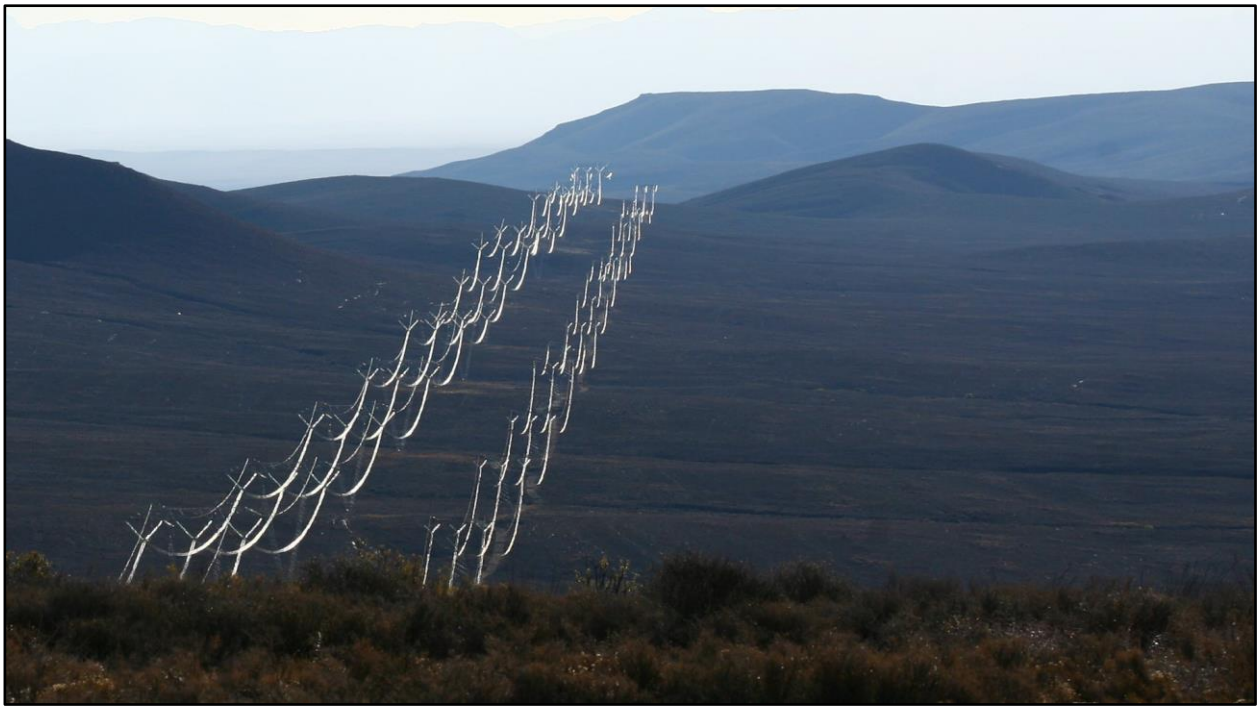
ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED BRANDVALLEY WIND ENERGY FACILITY:

FAUNA & FLORA SPECIALIST IMPACT ASSESSMENT REPORT



PRODUCED FOR EOH

ON BEHALF OF G7 RENEWABLE ENERGY (PTY) LTD

BY

SIMON TODD CONSULTING

Simon.Todd@3foxes.co.za

March 2016

CONTENTS

1 INTRODUCTION

Brandvalley Wind Farm (Pty) Ltd, a subsidiary of G7 Renewable Energies (Pty) Ltd, is proposing to develop a 140MW wind energy facility (WEF) between Matjiesfontein and Sutherland on the border of the Northern and Western Cape Province, South Africa. The Brandvalley wind energy facility will comprise approximately 70 turbines, covering several properties within the Karoo Hoogland Local Municipality, Northern Cape and Laingsburg Local Municipality, Western Cape.

The proposed Brandvalley project is intended to feed into the proposed Komsberg Eskom grid, to be constructed in 2016/2017. Apart from the turbines, other associated infrastructure would include underground 33kV cabling between turbines to be buried along access roads, 33kV powerlines in order to connect wind turbines to the preferred onsite substation, onsite substations and temporary infrastructure including a construction camp (~10ha) and an on-site concrete batching plant (~1ha), borrow pits and quarries and temporary infrastructure to obtain water from available local sources/ new or existing boreholes. A high voltage power line from the onsite substation to the National Grid at the Eskom Komsberg Main Transmission Substation would also be required, but is assessed under a different application from the wind farm itself.

As part of the above EIA process, this ecological specialist study details the ecological characteristics of the site and provides an assessment of the likely ecological impacts associated with the development of the wind energy facility. Impacts are assessed for the preconstruction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the EMPr for the development. The full scope of study is detailed in Section 2.3 below.

2 STUDY APPROACH

2.1 SCOPE OF STUDY

The scope of the study includes the following activities

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (incl. using direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts

- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct indirect and cumulative impacts of the development.

- a description and comparative assessment of all alternatives including cumulative impacts
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement which contains :
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity;
    - a comparative assessment of the positive and negative implications of identified alternatives

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for faunal or flora related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided which will be separated into the following project phases:

- Preconstruction
- Construction
- Operational Phase
- Decommissioning

2.2 ASSESSMENT APPROACH & PHILOSOPHY

The assessment will be conducted according to the EIA Regulations, published by the Department of Environmental Affairs (2014) as well as within the best-practice guidelines and

principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers *et al.* (2005).

This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should.

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;
    - Protect the environment as the people's common heritage;
    - Control and minimise environmental damage; and
    - Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show (through the EIA process) how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

To adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc*).

