habitat and Gamtoos Thicket areas were identified as being highly sensitive and have been avoided as far as possible with only a few strategic road crossing of seep/drainage line areas being necessary. Existing farm roads have been used where possible and it is likely that there will be an improvement as a result of better constructed road crossings in riparian areas after construction. All identified wetlands were avoided during the initial design phase.

B. Reduction or changes to ecological processes and functioning

Since the majority of the site is already disturbed (cultivation) impacts to ecological processes are likely to be significantly lower than were the site in a natural or pristine state. Some peripheral disruptions may occur where turbines are sited in intact Loerie Conglomerate Fynbos and Humansdorp Shale Renosterveld. Temporary fragmentation of habitats is likely to occur during construction of roads, most notably where riparian crossings may be necessary. Habitat fragmentation will persist for the duration of the development. However, this fragmentation will be

limited in significance and extent and is unlikely to persist after construction is completed provided rehabilitation is undertaken successfully. Some habitat fragmentation may persist during the operational phase. A potential risk of increased alien (and other exotic weed) invasion will persist during construction and operational phases as a result of the introduction and dispersal of plant propagules (seeds) from outside the site via increased traffic. This could be especially prevalent along disturbed road reserves where weedy and invasive species tend to proliferate. Fire regime changes may also be possible as a result of increased vehicular and other traffic into the area during and post construction. Accidental fire risk is likely to increase, which could result from discarded cigarette butts or other means. The opposite is also likely: because veld fires pose a hazard to the wind generators the veld (fynbos) may senesce and/or build up a very large (dangerous) fuel load. Veld/fire management will be critical both for the safety of the wind farm and for the health of the vegetation.

C. Loss of species of special concern and SSC habitat

A number of Species of Special Concern occur within the Loerie Conglomerate Fynbos and Humansdorp Shale Renosterveld which is likely to result in the potential loss of some SSC. It is unlikely that any SSC are present in the riparian areas, especially considering that layout design will target already disturbed areas for crossings. It is, furthermore, unlikely that any protected Gamtoos Thicket flora will be disturbed, although it is recommended that during micro-siting of turbines and roads, any thicket micro-clumps be avoided. Loss of SSC habitat will occur during construction and will persist for the duration of the project.

The following key impacts have thus been identified:

A. Loss of habitat

1. Loss of Loerie Conglomerate Fynbos Habitat
2. Loss of Humansdorp Shale Renosterveld Habitat
3. Loss of Gamtoos Thicket (including Thicket clumps) Habitat
4. Loss of Riparian and Wetland vegetation Habitat

B. Reduction or changes to ecological processes and functioning

5. Alteration of Loerie Conglomerate Fynbos ecological processes and functioning
6. Alteration of Humansdorp Shale Renosterveld ecological processes and functioning
7. Alteration of Gamtoos Thicket (including Thicket clumps) ecological processes and functioning
8. Alteration of Riparian and Wetland vegetation ecological processes and functioning
9. Temporary fragmentation of habitats during construction
10. Increased risk of alien plant invasion in drainage lines and disturbed areas
11. Changes in the natural fire regime
12. Overall reduction in ecosystem functioning

C. Loss of species of special concern and SSC habitat

13. Loss of Loerie Conglomerate Fynbos SSC and SSC habitat
14. Loss of Humansdorp Shale Renosterveld SSC and SSC habitat
15. Loss of Gamtoos Thicket SSC and SSC habitat
16. Loss of Floral SSC and SSC habitat

5.4.2 Fauna

Within the scope of this report, five main impacts on the fauna have been identified with respect to the erection of wind turbines, and the construct and operational phases.

The identified impacts are as follows:

1. Habitat destruction may affect faunal diversity and composition;
2. Road mortality from trucks and other service vehicles;

3. Poaching(mammals);
4. Fauna harmed by fences (mammals/reptiles); and
5. Corridor disruptions as a result of habitat fragmentation.

1. Habitat destruction may affect faunal diversity and composition

The construction of roads, widening of existing roads, building of bridges; and site clearing will destroy existing habitats.

Description of the Impact: This impact involves the direct removal and destruction of habitats, for example: When constructing a road which is five meters wide the actual destruction tends to be greater than 5 meters in width, to allow for construction vehicles etc. to travel next to the road under construction. The same principle applies to the widening of an existing road. With reference to the erection of wind turbines, the disturbance footprint in the construction phase may be greater than 20 x 20 meters. This may seem minimal but consideration must be taken into account of the turning areas needed for the large delivery trucks and machinery used in construction. As a case study, the wind turbine erected at the Coega site clearly shows that a larger footprint has been cleared during construction. The edges of the development footprint do however often create new habitats for reptiles.

Figure 5-36: Example of typical wind turbine footprint lay down area (Coega IDZ).

Figure 5-37: Example of typical wind turbine footprint (including lay down area and turbine footprint).

2. Road mortality from trucks and other service vehicles

Frequent truck/vehicle road activity will result in mortality of reptiles.

Description of the Impact: Reptiles frequent roads for various reasons including searching for food, basking during the day, "moon basking" which occurs when reptiles lie on roads at night to absorb warmth from the road surface, or merely to cross to the other side. Amphibians frequent roads mainly to cross between wetlands or from aestivation places to wetlands during migrations. The main factor influencing amphibian movement is rain and during rainy periods amphibians are at their most mobile. For example Leopard toads will migrate simultaneously from aestivation grounds to the nearest breeding grounds (i.e. seasonal wetlands) and inevitably have to cross roads. As many as 298 leopard toads were killed within an hour along a 50 meter stretch of road near Lake Farm in Port Elizabeth during one such event. Many carnivorous mammals are attracted to roads to search for food. Mammals also frequently cross roads. These factors all contribute to the fauna being subjected to road mortality.

Figure 5-38: Example of Puff adder (*Bitis arietans*), killed on road

Figure 5-39: Example of Marsh terrapin killed by vehicle on road.

3. Poaching (Mammals)

The construction/operational activities will take place near fence lines. Workers may set snares to trap animals for food etc.

Description of the Impact: Many customary traditions involve the hunting of animals with particular interest in mammals such as grysbok. The demand for so called 'bush-meat' is often high within rural communities. Wild animals are used for meat, fur coats, medicinal uses etc. The main method utilised for poaching animals is the noose/wire snare which is usually placed on a fence line, where animals are noted to cross. The animal pushes its head through the circular snare, and as it passes through the snare, the snare tightens and eventually suffocates the animals. The wire snare often catches on the animals limbs, which can also result in the animals becoming disabled.

4. Fauna harmed by fences (mammals/reptiles)

Fauna such as grysbok may enter the fenced off areas around the wind turbine (and sub-station) footprints and get trapped (Figure 5-40 & Figure 5-41).

Description of the Impact: The wind turbine sites may be fenced off during the operational phase or certain "no go" areas may be fenced off during construction. In this situation certain animal species may be harmed. For example animals such as the blue duiker and grysbok will run against a fence until they find an escape route. In this process they can injure themselves severely. Access gates which are left open may act as a trap. The animal wanders into the fenced area and does not know the way out. The type of fence in this situation will greatly affect the impact. Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards. They may be harmed or killed by electrocution when trying to pass through such fences.

Figure 5-40: Example of water monitor electrocuted in fence

Figure 5-41: Example of fence-line near a proposed development site

5. Corridor disruptions as a result of habitat fragmentation
The ecological corridor may be disturbed when permanent structures are placed within a functioning corridor.

Description of the Impact: In terms of ecological corridors, the fauna within the proposed development site as a whole are familiar with their surroundings. For example tortoises know their home ranges etc. With the construction of a feature such as a raised road through their habitat, they can become displaced or disorientated. Throughout the entire development site as a whole there are numerous movement corridors which may be altered, manipulated or destroyed. The main factor regarding corridors for animal is access. Allowance has to be made for animals to gain access through each corridor and between corridors and the road design should allow for this wherever possible.

5.4.3 Site layout Alternatives

5.4.3.1 Alternative A: 50 X 2MW Turbines (V90)

Proposed alternative Layout A will comprise 50 x 2 MW wind turbines with associated access roads and cabling. Existing roads will be utilised as far as possible which will serve to reduce overall impacts to some extent. Layout A in relation to the mapped vegetation of communities is shown in Figure 5.42.

The resulting loss of habitat will be proportional to the area vegetation clearing required to construct the access roads, cabling and the 50 turbine sites with associated hard-standing surfaces.

