Environmental Impact Assessment for the proposed Banna Ba Pifhu Wind Energy Project near Humansdorp, Eastern Cape: Draft Environmental Impact Assessment Report

Chapter 5:

Impact on Fauna and Flora

Prepared by:
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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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Author

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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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 WKN Windcurrent Banna Ba Pifhu Wind Energy Project near Humansdorp. 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 is 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;
- Integrate 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, A Complete guide to the frogs of Southern Africa (Du Preez & Carruthers 2009) and the 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

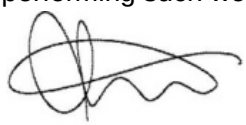
- Faunal surveys based upon a limited sampling time period may not reflect the actual species composition of the site because of seasonal variations.
- An amphibian survey was conducted in the autumn thus actual presence/absence of species could not necessarily be verified and reliance on literature 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

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 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.



Mr 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 and infrastructure

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 kV Eskom grid will be built. Preferably close to the 132 kV line.	The terrestrial environment will be impacted where vegetation clearing is required for substation construction
The connection from the substation to the Eskom grid is **a stretch of overhead line with a pole**, depending on the location of the substation relative to the 132 kV line.	Any ecological impacts will be localised and isolated to disturbances to habitat (this assessment does not apply to birds and bats)
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)
Permanent **wind measuring mast** of 100 m height.	The terrestrial environment is 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 south-west of Humansdorp, Eastern Cape (Figure 5-1).

5.3.2 Site Topography

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 (Appendix 5.1; Figure 5.1). 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 centre of the site and a number of small dams are present along the drainage lines.

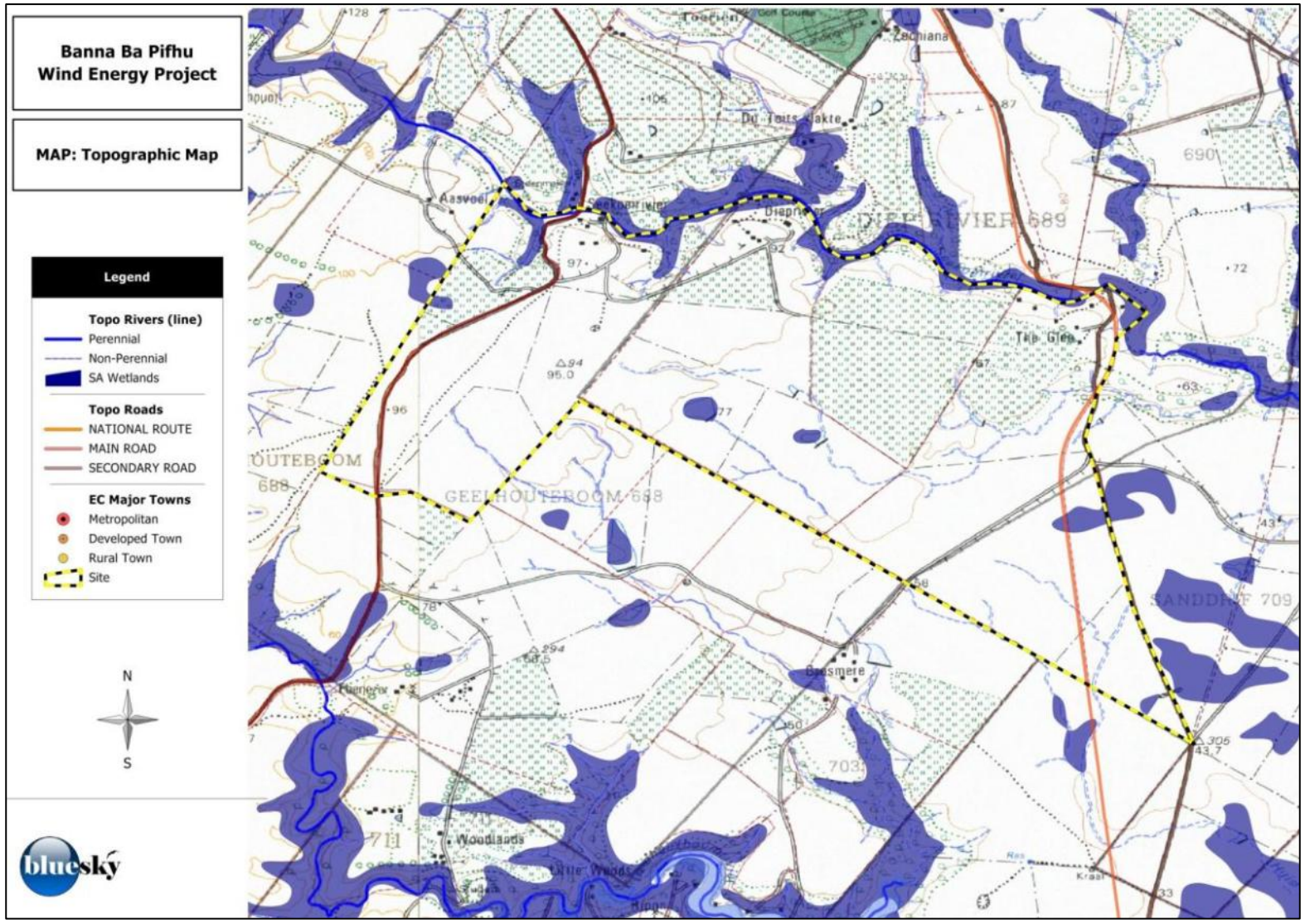


Figure 5-1: Site locality, south-west of Humansdorp.

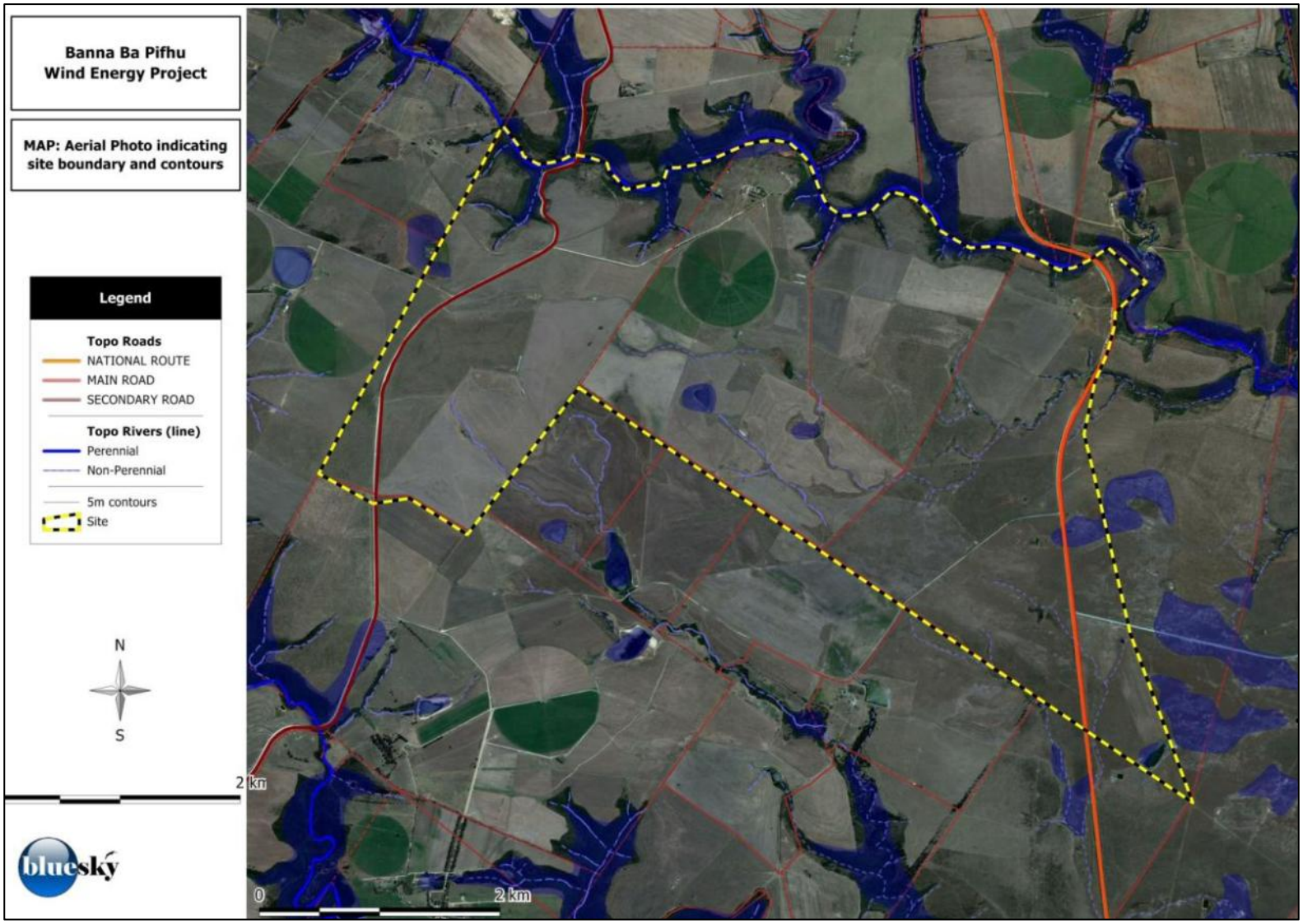


Figure 5-2: Aerial photo of the site, indicating some key topographical features.

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 karroo flora*; hence the vegetation generally is highly diverse.

The Cape Floral Kingdom, typically referred to as Fynbos, is broadly 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 best known 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'*. The Garden Route Biodiversity Sector Plan (2010) provides a synthesis of prioritised information to planners and land-use managers, enabling the integration of biodiversity into land-use planning and decision-making (LUPDM). It identifies those sites that are critical for conserving biodiversity and in this way, facilitates the integration of biodiversity into decision-making (i.e. mainstreaming biodiversity). The overall aim is 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. The broad objective is to ensure appropriate land-use for the best possible sustainable benefits and to promote integrated management of natural resources.

A summary of the affected vegetation units and conservation/ecosystem status as per the various National and Regional Bioregional Plan are provided for in Mucina & Rutherford Vegetation of Southern Africa in (VegSA; Table 5.1 & Figure 5-3); Sub-Tropical Ecosystem Planning (STEP, Table 5.2; Figure 5-4) as well as the Garden Route Biodiversity Spatial Plan (GRBSP, Table 5.3 & Figure 5-5. 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 site as indicated in Table 5.1. Humansdorp Renosterveld is classified as *Endangered* at a National Level.

Table 5.1: Veg Map vegetation units and conservation status.

Vegetation Unit	Conservation Status	Comment
Humansdorp Shale Renosterveld	Endangered	NEMBA 57 (1)
Gamtoos Thicket	Least threatened	

Mucina and Rutherford (2006) 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. All units are classed as being Vulnerable)

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 Garden Route Biodiversity Sector Plan

Numerous Garden Route Biodiversity Sector Plan (GRBSP) vegetation units occur in the vicinity of the proposed development site, which are summarised in Table 5.3. The Garden Route Biodiversity Sector Plan thus identifies *Osbosch Thicket -Renosterveld*, *Kabeljous Valley Thicket* and *Soutvlei Inland Pans* as being Vulnerable, with *Humansdorp Perennial Stream* and *Tsitsikamma Riverine Forest* as being Least Threatened. The conservation status of these vegetation types is primarily driven by loss of habitat through transformation, including predominantly agricultural and urban development activities, but also through degradation as a result of alien plan infestation. Transformation as a result of agricultural activities has resulted in the loss of large areas of potential habitat.

Table 5.3: The Garden Route Bioregional Sector Plan Vegetation variants and respective conservation status.