Species level

- Red Data Book species (giving location if possible using GPS)
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify species of special concern (SSC) and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species);
    - or, are of cultural significance.
- Provide monitoring requirements as input into the Environmental Management Plan (EMP) for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).

- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

2.3 RELEVANT ASPECTS OF THE DEVELOPMENT

The proposed Brandvalley WEF will have an energy generation capacity of up to 140MW and will include the following components:

Wind Turbines:

- Up to 70 potential wind turbine positions (between 1.5MW and 4MW in capacity each), each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 120m, and the rotor diameter up to 140m.
- Permanent compacted hard-standing laydown areas for each wind turbine (70mx50m, total 24.5ha)
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations)
- Underground 33kV cabling between turbines buried along access roads, where feasible.

Access Roads:

- The site will be accessed via the R354.
- Internal access roads up to 12m wide, including structures for storm-water control, would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.

Additional Infrastructure:

- An operations and maintenance building (O&M building) next to the smaller substation (On-Site).
- Up to four 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
- The facility itself would not be fenced and would be compatible with the current existing internal and external farm fences. New fencing will be limited to around the construction camp and the height of such fencing is anticipated to be up to 4m.

Electrical Connections:

- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s). A number of potential electrical 33kV powerlines will be required to connect wind turbines to the preferred onsite substation. The layout of the 33kV powerlines will be informed by sensitive features identified. The facility will consist of both above and below ground 33kV electrical infrastructure depending on what will require the shortest distance and result in the least amount of impacts to the environment.
- A number of potential 33/132kV onsite substation location(s) will be assessed. The applicant will remain in control of the low voltage components of the 33/132kV substation (including isolators, control room, cabling, transformers etc), whereas the high voltage components of this substation will likely be ceded to Eskom. The total footprint of this onsite substation will be approximately 200m x 200m.
- The impacts thereof will be considered in a separate assessment.

A number of temporary activities will take place during construction of the wind farm. These will include:

- Temporary infrastructure including a large construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Borrow pits and quarries for locally sourcing aggregates required for construction (~4.5ha), in addition to onsite turbine excavations where required. All materials excavated will eventually be used on the compacting of the roads and hard-standing areas and no material will be sold to any third parties. The number and size of the borrow pits depends on suitability of the subsurface soils and the requirement for granular material for access road construction and other earthworks. The borrow pits constitute a mining activity and are covered under a different application process from the facility and are not dealt with any further here.
- Temporary infrastructure to obtain water from available local sources/ new or existing boreholes. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the DWS will be applied for separately to this EIA process.

The following Brandvalley alternatives were selected in the Scoping Phase and require consideration in the EIA Phase:

1. Fundamental alternatives:
   1.1 Project area location alternative: One project location alternative namely Brandvalley Wind Farm
   1.2 Access road location alternatives: two access road alternatives namely access road alternative 1 and access road alternative 2
   1.3 Construction camp alternatives namely construction camp 1, 2, or 3.
   1.4 Four onsite substation location alternatives namely substation alternative 1, 2, 3 or 4.
   1.5 Technology alternative: One technology alternative namely a WEF
2. Incremental alternatives:
   2.1 Turbine layout alternatives
   2.2 200m buffer on access roads for sensitivity alternatives
3. No-go alternative

3 METHODOLOGY

3.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas for the site and surroundings were extracted from the *Namakwa District Biodiversity Sector Plan* (Desmet & Marsh 2008) as well as the *Biodiversity Assessment of the Central Karoo District Municipality* and the Winelands District Municipality (Skowno et al. 2009).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 3320CD, 3320DC, 3320AB, 3320BA was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
- The IUCN conservation status (Figure 1) of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2013).

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna:

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2015 (See Figure 1) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. To address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

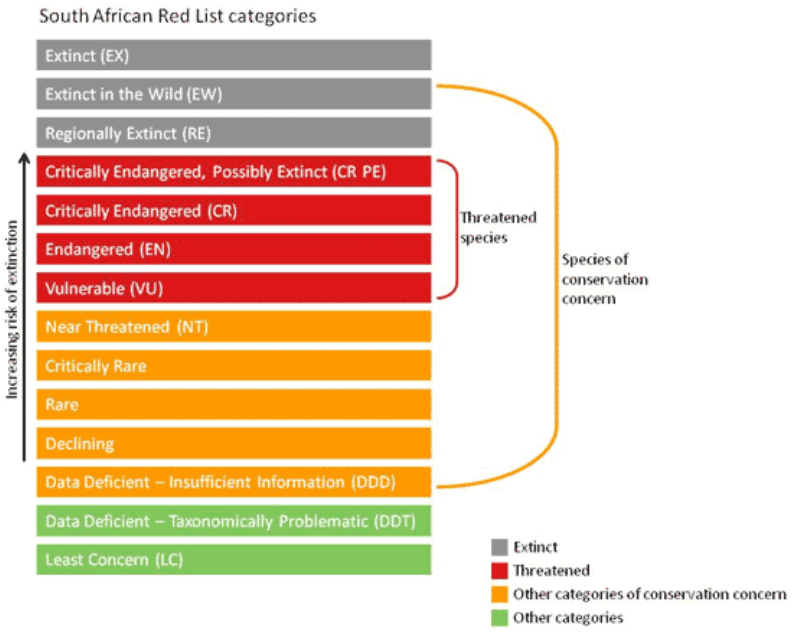


Figure 1. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

3.2 SITE VISIT

A site visit to the study area was conducted from the 19-22 February 2016. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were investigated in the field and all plant and animal species observed were recorded. Specific attention was paid to the areas affected by the turbines and features in close proximity to the development footprint that might be impacted by the development. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

Apart from the current site visit, the area has also been visited in the past at different times of the year for a variety of other assessments. This includes the site in 2010, as well as numerous field surveys of the adjacent authorized Roggeveld and Kareebosch wind energy facilities between 2012 and 2015. This information is used to inform the current study as appropriate.