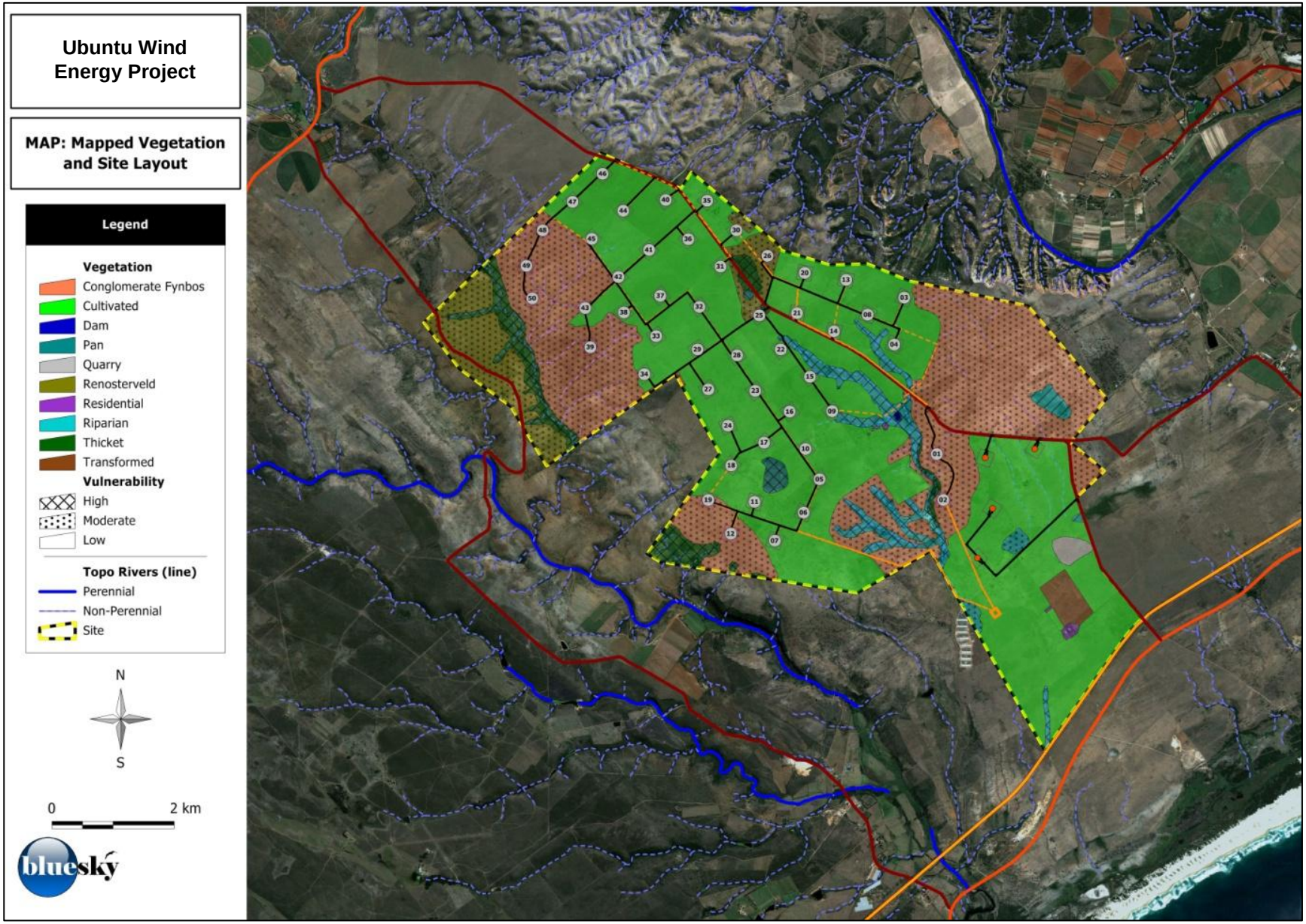


Figure 5.42: Mapped Vegetation communities with alternative A layout overlain (V90).

5.4.3.2 Alternative B: 40 X 2.5MW Turbines (V100)

Proposed alternative Layout B will comprise 40 x 2.5 MW wind turbines with associated access roads and cabling (see Figure 5.43). Existing roads have been utilised as far as possible, which will serve to reduce overall impacts to some extent.

The resulting loss of habitat will be proportional to the area vegetation clearing required to construct the access roads, cabling and 33 turbine sites with associated hard-standing surfaces. Overall this is likely to result in a significantly lower impact (due to the lower number of hard-standing surfaces) to the overall site than alternative A (and slightly lower than alternative B), although access roads will still be required.

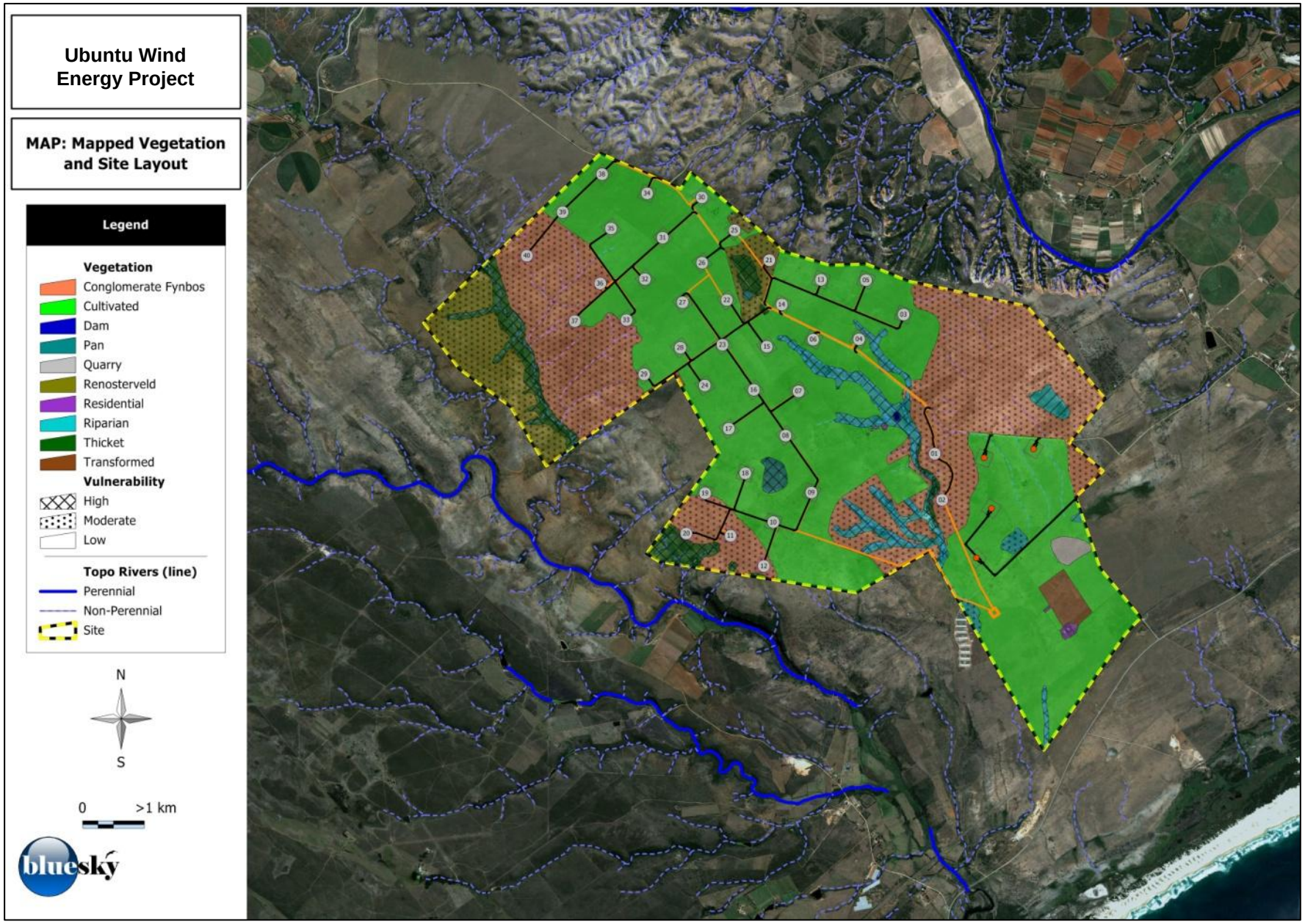


Figure 5.43: Mapped Vegetation communities with alternative B layout overlain (V100).

5.4.3.3 Alternative C: 33 X 3MW Turbines (V112)

Proposed alternative Layout C will comprise 33 x 3 MW wind turbines with associated access roads and cabling (see Figure 5.44). Existing roads have been utilised as far as possible, which will serve to reduce overall impacts to some extent.

The resulting loss of habitat will be proportional to the area vegetation clearing required to construct the access roads, cabling and 40 turbine sites with associated hard-standing surfaces. Overall this is likely to result in a slightly lower impact (due to the lower number of hard-standing surfaces) to the overall site than alternative A, although access roads will still be required.