Vegetation Variant	Vegetation Habitat	Conservation Status
Humansdorp Perennial Stream	Perennial Stream	Least Threatened
Kabeljous Valley Thicket	Valley Thicket	Vulnerable
Osbosch Thicket -Renosterveld	Mesic Mosaic Valley Flora	Vulnerable
Soutvlei Inland Pans	Inland Pans	Vulnerable
Tsitsikamma Riverine Forest	Coastal Riverine	Least Threatened

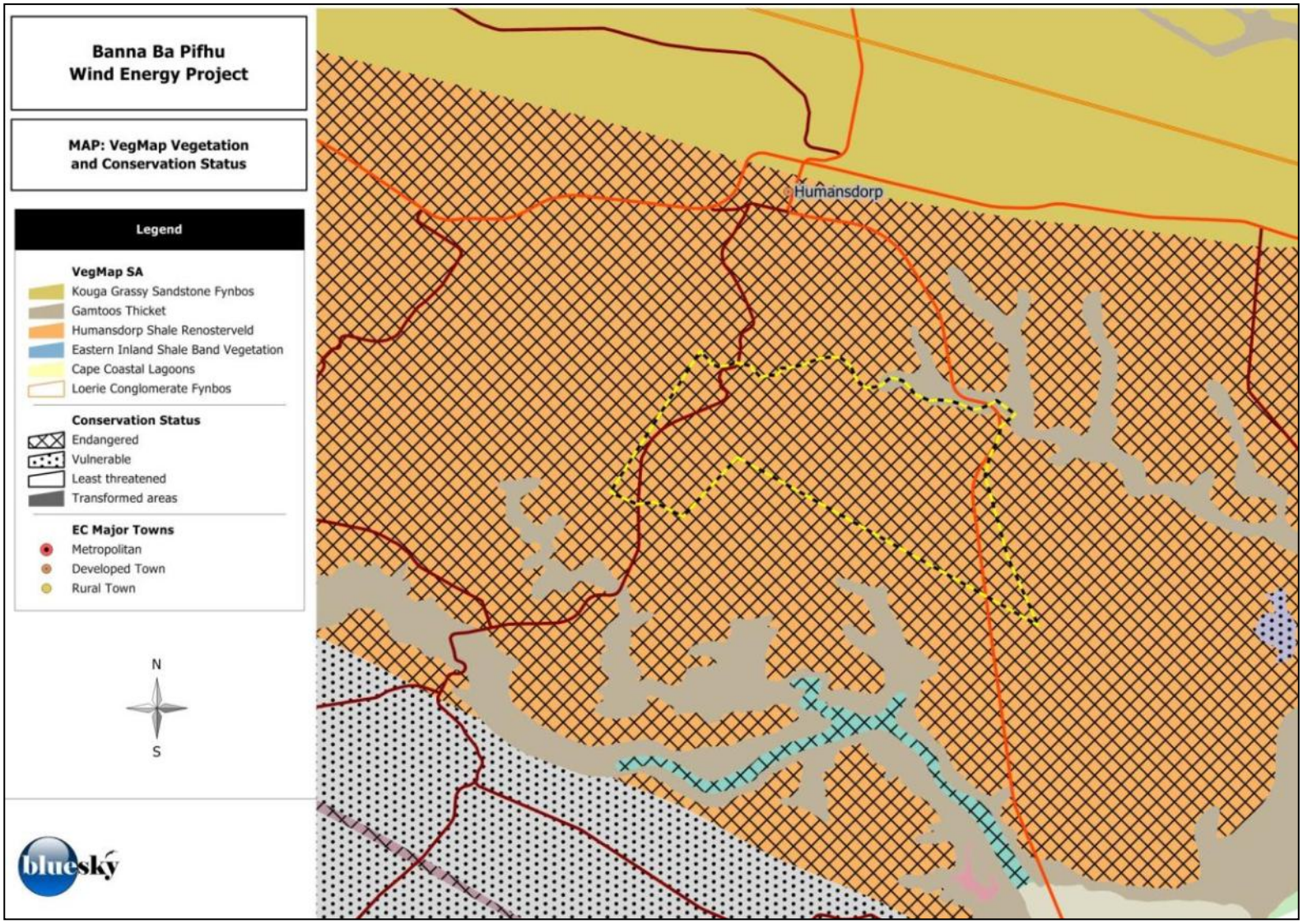


Figure 5-3: VegSA (Mucina & Rutherford) vegetation units and conservation status.

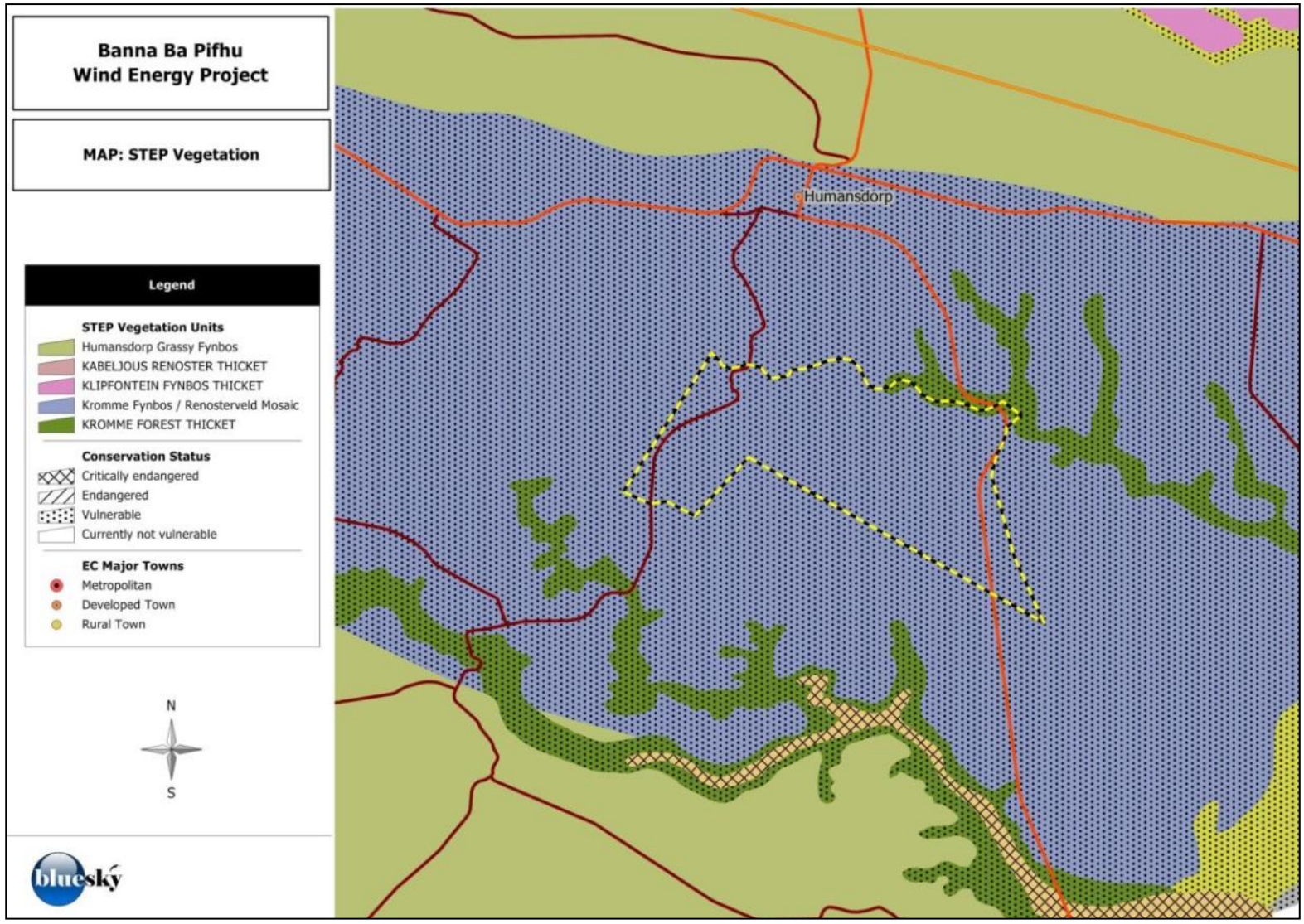


Figure 5-4: STEP vegetation units and conservation status.

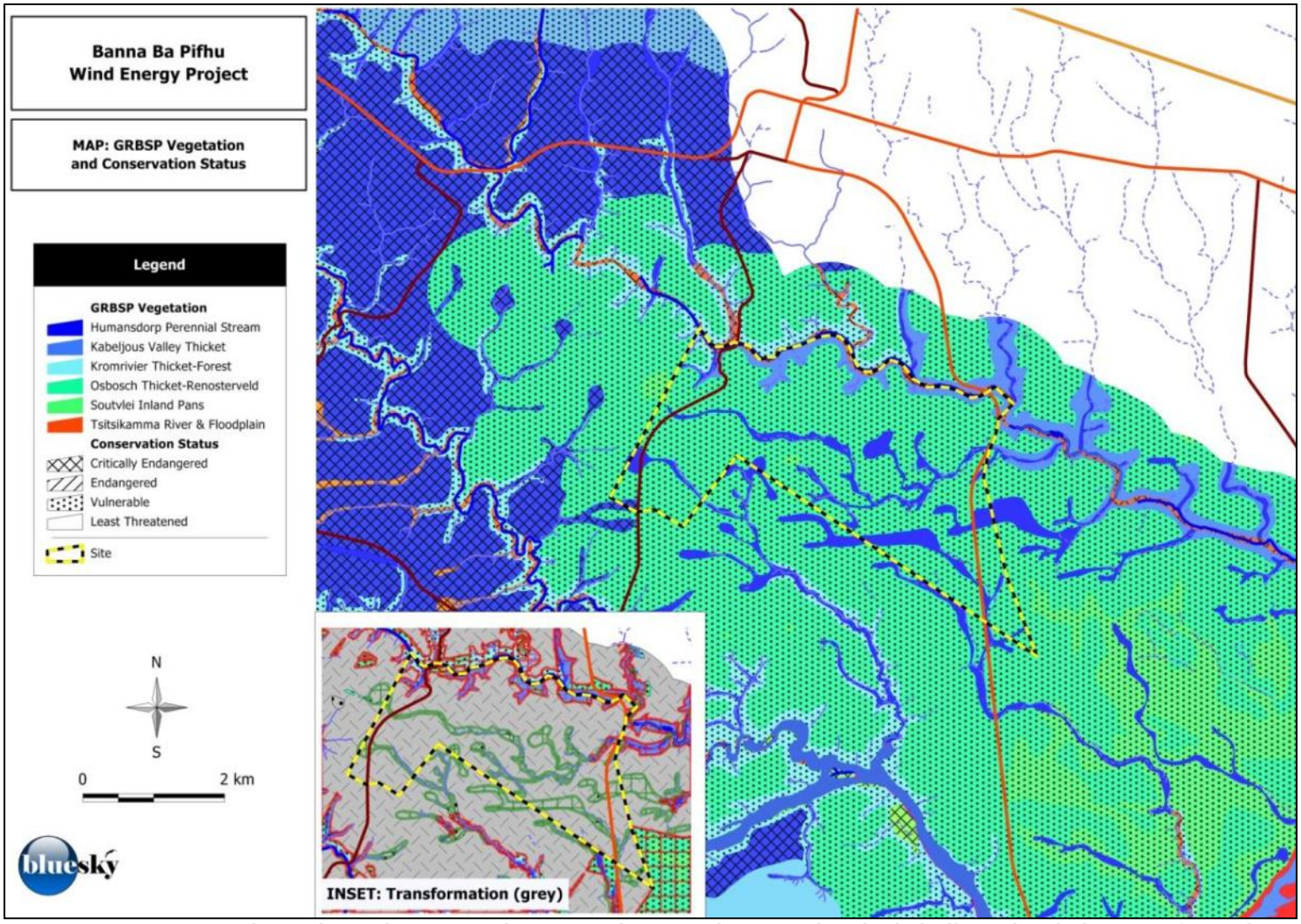


Figure 5-5: GRBSP vegetation units and conservation status (INSET: almost entire site is indicated as being transformed - grey).

5.3.4 Implications of national list of ecosystems that are threatened and in need of protection according to National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (1997) noted that little attention had historically been paid to protection of ecosystems outside protected areas. This laid the basis for the Biodiversity Act to introduce a suite of new legal tools for biodiversity conservation outside protected areas, including listing of threatened or protected ecosystems, listing of threatened or protected species, bioregional plans and biodiversity management plans for ecosystems or species, and biodiversity management agreements.

The purpose of listing threatened ecosystems is primarily to **reduce the rate of ecosystem and species extinction**. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value. For both threatened and protected ecosystems, the purpose includes enabling or facilitating proactive management of these ecosystems. It is likely that ecosystem listing will also play a symbolic and awareness-raising role; however, this is not the primary purpose of listing ecosystems.

The purpose of listing threatened or protected ecosystems is **NOT** to ensure the persistence of landscape-scale ecological processes or to ensure the provision of ecosystem services, even though listing ecosystems may contribute towards these important goals. Bioregional plans published in terms of the Biodiversity Act identify critical biodiversity areas, which will include landscape-scale ecological features (such as ecological corridors and important catchments) which are crucial for biodiversity conservation but which will not be protected through listing of threatened or protected ecosystems. A Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans was gazetted in March 2009.

How were listed ecosystems identified?

- As a starting point, several principles were established for identifying threatened or protected ecosystems:
- The approach must be explicit and repeatable;
- The approach must be target-driven and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed and an ecosystem is listed based on its highest ranking criterion;
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of the ecosystems concerned.