3.3 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern.
The purpose of this map is to provide a guide to development at the site and ensure that areas that are intrinsically sensitive or vulnerable to disturbance could be accommodated at the planning stage within the layout as much as possible.

The ecological sensitivity of the different units identified in the mapping procedure for the broad-scale sensitivity map was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important

ecological services such as water flow regulation or forage provision. Development within these areas is usually undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided. However, in case of linear features such as drainage lines, it may be necessary for access roads and other infrastructure to traverse such features. However no turbines should be located within such areas and other disturbance should be minimized. Excessive disturbance or impact to such areas may be considered to constitute a fatal flaw of the development and as such should be avoided and minimized as much as possible.
- In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

3.4 LIMITATIONS & ASSUMPTIONS

The site visit took place during the summer dry season, which places some limitations on the study as the site falls within the winter rainfall region and the majority of species of concern are not active in the summer. Although the older site visits and the information gathered from the adjacent wind energy facilities reduces the uncertainty associated with the current site visit, it is not possible to confirm the presence or absence of most of the listed species known from the area at this particular site. As a result the sensitivity assessed is based largely on the habitat present and the dominant perennial shrub species observed and the known association with species of concern. Where development has been planned within the areas identified here as high sensitivity, there should be a follow-up vegetation survey within these areas to clarify the potential presence of species of concern within these areas, so that suitable avoidance and adjustment of the final development footprint can be made. However, it is important to note that the ecological patterns at the site were clear and this provides an adequate basis on which to assess the likely impacts of the development on the ecological features of the site.

The lists of amphibians, reptiles and mammals for the site are based on those observed at the site and on the adjacent sites as well as those likely to occur in the area based on their distribution and habitat preferences. Several site visits have been conducted during various seasons to the area and information on fauna observed in the area is included where relevant. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map, two vegetation types occur within the study area (Figure 2). The vast majority of the site is mapped as Central Mountain Shale Renosterveld while several smaller areas are mapped as Koedoesberge-Moordenaars Karoo.

Central Mountain Shale Renosterveld occurs in the Western and Northern Cape on the southern and southeastern slopes of the Klein Roggeveldberge and Komsberg below the Komsberg section of the Great Escarpment as well as farther east below Besemgoedberg and Suurkop and in the west in the Karookop area. It is associated with clayey soils overlying Adelaide Subgroup mudstones and subordinate sandstones with land types mostly Ib and Fc. Although this vegetation type is classified as Least Threatened, it has a very limited extent of 1236km^2 and is not formally conserved anywhere. Levels of transformation are however low and it is considered to be 99% intact. Although no endemic species are known to occur within this vegetation type, little is known about this Renosterveld type and it has been poorly sampled. Experience from this and other projects in the area indicate that this should be considered to be a relatively sensitive vegetation type with a relatively high abundance of species of conservation concern and in context of the site should in fact be considered to have a higher sensitivity than those areas of Koedoesberge-Moordenaars Karoo. The majority of the development footprint falls within this vegetation type with no turbines within the Koedoesberge-Moordenaars Karoo which occurs in the low-lying areas. The Komsberg area is also a recognized centre of plant diversity and endemism and the majority of this diversity is associated with the high elevation areas of Central Mountain Shale Renosterveld (Clark *et al.* 2011).