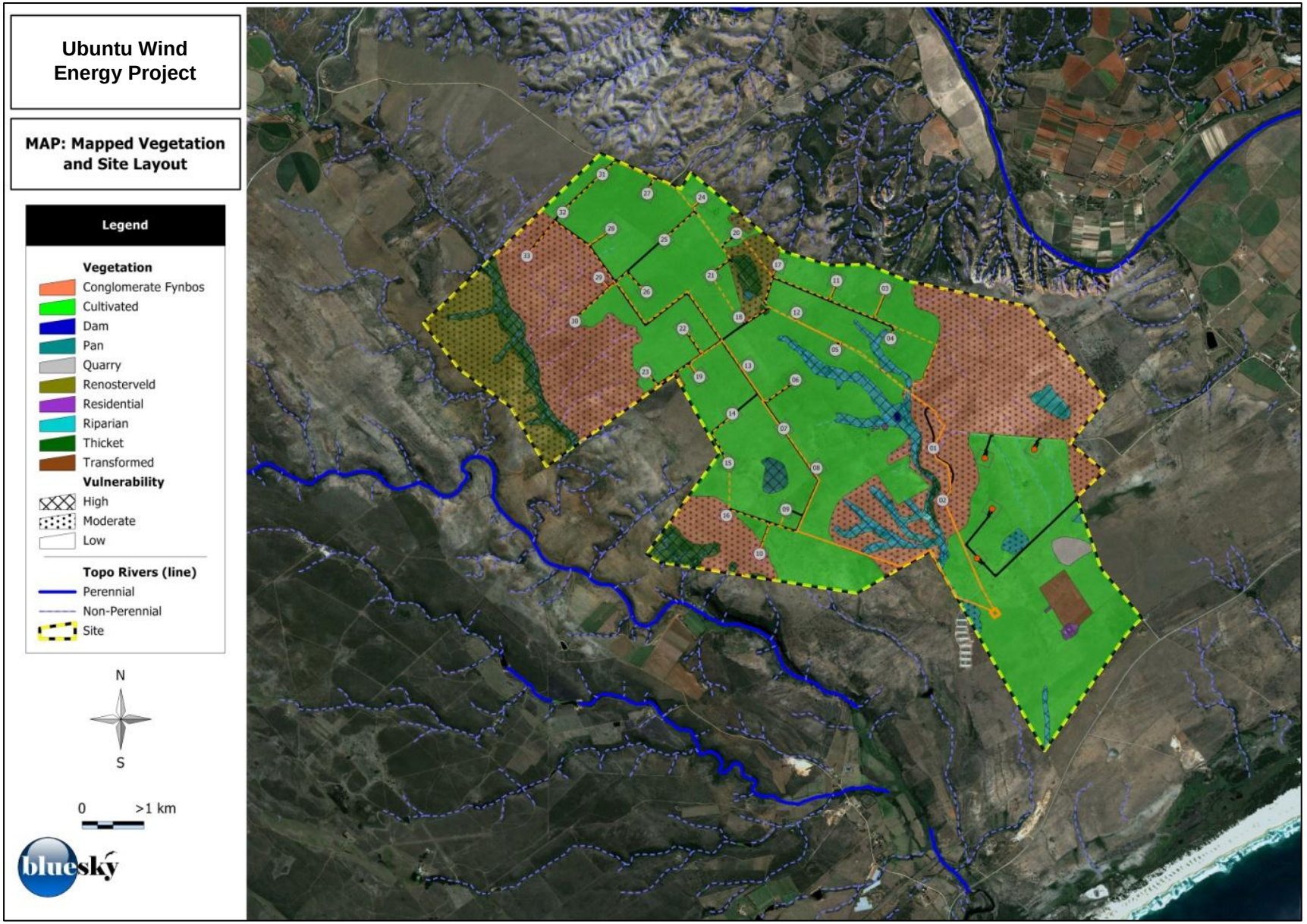


Figure 5.44: Mapped Vegetation communities with alternative C layout overlain (V112).

5.5 PERMIT REQUIREMENTS

5.5.1 Obtaining permission for the destruction, relocation and/or removal of protected plant species

It is recommended that before the clearing of the proposed site is authorized, the appropriate permission be obtained timeously from the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA) for the destruction of both animal and plant species protected by the Provincial Nature Conservation Ordinance of 1974 and ToPS (Trade of Protected Species). In order to obtain permission to remove or destroy species occurring under the respective legislation, an application letter needs to be sent to DEDEA together with a Flora and Fauna Relocation Plan. This letter must list the species (separate fauna and flora applications) that will be removed, destroyed or relocated and the reason for their removal or destruction. These permits may be subject to certain conditions, for example allowing various nurseries to collect plants before vegetation clearance commences, the removal of certain species for rehabilitation purposes etc. The project proponent will be informed of these conditions after the application has been received by DEDEA and a possible site visit undertaken. On completion of the relocation operation an audit report will be required by the department.

Plant species identified for which permits will be required in terms of the Provincial Nature Conservation Ordinance No. 19 of 1974 (PNCO), the National Forests Act of 1998 (NFA), and those classified as threatened or near threatened according to IUCN 2002 (Golding, 2002) are listed in Table 5.4. Protected species will be removed from the construction areas and relocated to a designated relocation area. Plant search and rescue should be conducted within the areas where construction/ vegetation clearing activities are to occur. Permits for the protected flora must be obtained timeously from the respective departments:

- Department of Forestry and (DWAF) for NFA permits: Mr Thabo Nokoyo; Department of Water Affairs and Forestry; Port Elizabeth; Email: NokoyoT@dwaf.gov.za; Tel: (041)586 4884; Fax: (041) 586 0379.
- Department of Economic Development and Environmental Affairs (DEDEA) for PNCO permits: Alan Southwood; Private Bag X5001; Greenacres; Port Elizabeth; 6057; Email: alan.southwood@deaet.ecape.gov.za ;Tel: (041) 508 5800; Fax: (041) 585 1964/585 1958.

5.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

5.6.1 General Impact Rating Scale for Specialists/ Baseline data

5.6.1.1 Methodology for rating significance of impacts:

The following methodology is to be applied in the specialist studies for the assessment of potential impacts (methodology supplied by the CSIR).
The assessment of impact significance should be based on the following convention:
Nature of impact - this reviews the type of effect that a proposed activity will have on the environment and should include "what will be affected and how?".
Extent - this should indicate whether the impact will be:

- local and limited to the immediate area of development (the site);

- limited to within 5 km of the development; or
- whether the impact may be realized regionally, nationally or even internationally.

Duration - this should review the lifetime of the impact, as being:

- very short term (0 - 1 years),
- short term (1 - 5 years),
- medium (5 - 15 years),
- long term (>15 years but where the impacts will cease after the operation of the site), or
- permanent.

Intensity - here it should be established whether the impact is destructive or innocuous and should be described as either:

- low (where no environmental functions and processes are affected)
- medium (where the environment continues to function but in a modified manner) or
- high (where environmental functions and processes are altered such that they temporarily or permanently cease).

Probability - this considers the likelihood of the impact occurring and should be described as:

- improbable (low likelihood)
- probable (distinct possibility)
- highly probable (most likely) or
- definite (impact will occur regardless of prevention measures).

Status of the impact: A description as to whether the impact will be positive (a benefit), negative (a cost), or neutral.

Degree of confidence in predictions: The degree of confidence in the predictions, based on the availability of information and specialist knowledge. This should be assessed as high, medium or low.

Based on the above considerations, the specialist must provide an overall evaluation of the **significance** of the potential impact, which should be described as follows:

- Low*:* Where the impact will not have an influence on the decision or require to be significantly accommodated in the project design
- Medium: Where it could have an influence on the environment which will require modification of the project design or alternative mitigation;
- High: Where it could have a 'no-go' implication for the project unless mitigation or re-design is practically achievable.

Significance Rating

Intensity: HIGH

		Duration				
		Permanent	Long term	Medium term	Short term	Very short term
Extent	National	High	High	High	High	Medium
	Regional	High	High	High	High	Medium
	Local	High	High	Medium	Medium	Medium
	Site specific	Medium	Medium	Medium	Medium	Medium

Intensity: MEDIUM

		Duration				
		Permanent	Long term	Medium term	Short term	Very short term
Extent	National	High	High	High	Medium	Medium
	Regional	High	High	High	Medium	Medium
	Local	Medium	Medium	Medium	Medium	Medium
	Site specific	Medium	Medium	Medium	Medium	Low

Intensity: LOW

		Duration				
		Permanent	Long term	Medium term	Short term	Very short term
Extent	National	Medium	Medium	Medium	Medium	Medium
	Regional	Medium	Medium	Medium	Medium	Medium
	Local	Medium	Medium	Medium	Medium	Low
	Site specific	Medium	Medium	Medium	Low	Low

Furthermore, the following must be considered:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for both the construction, operations and decommissioning phases of the project, where relevant.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region, if relevant.
- Management actions: Where negative impacts are identified, specialists must specify practical mitigation objectives (i.e. ways of avoiding or reducing negative impacts). Where no mitigation is feasible, this should be stated and the reasons given. Where positive impacts are identified, management actions to enhance the benefit must also be recommended. The specialists should set quantifiable standards for measuring the effectiveness of mitigation and enhancement.

Monitoring: Specialists should recommend monitoring requirements to assess the effectiveness of mitigation actions, indicating what actions are required, by whom, and the timing and frequency thereof.

Table 5.6. Impact assessment

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE									
Loss of vegetation habitat in:									
Loerie Conglomerate Fynbos	Negative	localised	permanent	medium	definite	medium	Vegetation clearing must be limited to the required footprint. Micro-siting of footprints should avoid more sensitive vegetation during final site planning as far as possible.	low	high
Humansdorp Shale Renosterveld	Negative	localised	permanent	medium	definite	medium	Vegetation clearing must be limited to the required footprint. Micro-siting of footprints should avoid more sensitive vegetation during final site planning as far as possible.	low	high
Gamtoos Thicket	Negative	localised	permanent	low	improbable	medium	River crossing and clearing of thicket should be avoided	low	high
Riparian and Wetland vegetation	Negative	Highly localised	Long-term	low	probable	medium	Crossing of riparian areas should use existing road crossings where possible Rehabilitation of vegetation to take place after construction. Clearing of vegetation to be kept to required for crossing construction.	low	high
Reduction or changes to ecological processes and functioning in:									
Loerie Conglomerate Fynbos	Negative	localised	long-term	medium	definite	medium	Road network to be kept to a minimum in this vegetation unit and clearing to be kept to a minimum width. Road network kept to a minimum in	low	high

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
							design phase.		
Humansdorp Shale Renosterveld	Negative	localised	long-term	medium	definite	medium	Road network to be kept to minimum width and avoid more sensitive seep areas and drainage lines.	low	high
Gamtoos Thicket	Negative	localised	permanent	low	improbable	medium	Loss of Gamtoos Thicket and thicket clumps unlikely to occur and small thicket clumps should be avoided during micro-siting.	low	high
Riparian and Wetland vegetation	Negative	localised	permanent	low	improbable	medium	Loss of Riparian vegetation limited to a few well sited crossing along roads and unlikely to be significant. Appropriate measures to be implemented to minimise impacts at stream crossings.	low	high
Temporary fragmentation of habitats	Negative	localised	long term	medium	probable	medium	Vegetation clearing must be limited to the required footprint and rehabilitated immediately after construction. Road construction should be commenced in a phased manner to reduce large scale fragmentation.	low	high
Increased risk of alien invasion in drainage lines and disturbed areas	Negative	localised	long term	medium	probable	medium	Alien invasive management plan to be implemented during operational phase Rehabilitation to be implemented in a phased manner directly after construction for a given area is completed.	low	high
Changes in natural fire regime (reduction in wildfires is positive, elimination of all fires is negative for fynbos-controlled burns should	Negative/ positive	localised	long term	medium	probable	medium	Maintaining sufficient buffer zones to allow the presence of suitable fire breaks Roads may act as additional fire breaks and help to decrease extent of runaway fires.	low	moderate