In deciding on the appropriate spatial scale for identifying threatened or protected ecosystems, it was important to consider the purpose and rationale for listing ecosystems as well as the legal implications. These two considerations combined require that listed ecosystems be defined at the local rather than the regional scale. For the current phase of listing, threatened terrestrial ecosystems have been delineated based on one of the following: the South African Vegetation Map, national forest types recognised by DAFF, priority areas identified in a provincial systematic biodiversity plan, or high irreplaceability forests patches or clusters systematically identified by

DAFF. For future phases of listing, ecosystems may be identified at a finer spatial scale than these units, but will not be identified at a broader spatial scale than these units.
The development of criteria for identifying threatened terrestrial ecosystems was done through extensive engagement and consultation with provincial conservation authorities, the Branch: Forestry previously of DWAF and now located in DAFF, and relevant experts, and was based on best available science. The criteria and thresholds for critically endangered, endangered and vulnerable ecosystems are summarised in Table 1 and explained in more detail in the main document. If an ecosystem meets any one of the criteria, it should be listed. If an ecosystem meets more than one criterion, it should be listed based on its highest ranking criterion. For example, if an ecosystem meets the threshold for vulnerable on one criterion and the threshold for endangered on another criterion, it should be listed as endangered.
Table: Criteria used to Identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems

Criterion	Critically Endangered (CR)	Endangered (EN)	Vulnerable (V)
A1: Irreversible loss of habitat	Remaining natural habitat ≤ biodiversity target	Remaining natural habitat ≤ (biodiversity target + 15 %)	Remaining natural habitat ≤ 60 of original area of ecosystem

What are the Implications of listing an ecosystem?
There are four main types of implications of listing an ecosystem:

- Planning related implications, linked to the requirement in the Biodiversity Act for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications, in terms of NEMA and EIA regulations;
- Proactive management implications, in terms of the Biodiversity Act;
- Monitoring and reporting implications, in terms of the Biodiversity Act.

The environmental authorisation Implications are summarised here
The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010),
- Listing Notice 2: activities that require scoping and environmental impact report (EIR} (R545 of 2010),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300 m^2 of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means **any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a basic assessment** in terms of the EIA regulations. It is important to note that **while the original extent of each listed ecosystem has been mapped, a basic assessment report In terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem and not in portions of the ecosystem** where natural habitat has already been irreversibly lost.

The following categories of ecosystems may be listed:

- **critically endangered (CR) ecosystems**, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;

- **endangered (EN) ecosystems**, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- **vulnerable (VU) ecosystems**, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems;
- **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

Only species threatened by restricted activities as defined In the Biodiversity Act have been Included In the lists of threatened or protected species. The Biodiversity Act defines restricted activities as:

- hunting, catching, capturing or killing any living specimen;
- gathering, collecting or plucking any specimen;
- picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen;
- importing or exporting any specimen;
- having in possession or exercising physical control over any specimen;
- growing, breeding or in any other way propagating any specimen or causing it to multiply;
- conveying, moving or otherwise translocating any specimen;
- selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any way acquiring or disposing of any specimen.

This list of restricted activities does not include destruction of the habitat of a species, which is the main driver of loss of terrestrial species. Many species are threatened only by habitat loss; however, these species have not been listed in terms of the Biodiversity Act. Partly for this reason Criterion D: Threatened Species Associations was developed for listing ecosystems. This criterion identifies ecosystems containing high numbers of threatened species. However, it will not be possible to protect all species threatened by habitat loss via the ecosystem listing process, partly because knowledge of the locations of these species is incomplete.

<u>Criterion A1: Irreversible loss of natural habitat</u>

This criterion Identifies ecosystems that have undergone loss of natural habitat, impacting on their structure, function and composition. Loss of natural habitat includes outright loss, for example the removal of natural habitat for cultivation, building of infrastructure, mining etc., as well as severe degradation. For this purpose, habitat is considered severely degraded if it would be unable to recover to a natural or near-natural state following the removal of the cause of the degradation (e.g. invasive aliens, over-grazing}, even after very long time periods. For the current phase of listing, Criterion A1 has been applied to ecosystems defined as national vegetation types in the South African Vegetation Map 16 or as national forest types recognised by DAFF. The thresholds for this criterion are based on the biodiversity targets developed In the National Spatial Biodiversity Assessment (NSBA) 2004. The biodiversity target for a vegetation type is the proportion of the original extent of the vegetation type required to conserve the majority of species associated with that vegetation type. It Is expressed either as a percentage of the original extent of the vegetation type or in hectares. Biodiversity targets for national vegetation types range from 16% to 36%, with higher targets for more species rich vegetation types. For example, a species rich vegetation type with an original extent of 10 000 ha could have a biodiversity target of 30% or 3 000 ha.

An ecosystem is categorised as critically endangered if the extent of remaining natural habitat in the ecosystem is less than or equal to its biodiversity target. This threshold indicates a loss of species and change in species composition within the ecosystem. For example, a 10 000 ha ecosystem with a biodiversity target of 30% would be categorised as critically endangered if 3 000 ha or less of the ecosystem remained in a natural state (or conversely If more than 7 000 ha of the original extent of the ecosystem had been lost). An ecosystem Is categorised as endangered if the extent of remaining natural habitat In the ecosystem Is less or equal to than Its biodiversity target plus 15%. This threshold provides a buffer for critically endangered ecosystems. For example, the 10 000 ha ecosystem with a biodiversity target of 30% would be categorised as endangered if 4 500 ha (45%) or less of the ecosystem remained in a natural state. An ecosystem is categorised as vulnerable if the extent of remaining natural habitat in the ecosystem is less than or equal to 60% of the original extent of the ecosystem. This threshold indicates a loss of ecosystem functioning. For example, a 10 000 ha ecosystem would be categorised as vulnerable if 6 000 ha or less of the ecosystem remained in a natural state. Note that while the Criterion A thresholds for critically endangered and endangered ecosystems vary depending on the biodiversity target for the ecosystem, the threshold for vulnerable ecosystems is independent of the biodiversity target.

The spatial analysis for this criterion used the best available land cover data. For Free State, Limpopo, North West and Northern Cape the best available land cover data was provided by combining the National Land Cover (NLC) 2000 and the NLC 1996. Eastern Cape, Gauteng, KwaZulu-Natal, Mpumalanga and Western Cape had land cover data layers that improved on the NLC 2000 and NLC 1996. These improved data layers were clipped into the combined NLC 2000 and NLC 1996 to make a new "mosaic" national land cover layer that represented the best available land cover data for the country. Land cover categories that were considered to represent outright loss of natural habitat were cultivated areas, forestry plantations, mines and quarries, and urban or built-up areas. Information on severe degradation was included where available; however, degradation has to date been poorly mapped in South Africa, and distinctions between moderate and severe degradation are usually not made in available spatial information.

Table 5.4: Critically Endangered or Endangered vegetation units affected by the proposed development.

Ecosystem	Biome	Criterion
Endangered		
Humansdorp Shale Renosterveld (FRS 19)	Fynbos	A1

Table 5.5: Turbine infrastructure affected by the NEMBA.

Turbines Directly Affected	Turbines Partially Affected	Turbines with access roads passing through
01, 11, 17, 26, 27, 28	23	01, 07, 11, 16, 20, 27, 28

Implications for proposed development
The following listed activities are triggered i.t.o the EIA regulations:

GN R546: Activity 12. The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.
(a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;

A permit in terms of section 57(1) of NEMBA is required to carry out 'restricted activities' (including uprooting, damaging, destroying specimens) of listed threatened or protected species (as listed in terms of section 56 of NEMBA).

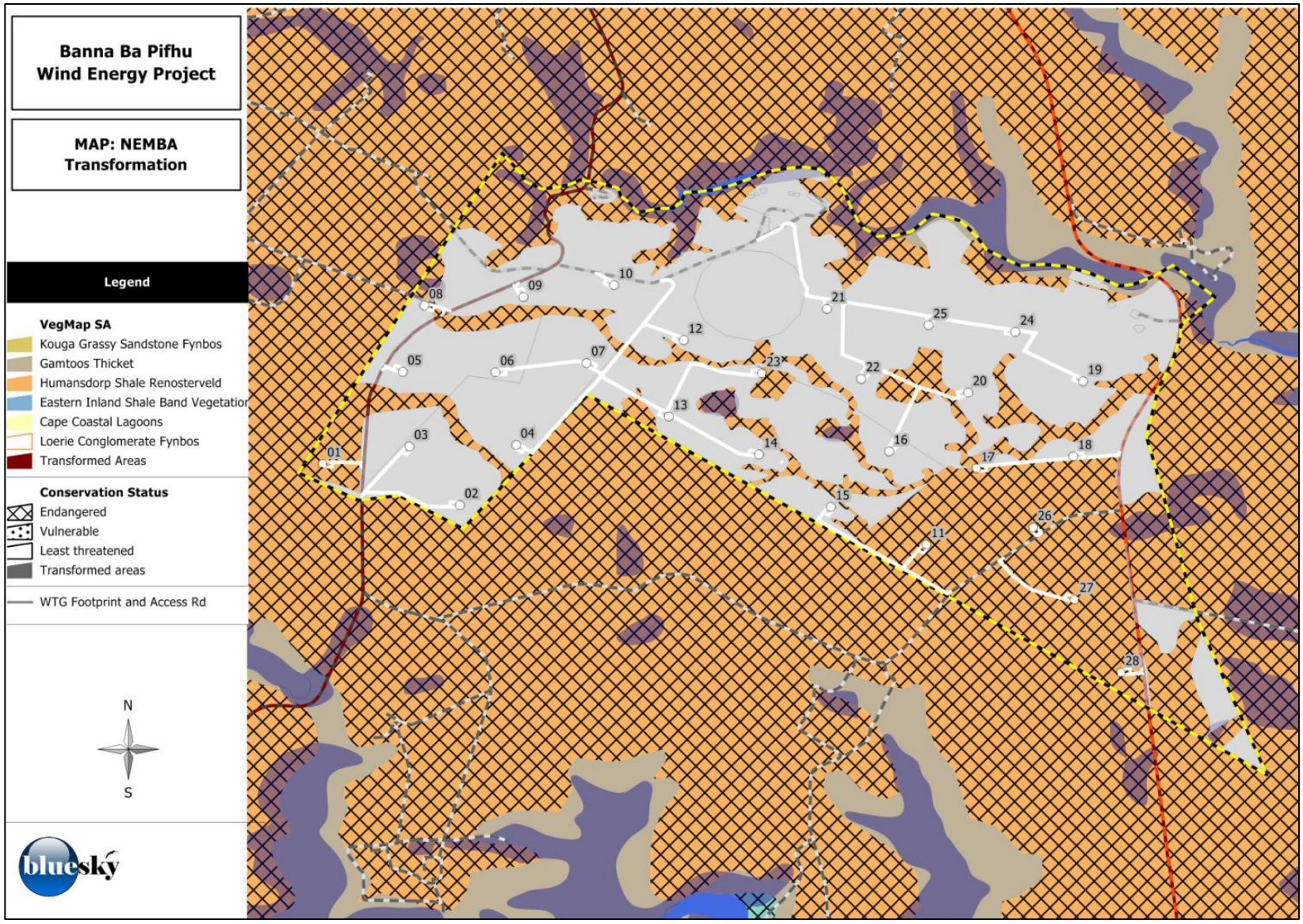


Figure 5-6: Site layout plan indicating turbine sites affected by NEMBA. Transformed areas indicated in grey.

5.4 PERCEIVED REFERENCE STATE: GARDEN ROUTE BIODIVERSITY SECTOR PLAN

The perceived Reference State refers to the original vegetation that would have occurred in an area in the absence of any anthropogenic changes that may have occurred. The designated conservation status of these units is based on the percentage of intact habitat that remains of the original extent.