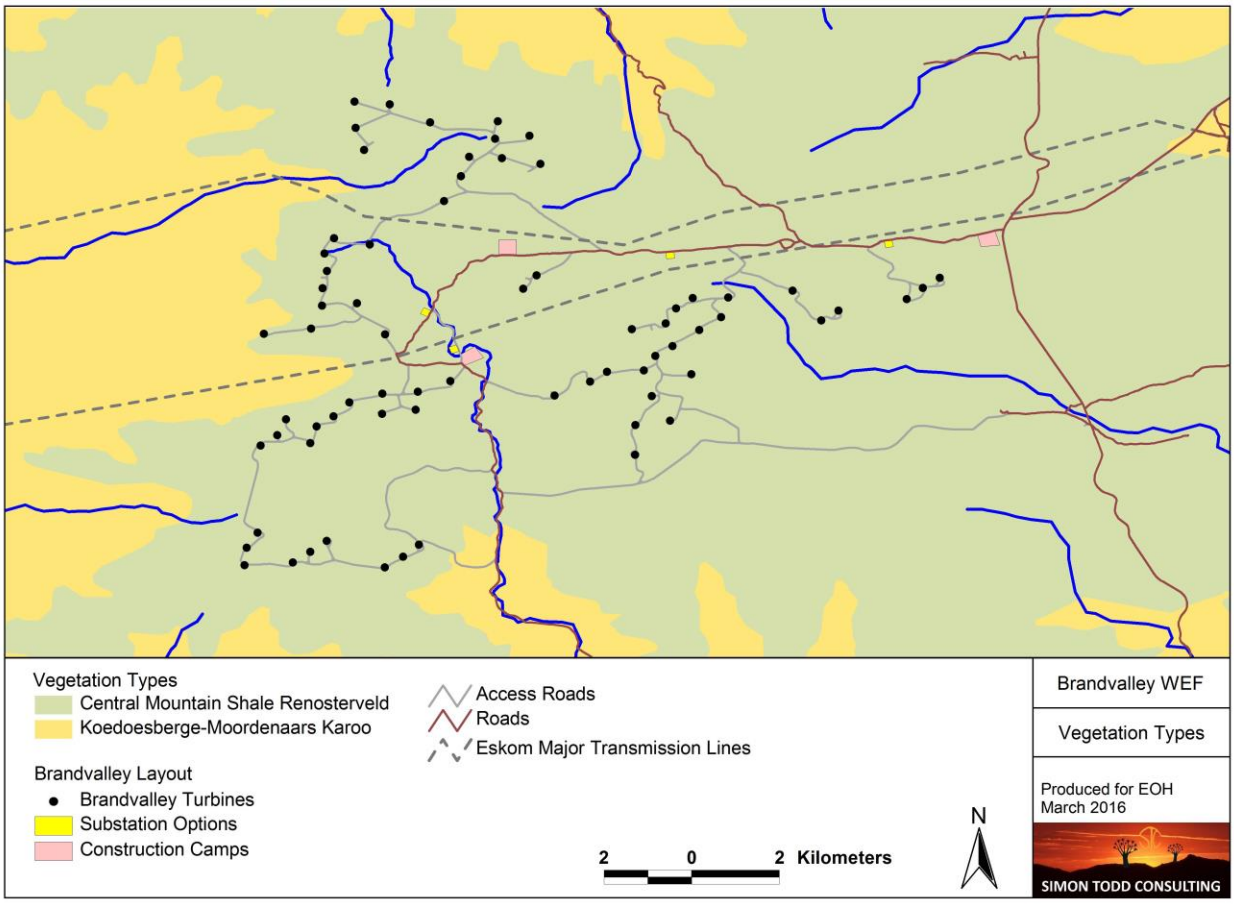


Figure 2. Vegetation map (Mucina and Rutherford 2006) of the Brandvalley Wind Farm study area. The majority of the affected area falls within the Central Mountain Shale Renosterveld with marginal impact on Koedoesberg-Moordenaars Karoo.

According to Mucina & Rutherford (2006) the Koedoesberge-Moordenaars Karoo vegetation type has an extent of 4714km^2. This unit occurs in the Western and Northern Cape on the Koedesberge and Pienaar se Berg low mountain ranges bordering on the southern Tanqua Karoo and separated by the Klein Roggeveld Mountains from the Moordenaars Karoo in the broad area of Laingsburg and Merweville. Koedoesberge-Moordenaars Karoo is associated with slightly undulating to hilly landscape covered by low succulent scrub with scattered tall shrubs. It occurs on mudstones, shale and sandstone of various origins including Adelaide Subgroup, Ecca Group and Dwyka Group diamictites, which give rise to shallow skeletal soils. Land types are mainly Fc and lesser extents of lb. This vegetation type is classified as Least Threatened and has not been significantly impacted by transformation. Conservation status is however poor and of the target of 19% only a very small proportion is conserved within the Gamkapoort Nature Reserve (<1%). At least 14 endemic species are known from this vegetation type, which is a high number considering that this vegetation unit occupies less than

5000km^2. In addition, the majority of listed species known from the broader area are associated with this vegetation type. It is however very poorly known and little research has been conducted within this unit.

4.2 HABITAT TYPES

The major habitats that would be affected by the development are described in greater detail below.

High-Lying Plateau and Low Hills

The majority of the Brandvalley site consists of a high-lying plateau at 1100m-1300m broken by higher hills and drainage lines. The vegetation in these areas is relatively homogenous and there is not a lot of variation in vegetation composition within this elevation range. Dominant species include shrubs such as *Ruschia intricata*, *Eriocephalus microphyllus* var. *microphyllus*, *Chrysocoma ciliata*, *Hirpicium alienatum*, *Asparagus capensis*, *Amphiglossa tomentosa*, *Pteronia ciliata*, *Pteronia sordida*, *Pentzia incana*, *Tripteris sinuata* and *Oedera genistifolia*, grasses including *Ehrharta calycina* and *Merxmeullera stricta* and succulents such as *Tylecodon wallachii* and *Crassula tetragona* subsp. *connivens*. The diversity of listed plant species within this habitat was observed to be low, although given the dry conditions there may be additional species present that were not observed. However, previous experience in the area suggests that a high abundance of such species in these areas is not likely and that development within this habitat would generate low impacts on species of concern. While there are some steep areas associated with hillslopes present within this habitat, the majority of the area is relatively flat and would have a relatively low risk of erosion within mitigation and overall is considered to be of moderate sensitivity. Although the majority of the site consists of this habitat, the turbines are located largely around the margin of the site and the number of turbines within this habitat is fairly low, although there is a lot of other infrastructure such as access roads and cables traversing these areas.

Figure 3. Looking out over the northern part of the site, showing the homogenous nature of the vegetation of this area. The existing 400kV line is visible traversing the plain in the distance. This vegetation is considered consistent with the Central Mountain Shale Renosterveld vegetation type of Mucina & Rutherford.

Figure 4. The majority of turbines are located around the margin of the site, towards the edges of the escarpment, where there may be more sensitive features such as cliffs present.

High-Lying Ridges

There is a clear change in the vegetation discernable above 1350m, where the cooler and wetter conditions results in a change in composition compared to the lower elevation areas. Although the vegetation is broadly similar in terms of the dominant species, species which characterise these areas which are not present or uncommon at lower elevations include *Rosenia spinescens, Eriocephalus grandiflorus* (Rare), *Ehrharta eburnea* (NT) and *Tribolium purpureum*, *Pelargonium griseum*, *Zygophyllum spinosum*, *Berkheya heterophylla* var. *heterophylla* and *Ruschia lineolata*. Although it was dry at the time of the site visit, indications are that the abundance of geophytes and other species of potential concern are significantly higher within this habitat. Based on patterns from the adjacent Karreebosch and Roggeveld wind energy facilities, this habitat is likely to include a variety of listed geophytes and dwarf succulents. As this is a restricted habitat of limited extent, impacts on these areas are of particular concern, especially given the potential for significant cumulative impact in the area. Due to the presence of listed species in this habitat and its' limited extent, it may not be possible to mitigate all impacts effectively and this is considered to be a habitat of high to very high sensitivity.