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
be done every 10 years or so.							Road borders should be regularly maintained to ensure that vegetation remains short and that they therefore serve as an effective firebreak. Flammable litter and discarded glass bottles should be removed regularly. Implement fire fighting strategy as part of EMP. Signage along roads to indicate fire risk in the area.		
Reduction of ecosystem functioning	Negative	localised	long term	low	probable	medium	Alien species should be monitored and cleared when necessary. Avoid direct loss of natural vegetation outside of required footprints where possible. Final planning to avoid ecologically more sensitive areas.	low	high
Loss of species of special concern and SSC habitat									
Loerie Conglomerate Fynbos habitat	Negative	localised	permanent	medium	definite	medium	Vegetation clearing must be limited to the required footprint.	low	high
Humansdorp Shale Renosterveld	Negative	localised	permanent	medium	definite	medium	Vegetation clearing must be limited to the required footprint.	low	high
Gamtoos Thicket habitat	Negative	localised	permanent	low	improbable	medium	Vegetation clearing must be limited to the required footprint.	low	high
Loss of floral SSC	Negative	localised	permanent	medium	probable	medium	Vegetation clearing must be limited to the required footprint. Plant rescue and relocation operation must be conducted before any site clearing occurs, especially within areas having intact vegetation.	low	medium

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Habitat destruction may affect faunal diversity and composition									
Reptiles	Negative	Site/Footprint	Permanent	Medium	Definite	Medium	Search and rescue operations conducted before construction phase begins. Reptiles must be relocated to a place similar to the place where they were found. Reptiles which enter the construction zone must be relocated as soon as possible from the site. A professional reptile handler must be used when removing and relocating a reptile. Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas. Clearly marked buffer zones should be in place between the construction zone and no-go areas. Materials, such as rocks, taken from the construction zone must be stored and kept to be used in the rehabilitation process to create new habitats for the reptiles.	Low	High
Amphibians	Negative	Site/Footprint	Permanent	Medium	Definite	Medium	Search and rescue operations conducted before construction phase begins. Amphibians must be relocated to a place similar to the place where they were found. Amphibians which enter the	Low	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
							construction zone must be relocated as soon as possible from the site. Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.		
Mammals	Negative	Site/Footprint	Permanent	Low	Probable	Medium	Search and rescue operations conducted before construction phase begins. Mammals must be relocated to a place similar to the place where they were found. Mammals which enter the construction zone must be relocated as soon as possible from the site. Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.	Low	High
Road mortality from truck/vehicle and other service vehicles									
Reptiles	Negative	Site/Roads	Short-term	Medium	Definite	High	Search and rescue conducted before or during this activity. Care should be taken when working in this area. Care must be taken to ensure slow driving on the site, speed limits should be enforced. Should areas be noted where Death on Road incidents are excessive, traffic calming measures should be implemented.	Low	High
Amphibians	Negative	Site/Roads	Short-term	Medium	Definite	**High (when**	Search and rescue conducted before	Low	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
						raining) Low when not raining	or during this activity. Care must be taken to ensure slow driving on the site during rainfall periods. Search and rescue conducted before or during this activity. Should areas be noted where Death on Road incidents are excessive, notably after rainfall, traffic calming measures should be implemented or roads temporarily closed.		
Mammals	Negative	Site/Roads	Short-term	Medium	Probable	Medium	Search and rescue conducted before or during this activity for small mammals only, large mammals will move away from the site. Care must be taken to ensure slow driving on the site, speed limits should be enforced. Dead animals found on the roads must be removed to prevent scavengers from being attracted to the road and harmed. Should areas be noted where Death on Road incidents are excessive, traffic calming measures should be implemented.	Low	High
Poaching									
Mammals	Negative	Site	Permanent	Low	Possible	Medium	Worker education, Monitoring and removal of snares to be implemented	Low	High
Fauna harmed by fences (mammals/reptiles)									
Reptiles/ Mammals	Negative	Site/Fence	Permanent	High	Probable	High	The fence used to surround the	Medium	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
		lines					footprint must be of a nature to allow fauna to pass through it, especially electrified fences. Use of Bonox type fencing that allows through movement of fauna. Regular visits to the site to check if any fauna are indeed trapped. Access gates into the fenced off areas to be closed at all times.		
Corridor disruptions as a result of habitat fragmentation for:									
Reptiles	Negative	Site	Permanent	Low	Possible	Medium	Road design must be such that it allows free movement of fauna Do not places fences on the side of the roads	Low	High
Amphibians	Negative	Site	Permanent	Low	Possible	Medium	Road design must be such that it allows free movement of fauna Do not places fences on the side of the roads Construction of roads over wetlands/rivers/streams must be of the nature that the water is allowed to flow under the road, this will secure corridor continuity for amphibians.	Low	High
Mammals	Negative	Site	Permanent	Low	Improbable	Medium	Road design must be such that it allows free movement of fauna Do not places fences on the side of the roads	Low	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
OPERATIONAL PHASE									
Reduction or changes to ecological processes and functioning in:									
Loerie Conglomerate Fynbos	Negative	localised	long-term	medium	definite	medium	Road network to be kept to a minimum in this vegetation unit and clearing to be kept to a minimum width. Road network kept to a minimum in design phase.	low	high
Humansdorp Shale Renosterveld	negative	localised	long-term	medium	definite	medium	Road network to be kept to minimum width and avoid more sensitive seep areas and drainage lines.	low	high
Gamtoos Thicket	negative	localised	permanent	low	improbable	medium	Loss of Gamtoos Thicket and thicket clumps unlikely to occur and small thicket clumps should be avoided during micro-siting.	low	high
Riparian and Wetland vegetation	negative	localised	permanent	low	improbable	medium	Loss of Riparian vegetation limited to a few well sited crossing along roads and unlikely to be significant. Appropriate measures to be implemented to minimise impacts at stream crossings.	low	high
Increased risk of alien invasion in drainage lines and disturbed areas	negative	localised	long term	medium	probable	medium	Alien invasive management plan to be implemented during operational phase.	low	high
Changes in natural fire regime	negative /positive	localised	long term	medium	probable	medium	Maintaining sufficient buffer zones to allow the presence of suitable fire breaks Roads may act as additional fire breaks and help to decrease extent of runaway fires. Road borders should be regularly	low	moderate

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
							maintained to ensure that vegetation remains short and that they therefore serve as an effective firebreak. Flammable litter and discarded glass bottles should be removed regularly Implement fire fighting strategy as part of EMP. Signage along roads to indicate fire risk in the area.		
Reduction of ecosystem functioning	negative	localised	long term	low	probable	medium	Alien species should be monitored and cleared when necessary.	low	high
Habitat destruction may affect faunal diversity and composition for:									
Reptiles	Positive	Site	Permanent	Medium	Probable	Low	Habitat may be created after construction.	Low	High
Amphibians	Negative	Site	Permanent	Medium	Probable	Low	Road mortalities to be monitored.	Low	High
Mammals	Negative	Site	Permanent	Medium	Probable	Low	Mammals likely to adapt to new environment.	Low	High
Road mortality from truck/vehicle and other service vehicles									
Reptiles	Negative	**Site/Roads**	**Permanent**	**High**	**Definite**	**High**	Must be audited and monitored and traffic calming measures implemented.	Medium	High
Amphibians	Negative	**Site/Roads**	**Permanent**	**High**	**Definite**	**High (when raining) Low when not raining**	Must be audited and monitored and traffic calming measures implemented.	Medium	High
Mammals	Negative	**Site/Roads**	**Permanent**	**High**	**Definite**	**High**	Must be audited and monitored and traffic calming measures implemented.	Medium	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Poaching									
Mammals	Negative	**Site**	**Permanent**	**Low**	**Possible**	**Low**	Monitoring and removal of snares to be implemented.	Low	High
Fauna harmed by fences (mammals/reptiles)									
Reptiles/ Mammals	Negative	**Site**	**Permanent**	**Medium**	**Probable**	**Medium**	Fences design to be fauna friendly.	Low	High
Corridor disruptions as a result of habitat fragmentation									
Reptiles	Positive	**Site**	**Permanent**	**Medium**	**Definite**	**Medium**	Habitat may be created after construction.	Low	High
Amphibians	Negative	**Site**	**Permanent**	**High (when raining) Low when not raining**	**Definite**	**High (when raining) Low when not raining**	Road mortalities to be monitored.	Medium	High
Mammals	Negative	**Site**	**Permanent**	**Low**	**Probable**	**Low**	Mammals likely to adapt to new environment. Road mortalities to be monitored.	Low	High

Table 5.7. Monitoring programme

Impact	Mitigation/Management action	Monitoring		
		Methodology	Frequency	Responsibility
CONSTRUCTION PHASE				
Loss of vegetation habitat	Search and Rescue before/during construction and post construction rehabilitation to be undertaken	Search and Rescue to be audited and species recorded	Weekly	ECO Search and Rescue contractor
Temporary fragmentation of habitats	Construction areas to be kept to minimum	Construction activities to be monitored and audited	Weekly	ECO Search and Rescue contractor
Increased risk of alien invasion in drainage lines and disturbed areas	Alien management Plan to be implemented	Audit Alien Management and monitor occurrence of weedy and alien species	Monthly	ECO
Changes in natural fire regime	Fire management plan to be implemented	Regular checks that fire management plan recommendations are implemented	Monthly	ECO
Reduction of ecosystem functioning	No monitoring			
Loss of species of special concern and SSC habitat	A plant search and rescue plan to be implemented before construction commences COnstruction footprint and disturnace to within reasonable limits	A list of relocated flora to be compiled as part of site audit	Weekly	ECO