5.4.1 Osbosch Thicket - Renosterveld

This habitat differs from the Solid Renosterveld in having patches of Subtropical Flora present in fire-protected sites, such as rocky outcrops. The matrix Renosterveld remains similar, but the endemic *Eriocephalus tenuifolius* is absent. The **Osbosch Flora-Renosterveld** differs from the Kabeljous- and Langkloof Flora-Renosterveld in being restricted to the lowland shale flats between Kromriviermond, Jeffrey's Bay and Humansdorp. It is a harsh and windy environment and the clay to loam soils support a dense sward of grasses including *Themeda triandra*. Fairly regular fires sweep through this relatively flat landscape. Indicator species for this unit are: *Aizoon rigidum, Aloe africana, Argyrolobium incanum, Aspalathus spinosa, Bergeranthus multiceps, Berkheya heterophylla, Blepharis procumbens, Cliffortia linearifolia, Convolvulus farinosus, Crassula ciliata, Delosperma cf frutescens, Delosperma robustum, Delosperma prasinum, Elytropappus rhinocerotis, Eustachys paspaloides, Haworthia fasciata, Hermannia flammea, Hermannia involucrata, Indigofera denudata, Ischyrolepis triflora, Metalasia aurea, Metalasia pungens, Leysera gnaphalodes, Oedera genistifolia, Oxalis punctata, Ruschia tenella, Selago canescens, Selago corymbosa, Thunbergia capensis, Rhus pallens, Teucrium trifidum, Tephrosia capensis, Themeda triandra* and *Trachypogon spicatus*.
Conservation Status: Vulnerable

5.4.2 Kabeljous Valley Thicket

Only small examples of this habitat occur along river drainage lines in the eastern section of the domain. Spiny shrubs and trees are abundant in the Valley-Flora, which differs from the Dune Flora in being largely restricted to deep clayey soils, derived from Bokkeveld shale and the species present differs. The tree component is better developed with species such as *Euclea undulata, Pappea capensis, Rhus glauca, Schotia afra* and *Scolopia mundii* more abundant. The shrub component is very similar to those of the Dune Flora, but species such as *Azima tetracantha* and *Rhus crenata* are absent and replaced by species such as *Capparis sepiaria, Clutia daphnoides* and *Ehretia rigida* in the Valley Flora. The **Kabeljous Valley Flora** is found in kloofs and sheltered sites in and around Jeffrey's Bay. *Euphorbia triangularis* reaches its western most distribution on the coastline here. The stunted (<5 m tall) woody component is also highly characteristic of this unit. Being close to the coastline there are several species from the adjacent dune thicket (e.g. *Aloe africana, Sideroxylon inerme)* that co-occur with species more typical of Valley Flora vegetation e.g. *Euclea undulata, Schotia afra* and *Carissa bispinosa*. There are a number of unusual plants around the edges of this vegetation where it forms mosaics with Renosterveld (e.g. *Haworthia fasciata*, *Crassula tetragona, Phyllanthus incurvus, Pteronia hirsuta, Delosperma prasinum, Delosperma cf frutescens)* **Grassy** Fynbos (e.g. *Euryops euryopoides, Agathosma ovata, Metalasia acuta*), or even Strandveld vegetation (e.g. *Rhus pallens* and *Felicia erigeroides*). Although some kloofs appear to be protected in Jeffrey's Bay,

the rapid consolidation and expansion of this town threatens this unit. Special measures need to be taken to ensure the protection of this unit and its edges/transitions and boundaries with adjacent units.
Conservation Status: Vulnerable

5.4.3 Humansdorp Perennial Stream

Humansdorp Perennial Streams occur on shale and the water tends to be muddy and brackish, and is usually surrounded by dense thicket vegetation that often forms a mosaic with Grassy Fynbos on the higher hills, or Renosterveld on the lower slopes. The unit could, perhaps have been included in the River & floodplain habitat, but it probably carried larger amounts of freshwater in the past, which is now utilized by agriculture. Kabeljous Valley Flora occurs with emergent *Euphorbia triangularis* in eastern examples of the unit, indicating that this unit would have been a favoured habitat for a wide variety of game including rhinoceros.
Conservation Status: Least Threatened

5.4.4 Soutvlei Inland Pans

Inland pans are isolated endorheic depressions in the landscape that periodically have stagnant surface water, which play an important hydrological role, but are not directly linked to the other aquatic systems. Little is known about their dynamics, but some may well have been maintained in the past through the impact of large animals such as elephant that used them periodically as wallows. Currently most of these pans are rather severely overgrown, resulting in the rapid loss of smaller associated species such as *Marsilea schelpeana*. We recognize three units in this habitat. Due to their current rather transformed state it is not only difficult to map their occurrence, but also to develop some idea about their original flora. We believe they warrant more attention than has been afforded to them thus far. The **Soutvlei Inland Pans** are situated in the lowland flats or coastal plain south east of Humansdorp. The vegetation is very short and made up of plants with underground spreading rhizomes with vertical shoots. The water in the pans is brackish and muddy and only a few of the pans have perennial water. This unit would have attracted a wide variety of game in the past, and most of the plants are adapted to tolerate heavy grazing pressure. Today this unit is still exposed to grazing by cattle and sheep. Indicator species of this unit include: *Sporobolus virginicus, Asparagus stipulaceus, Asparagus capensis var littoralis, Felicia muricata subsp muricata, Bergeranthus multiceps, Atriplex semibaccata, Crassula capitella, Crassula ciliata, Spergularia media, Limonium scabrum, Gnaphalium vestitum, Sarcocornia spp.* and *Salicornia spp.*
Conservation Status: Vulnerable

Within the site, turbines will primarily be located within Osbosch Thicket - Renosterveld with roads crossing through areas having Soutvlei Inland Pans and Humansdorp Perennial Stream vegetation. Both Osbosch Thicket - Renosterveld and Soutvlei Inland Pans have a Vulnerable conservation status, with Humansdorp Perennial Stream having a Least Threatened conservation status.

5.4.5 Critical Biodiversity Area Guidelines

The Garden Route Biodiversity Sector Plan recognizes **Critical Biodiversity** and **Ecological Support Areas** within and in the vicinity of the proposed wind turbine site. **Critical Biodiversity**

Areas (CBA) are terrestrial (land) and aquatic (water) areas which must be safeguarded in their natural or near natural state as they are critical for conserving biodiversity and maintaining ecosystem functioning. These areas include: (a) natural areas identified as requiring safeguarding in order to meet national biodiversity thresholds; (b) areas required to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services; and/or (c) important locations for biodiversity features or rare species. Ecological Support Areas (ESA) are supporting zones or areas which must be safeguarded as they are needed to prevent degradation of Critical Biodiversity Areas and formal Protected Areas. Although biodiversity pattern and process are interdependent, there are situations where even though pattern is disrupted, certain processes are able to continue functioning. Riparian zones and wetlands in areas of intensive agriculture or plantations may still play an important role in maintaining water quality in rivers that flow through these areas. In Protected Areas and Critical Biodiversity Areas, both pattern and process need to be protected against degradation, whereas in Ecological Support Areas, the protection of ecological processes is required.

Small peripheral portions of the site fall within designated Critical Biodiversity Areas (CBAs) relating to the presence of the inland pans and Ecological Support Areas (ESAs) where Humansdorp Perennial Streams are present. Where areas are designated as CBA or ESA, the Garden Route BSP (2010) guidelines provide guidelines or **Desired Management Objectives** for any proposed activities.

The **Desired Management Objective** for a parcel of land or aquatic ecosystem refers to the ecological state or condition in which it should be maintained (or managed). Different categories require specific management objectives according to their biodiversity priority. In broad terms, the biodiversity priority areas need to be managed in a healthy and functioning condition while the heavily impacted or transformed areas can be further developed. The desired management objectives for designated CBA areas are to "Maintain *natural land. Rehabilitate degraded to natural or near natural and manage for no further degradation*" and to "*Maintain ecological processes*" in Ecological Support Areas. **Figure 5-7** indicates preferred land-use recommendations for CBA and ESA areas.

Critical Biodiversity and Ecological Support Area permits **infrastructure installation** related land-uses in designated CBA and ESA areas having a **restricted** nature and guidelines recommend 'strict controls' over activities in these areas.

Infrastructure Installations

This land-use accommodates infrastructure installations serving both the urban and rural areas where such installations include:

- Wastewater treatment works, airports, water extraction purification plants, safety and security (e.g. police stations), irrigation infrastructure, roads, power lines, railways and pipelines;
- Nuclear power stations, wind farms or other alternative energy technologies requiring large areas of undeveloped land; and
- All substantial impoundments, reservoirs or dams and weirs, with associated pipelines, canals, access roads and bulk water transfer schemes).

The following conditions/controls are assumed:

- Installations to be located on transformed, disturbed or low-value agricultural land, where possible.
- A shared location and/or facility (e.g. police and clinic in a community service centre).

- Infrastructure installations requiring a location outside the urban edge is restricted to extensive agricultural areas peripheral to settlements in close proximity to regional routes to facilitate access and restrict fragmentation of the agricultural landscape.
- Installations in intensive agricultural areas are restricted to essential services (e.g. irrigation infrastructure, safety and security).
- Energy generating developments (i.e. nuclear power, wind farms, etc) are associated with large areas of land left undeveloped thereby maintaining low transformation levels relative to the property size.
- Avoidance of sensitive areas such as floodlines, river and wetland buffers and Special Habitats.
- All water-use developments should be subject to the Ecological Reserve in terms of the National Water Act.

The Garden Route BSP further recommends the following for activities within areas designated as CBAs or ESAs:

- Minimise loss of any natural habitat and Minimise further fragmentation of habitat.
- If degraded or disturbed lands are identified as components of a landscape corridor, no further hardening of the surface should be allowed as this poses threats to the functioning of the corridor.
- Prioritise as prime candidates for biodiversity offset receiving areas.
- Implement management programmes to maintain natural ecological processes; e.g. fire management in fynbos vegetation types.
- Implement regular environmental monitoring and reporting of biodiversity and/or change of land-use to prevent unauthorized development or degradation by neglect or ignorance. To be carried out by DEDEA, Department of Water Affairs (of DWEA), and the Department of Agriculture (of DAFF).
- Prioritise as prime areas for conservation projects or activities and alien clearance programmes etc. by LandCare, Working for Water, Working for Wetlands, Working for the Coast, (CoastCare) and NGOs.
- Implement restoration or rehabilitation programmes in degraded or disturbed sites i.e. an integrated alien management plan.
- Compile Environmental Management Plans, where possible, to include, e.g. alien plant control, fire management etc.
- Prioritise for incorporation into the protected areas network, and for stewardship agreements.
- Prioritize for rates rebates by Municipalities (in terms of the Municipal Property Rates Act 6 of 2004).
- Use CBA boundaries to demarcate urban edges to limit lateral expansion of urban development along landscape corridors.
- Incorporate CBA into Urban Open Space Systems.
- All the management conditions/controls that correlate to the recommended land-uses in CBA should be adhered to. These should be further supported by the Western Cape Provincial Rural Land-Use Planning and Management Guidelines.
- Any loss in CBA should be recorded, preferably in GIS format, to encourage monitoring of the CBA Map.

KEY: Biodiversity sector land-use recommendations

- **Yes = Encouraged;**
- **No = Discouraged;**
- **Restricted = Land-use possible under strict controls in order to avoid impacts on biodiversity.**

CBA MAP CATEGORY →	Refer to Table 4.3 (pg 36) for the land-use activity descriptions as per pre-defined Town and Regional planning terms	Formal Protected Areas	Critical Biodiversity Areas	Ecological Support Areas	Other Natural Areas	No Natural Areas Remaining
DESIRED MANAGEMENT OBJECTIVE →		Maintain natural land. Rehabilitate degraded to natural or near natural and manage for no further degradation.	Maintain natural land. Rehabilitate degraded to natural or near natural and manage for no further degradation.	Maintain ecological processes	Sustainable Management within general rural land-use principles	Sustainable Management within general rural land-use principles. **Favoured areas for development.**
PSDF SPATIAL PLANNING CATEGORY → / LAND-USE ACTIVITY ↓		**Core 1**	**Core 1**	**Core 2**	Buffer 1 or 2 at the discretion of Town and Regional Planners	Intensive Agriculture and Settlement
1) CONSERVATION		LAND-USE GOVERNED BY THE NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT (NEMPAA) AND A PROTECTED AREA MANAGEMENT PLAN	Yes	Yes	REFER TO THE PROVINCIAL RURAL LAND-USE PLANNING AND MANAGEMENT GUIDELINES[18] FOR GUIDANCE IN IDENTIFYING APPROPRIATE LAND-USE ACTIVITIES ALWAYS MANAGE FOR SUSTAINABLE DEVELOPMENT WHEN CONSIDERING LAND and WATER RESOURCE USE APPLICATIONS IN NATURAL AREAS	
2a) AGRICULTURE -HIGH IMPACT : Intensive Agriculture *(includes forestry plantation and space extensive agricultural enterprises)*			No	No		
2b) AGRICULTURE - LOW IMPACT: Extensive Agriculture			Restricted	Yes		
3) HOLIDAY ACCOMMODATION			Restricted	Restricted		
4a) RURAL HOUSING: Low Density Rural Housing *(Consolidation of rural erven for conservation)*			Restricted	Restricted		
4b) RURAL HOUSING: On-Farm Workers Settlement			No	Restricted		
5a) TOURIST and RECREATIONAL FACILITIES - LOW IMPACT: Lecture rooms, restrooms, restaurants, gift shops and outdoor recreation			Restricted	Restricted		
5b) TOURIST and RECREATIONAL FACILITIES - HIGH IMPACT: Golf , polo, and housing eco-estates			No	No		
6a) RURAL BUSINESS: Place Bound			Restricted	Restricted		
6b) RURAL BUSINESS: Non Place Bound			No	No		
7) RURAL INDUSTRY			No	No		
8) SMALL HOLDINGS			No	No		
9) COMMUNITY FACILITIES and INSTITUTIONS			No	No		
10) INFRASTRUCTURE INSTALLATIONS			Restricted	Restricted		
11a) SETTLEMENT: Existing Settlements (Urban Expansion)			No	No		
11b) SETTLEMENT: New Settlements			No	No		

IMPORTANT NOTE: These land-use guidelines serve as the primary biodiversity informant to land-use planning and decision-making, and cannot grant or take away existing land-use rights.