Figure 4. The vegetation composition of the highest-lying ridges is clearly different from the lower-lying plains below and includes a number of listed species which are not found at lower elevations.

Figure 5. The high-lying plateau which forms the northern-most extension of the wind energy facility is considered particularly sensitive.

Drainage Lines & Wetlands

Although many of the drainage lines of the site are small and not well developed, some of the larger drainage lines have well developed associated wetlands with extensive reed beds and in the lower reaches, where the rives become more confined, there is usually a well-developed woody component. Dominant and common species include *Pseudoschoenus inanis*, *Athanasia minuta* subsp. *inermis*, *Felicia filifolia*, *Lycium cinereum*, *Euryops imbricatus*, *Dicerothamnus rhinocerotis*, *Phragmites australis*, *Conyza scabrida*, *Mentha longifolia* subsp. *capensis*, *Artemisia afra* and trees such as a *Searsia lancea, Salix mucronata* and *Acacia karoo*. Some significant populations of *Brunsvigia josephinae* (VU) were observed in the wetlands at the site in close proximity to the existing access roads and if the development goes ahead then specific attention would need to be paid to avoiding the plants near to the access roads as well as ensuring their long-term protection from harvesting.

There are some significant lengths of access roads which travel near to or traverse drainage lines multiple times and together with broader-scale impacts on drainage systems, the potential impact on these systems is potentially high. The most likely source of impact would be from erosion of the disturbed areas created during construction with resultant siltation of the drainage systems as well as direct impact in areas where roads are in close proximity to drainage systems.

Figure 7. Reed beds in the upper reaches of the Groot Rivier, dominated by *Pseudoschoenus inanis* with occasional woody species such as *Dicerothamnus rhinocerotis*.

Figure 8. Further down the Groot Rivier, showing *Acacia karoo*, *Searsia lancea* and *Salix mucronata* as well as large shrubs such as *Diospyros austro-africana* and the large sedge *Pseudoschoenus inanis*.

Brunsvigia josephinae which is listed as Vulnerable is common in parts of the Groot Rivier. This species has large flower heads up to 1m or more across.

4.3 ALIEN PLANT SPECIES

The majority of the site is currently free or has low abundance of alien species. There are however disturbed areas around farmsteads, old croplands and livestock watering points which harbor a variety of alien species. Mesquite, *Prosopis* spp. is common at most farmsteads and is a potential problem especially in lowlands habitats around the site and is a potentially significant invader as it can alter hydrological function under dense invasion. Other common invasive and indigenous weedy species observed at the site include *Bromus* spp., *Lolium* spp. *Avena fatua*, *Salsola kali*, *Dittrichia graveolens*, *Amsinckia retrorsa* and *Conyza bonariensis*.

4.4 LISTED & PROTECTED PLANT SPECIES

According to the SANBI SIBIS database, nearly 681 indigenous species have been recorded from the four quarter degree squares around the site. This includes 61 threatened species and an additional 101 species of lower conservation concern (Appendix 1). Although this is a considerably larger area than the study area and includes a wide variety of habitats, many of which are not found within the study area, this is an exceptionally high number for a semi-arid environment. This serves to illustrate the high species richness of the area and high potential impact of the development on plant species of conservation concern.

The only species of conservation concern that were observed at the site were *Brunsvigia josephinae* (VU), *Eriocephalus grandiflorus* (Rare) and *Ehrharta eburnea* (NT), but it is certain

that there are a number of additional species present as well. Species of concern are likely to be concentrated along the alluvial soils of the drainage lines and on the high-lying ridges of the site above 1350m. The latter are of particular concern as a significant amount of impact would be concentrated within these areas.

Apart from the red data listed species, there are many provincially protected species present at the site. Within the Western Cape these are listed within the the *Western Cape Nature Conservation Laws Amendment Act* of 2000. Of particular relevance are the following, which highlights some of the plant genera and families commonly encountered at the site, but is not intended to be a comprehensive list.

Schedule 4 Protected Flora:

- *Amaryllidaceae* – All species
- *Lachenalia* – All Species
- *Iridaceae* – All Species
- *Mesembryanthemaceae* – All species

Within the Northern Cape, the situation is similar and under Northern Cape Nature Conservation Act of 2009 the following families and genera are protected.

Schedule 1: Specially Protected Flora

- Family GERANIACEAE - Pelargonium spp. all species

Schedule 2 Protected Flora

- *Amaryllidaceae* – All species
- *Apiaceae* – All Species
- *Apocynaceae* – All Species
- *Asphodelaceae* – All species except Aloe ferox
- *Iridaceae* – All species
- *Mesembryanthemaceae* – All species
- *Capparaceae* - Boscia spp. Sheperd's trees, all species
- *Androcymbium* spp. - All species
- *Crassulaceae* - All species except those listed in Schedule 1
- *Euphorbiaceae* - Euphorbia spp. All species
- *Oxalidaceae* - Oxalis spp All species
- *Portulacaceae* - Anacampseros spp. All species

However, it is important to note that these acts are intended to protected rare and endemic or otherwise significant species and not common and widespread species which may form the dominant species over large parts of the site. A final list of affected species would be identified through a walk-though of the final development footprint prior to construction and would be a requirement for provincial permitting of the development.