Impact	Mitigation/Management action	Monitoring		
		Methodology	Frequency	Responsibility
Loss of floral SSC	Search and Rescue before/during construction and post construction rehabilitation to be undertaken.	Pre-construction search and rescue Site Audit	Daily Weekly	Flora specialist ECO
Loss of Faunal Habitat	Search and Rescue before/during construction and rehabilitation to be undertaken. Monitor for trapped/displaced fauna Monitor for injured fauna and DoR incidents	Pre-construction search and rescue Site Audit	Daily Weekly	Faunal specialist ECO
Road mortality from truck/vehicle and other service vehicles	Monitor for injured fauna and DoR incidents	Site Audit	Weekly and during rainfall for amphibians	ECO
Poaching	Check fences for snares	Site Audit	Weekly	ECO
Fauna harmed by fences (mammals/reptiles)	Check fences for snares	Site Audit	Weekly	ECO
Corridor disruptions as a result of habitat fragmentation	Monitor for trapped/displaced fauna	Site Audit	Weekly	ECO
OPERATIONAL PHASE				
Reduction or changes to ecological processes and functioning	Check that mitigation recommendations have been implemented and adhered to	Site Audit	Monthly	ECO

Impact	Mitigation/Management action	Monitoring		
		Methodology	Frequency	Responsibility
Increased risk of alien invasion in drainage lines and disturbed areas	Alien management Plan to be implemented	Audit Alien Management and monitor occurrence of weedy and alien species	Biannually	ECO
Changes in natural fire regime	Fire management plan to be implemented	Regular audit of Fire Management Plan implementation and record any fires	Biannualy and record location and extent after each fire and actions implemented	ECO
Loss of Habitat	Monitor for trapped/displaced fauna	Site Audit	Monthly	ECO
Road mortality from truck/vehicle and other service vehicles	Monitor for injured fauna and DoR incidents Implement traffic calming measures where necessary	Site Audit	Monthly and during/after rainfall for amphibians	ECO
Poaching	Check fences for snares	Site Audit	Monthly	ECO
Fauna harmed by fences (mammals/reptiles)	Check fences for snares	Site Audit	Monthly	ECO
Corridor disruptions as a result of habitat fragmentation	Monitor for trapped/displaced fauna	Site Audit	Monthly	ECO

5.7 CONCLUSIONS

5.7.1 Vegetation and Flora

Within the context of the original vegetation of the area the a range of Gamtoos Thicket, Loerie Conglomerate Fynbos, Shale Renosterveld, Wetland/Pan/Seep vegetation communities cover the sites. These areas have been transformed and degraded to a varying extent predominantly through agriculture and some alien plant infestation. Specialised habitats within this matrix would have included the fire resistant rocky refugia, seasonal seeps and pans and drainage lines with associated riparian vegetation and seep areas.

- Site sensitivity is variable across the site, largely dependent on the level of agriculture related transformation and degradation.
- Degradation in the form of invasive alien plant infestations tends to be very limited and patchy on the site.
- Areas with a moderate sensitivity include those having intact vegetation but with a Least threatened or Vulnerable conservation status.
- Areas indicated as having a high sensitivity include critically endangered and endangered vegetation units and specialised habitats including rocky outcrops, seeps, wetlands and pans.
- Areas having a low sensitivity include areas transformed for pastures, severely degraded and heavily invaded areas, and areas having a low conservation status.

Impacts identified as having a moderate significance after mitigation tend to be those where sites and access roads are sited in areas indicated as having a moderate to high sensitivity vegetation units, or where disruptions to ecological processes may occur (drainage lines). In the initial design phase these more sensitive areas (Gamtoos Thicket, drainage lines, wetlands and intact vegetation) have been avoided very effectively and thus impacts will be minimal

Turbine sites having a moderate sensitivity include sites positioned in vegetation with intact habitat and an elevated conservation status (Humansdorp Shale Renosterveld and Loerie Conglomerate Fynbos and wetlands) and/or provides important ecological functions that may be reduced as a result of the proposed activity (drainage lines). Whilst final micro-siting and mitigation measures are recommended, no turbine sites or access roads are present that can be deemed to have a high sensitivity. Final positioning of turbine and hard standing areas to avoid the most-sensitive areas is recommended (such as avoiding small thicket pockets, any rocky outcrops and seeps/ wetlands or drainage lines) and minor changes to road alignments to maximise use of already disturbed areas (such as existing roads and fence lines).

Areas having an elevated sensitivity were identified during the initial design phase and these areas have been effectively avoided in the windfarm layout.

Turbines (and associated roads and infrastructure) in moderate sensitivity areas would be considered to be acceptable if the recommendations are implemented and monitored adequately in the EMP.

5.7.2 Fauna

This specialist study described the terrestrial fauna potentially affected by the construction and operation of the wind farm and its associated infrastructure. Potential impacts on the terrestrial

fauna of the area were identified and assessed for their significance. The most important findings of the investigation are summarised below.

- The erection of the wind turbines, i.e. during construction, may give rise to certain impacts, but provided the mitigatory measures are enforced, these impacts can be minimised, or eliminated entirely.
- The erection of the wind turbines in terms of the operational phase has the potential to result in positive impacts, such as habitat preservation etc.
- In terms of decommissioning the impacts will be similar to those that occur during construction. It is presumed that the wind farms are permanent, i.e. they will undergo periodic upgrades but will not be decommissioned, therefore discussion of the potential impacts of decommissioning is likely to be academic.
- The development of this project will be positive; i.e.: a "no-go" alternative will lead to non-preservation of the area and thus will be negative.
- Some species of special concern present in the area will be affected by this development.
- All amphibians are of *least concern* and are well protected elsewhere.
- The reptiles of special concern are the FitzSimon's long-tailed seps and the Elandsberg Dwarf Chameleon. Although these species are well protected elsewhere (.i.e. Lady Slipper Nature Reserve) their known distribution is limited.
- The species that will be mostly affected during the construction of this project are the species that cannot vacate the affected area themselves, e.g. tortoises, burrowing reptiles and burrowing mammals. These species can suffer direct mortality. Traffic on the access roads to and from the construction sites would most likely result in road kills.

5.7.3 Summary of Risks and Impacts

The following key impacts as a result of the project are expected:

5.7.3.1 Direct loss of habitat

Construction of the turbines will result in a loss of habitat but most of the turbine sites are in areas having a lower conservation status and/or are in a degraded or transformed state. Those sites within areas having an elevated conservation status are restricted in number. Overall loss (footprint area) will be limited in extent and thus impacts are deemed to be within acceptable levels. Impacts in the elevated risk areas can be reduced by micro siting to avoid high sensitivity areas as far as possible.
Roads will have the greatest impact where the access roads impact exposed outcrop habitat and traverse seep, wetland or inland pans. This can be reduced to acceptable levels through appropriate crossing design and final micro siting to use existing crossing points and areas that are already degraded and/or transformed.
Although final **Infrastructure** positioning has not been undertaken (including temporary lay-down areas, cluster construction sites and substations), these can and should be sited in areas that are already transformed.

5.7.3.2 Loss of Species of special concern and habitat

- Loss of SSCs and habitat is most extensive on exposed outcrops on hilltops and ridges;

- The final siting of turbines and construction / infrastructure areas should be undertaken by the ECO in consultation with respective specialists to minimise any loss of SSCs and habitat;
- Avoid areas containing SSCs where possible (i.e. endemics on exposed outcrops);
- Permits will be required for species to be removed and/relocated;
- Relocate SSCs when unavoidable into adjacent areas.

5.7.3.3 Changes to species composition and changes to ecological processes

- Possible drying out of seeps and wetlands (and dams) as result of road network;
- Final road design should take cognisance of these constraints (in conjunction with the hydrological specialist report)
- Changes in seed dispersal due to dispersal agent mortalities (i.e. birds and bats) – this is likely to have the greatest impact on thicket habitat;
- Fragmentation of intact habitats (via roads and power lines) can result in the reduction or changes to ecological connectivity and ecological processes.

5.7.3.4 Increased fire risk and alien plant invasion resulting from vehicles

- Fire frequency and magnitude may be decreased after construction because of the fire-break effect of roads and easier access during fires;
- A fire management plan and awareness signage must be implemented as part of the EMP;
- Alien plant species could be introduced during the construction and operational phases, especially along road verges and adjacent to turbine footprints;
- An alien plant management plan including comprehensive monitoring to be incorporated into the EMP for the construction and operational phases;

5.7.4 Recommendations

5.7.4.1 Vegetation

- Rocky outcrops should be avoided as far as possible, especially with respect to fragmentation by roads.
- Endemic and protected plants must be removed from the site footprints to be safeguarded from destruction and relocated either to undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists. These plants can be replanted in adjacent areas or used in rehabilitation.
- The portions of the site that are already degraded/transformed are well suited to the proposed development.
- An ECO/ESO must be appointed to oversee the Environmental Management Plan and relocation of the Species of Special Concern before construction commences.
- The removal of alien invasive plant species from the site will reduce the spread of these species into surrounding areas.
- A long-term alien management plan to control invasive species must be implemented within the designated Open Space areas.
- Permission must be obtained from the provincial authorities to destroy or remove any protected plant species (indicated in Table 5.5).
- Kikuyu grass must NOT be utilised during regrassing of verges, turbine footprints and other landscaped areas within the site, particularly adjacent to riparian and/wetland habitats.