Figure 5-7: Recommended biodiversity-compatible land-use guidelines matrix (source: Garden Route BSP, 2010).

The Garden Route BSP guidelines thus permit the use of areas for large-scale wind turbine farms where they 'are associated with large areas of land left undeveloped thereby maintaining low transformation levels relative to the property size'; installations to be located on transformed, disturbed or low-value agricultural land, where possible' and ' avoidance of sensitive areas such as floodlines, river and wetland buffers and Special Habitats'

5.4.5.1 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.

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.

- 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.

5.4.6 Description of Vegetation, Flora and Fauna

5.4.6.1 Vegetation Communities - Present Ecological State (PES)

The present Ecological State describes the current ecological condition, taking into account levels of land degradation, alien infestation, transformation and such activities that will have altered the vegetation from its original state. Whilst the Garden Route BSP identifies a number of distinct vegetation variants, for the purposes of this report, these have been broadly grouped into similar ecological functional groups, namely:

A. Shale Renosterveld or Osbosch Thicket - Renosterveld community
B. Gamtoos Thicket or Kabeljous Valley Thicket
C. Riparian Vegetation along seeps and ephemeral river courses (Humansdorp Perennial Streams) and wetlands
D. Inland Pans
E. Transformed vegetation

These similar functional groups have been sub-divided into similar communities, bases on the Garden Route Biodiversity Sector Plan Variant classification described in the previous section and described and mapped accordingly in the respective sections below including the habitat sensitivity assessment.

A. Shale Renosterveld or Osbosch Thicket - Renosterveld community

The Osbosch Thicket Renosterveld, where not invaded and disturbed or transformed tends to be typical of the vegetation units, but is largely transformed within the site. The unit tends to be most intact in areas having shallow soil, often associated with or surrounding the distinct rocky refugias. Extensive areas of Strandveld present on vegetated dunes. Where intact, it is composed of a mix of small shrubs, herbs, grasses and restios typically less than 0.5 m in height. Thicket elements are present in scattered clumps where conditions permit. A number of protected species are present within these habitats. Footprints will result in a minimal loss of the units due to the limited footprint size and dispersed nature of the turbine layout. Ecological functioning is intact, where excessive fire has not occurred and it provides an important habitat for faunal species.

- 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 (predominantly pastures and grazing;

- Severely degraded (non-restorable) portions of this vegetation type are present where extensive areas have been converted to pastures.

Some elements of this unit are present with *Elytropappus rhinocerotis* dominating degraded areas, however it is 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 0.5 m 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 5-8: Typical pasture with re-establishment of Renosterveld elements

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

Osbosch Thicket 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, 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; and
- A few severely degraded (non-restorable) portions of this vegetation type are present.

Implications for the proposed windfarm

- Loss of intact vegetation dependent 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. Gamtoos Thicket or Kabeljous Valley Thicket

The thicket tends to be limited to slopes around drainage lines, with some pockets in fire protected areas within the grassy fynbos mosaic. 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 some pockets of alien trees are present and some of the original vegetation has been lost through direct clearing and in areas flooded by dams. The thicket (Figure 5-10 & Figure 5-11) tends to be limited to slopes around drainage lines, with some pockets in fire protected areas within the grassy fynbos mosaic.

Figure 5-10: Typical Thicket

Figure 5-11: Typical 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.

C. Riparian Vegetation

The seasonal wetlands and seep areas comprise primarily the Soutvlei Inland Pans but are also represented in the GRBSP Humansdorp Perennial Stream Variants as described above. Wetlands, Pans and Seeps can mostly be distinguished by having a variety of short grasses present. No species of special concern were noted to be within the pans. Typical and abundant species include: *Cynodon dactylon, Ehrharta calycina, Eragrostis capensis, Ficinia sp., Melinis repens, Panicum maximum, Sporobolus africana, Stenotaphrum secundatum* and *Themeda triandra.*

GRBSP Variants include Humansdorp Perennial Stream as described above. Typical Riparian vegetation elements, including the grasses, Cyperaceae, *Ficinia sp*., *Phragmites australis* and *Typha capensis* are present, especially around dams. Some thicket and forest elements along slopes adjacent to drainage lines in places.

- Large areas intact, but some degradation evident as a result of historical land-use practices in the area, including pastures;

A few severely degraded (non-restorable) portions of this vegetation type are present along the southern boundary.

The seasonal wetlands (Figure 5-12 to Figure 5-17) 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 5-12: Typical Soutvlei Inland Pan

Figure 5-13: Seasonal stream with typical seasonal grasses and sedges dominating

Figure 5-14: Typical Riparian Seep along a drainage line with short seasonal grasses

Figure 5-15: Seasonal stream with typical seasonal grasses and sedges dominating

Figure 5-16: Modified drainage line with dam constructed

Figure 5-17: 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.

D. Transformed vegetation.

The transformed areas 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 5-18: Irrigated lands

Figure 5-19: Cultivated land with some regeneration of shrub elements

Figure 5-20: Typical pastures dominating the majority of the site

Figure 5-21: Extensive transformed pastures throughout the site

Typical grass species include *Digitaria* sp., *Pennisetum clandestinum, Stenotaphrum secundatum* and *Themeda triandra.* Protected 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.

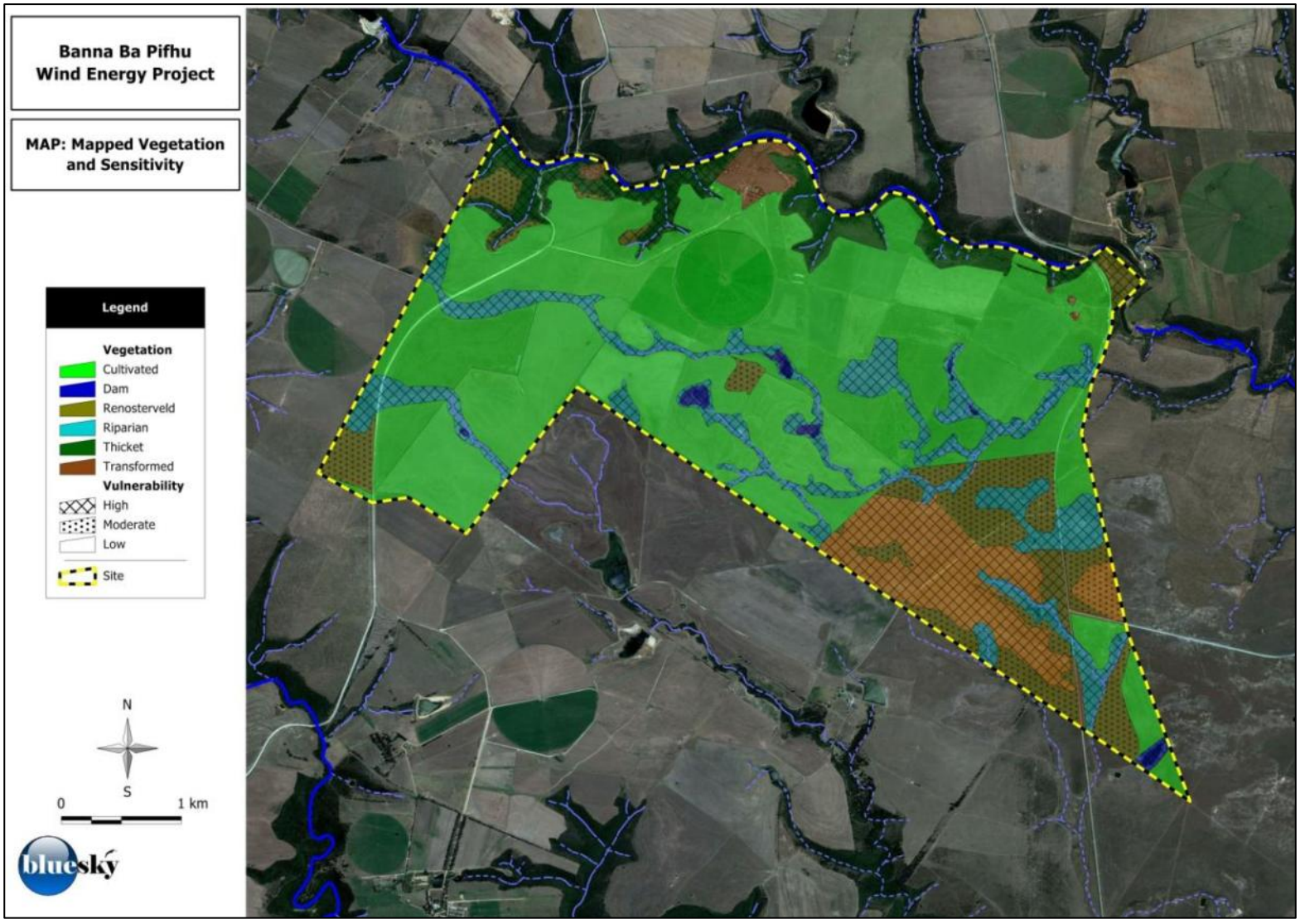


Figure 5-22: Mapped Vegetation communities with respective ecological sensitivity indicated.

5.4.6.2 Terrestrial Habitat Vulnerability Assessment Method

An overall vulnerability assessment incorporating key vegetation and ecological indicators (summarised in Table 5.6) was made and includes the following key criteria:

- Relative levels of *intactness* in terms of 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.

5.4.6.3 Ecological Indicators

A summary of key Present Ecological State indicators for the area are presented in Table 5.6 below. Since historical data are lacking some assumptions have been made where necessary.

Table 5.6: 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 site is relatively flat to gently undulating plateaux
Substrate	Predominately shale
Habitat 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.
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)
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 for 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 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	Amphibians associated with wetlands and seeps and may migrate during rainfall periods.
Indigenous Species of Special Concern	See Table 5.7 below for list

Aspect	Description
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 largely absent.
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 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.
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 extensive historical 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)	Gamtoos Thicket is widespread, but restricted to kloofs and river valleys. Humansdorp Shale Renosterveld tends to be transformed and degraded through agricultural activities.
Relative Conservation importance	Humansdorp Shale Renosterveld vegetation has a low to moderate local conservation importance where intact, Gamtoos Thicket has a moderate local conservation importance but both tend to be transformed and degraded through agricultural activities.
Overall Intactness	Excessive bush clearing, cultivation, 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.

5.4.6.4 Floral diversity

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 the majority of the site extensively transformed as a result of cultivation. Turbine and associated infrastructure 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

Twenty-Five protected plant species occurred within the site (Table 5.7). Most of the species are widely distributed and it is unlikely that the proposed development would have any significant impact on populations.

Table 5.7: Indigenous Species of Special Concern.

Botanical Name*	Family	Status**	Regional Distribution/ Endemism+	Distribution within the site
Aloe africana	Asphodelaceae	PNCO	Regionally Widespread and Common	Renosterveld, Thicket
Aloe speciosa	Asphodelaceae	PNCO	WC, EC	Thicket
Asparagus aethiopicus	Asparagaceae	PNCO	Namaqualand to Transkei	Thicket
Asparagus capensis	Asparagaceae	PNCO	Namibia to Transkei	Renosterveld
Asparagus racemosus	Asparagaceae	PNCO	Widespread	Thicket
Asparagus striatus	Asparagaceae	PNCO	WC, EC, FS	Thicket
Bobartia orientalis	Iridaceae	PNCO	Widespread	Renosterveld
Bulbine frutescens	Hyacinthaceae	PNCO	Widespread	Renosterveld
Chasmanthe aethiopica	Iridaceae	PNCO	EC, WC	Renosterveld
Disa sp.	Orchidaceae	PNCO		Renosterveld
Gladiolus longicollis	Iridaceae	PNCO	Widespread	Thicket
Haemanthus sp.	Amaryllidaceae	PNCO		Thicket
Hypoxis angustifolia	Hypoxidaceae	PNCO	Widespread	Thicket
Ischyrolepis sp	Restionaceae	PNCO	Widespread	Thicket
Ledebouria ensifolia	Hyacinthaceae	PNCO	Widespread	Thicket
Ornithogalum longibracteatum	Hyacinthaceae	PNCO	Widespread	Thicket
Pelargonium reniforme	Geraniaceae	PNCO	Widespread	Thicket
Pittosporum viridiflorum	Pittosporaceae	NFA	Widespread	Thicket
Protasparagus densiflorus	Asparagaceae	PNCO	Widespread	Renosterveld
Romulea minutiflora	Iridaceae	PNCO	WC, EC	Thicket
Satyrium membranaceum	Orchidaceae	PNCO	Widespread	Thicket

Schotia afra var afra	Fabaceae	NFA	Widespread	Thicket
Sideroxylon inerme	Sapotaceae	NFA	Widespread	Thicket
Thamnochortus sp	Restionaceae	PNCO	Widespread	Renosterveld
Watsonia pillansii	Iridaceae	PNCO	Widespread	Renosterveld

*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 in rehabilitation. 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 can be housed in a temporary nursery until such time as relocation areas have been identified.