4.5 CRITICAL BIODIVERSITY AREAS & BROAD SCALE ECOLOGICAL PROCESSES

The site itself lies along the boundary of the Western Cape and Northern Cape as well as along the boundary between the Central Karoo and Winelands District Municipalities within the Western Cape. As a result, the site lies at the junction of three different conservation plans and Figure 9 below is a composite of all these different plans. Those parts of the site within the Northern Cape fall within the planning domain of the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008), while the Western Cape Sections are within the Biodiversity Assessment of the Central Karoo District Municipality as well as that for Cape Winelands District Municipality (Skowno et al. 2009). These district-wide biodiversity assessments were commissioned to inform Spatial Development Frameworks (SDFs), Biodiversity Sector plans, Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and the Environmental Impact Assessment (EIA) process. The Biodiversity Assessments identify Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Once gazetted, and incorporated into municipal SDFs and bioregional plans, such fine-scale plans are recognized under NEMA and the various activities listed under the act as described in Section 2.4 come into effect. The CBA map for the general area surrounding the site is depicted below in Figure 9.

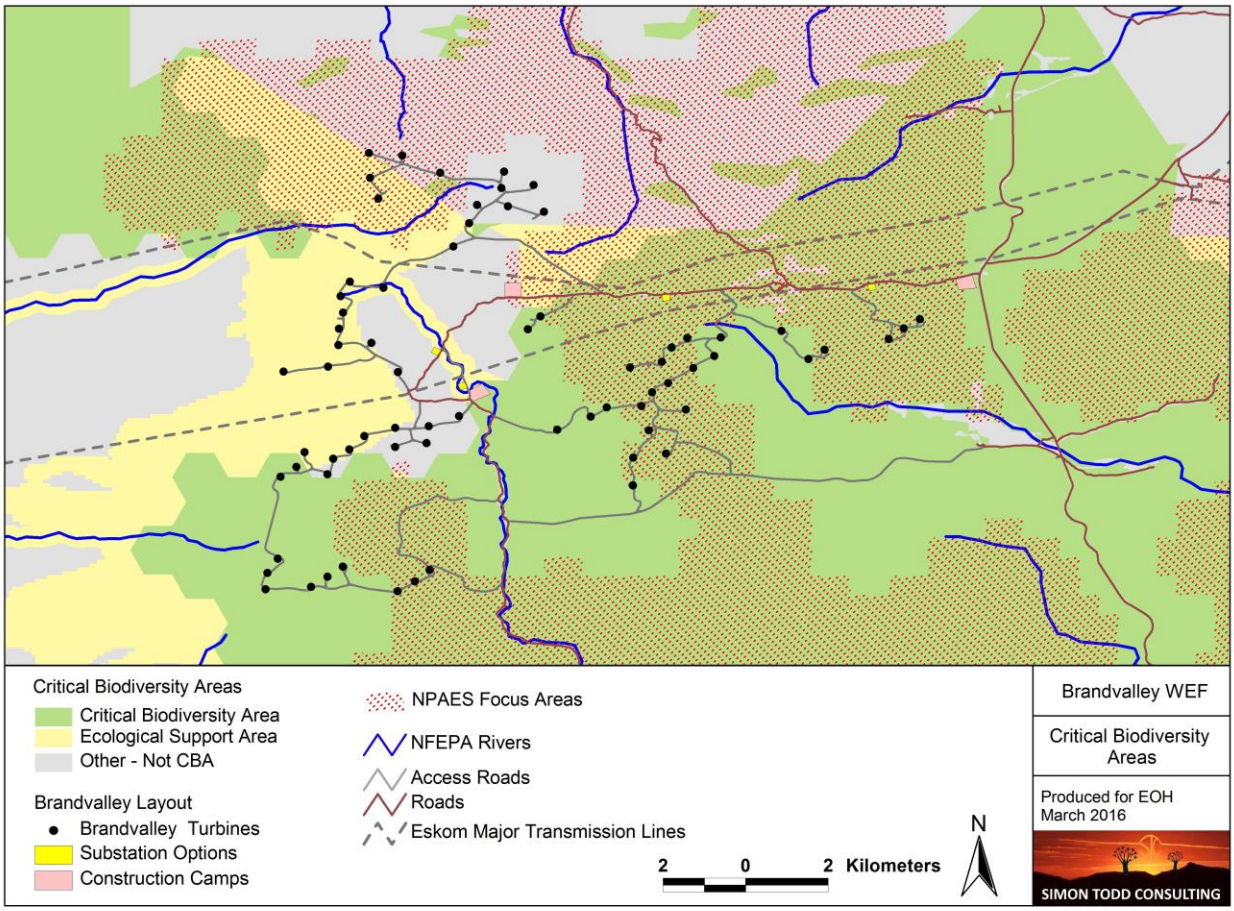


Figure 9. Amalgamated Critical Biodiversity Areas map of the proposed Brandvalley Wind Farm and the surrounding area.

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within these areas is not encouraged and may not be compatible with the objectives of the CBA. The likely implications and impacts of development within the CBAs and their immediate environment is a significant concern for the Brandvalley development that needs to be carefully addressed as the majority of the development footprint is within CBAs and ESAs. Pertinent issues in this regard include establishing why the area has been identified as a CBA and if there are any mitigation measures that can be implemented that can significantly reduce or avoid impacts to the CBAs.