5.7.4.2 Drainage Lines, Seeps, Wetlands, Pans and Dams

- No disturbance may occur within 32 m of any water-course and construction or any other disturbance should be avoided within a 32 m buffer around any wetland features, pans and dams without necessary permission from the Department of Water Affairs. Where unavoidable the required General Authorisation permits will be required from the Department of Water Affairs **before** any construction activities commence.
- Activities in wetland areas should seek to minimize the following impacts:
    a. Changes to the flow pattern within the wetland through drainage channels which cause flow to become more channelled and less diffuse, thereby reducing the wetness of the area. Road crossings must be constructed using appropriate engineering to minimize any flow pattern changes. Drainage line crossings (bridges/culverts) must take into account the sensitivity of the habitat and ecological processes and appropriate designs must be utilised so as not to impede water flow regimes and ecological processes.
    b. Disturbances of the soil, making it more susceptible to erosion. Any disturbances during construction must be done as rapidly as possible and disturbed areas rehabilitated timeously. Construction in wetland/seep areas is best not undertaken during the rainy season.
    c. Changes in the surface roughness and vegetation cover (when these are reduced the ability of the wetland to slow down water flow, reduce erosion and purify water are reduced).
    d. Replacement of the natural vegetation by introduced plants, which generally reduces the value of the wetland for wetland dependent species. Only local species should be used in any rehabilitation work after construction.
- Disturbances to seep areas and areas will require detailed surveying before any construction commences so that appropriate design measures can be implemented to facilitate lateral water flow, especially where roads may traverse such areas.
- Where stream and seep crossings cannot be avoided, they should be sited where seeps/streams are narrowest and most disturbed or existing road and track crossings should be upgraded. Stream and seep crossing design must incorporate measures to minimise alterations to lateral flow, to prevent downstream drying-out and up-stream flooding that differs substantially from current conditions. No seasonal pans should be traversed, including those that have been excavated to increase water storage capacity. Any roads running upslope of pans must be constructed so as not to impede lateral water movement and must minimise siltation and erosion risks.

5.7.4.3 Environmental Management Programme Recommendations

A. <u>Guidelines for inclusion in the Environmental Management Programme (EMP):</u>

- Since the sites are located in catchment areas, activities at certain sites (and road crossings) may have an impact on downstream areas. The retention of natural areas is important to minimize cumulative downstream impacts, especially those associated with stormwater runoff. Removal of alien vegetation, rehabilitation of natural vegetation and long-term erosion management are important aspects that must be addressed in the EMP.
- Open Space Management guidelines must be incorporated into the EMP to manage areas adjacent to turbine sites and to help inform landowners as to possible risks and the appropriate management measures.
- A plant relocation plan must be incorporated into the EMP and for submission with permit applications. Comprehensive rescue and temporary storage in a suitable constructed

temporary nursery or storage area for plants deemed to require rescue for replanting, and for plants that will be useful during rehabilitation
- Special attention should be given to *Cyrtanthus obliquus*, *Delosperma ecklonis, Erepsia aristata* and *Gasteria pulchra* which, although not uncommon in other areas are somewhat less widespread and common than other species.
- The Construction EMP should contain clear guidelines for clearing of vegetation where construction activities are to commence;
- The Operational EMP must contain management measures to be implemented during operation of the wind farm. These measures should cover alien plant control and fire management plans.
- A detailed revegetation and rehabilitation plan must be implemented during the post-construction and operational phase.

B. Rehabilitation potential and processes
- A detailed environmental specification guideline is provided in Appendix B.1 in EMP, Section B of this EIA Report.

C. "No-Go" Areas
- "No-go" areas must be demarcated clearly (using fencing and appropriate signage) before construction commences.
- Contractors and construction workers must be informed of the "no-go" areas and held accountable for any infringements that may occur.
- No access to the demarcated areas should be permitted during construction and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.
- Activities including, but not restricted to, the following must not be permitted in designated "no-go" areas:
    - Dumping of any material during and after construction;
    - Turning of vehicles;
    - Trampling and urination by construction workers; and
    - Lighting fires.

D. Alien Vegetation Management Plan
- An alien vegetation removal programme must be implemented to remove alien vegetation from within the "no-go" areas and should run concurrently with construction activities;
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist;
- Cleared vegetation must be either removed from site or burned *in-situ* in the temporary storage area;
- Any seed bearing material should be removed from the drainage area to prevent the spread of seed.
- Chopped brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities;
- A suitable revegetation or rehabilitation plan must be implemented after alien vegetation clearing.
- A long-term alien vegetation maintenance plan, including monitoring and removal of new invasive plants, must be designed and implemented in conjunction with a suitably qualified expert.

E. River crossings

- Bridge/culvert design must be such that it minimises impact to the riparian areas with minimal alterations to water flow and must permit the movement of fauna and flora;
- Bridge/culvert construction must be completed as timeously as possible and efforts must be in place to minimise the erosion risk and sedimentation of the stream during construction, especially during high rainfall events.

F. Plant Relocation Plan and Species of Special Concern Search and Rescue

- A suitable timeframe must be allowed *before* construction commences to undertake the plant rescue and relocation operation;
- Plants that can be used during rehabilitation should be identified and stored appropriately off-site for use after construction and alien vegetation clearing;
- Plants identified as being suitable for relocation can either be removed from the site or replanted within the proposed buffer areas.

G. Permit applications for the destruction, relocation and/or removal of protected plant species

It is recommended that before the clearing of the proposed site is authorized, the appropriate permission be obtained timeously from the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA) for the **destruction of flora and fauna species protected by the Provincial Nature Conservation Ordinance of 1974**.

All individuals of the protected indigenous species should be avoided if possible, if not they should be translocated or utilized during rehabilitation and landscaping. If neither is possible permits will be required to either trim or remove individuals. Species indicated as being protected would require permits from the respective department **before** any site clearing/removal commences.

The person or organisation responsible for the relocation of these plant species must work in advance of the vegetation clearing team, and locate as well as relocate individual plant specimens. Removed plants must be excavated by hand in such a way that the plants, especially the roots are not damaged. Plants should be temporarily planted out either in plastic bags or in-situ in an area that is not affected by the proposed development. Should bags be used, they shall be large enough to contain the entire plant's root system. Bags must be filled with local top soil material. Plants must be watered regularly, protected from damage and otherwise maintained to ensure healthy growth. On completion of the civil work the plants must be re-planted out in scattered clumps at areas on the site to be rehabilitated as directed by the Environmental Control Officer (ECO). Individuals of all removed species will need to be housed in a nursery until such time as relocation areas have been identified.

5.7.5 Fauna

- Ecological corridors occur predominantly along the rivers, drainage lines and seep areas, thus design should be such that it does not impede these corridors unnecessarily;
- Riparian zone and stream crossings should be designed to allow for animal movement where necessary;
- Restrict road development to the required footprint;
- No off-road vehicle use outside of designated road network should be permitted;
- Limit road activity where possible to daylight working hours;
- Maintaining wide road verges with low vegetation cover may further minimise mortalities
- Search and rescue operations must be conducted before construction begins.

- The construction zone and "no-go" areas must be clearly marked.
- Animals must be relocated to places similar to those where they were found;
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be used when removing and relocating a reptile.
- Habitats near the construction site where no construction is to take place must be clearly demarcated as "no-go" areas.
- Materials, such as rocks, taken from the construction zone must be stored and kept to be used in the rehabilitation process to create new habitats for reptiles.
- Care must be taken to ensure vehicles are driven slowly on the site. Speed limits should be enforced particularly during rain storms when frogs may cross the roads. A speed limit of 60 km/h should be implemented on the access roads to the site and a 40 km/h speed limit on the construction site for the cranes and on access roads during rainstorms.
- Road kills should be removed to avoid additional mortalities of scavengers
- The workers on site must be educated during site induction about the laws protecting wildlife. Penalties should be used as a deterrent.
- Regular fence inspections need to be conducted to remove any snares and to check for trapped animals.
- Fences used to surround the footprint must be of a nature to allow animals to pass through them.
- Regular monitoring on the site for any fauna trapped animals.
- Access gates into the fenced off areas to be closed at all times.
- Placing of structures (culverts) under roads to allow reptiles such as tortoises to cross under the road will promote corridor continuity.
- If fences are placed along roads, they must permit animals to pass through them.
- Construction of roads over wetlands/rivers/streams must be designed so that the water is allowed to flow under the road, this will secure corridor continuity for amphibians.

5.8 APPENDICES

Appendix 5.1. Plant Species List

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Abutilon sonneratianum	Malvaceae				Y	
Acacia cyclops	Fabaceae	CARA 2		Y		Y
Acacia mearnsii	Fabaceae	CARA 2			Y	
Acanthaceae sp.	Acanthaceae			Y		
Allophylus decipiens	Sapindaceae				Y	
Aloe africana	Asphodelaceae				Y	
Aloe africana	Asphodelaceae	PNCO		Y	Y	
Aloe speciosa	Asphodelaceae	PNCO			Y	
Anginon sp.	Apiaceae					
Anthospermum aethiopicum	Rubiaceae				Y	
Apodytes dimidiata	Icacinaceae				Y	
Argyrolobium polyphyllum	Fabaceae			Y		
Aristida sp.	Poaceae		Y	Y		
Aspalathus chortophila	Fabaceae			Y		
Asparagus aethiopicus	Asparagaceae	PNCO			Y	
Asparagus capensis	Asparagaceae	PNCO			Y	
Asparagus racemosus	Asparagaceae	PNCO			Y	
Asparagus striatus	Asparagaceae	PNCO			Y	
Asplenium cordatum	Aspleniaceae				Y	
Atriplex sp.	Chenopodiaceae		Y			
Azima tetracantha	Salvadoraceae				Y	
Barleria irritans	Acanthaceae			Y		
Berkheya heterophylla	Asteraceae			Y		Y
Blepharis integrifolia	Acanthaceae				Y	
Blepharis procumbens	Acanthaceae			Y		
Bobartia orientalis	Iridaceae	PNCO		Y		
Boophone disticha	Amaryllidaceae	PNCO		Y		
Briza maxima	Poaceae		Y			Y
Bulbine frutescens	Hyacinthaceae	PNCO			Y	
Canthium spinosum	Rubiaceae				Y	
Capparis sepiaria	Brassicaceae				Y	
Carissa bispinosa	Apocynaceae				Y	
Cenchrus ciliaris	Poaceae				Y	
Centella asiatica	Apiaceae			Y		Y
Chaetacanthus setiger	Acanthaceae				Y	
Chasmanthe aethiopica	Iridaceae	PNCO			Y	
Chasmanthe sp.	Iridaceae	PNCO		Y		
Cheilanthes viridis	Pteridophyta				Y	
Chrysocoma ciliata	Asteraceae			Y		