C. Invasive Flora

Three invasive alien plant species were present within the sites (Table 5.8), 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 Appendices.

Table 5.8: 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 E for removal requirements.

D. Eradication protocol

Specific eradication and management procedures must be stipulated in the Environmental Management Plan (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).

5.4.6.5 Fauna

The faunal diversity of the central and western regions of the Eastern Cape, including Humansdorp and Jeffreys 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.

Description of Area

The proposed site consists of secondary grasslands, wetlands and seeps with a large portion of the area consisting of agricultural land for the cultivation of crops, pastures and livestock grazing. There are numerous wetlands through the site which are vegetated with indigenous vegetation. Rocky outcrops are mainly artificial and limited to small pockets of rocks which were removed and piled outside of cultivated lands. A number of small dams and ponds are present within the site.

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: There are 14 amphibian species which could occur within the site, all of which are of least concern in terms of conservation status. The amphibians in the proposed development site include clicking stream frog (*Strongylopus grayii*), leopard toad *(Amietophrynus pardalis*) and raucous toad (*Amietophrynus regius*). As the case with most frog species, the frogs in this area are dependent on water, therefore the majority of them will be found in or near the permanent water source or active seeps. During times of rainfall, they will spread in distribution and enter now watered seeps, pans etc. Frogs, for example, Common Cacos (*Cacosternum boettgeri*) will gather under accessible stones and fallen logs during dry spells and emerge during rainfall periods. The two toads present, namely raucous toad and leopard toad burrow underground during dry spells and will also emerge during times of rainfall, usually after dark. All the amphibians within the proposed development site are listed as least concern in terms of their conservation status.

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 Penther's rain frog (*Breviceps adspersus pentheri*), a terrestrial breeder independent of standing water for reproduction, is probably widely distributed throughout the fynbos habitat.

Figure 5-23: Painted reed frog (*Hyperolius marmoratus*)

Figure 5-24: Eastern leopard toad (*Amietophrynus pardalis*)

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 (see Appendices 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 pers. comm.) emphasizes the need for more surveys in the area and to understand the ecology of these species.
Reptiles will inhabit portions of natural vegetation which have not been disturbed by agriculture. Common reptiles are Puff Adders (*Bitis arietans*) and Rinkhals (*Hemachatus haemachatus*). Open natural vegetation which consists of grassy to woody habitat provides habitat for snakes such as rhombic skaapstekers (*Psammophylax rhombeatus*) and grass snakes such as crossed marked sand snake(*Psammophis crucifer*). The yellow bellied house snake (*Lamprophis fuscus*) which is near threatened occurs within this area and can be found under grounded logs and rocks. The snakes from these habitats often venture into the crops and ecotones. Red Lipped Herald Snakes (*Crotaphopeltis hotamboeia*) will occur due to the abundance of seeps and wetland which will be high in amphibians. Red Lipped Herald Snakes together with Rinkhals and Night Adders will frequent this site due to the high presence of amphibians; being their primary

food source. FitzSimon's long-tailed seps (*Tetradactylus fitzsimonsi*), is listed as vulnerable and occurs within this area.

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 in 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 Renosterveld 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 thicket/forest edges or clearings.

Figure 5-25: Puff adder (*Bitis arietans*) common species

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

Figure 5-27: Cape girdled lizard (*Cordylus cordylus*); CITES II

Figure 5-28: Mountain tortoise (*Stigmochelys pardalis*); CITES II

Figure 5-29: Cape grass lizard (*Chamaesaura anguina anguina*) Near threatened.

Figure 5-30: Red sided skink (*Tetradactylus homalocephala*); Least Concern

Figure 5-31: Herald snake (*Crotaphopeltis hotamboeia)*

Figure 5-32: Rinkhals *(Hemachatus haemachatus)*

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*).

There are 52 species of mammals which could occur on the site, of these species, three are of special concern. The mammals can be divided into groups, namely: small (including predators), medium sized (including predators) and large (including predators).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, may occur on the site, but this subject to the availability of prey items such as rodents. Blue duiker (*Philantomba monticola*), is listed as vulnerable in terms of its conservation status (IUCN) and listed under the Threatened or Protected Species Act as protected, will occur within the area, but will be restricted to wooded areas. Medium-sized mammals such as grysbok, common duiker and porcupine occupy habitats

ranging from grassland to shrubby areas; due to the lack of these habitats, the presence of these mammals will be limited. Medium-sized predators, for example caracal occur in this habitat but few are present due to eradication methods, as caracal are often in conflict with live stock farming. Large mammals such as bush buck may not occur within this area due to the lack of heavily wooded habitat. They are browsers and the browsing capacity is limited within the proposed development site. The distribution of leopards covers the proposed development site. It is highly unlikely that leopards are still present in the area as they are a major threat to livestock farming and probably have been eradicated from the area. Although not habitat-specific, the honey badger (*Mellivora capensis*) with near threatened conservation status, and is listed in the Threatened Or Protected Species Act, may occur within the area.

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-Renosterveld-Thicket mosaic. The striped mouse is an important pollinator of some proteas (Cowling and Richardson 1995).

5.5 IDENTIFICATION OF ISSUES AND IMPACTS

5.5.1 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 crossings 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 Humansdorp Shale Renosterveld habitat
2. Loss of Gamtoos Thicket (including Thicket clumps) habitat
3. Loss of riparian and wetland vegetation habitat

B. Reduction or changes to ecological processes and functioning
4. Alteration of Humansdorp Shale Renosterveld ecological processes and functioning
5. Alteration of Gamtoos Thicket (including Thicket clumps) ecological processes and functioning
6. Alteration of riparian and wetland vegetation ecological processes and functioning
7. Temporary fragmentation of habitats during construction
8. Increased risk of alien plant invasion in drainage lines and disturbed areas
9. Changes in the natural fire regime
10. Overall reduction in ecosystem functioning

C. Loss of species of special concern and SSC habitat
11. Loss of Humansdorp Shale Renosterveld SSC and SSC habitat
12. Loss of Gamtoos Thicket SSC and SSC habitat
13. Loss of Floral SSC and SSC habitat

5.5.2 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:

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.

<u>1. Habitat destruction may affect faunal diversity and composition</u>

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 metres wide the actual destruction tends to be greater than 5 metres 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 metres. 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 5-33: Example of typical wind turbine footprint lay down area (Coega IDZ).

Figure 5-34: 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 traverse the road. 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. For example, as many as 298 Leopard toads were killed within an hour along a 50 metre 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 5-35: Puff adder (*Bitis arietans*), killed on road

Figure 5-36: Marsh terrapin killed on road by vehicle.

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 5-37 & Figure 5-38).

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 animals 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 5-37: Example of water monitor electrocuted in fence

Figure 5-38: Example of fence-line within the 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 is 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 animals 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.

5.5.3 SiteLlayout Plan

The site layout plan for the proposed wind energy project consists of 25 sites plus 3 optional additional sites (sites 26 -28). Alternative site layout scenarios would consist of 19 to 28 Wind Turbine Generator sites based on the layout plan provided, depending on the overall capacity of the turbines selected. Since the majority of the site is transformed cultivated lands and pastures, the overall impacts of the three alternatives will be similar, but layout differences will result in slightly different potential impacts.

The proposed layout will comprise 28 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. The layout in relation to the mapped vegetation of communities is shown in Figure 5-39.

The resulting loss of habitat will be proportional to the area vegetation clearing required to construct the access roads, cabling and the 28 turbine sites with associated hard-standing surfaces. Overall impact will be significantly lower

Implications

- Drainage line road crossings will be required between turbines 20 and 22 as well as between 22 and 23.
- Turbines 8, 9, 12, 14, 15, 17, 18, 19, 20 and 23 are sited directly adjacent to or within drainage lines or wetland areas or areas that would be classified as being watercourses and additional care should be taken as per recommendations of wetland specialist.
- Turbine sites 01 and 23 are located within or adjacent to areas having a moderate ecological sensitivity.
- Turbine sites 11, 17, 26, 27 and 28 are located within areas having a high ecological sensitivity.
- Selection of sites for a lesser number of higher capacity turbines should be made according to site sensitivity and higher sensitivity sites should be removed under these scenarios.

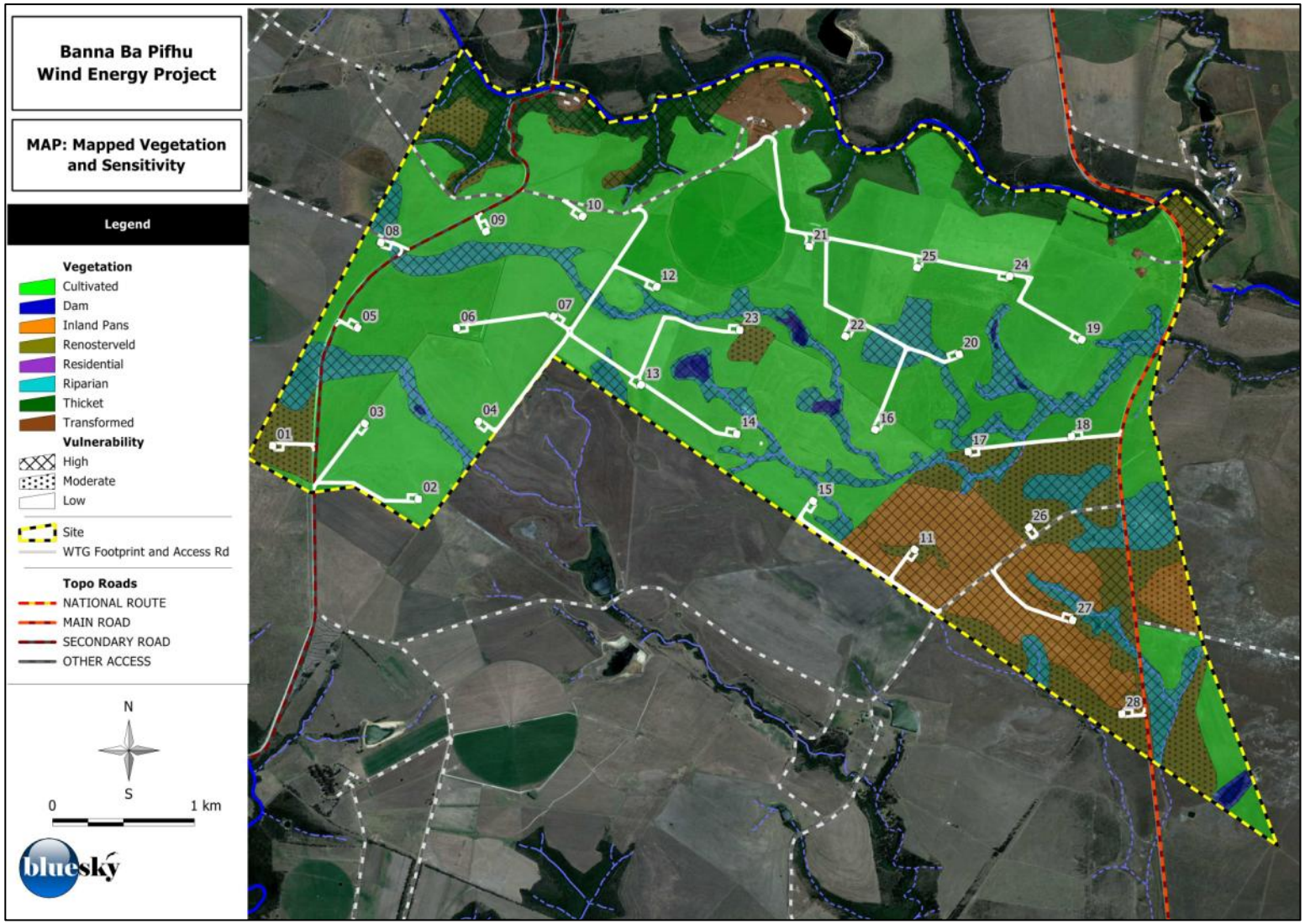


Figure 5-39: Mapped Vegetation communities with layout overlain for maximum number of sites (28 x 2 MW turbines).

5.6 PERMIT REQUIREMENTS

5.6.1 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 5.7. 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.