Within the Northern Cape, the CBAs are associated with south-facing slopes and are based on the assumption that these areas are important as refuges for fauna and flora in the face of climate change. Although there is no impact on CBAs within the Northern Cape, there is a large discrepancy along the Western Cape-Northern Cape boundary in terms of areas defined as CBAs, with most of the Western Cape being classified as CBA and only the south-facing slopes of the Northern Cape being classified as CBA. This is problematic because it is clear that the

approach used to derive the CBA maps within each area is not harmonized and the CBA map for the Namakwa District was made at a much coarser scale than that for the CKDM and Winelands. The ultimate effect of this is that the CBA map for the Northern Cape fails to adequately capture the important ecological pattern and process of the area.

Within vegetation types that are highly transformed, CBAs include a large proportion of irreplaceable vegetation fragments that cannot be substituted. However, within the study area, all the vegetation types present are little transformed, with both Koedoesberge-Moordenaars Karoo and Central Mountain Shale Renosterveld being 99% intact. Within semi-arid areas where the majority of vegetation is natural, there are often many choices as to which areas could fall under CBAs and the final solution may be a design issue rather than a clear-cut biodiversity-priority one. The extent to which this scenario is representative of the site is discussed in more detail below.

Within the study area, the extensive CBA within the Western Cape portion of the site is based on several different criteria. A large proportion of this CBA is related to the fact that is has been identified as a priority area within the National Protected Area Expansion Strategy for South Africa (NPAES). This area was identified as a priority area on the grounds that apart from being an extensive tract of unfragmented natural vegetation, it is also an area of high climate and landscape variation which is likely to be resilient to climate change. Such areas are likely to be more climatically stable over time, providing refugia where plants and animals can persist. As such, it is important to recognize that the site is therefore not replaceable due to the fact that there are not similar areas that can perform the same function and which contain a similar set of species available elsewhere. In addition, the highest-lying ridges are considered most important in terms of ecological patterns and processes in the area and these occupy a very small proportion of the site with the result that these are likely to experience a disproportionate impact from the development which also targets these areas for development.

Overall, the CBA maps for the study area are considered inadequate for use at a fine scale and the data collected on-site is considered to be of greater weight than the CBA status. This is particularly important with regards to the parts of the site within the Northern Cape, the majority of which is not mapped as CBA, but was observed in the field to be clearly the most sensitive part of the site. Therefore, the CBA status of the site is considered secondary to the actual assessed biodiversity status of the different parts of the site. Within the Western Cape, the higher ridges are identified as the most important and the lower lying areas are generally considered significantly less sensitive. Where CBAs have been designed for connectivity and not to capture high biodiversity areas, they are less vulnerable to habitat loss and in the current case, there are significant gaps in the strings of turbines and it is not likely that the development would disrupt the connectivity of the landscape for the majority of species.

In terms of the impact of the development on the NPAES Focus Area, the total extent of habitat lost to the current development is not highly significant and would not compromise the overall availability of land to meet conservation goals within the affected NPAES. However, the density of renewable energy developments in the area is high and the cumulative impact of development may have an impact on future conservation options in the area. It is however also pertinent to consider the extent to which wind energy development is compatible with biodiversity conservation. The actual footprint of the development is low and the majority (98%) of the affected area will remain intact. With mitigation and avoidance, the impact on vegetation and plant species can be reduced to an acceptable level and as such, the development can be considered compatible with the maintenance of plant diversity. Although many fauna will become habituated to the turbines and will not be significantly impacted, some fauna are likely to avoid the area on a long-term basis. As a result, the development will have some residual impact on fauna, regardless of mitigation. However, the area is a priority area for flora and there are no faunal species within the development area that are a very high conservation priority, the overall impact on biodiversity features of concern would be relatively low. Furthermore, as the total footprint of the development is low, the potential for future rehabilitation of the area after decommissioning of the facility is high and so in the long-term, the potential future conservation value of the area would remain largely intact.

4.6 CUMULATIVE IMPACT

According to the map of DEA-registered projects as at January 2016, there are a large number of renewable energy projects in the area (Figure 10). The authorized Roggeveld and Karreebosch facilities are immediately north of the site, while there are several developments to the east as well. Due the topographic diversity of the area, the region is diverse in terms of the different vegetation types represented in the area, with the result that each facility tends to impact different vegetation types or plant communities. There has however been significant cumulative impact on Central Mountains Shale Renosterveld, which occurs on the rugged hills and mountains south of the escarpment and has borne the brunt of most of the approved facilities to date. Cumulative impacts on Central Mountains Shale Renosterveld appear to be a particular concern as this vegetation type has a relatively limited extent and a significant proportion, especially in the west, is within renewable energy development application areas. As this stage, the number of projects which have won bids and are therefore likely to be built is still relatively low and includes the ACED Hidden Valley facility north east of the site as well as the Roggeveld Wind Farm immediately north of the site. Although the actual footprint of each facility is likely to be in the order of 200ha or less, even taking an extreme scenario of 500ha per development, the current total loss of Central Mountains Shale Renosterveld would remain at less than 1% of the current total.

At a more local scale, the Roggeveld and Karreebosch Wind Farms are also of significance as these facilities share a common environment and all occur adjacent to one another. As the turbines for these facilities are restricted to the high-lying ridges, there would be a high local cumulative impact on these areas and the connectivity of the landscape may be disrupted for fauna and flora which utilize these areas. As the total extent of habitat at a certain elevation declines with increasing elevation, the potential for cumulative impact rises significantly as the development footprint within these restricted high-elevation areas increases. In addition, it is clear from the field sampling of the current and the other facilities that the higher-lying ridges are the most important in terms of species and habitats of conservation concern and the footprint of the development must be considered in this context rather than at scale of the entire site. In the current context, the northernmost ridge is considered the most significant, followed by the other high-lying ridges in the central and northeast of the site. The areas to the south are not similar to the vegetation of the high lying ridges and there is significantly less concern regarding development in these areas as it becomes increasingly arid towards the south and the abundance of species and habitats concern declines significantly.