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Cliffortia sp.	Rosaceae			Y		
Clutia sp.	Euphorbiaceae			Y		
Commelina africana	Commelinaceae		Y	Y		
Conyza ivaefolia	Asteraceae		Y	Y		
Corymbium africanum	Asteraceae			Y		
Cotyledon campanulata	Crassulaceae				Y	
Cotyledon tomentosa	Crassulaceae				Y	
Crassula muscosa	Crassulaceae				Y	
Crassula nemorosa	Crassulaceae			Y	Y	
Crassula orbicularis	Crassulaceae				Y	
Crassula tetragona	Crassulaceae			Y		
Crotalaria capensis	Fabaceae				Y	
Cussonia thyrsiflora	Araliaceae				Y	
Cyanotis speciosa	Commelinaceae					
Cynanchum ellipticum	Apocynaceae				Y	
Cynodon dactylon	Poaceae		Y		Y	Y
Cyperus sp.	Cyperaceae		Y			
Cyphia sylvatica	Campanulaceae			Y		
Cyrtanthus obliquus	Amaryllidaceae	PNCO		Y		
Cyrtanthus sp.	Amaryllidaceae					
Delosperma ecklonis	Mesembryanthemaceae	PNCO			Y	
Digitaria eriantha	Poaceae					Y
Diospyros pallens	Ebenaceae			Y	Y	
Disa sp.	Orchidaceae	PNCO		Y		
Disparago ericoides	Asteraceae			Y		
Dodonaea viscosa	Sapindaceae			Y		
Ehretia rigida	Poaceae				Y	Y
Ehrharta calycina	Poaceae		Y		Y	Y
Ehrharta erecta	Poaceae				Y	Y
Elytropappus rhinocerotis	Asteraceae			Y	Y	Y
Eragrostis capensis	Poaceae		Y			Y
Eragrostis curvula	Poaceae					Y
Erepsia aristata	Mesembryanthemaceae	PNCO		Y		
Erica cerinthoides	Ericaceae	PNCO		Y		
Erica pectinifolia	Ericaceae	PNCO		Y		
Eriocephalus africanus	Asteraceae				Y	
Eriospermum brevipes	Ruscaceae			Y		
Euclea crispa	Ebenaceae				Y	
Euclea racemosa	Ebenaceae				Y	
Euclea undulata	Ebenaceae			Y	Y	
Euphorbia silenifolia	Euphorbiaceae					
Euphorbia triangularis	Euphorbiaceae				Y	
Euphorbia woodii	Euphorbiaceae					
Euryops sp.	Asteraceae			Y		

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Eustachys paspaloides	Poaceae				Y	Y
Exomis microphylla	Amaranthaceae				Y	
Felecia filifolia	Asteraceae			Y		
Ficinia nodosa	Cyperaceae				Y	
Gasteria pulchra	Asphodelaceae	PNCO			Y	
Gazania linearis	Asteraceae			Y		
Gerbera sp.	Asteraceae			Y		
Gladiolus longicollis	Iridaceae	PNCO		Y		
Gnidia styphelioides	Thymelaeaceae			Y		
Grewia occidentalis	Tiliaceae				Y	
Gymnosporia capitata	Celastraceae			Y	Y	
Gymnosporia heterophylla	Celastraceae				Y	
Gymnosporia polyacantha	Celastraceae				Y	
Haemanthus sp.	Amaryllidaceae	PNCO		Y		
Haplocarpha lyrata	Asteraceae			Y		
Haworthia cooperi	Asphodelaceae	PNCO		Y		
Helichrysum anomalum	Asteraceae			Y		
Helichrysum cymosum	Asteraceae			Y		Y
Helichrysum nudifolium	Asteraceae			Y		
Hermannia althaeoides	Sterculiaceae			Y		
Hermannia flammea	Sterculiaceae			Y		
Heteropogon contortus	Poaceae				Y	Y
Hibiscus aethiopica small	Malvaceae			Y		
Hibiscus pusillus	Malvaceae			Y	Y	
Hippobromus pauciflorus	Sapindaceae				Y	
Hyparrhenia hirta	Poaceae			Y		Y
Hypoestes aristata	Acanthaceae				Y	
Hypoxis angustifolia	Hypoxidaceae	PNCO		Y		
Indigastrum costatum	Fabaceae				Y	
Indigofera denudata	Fabaceae			Y		
Indigofera hedyantha	Fabaceae				Y	
Indigofera heterophylla	Fabaceae			Y		
Ischyrolepis sp.	Restionaceae	PNCO		Y		
Jasminum angulare	Oleaceae				Y	
Knowltonia cordata	Ranunculaceae					
Lactuca capensis	Asteraceae					
Launaea sp.	Asteraceae					
Lauridia tetragona	Celastraceae				Y	
Ledebouria ensifolia	Hyacinthaceae	PNCO		Y		
Leonotis ocymifolia	Lamiaceae			Y		
Leucadendron salignum	Proteaceae	PNCO		Y		
Leucospermum cuneiforme	Proteaceae	PNCO		Y		
Lobelia tomentosa	Lobeliaceae			Y		
Lycium ferocissimum	Solanaceae					

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Maerua cafra	Capparaceae				Y	
Maytenus undata	Celastraceae				Y	
Melica racemosa	Poaceae				Y	
Melinis repens	Poaceae		Y			Y
Metalasia aurea	Asteraceae			Y		
Metalasia densa	Asteraceae			Y		
Montinia caryophyllacea	Montiniaceae			Y		
Morella serrata	Myricaceae			Y		
Mystroxylon aethiopicum	Celastraceae				Y	
Nemesia floribunda	Scrophulariaceae			Y		
Nylandtia spinosa	Polygalaceae				Y	
Oedera genistifolia	Asteraceae			Y		
Olea europaea subsp africana	Oleaceae				Y	
Ornithogalum longibracteatum	Hyacinthaceae	PNCO			Y	
Osteospermum sp.	Asteraceae			Y		
Osyris compressa	Santalaceae				Y	
Oxalis imbricata	Oxalidaceae			Y		
Oxalis polyphylla	Oxalidaceae			Y		
Panicum deustum	Poaceae				Y	
Panicum maximum	Poaceae		Y		Y	
Pappea capensis	Sapindaceae				Y	
Passerina sp.	Thymelaeaceae			Y		
Pelargonium pulverulentum	Geraniaceae				Y	
Pelargonium reniforme	Geraniaceae	PNCO	Y	Y		Y
Pennisetum clandestinum	Poaceae		Y			Y
Phyllanthus incurvus	Euphorbiaceae					
Phyllanthus maderaspatensis	Euphorbiaceae				Y	
Pinus sp.	Pinaceae	CARA 2				Y
Pittosporum viridiflorum	Pittosporaceae	NFA			Y	
Plectranthus grandidentatus	Lamiaceae				Y	
Plectranthus madagascariensis	Lamiaceae				Y	
Plumbago auriculata	Plumbaginaceae				Y	
Polygala ericaefolia	Polygalaceae			Y		
Protasparagus densiflorus	Asparagaceae	PNCO			Y	
Protea neriifolia	Proteaceae	PNCO		Y		
Ptaeroxylon obliquum	Rutaceae				Y	
Pterocelastrus tricuspidatus	Celastraceae				Y	
Pteronia incana	Asteraceae				Y	
Putterlickia pyracantha	Celastraceae				Y	
Pycreus polystachyos	Cyperaceae				Y	
Rhoiacarpos capensis	Vitaceae				Y	
Rhoicissus digitata	Vitaceae				Y	
Rhoicissus sp.	Vitaceae				Y	

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Rhus glauca	Anacardiaceae				Y	
Rhus incisa	Anacardiaceae				Y	
Rhus longispina	Anacardiaceae				Y	
Rhus lucida	Anacardiaceae				Y	
Rhus pterota	Anacardiaceae				Y	
Rhus refracta	Anacardiaceae				Y	
Rhynchosia capensis	Fabaceae			Y		
Romulea minutiflora	Iridaceae	PNCO		Y		
Rubiaceae sp.	Rubiaceae					
Sansevieria hyacinthoides	Dracaenaceae			Y	Y	
Sarcostemma viminale	Apocynaceae				Y	
Satyrium membranaceum	Orchidaceae	PNCO		Y		Y
Scabiosa columbaria	Dipsacaceae			Y		
Schotia afra var. afra	Fabaceae	NFA		Y	Y	
Scolopia zeyheri	Flacourtiaceae				Y	
Scutia myrtina	Rhamnaceae				Y	
Selago corymbosa	Scrophulariaceae			Y		Y
Senecio chrysocoma	Asteraceae			Y		
Senecio coronatus	Asteraceae			Y		
Senecio crenatus	Asteraceae			Y		
Senecio deltoides	Asteraceae				Y	
Senecio inaequidens	Asteraceae			Y		Y
Senecio pterophorus	Asteraceae			Y		
Senecio radicans	Asteraceae				Y	
Setaria sphacelata	Asteraceae				Y	Y
Sideroxylon inerme	Sapotaceae	NFA			Y	
Solanum tomentosum	Solanaceae					
Sporobolus africana	Poaceae		Y		Y	Y
Stachys aethiopica	Lamiaceae			Y		
Stenotaphrum secundatum	Poaceae		Y			
Stoebe plumosa	Asteraceae			Y		
Struthiola parviflora	Thymelaeaceae			Y		
Sutera microphylla	Scrophulariaceae				Y	
Syncarpha sp.	Asteraceae					
Tarchonanthus camphoratus	Asteraceae				Y	
Tephrosia capensis	Fabaceae			Y		
Thamnochortus sp.	Restionaceae	PNCO		Y		
Themeda triandra	Poaceae		Y	Y	Y	Y
Thesium strictum	Santalaceae					
Thunbergia capensis	Acanthaceae			Y		
Tribolium hispidum	Fabaceae				Y	
Tristachya leucothrix	Poaceae			Y		Y
Tylecodon striatus	Crassulaceae				Y	
Vepris lanceolata	Rutaceae				Y	

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/ Fynbos	Thicket	Pastures and Transformed
Viscum rotundifolium	Viscaceae				Y	
Wahlenbergia sp.	Campanulaceae			Y		
Watsonia pillansii	Iridaceae	PNCO		Y		
Zehneria scabra	Cucurbitaceae					
TOTAL						

Appendix 5.2. Fauna Species List

List of species recorded or likely to occur in the general study area, together with the conservation status. *** CE**: Critically endangered; **E**: Endangered; **VU**: Vulnerable; **LC**: Least concern.