5.7 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

5.7.1 General Impact Rating Scale for Specialists/ Baseline data

5.7.1.1 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, operation 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.

ASSESSMENT OF THE REVERSIBILITY OF IMPACT

Assessment term	Explanation of how to use this term
High reversibility of impacts	This is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts from wind turbines can be considered to be highly reversible at the end of the project life, when
Moderate reversibility of impacts	
Low reversibility of impacts	
Impacts are non- reversible	This is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by turbine foundations could be non-reversible.

ASSESSMENT OF THE DEGREE TO WHICH THE IMPACT CAUSES IRREPLACEABLE LOSS OF RESOURCES

Assessment term	Explanation of how to use this term
High irreplaceability of resources	This is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable.
Moderate irreplaceability of resources	
Low irreplaceability of resources	
Resources are replaceable	This is the most favourable assessment for the environment.

Table 5.9. 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:									
Humansdorp Shale Renosterveld	Negative	localised	permanent	medium	definite	high	Vegetation clearing must be limited to the required footprints. Micro-siting of footprints should avoid more sensitive vegetation during final site planning as far as possible.	moderate	high
Gamtoos Thicket	Negative	localised	permanent	low	improbable	low	River crossing and clearing of thicket should be avoided	very low	high
Riparian and Wetland vegetation	Negative	Highly localised	Long-term	low	definite	high	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 width for crossing construction.	medium	high
Reduction or changes to ecological processes and functioning in:									
Humansdorp Shale Renosterveld	Negative	localised	long-term	medium	definite	high	Road network to be kept to minimum width and avoid more sensitive seep areas and drainage lines	medium	high
Gamtoos Thicket	Negative	localised	permanent	low	improbable	low	Loss of Gamtoos Thicket and thicket clumps unlikely to occur and small thicket clumps should be avoided during micro-siting	very low	high
Riparian and Wetland vegetation	Negative	localised	permanent	low	improbable	high	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	medium	high
Temporary fragmentation of	Negative	localised	long term	medium	probable	medium	Vegetation clearing must be limited to the required footprint	low	high

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
habitats							and rehabilitated immediately after construction Road construction should be commenced in a phased manner to reduce large scale fragmentation		
Increased risk of invasion by alien plants in drainage lines and disturbed areas	Negative	localised	long term	medium	probable	medium	Management of Alien invasive plants 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 be done every 10 years or so.	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 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	low	moderate
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									
Humansdorp	Negative	localised	permanent	medium	definite	high	Vegetation clearing must be	medium	high

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Shale Renosterveld							limited to the required footprint. Relocation of protected flora to be undertaken with necessary permits.		
Gamtoos Thicket habitat	Negative	localised	permanent	low	improbable	low	Vegetation clearing must be limited to the required footprint	very 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
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

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
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 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
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

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Amphibians	Negative	Site/Roads	Short-term	Medium	Definite	High (when raining) Low when not raining	Search and rescue conducted before 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.	Low	High
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 & penalties if workers are caught poaching	Low	High
Fauna harmed by fences (mammals/reptiles)									
Reptiles/ Mammals	Negative	Site/Fence lines	Permanent	High	Probable	High	The fence used to surround the footprint must be of a nature to	Medium	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
							allow animals to pass through it, especially electrified fences. Use of Bonox type fencing that allows through movement of animals. Regular visits to the site to check if any animals 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 animals 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 animals 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 animals Do not places fences on the side of the roads	Low	High
OPERATIONAL PHASE									
Reduction or changes to ecological processes and functioning in:									
Humansdorp Shale Renosterveld	negative	localised	long-term	medium	definite	high	Road network to be kept to minimum width and avoid more sensitive seep areas and drainage lines	medium	high

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Gamtoos Thicket	negative	localised	permanent	low	improbable	low	Loss of Gamtoos Thicket and thicket clumps unlikely to occur and small thicket clumps should be avoided during micro-siting	very low	high
Riparian and Wetland vegetation	negative	localised	permanent	low	improbable	high	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	medium	high
Increased risk of alien invasion in drainage lines and disturbed areas	negative	localised	long term	medium	probable	medium	Alien invasive plant 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 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	low	moderate
Reduction of ecosystem functioning	negative	localised	long term	low	probable	medium	Alien plant 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

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
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	Low	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	Low	High
Mammals	Negative	Site/Roads	Permanent	High	Definite	High	Must be audited and monitored and traffic calming measures implemented	Low	High
Poaching									
Mammals	Negative	Site	Permanent	Low	Possible	Low	Education, Monitoring and removal of snares to be implemented & penalties	Low	High
Fauna harmed by fences (mammals/reptiles)									
Reptiles/ Mammals	Negative	Site	Permanent	Medium	Probable	Medium	Fences design to be animal 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 5.10. 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 disturbance to within reasonable limits	A list of relocated flora to be compiled as part of site audit	Weekly	ECO
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 animals 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 animals 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

Impact	Mitigation/Management action	Monitoring		
		Methodology	Frequency	Responsibility
OPERATIONAL PHASE				
Reduction or changes to ecological processes and functioning	Check that mitigation recommendations have been implemented and adhered to	Site Audit	Biannually	ECO
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	Biannually and record location and extent after each fire and actions implemented	ECO
Loss of Habitat	Monitor for trapped/displaced fauna	Site Audit	Biannually	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	Biannually	ECO
Fauna harmed by fences (mammals/reptiles)	Check fences for snares	Site Audit	Biannually	ECO
Corridor disruptions as a result of habitat fragmentation	Monitor for trapped/displaced fauna	Site Audit	Biannually	ECO

5.8 CONCLUSIONS

5.8.1 Vegetation and Flora

Within the context of the original vegetation of the area the a range of Gamtoos Thicket, Shale Renosterveld, Wetland/Pan/Seep vegetation communities cover the sites. These areas have been extensively transformed and degraded predominantly through agricultural cultivation and some alien plant infestation. Specialised habitats within this matrix would have include seasonal seeps and pans and drainage lines with associated riparian vegetation and seep areas.

- Site sensitivity varies 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 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 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.
Turbines (and associated roads and infrastructure) in high sensitivity areas would be considered to be not acceptable and should preferable not be constructed or sited into less sensitive areas, unless the overall footprint would be negligible.

- Sites 11, 17, 27 and 28 are within areas having a high ecological sensitivity, however the overall WTG and road footprint is low and overall impact at a regional scale will be will be low with implementation of mitigation measures.

Lower density WTG alternatives would be the preferred and recommended layout options for the wind energy project, having a lower overall impact.

5.8.2 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 in terms of the constructional phase stimulates certain impacts, but with the enforcement of mitigating measures, these impacts can be minimised, or removed entirely.
- The erection of the wind turbines in terms of the operational phase has the potential to stimulate positive impacts, such as habitat preservation etc.
- In terms of the decommissioning phase, the impacts will be similar to the construction phase impacts. It is presumed that the wind farms are permanent, therefore impacts will most likely be negligible.
- The development of this project will be positive; i.e.: a no-go alternative will result in the area not begin preserved and 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.

5.8.3 Summary of Risks and Impacts

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

5.8.3.1 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. Although some infrastructure is sited within endangered intact Humansdorp Shale Renosterveld, overall impact relating to implications of national list of ecosystems that are threatened and in need of protection according to the National Environmental Management: Biodiversity Act, 2004 (act no. 10 of 2004) will be negligible with the implementation of recommended mitigation measures.

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.

Final **Infrastructure** positioning (micrositing) should be been undertaken (including temporary lay-down areas, roads and substations), to minimise impacts where possible before construction commences.

5.8.3.2 Loss of Species of special concern and habitat

- Loss of SSCs and habitat is unlikely to be significant due to the transformed nature of the site;
- 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. populations of endemics);
- Permits will be required for species to be removed and/relocated;
- Relocate SSCs when unavoidable into adjacent areas.

5.8.3.3 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.

5.8.3.4 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;

5.8.4 Assessment of Reversibility

5.8.4.1 Vegetation and Flora impacts:

For areas where concrete foundations are constructed, loss of habitat will be non- reversible without excessive cost implications. For other hard standing surfaces and roads (i.e. with removal of gravels and replacement of topsoil), impacts are likely to have a low reversibility but dependant on potential rehabilitation budget, this could be elevated to moderate reversibility.

5.8.4.2 Fauna:

For areas where concrete foundations are constructed, loss of habitat will be non- reversible without excessive cost implications. For other hard standing surfaces and roads, impacts are likely to have a low reversibility but dependant on potential rehabilitation budget (i.e. with removal of gravels and replacement of topsoil), this could be elevated to moderate reversibility. Artificial habitat could be created for reptile habitat, which would result in a moderate to high reversibility,, but this would also be budget dependant.

5.8.5 Assessment of Irreplaceability

5.8.5.1 Fauna and Vegetation:

Since most of the site is agricultural land, the resources are mostly replaceable to having a low irreplaceability. Ecological process areas and intact vegetation indicated as having either an elevated conservation status (i.e. Humansdorp Shale Renosterveld) and or high ecological sensitivity would be moderately to highly irreplaceable. However, due to the minimal footprint size of the proposed development compared to normal agricultural activities, the overall regional Irreplaceability is low.

5.8.5.2 Fauna

Since most of the site is agricultural land, and specialised faunal habitat is limited in extent, the resources are mostly replaceable having a low irreplaceability, except where ecological process areas (corridors) might be affected, where irreplaceability will be moderate.

5.8.6 Recommendations

5.8.6.1 Vegetation

- Water courses and seeps should be avoided as far as possible, especially with respect to fragmentation by roads. Existing roads should be upgraded as far as possible to minimise additional impacts.
- 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 plant management plan to control invasive plant species must be implemented within the designated Open Space areas, especially along access road verges.
- Permission must be obtained from the provincial authorities to destroy or remove any protected plant species (indicated in Table 5.8).

- 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.

5.8.6.2 Drainage Lines, Seeps, Wetlands, Pans and Dams

- Any disturbance occurring within 500 m of any wetland (including dams) requires the necessary permissions from the Department of Water Affairs and construction or any other disturbance should be avoided within a 32 m buffer around any water course, wetland features, pans and dams. Where unavoidable the required General Authorisation permits will be required from the Department of Water Affairs **before** any construction activities commence. The Department of Water Affairs **must** be involved as an interested and affected party and should be involved in the planning phase of the project.
- Activities in wetland areas should seek to minimize the following impacts:
    - 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.
    - 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.
    - 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).
    - 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.

5.8.6.3 Environmental Management Programme Recommendations

A. Guidelines for inclusion in the Environmental Management Programme (EMP):

- 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 should be included in the EMP.

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 alien plant 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

Before the clearing of the proposed site is authorized, the appropriate permits or licences must be obtained.

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.

5.8.7 Fauna

The following faunal impact mitigation measures should be included in the EMP and implemented during construction and operational phases:

- 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.
- Penalties should be used as a deterrent.
- 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
- 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;
- The workers on site must be educated about the laws protecting wildlife. Penalties should be used as a deterrent. Regular fence inspections need to be conducted to remove any snares.
- Regular fence patrols should be conducted within the site to check if any animals have been trapped.
- Access gates into the fenced off areas to be closed at all times.
- 90 degree corner fences must be sacrificed into two 45 degree corners, this will decrease the stress of a wild animal when approaching a corner. The animal will turn in front of the corner instead of running directly into it.
- Fences must be visible and permeable to animal movement.
- Prevent using electric fencing as far as is practically feasible.
- Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity.
- Do not places fences on the side of the roads
- Search and rescue operations conducted before construction phase begins.
- If a water system is to be destroyed, then tadpoles should be relocated before construction.
- If the tadpoles are relocated from a river with moving water; then the tadpoles must be released downstream from the construction.
- Amphibians must be relocated to a place similar to the place where they were found.
- Amphibians which enter the construction zone must be relocated as soon as possible from the site.
- 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.
- 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.
- Habitat islands should be created within the area cleared for the constructional site office etc. This will act as a safety retreat for any reptiles "trapped" on the construction site; and aid in habitat creation during the operational phase.
- Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.

- Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles
- 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
- Signs should be erected to remind and warn vehicle users where frog/toad crossings are, extreme slow driving needs to be practised in these zones.
- Care must be taken to ensure slow driving on the site, speed limits should be enforced, especially during rainfall periods.
- Do not encourage wet areas, through construction, next to the road; or a road between two wetlands closely connected to aestivation sites unless the road is not directly on the ground surface.
- Keep the grass/vegetation short next to the road to reduce mammal activity near the road. This will also allow the vehicle driver and mammal to see the danger early enough to avoid a negative impact.
- Already killed animals must be removed from the road as this will attract scavengers which may also be harmed on the road.
- Do not feed animals on or near the roads. Conditions in the EMP should pay attention to this impact. Strict control by the ECO must ensure that this impact is addressed.
- 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.

Figure 5-40: Example of habitat island created within cleared site

Figure 5-41: Reptile habitat indirectly created through site clearing

Figure 5-42: snakes; during a search and rescue

Figure 5-43: Trapping of small mammals for relocation(water mongoose)

With effective mitigation measures in place the reduction to impacts of low significance is possible, both during the construction and during the operational phases of the development.

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5.10 APPENDICES

1. Plant Species List

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/	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	
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	
Bobartia orientalis	Iridaceae	PNCO		Y		
Briza maxima	Poaceae		Y			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		
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	

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/	Thicket	Pastures and Transformed
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			
Cyrtanthus sp.	Amaryllidaceae					
Delosperma ecklonis	Mesembryanthemaceae	PNCO			Y	
Digitaria eriantha	Poaceae					Y
Diospyros pallens	Ebenaceae			Y	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
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					
Eustachys paspaloides	Poaceae				Y	Y
Exomis microphylla	Amaranthaceae				Y	
Felecia filifolia	Asteraceae			Y		
Ficinia nodosa	Cyperaceae				Y	
Gasteria pulchra	Asphodelaceae	PNCO			Y	
Gerbera sp.	Asteraceae			Y		
Grewia occidentalis	Tiliaceae				Y	
Gymnosporia capitata	Celastraceae			Y	Y	
Gymnosporia heterophylla	Celastraceae				Y	
Gymnosporia polyacantha	Celastraceae				Y	
Haemanthus sp.	Amaryllidaceae	PNCO		Y		
Helichrysum anomalum	Asteraceae			Y		
Helichrysum cymosum	Asteraceae			Y		Y
Helichrysum nudifolium	Asteraceae			Y		
Hermannia flammea	Sterculiaceae			Y		
Heteropogon contortus	Poaceae				Y	Y
Hippobromus pauciflorus	Sapindaceae				Y	
Hyparrhenia hirta	Poaceae			Y		Y
Hypoestes aristata	Acanthaceae				Y	
Indigastrum costatum	Fabaceae				Y	
Indigofera denudata	Fabaceae			Y		

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/	Thicket	Pastures and Transformed
Indigofera hedyantha	Fabaceae				Y	
Indigofera heterophylla	Fabaceae			Y		
Ischyrolepis sp.	Restionaceae	PNCO		Y		
Knowltonia cordata	Ranunculaceae					
Lactuca capensis	Asteraceae					
Launaea sp.	Asteraceae					
Lauridia tetragona	Celastraceae				Y	
Ledebouria ensifolia	Hyacinthaceae	PNCO		Y		
Lobelia tomentosa	Lobeliaceae			Y		
Lycium ferocissimum	Solanaceae					
Maerua cafra	Capparaceae				Y	
Maytenus undata	Celastraceae				Y	
Melica racemosa	Poaceae				Y	
Melinis repens	Poaceae		Y			Y
Metalasia densa	Asteraceae			Y		
Montinia caryophyllacea	Montiniaceae			Y		
Mystroxylon aethiopicum	Celastraceae				Y	
Nylandtia spinosa	Polygalaceae				Y	
Olea europaea subsp africana	Oleaceae				Y	
Ornithogalum longibracteatum	Hyacinthaceae	PNCO			Y	
Osyris compressa	Santalaceae				Y	
Oxalis imbricata	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	
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	
Rhus glauca	Anacardiaceae				Y	

Botanical Name	Family	Status*	Wetlands/Seeps	Renosterveld/	Thicket	Pastures and Transformed
Rhus incisa	Anacardiaceae				Y	
Rhus longispina	Anacardiaceae				Y	
Rhus lucida	Anacardiaceae				Y	
Rhus pterota	Anacardiaceae				Y	
Rhus refracta	Anacardiaceae				Y	
Sansevieria hyacinthoides	Dracaenaceae			Y	Y	
Sarcostemma viminale	Apocynaceae				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 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			
Sutera microphylla	Scrophulariaceae				Y	
Syncarpha sp.	Asteraceae					
Tarchonanthus camphoratus	Asteraceae				Y	
Thamnochortus sp.	Restionaceae	PNCO		Y		
Themeda triandra	Poaceae		Y	Y	Y	Y
Thesium strictum	Santalaceae					
Thunbergia capensis	Acanthaceae			Y		
Tristachya leucothrix	Poaceae			Y		Y
Tylecodon striatus	Crassulaceae				Y	
Vepris lanceolata	Rutaceae				Y	
Viscum rotundifolium	Viscaceae				Y	
Zehneria scabra	Cucurbitaceae					

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
Amphibia			
Amietophrynus pardalis	Eastern leopard toad	PNCO, LC	
Amietophrynus rangeri	Raucous toad	PNCO, LC	
Vandijkophrynus angusticeps	Cape sand toad	PNCO, LC	X
Hyperolius marmoratus	Painted reed frog	PNCO, LC	
Hyperolius horstockii	Arum lily frog	PNCO, LC	X
Kassina senegalensis	Kassina	PNCO, LC	X
Semnodactylus wealii	Rattling frog	PNCO, LC	X
Breviceps adspersus pentheri	Penther's rain frog	PNCO, LC	X
Xenopus laevis	Common platanna	PNCO, LC	X
Cacosternum boettgeri	Common caco	PNCO, LC	X
Cacosternum nanum	Bronz caco	PNCO, LC	X
Strongylopus fasciatus	Striped stream frog	PNCO, LC	X
Strongylopus grayii	Clicking stream frog	PNCO, LC	X
Tomopterna delalandii	Cape sand frog	PNCO, LC	X
Reptilia			
Chersina angulata	Angulate tortoise	PNCO, CITES APPENDIX 2 PROTECTED	X
Stigmochelys pardalis	Leopard tortoise	PNCO, CITES APPENDIX 2 PROTECTED	X
Homopus areolatus	Parrot beaked padloper	PNCO, CITES APPENDIX 2 PROTECTED	X
Pelomedusa subrufa	Marsh terrapin	PNCO, LC	
Rhinotyphlops lalandei	Delalande's beaked blind snake	PNCO, LC	X
Leptotyphlops nigricans	Black thread snake	PNCO, LC	X
Homorolapse lacteus	Harlequin snake	LC	X
Crotaphopeltis hotamboeia	Herald snake	LC	X
Dasypeltis scabra	Rhombic egg eater	LC	X
Dispholidus typus	Boomslang	LC	X
Duberria lutrix	Slug eater	LC	X
Lamprophis aurora	Aurora house snake	LC	X
Lamprophis capensis	Brown house snake	LC	X
Lamprophis fuscus	Yellow bellied house snake	PNCO, NT	X
Lamprophis guttatus	Spotted house snake	LC	X
Lamprophis inornatus	Olive house snake	LC	X
Lycodonomorphus rufulus	Brown water snake	LC	X
Lycodonomorphus laevissimus	Dusky bellied water snake	LC	
Lycophidion capense capense	Cape wolf snake	LC	X
Philothamnus hoplogaster	Green water snake	LC	X
Philothamnus natalensis occidentalus	Natal green snake	LC	X
Philothamnus semivariegatus	Spotted bush snake	LC	X
Prosymna sundevallii	Sundevalle's shovel snout	LC	X
Psammophis crucifer	Crossed marked sand snake	LC	X
Psammophis notostictus	Karroo whip snake	LC	X
Psammophylax rhombeatus	Rhombic skaapsteker	LC	X
Pseudaspis cana	Mole snake	LC	X

Taxon(Scientific name)	Common Name	Conservation Status*	Presence
Aspidelapse lubricus lubricus	Cape coral snake	LC	X
Hemachatus haemachatus	Rinkhals	LC	X
Naja nivea	Cape cobra	LC	
Bitis atropos	Berg adder	LC	X
Bitis arietans	Puff adder	LC	X
Causus rhombeatus	Night adder	LC	X
Acontias gracilicauda gracilicauda	Thin tailed legless skink	LC	X
Acontias percivali tasmani	Tasman's legless skink	LC	X
Acontias lineicauda	Algoa legless skink	LC	X
Acontias meleagris orientalis	Eastern legless skink	LC	X
Scelotes anguineus	Algoa dwarf burrowing skink	LC	X
Scelotes caffer	Cape dwarf burrowing skink	LC	X
Trachylepis capensis	Cape skink	LC	X
Trachylepis homalcephala	Red sided skink	LC	X
Trachylepis varia varie	Variable skink	LC	X
Nucras lalandii	Delalandes sandveld lizard	LC	
Pedioplanis pulchella	Pulchell's sand lizard	LC	
Tropidosaura montana montana	Common mountain lizard	LC	
Gerrhosaurus flavigularis	Yellow throated plated lizard	LC	
Tetradactylus fitzsimonsi	FitzSimon's long tailed seps	PNCO, VU	X
Tetradactylus seps	Short legged seps	LC	X
Chamaesaura anguina anguina	Cape grass lizard	PNCO, NT	X
Cordylus cordylus	Cape girdled lizard	CITES, Appendix 2	X
Cordylus tasmani	Tasman's girdled lizard	VU	X
Pseudocordylus m. microlepidotus	Cape crag lizard	LC	X
Agama atra	Southern rock agama	LC	
Bradypodion ventrale	Southern dwarf chameleon	CITES, Appendix 2	X
Bradypodion taeniabronchum	Elandsberg dwarf chameleon	CR , CITES, Appendix 2, TOPS Protected	
Varanus albigularis albigularis	Rock monitor	LC	
Varanus niloticus	Water monitor	LC	
Afrogecko porphyreus	Marbled leaf toed gecko	LC	X
Hemidactylus mabouia	Tropical house gecko	LC	X
Lygodactylus capensis capensis	Cape dwarf gecko	LC	X
Pachydactylus maculatus	Spotted thick toed gecko	LC	X
Mammalia			
Amblysomus corriae	Fynbos golden mole	NT	X
Amblysomus hottentotus	Hottentot golden mole	DD	X
Chlorotalpa duthieae	Duthie's golden mole	LC	X
Macroscelides proboscideus	Round eared elephant shrew	LC	X
Orycteropus afer	Aardvark	LC	
Procavia capensis	Rock hyrax	LC	X
Lepus saxatilis	Scrub hare	LC	
Pronolagus saundersiae	Hewitt's red rock rabbit	LC	X
Cryptomys hottentotus	African mole rat	LC	X
Georychus capensis	Cape mole rat	LC	X
Hystrix africaeaustralis	Cape porcupine	LC	
Graphiurus murinus	Woodland dormouse	LC	X
Graphiurus ocularis	Spectacled dormouse	LC	
Dendromus melanotis	Grey climbing mouse	LC	X
Dendromus mesomelas	Brant's climbing mouse	LC	X

Taxon(Scientific name)	Common Name	Conservation Status*	Presence
Mastomys natalensis	Natal multimammate mouse	LC	X
Micaelamys namaquensis	Namaqua rock mouse	LC	X
Mus minutoides	Pygmy mouse	LC	X
Mus musculus	House mouse	Alien	X
Otomys irroratus	Vlei rat	LC	
Otomys unisulcatus	Bush vlei rat	LC	X
Rattus rattus	House rat	LC	X
Rhabdomys pumilio	Four striped grass mouse	LC	
Saccostomus campestris	Pouched mouse	LC	
Cercopithecus pygerythrus	Vervet monkey	LC	
Papio cynocephalus ursinus	Chacma baboon	LC	X
Crocidura cyanea	Reddish-grey musk shrew	DD	X
Crocidura flavescens	Greater red musk shrew	DD	X
Myosorex varius	Forest shrew	DD	X
Caracal caracal	Caracal	LC	
Felis cattus	Feral cat	Feral (Alien)	X
Felis silvestris	African wild cat	LC	X
Panthera pardus	Leopard	LC	X
Genetta genetta	Small spotted genet	LC	X
Genetta tigrina	Large spotted genet	LC	X
Atilax paludinosus	Marsh mongoose	LC	X
Cynictis penicillata	Yellow mongoose	LC	X
Galerella pulverulenta	Cape grey mongoose	LC	X
Herpestes ichneumon	Large grey mongoose	LC	X
Canis vulgaris	Domestic dog	Feral(Alien)	X
Otocyon megalotis	Bat eared fox	LC	
Vulpes chama	Cape fox	LC	X
Aonyx capensis	African clawless otter	LC	X
Ictonyx striatus	Striped polecat	LC	X
Mellivora capensis	Honey badger	NT	X
Poecilogale albinucha	African striped weasel	DD	X
Potamochoerus larvatus	Bush pig	LC	X
Philantomba monticola	Blue duiker	VU TOPS Protected	X
Raphicerus campestris	Steenbok	LC	X
Raphicerus melanotis	Grysbok	LC	
Sylvicapra grimmia	Common duiker	LC	
Tragelaphus scriptus	Bush buck	LC	