Taxon(Scientific name)	Common Name	Conservation Status*	Presence
Amphibians			
Amietophrynus pardalis	Eastern leopard toad	LC	D
Amietophrynus rangeri	Raucous toad	LC	D
Vandijkophrynus angusticeps	Cape sand toad	LC	L
Hyperolius marmoratus	Painted reed frog	LC	L
Hyperolius horstockii	Arum lily frog	LC	L
Kassina senegalensis	Kassina	LC	L
Semnodactylus wealii	Rattling frog	LC	D
Breviceps adspersus pentheri	Penthers rain frog	LC	L
Xenopus laevis	Common platanna	LC	D
Cacosternum boettgeri	Common caco	LC	D
Cacosternum nanum	Bronz caco	LC	L
Strongylopus fasciatus	Striped stream frog	LC	D
Strongylopus grayii	Clicking stream frog	LC	D
Tomopterna delalandii	Cape sand frog	LC	L
Reptiles			
Chersina angulata	Angulate tortoise	LC	L
Stigmochelys pardalis	Leopard tortoise	LC	L
Homopus areolatus	Parrot beaked Padloper	LC	L
Pelomedusa subrufa	Marsh terrapin	LC	D
Rhinotyphlops lalandei	Delalandes beaked blind snake	LC	L
Leptotyphlops nigricans	Black thread snake	LC	L
Homorolapse lacteus	Harlequin snake	LC	D
Crotaphopeltis hotamboeia	Herald snake	LC	D
Dasypeltis scabra	Rhombic egg eater	LC	L
Dispholidus typus	Boomslang	LC	L
Duberria lutrix	Slug eater	LC	D
Lamprophis aurora	Aurora house snake	LC	L
Lamprophis capensis	Brown house snake	LC	L
Lamprophis fuscus	Yellow bellied house snake	NT	L
Lamprophis inornatus	Olive house snake	LC	L
Lycodonomorphus rufulus	Brown water snake	LC	L
Lycophidion capense capense	Cape wolf snake	LC	L
Philothamnus hoplogaster	Green water snake	LC	L
Philothamnus natalensis occidentalus	Natal green snake	LC	L
Philothamnus semivariegatus	Spotted bush snake	LC	U

Prosymna sundevallii	Sundavilles shovel snout	LC	U
Psammophis crucifer	Crossed marked sand snake	LC	D
Psammophis notostictus	Karroo whip snake	LC	L
Psammophylax rhombeatus	Rhombic skaapsteker	LC	D
Pseudaspis cana	Mole snake	LC	D
Aspidelapse lubricus lubricus	Cape coral snake	LC	U
Hemachatus haemachatus	Rinkhals	LC	D
Naja nivea	Cape cobra	LC	L
Bitis atropos	Berg adder	LC	L
Bitis arietans	Puff adder	LC	D
Causus rhombeatus	Night adder	LC	L
Acontias gracilicauda gracilicauda	Thin tailed legless skink	LC	L
Acontias percivali tasmani	Tasman's legless skink	LC	L
Acontias lineicauda	Algoa legless skink	NC	D
Acontias meleagris orientalis	Eastern legless skink	LC	L
Scelotes anguineus	Algoa dwarf burrowing skink	LC	L
Scelotes caffer	Cape dwarf burrowing skink	LC	L
Trachylepis capensis	Cape skink	LC	C
Trachylepis homalcephala	Red sided skink	LC	C
Trachylepis varia varie	Variable skink	LC	L
Nucras lalandii	Delalande's sandveld lizard	LC	C
Pedioplanis pulchella	Pulchell's sand lizard	LC	L
Tropidosaura montana montana	Common mountain lizard	LC	L
Gerrhosaurus flavigularis	Yellow throated plated lizard	LC	L
Tetradactylus fitzsimonsi	FitzSimon's long tailed seps	VU	L
Tetradactylus seps	Short legged seps	LC	L
Chamaesaura anguina anguina	Cape grass lizard	NT	L
Cordylus cordylus	Cape girdled lizard	LC	D
Cordylus tasmani	Tasman's girdled lizard	VU	L
Pseudocordylus m. microlepidotus	Cape crag lizard	LC	L
Agama atra	Southern rock agama	LC	D
Bradypodion ventrale	Southern dwarf chameleon	LC	D
Bradypodion taeniabronchum	Elandsberg dwarf chameleon	EN	L
Varanus albigularis albigularis	Rock monitor	LC	U
Varanus niloticus	Water monitor	LC	U
Afrogecko porphyreus	Marbled leaf toed gecko	LC	U
Hemidactylus mabouia (ALIEN)	Tropical house gecko	LC	L
Lygodactylus capensis capensis	Cape dwarf gecko	LC	C
Pachydactylus maculatus	Spotted thick toed gecko	LC	C
Mammals			
Amblysomus corriae	Fynbos golden mole	NT	L
Amblysomus hottentotus	Hottentot golden mole	DD	L

Chlorotalpa duthieae	Duthie's golden mole	LC	L
Macroscelides proboscideus	Round eared elephant shrew	LC	L
Orycteropus afer	Aardvark	LC	L
Procavia capensis	Rock hyrax	LC	L
Lepus saxatilis	Scrub hare	LC	D
Pronolagus saundersiae	Hewitt's red rock rabbit	LC	U
Cryptomys hottentotus	African mole rat	LC	L
Georychus capensis	Cape mole rat	LC	L
Hystrix africaeaustralis	Cape porcupine	LC	D
Graphiurus murinus	Woodland dormouse	LC	L
Graphiurus ocularis	Spectacled dormouse	LC	D
Dendromus melanotis	Grey climbing mouse	LC	L
Dendromus mesomelas	Brant's climbing mouse	LC	L
Mastomys natalensis	Natal multimammate mouse	LC	U
Micaelamys namaquensis	Namaqua rock mouse	LC	L
Mus minutoides	Pygmy mouse	LC	L
Mus musculus	House mouse	Alien	L
Otomys irroratus	Vlei rat	LC	D
Otomys unisulcatus	Bush vlei rat	LC	L
Rattus rattus(EXOTIC)	House rat	LC	D
Rhabdomys pumilio	Four-striped grass mouse	LC	D
Saccostomus campestris	Pouched mouse	LC	L
Cercopithecus pygerythrus	Vervet monkey	LC	D
Papio cynocephalus ursinus	Chacma baboon	LC	D
Crocidura cyanea	Reddish-grey musk shrew	DD	L
Crocidura flavescens	Greater red musk shrew	DD	L
Myosorex varius	Forest shrew	DD	L
Caracal caracal	Caracal	LC	
Felis cattus	Feral cat	Feral (Alien)	L
Felis silvestris	African wild cat	LC	L
Panthera pardus	Leopard	LC	U
Genetta genetta	Small spotted genet	LC	D
Genetta tigrina	Large spotted genet	LC	L
Atilax paludinosus	Marsh mongoose	LC	L
Cynictis penicillata	Yellow mongoose	LC	L
Galerella pulverulenta	Cape grey mongoose	LC	D
Herpestes ichneumon	Large grey mongoose	LC	L
Canis vulgaris	Domestic dog	Feral(Alien)	D
Otocyon megalotis	Bat eared fox	LC	D
Vulpes chama	Cape fox	LC	D
Aonyx capensis	African clawless otter	LC	L
Ictonyx striatus	Striped polecat	LC	L
Mellivora capensis	Honey badger	NT	L

Poecilogale albinucha	African striped weasel	DD	L
Potamochoerus larvatus	Bush pig	LC	D
Philantomba monticola	Blue duiker	VU	L
Raphicerus campestris	Steenbok	LC	L
Raphicerus melanotis	Grysbok	LC	D
Sylvicapra grimmia	Common duiker	LC	D
Tragelaphus scriptus	Bush buck	LC	D

Appendix 5.3 Indemnity and conditions relating to this project

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. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserves the right to modify aspects of the report including the recommendations if and when new information becomes available from ongoing research or further work in this field, or pertaining to this investigation.

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Mr Jamie Pote has a BSc honours degree in Botany and Environmental Science, specialising in Ecology, Rehabilitation and Invasive Alien Plant management with 3 years part-time and 5 years full-time experience in southern Africa across a broad spectrum of habitats and operations (mining, residential and resort developments, conservation projects, service provision including power-lines, roads and pipelines), conducting Biophysical Assessments and compiling Environmental Management Plans.

Mr Mark Marshal of Sandula Conservation assisted with the faunal survey and assessment (Terrestrial Mammals, Reptiles and Amphibians).

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