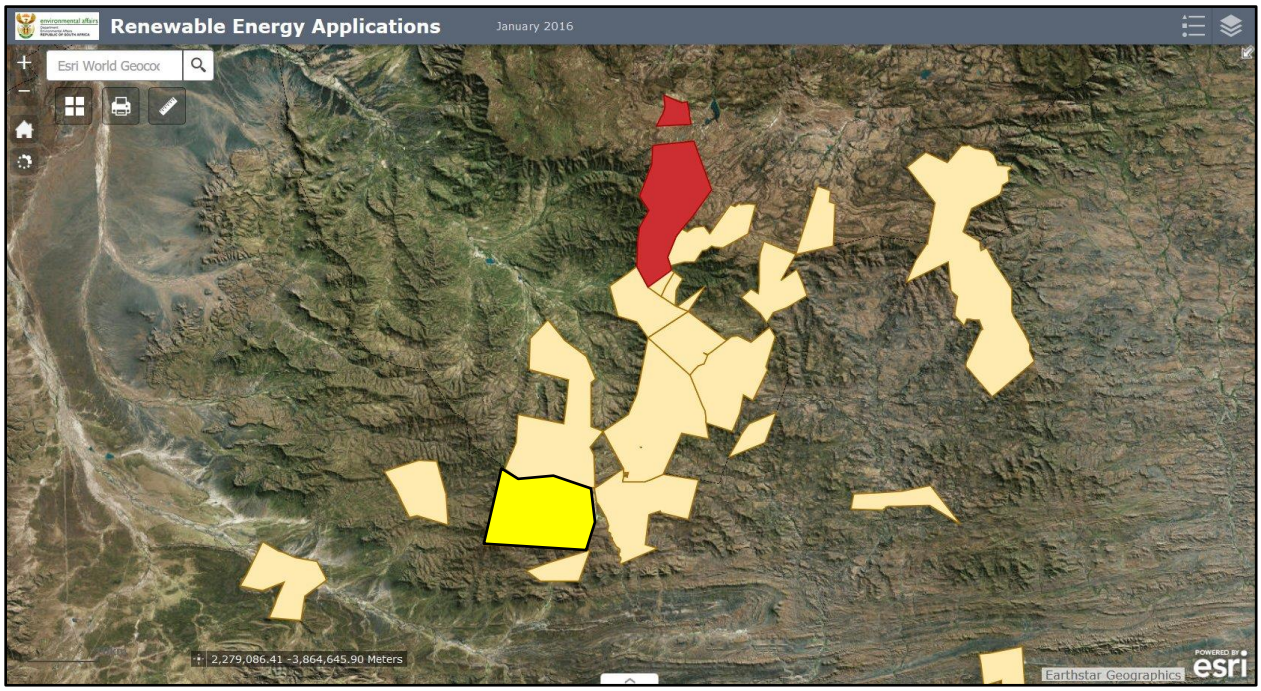


Figure 9. Current DEA-registered projects known from the vicinity of the Brandvalley Wind Energy Facility which is indicated in yellow. There are some errors and omissions on the map as well as not all affected land parcels have been indicated, but it nevertheless illustrates that high development pressure in the area, especially on the high-lying ground below the escarpment. The red land parcel is the proposed Gunstfontein WEF which is still in process

and is depicted in red as it was initially intended to include solar PV as well as wind energy development, but this is no longer the case and it currently only includes wind energy.

4.7 FAUNAL COMMUNITIES

Mammals

At least 50 mammal species potentially occur at the site (Appendix 2). Due to the diversity of habitats available, which includes rocky uplands, densely vegetated kloofs and riparian areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the broader site. The mammalian community is therefore relatively rich and due to the remote and inaccessible nature of large parts of the area probably has not been highly impacted by human activities aside from livestock grazing.

Despite trapping and hunting by the local landowners, medium sized carnivores such as jackal and caracal appear to remain relatively common in the area. The ridges, hills and uplands of the site, with rocky outcrops, rocky bluffs and cliffs provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, *Elephantulus edwardii*, Hewitt's Red Rock Hare *Pronolagus saundersiae*, Namaqua Rock Mouse *Micaelamys namaquensis* and Rock Hyrax, *Procavia capensis*. The lowlands contain an abundance of species associated with lowland habitats such as deeper soils and floodplain habitats, which includes Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy-footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*.

A number of antelope are relatively common at the site and would potentially be impacted by the development. Springbuck are confined by fences and occur only where farmers have introduced them or allowed them to persist and should be considered as part of the farming system rather than as wildlife per se. Both Duiker and Steenbok *Raphicerus campestris* are adaptable species that are able to tolerate moderate to high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Klipspringer *Oreotragus oreotragus* and Grey Rhebok *Pelea capreolus* are present along the ridges and are somewhat more specialized in their habitat requirements. Klipspringer are associated with steep slopes, cliffs and rocky outcrops and of the antelope present may be most vulnerable to impact from the development due to greater overlap between their habitat and the distribution of the wind turbines along the larger ridges and escarpments that would be home to this species. In the short-term it would be affected by construction-related noise and disturbance, while in the longer-term it may avoid the proximity of the turbines which would decrease the available habitat.

The Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered and is regarded as the most threatened mammal in South Africa is known to occur within the broad area. Populations of this species occur between Sutherland and Fraserburg to the northeast as well as in the Tanqua Karoo to the west. The drainage systems within the site do not contain wide flood plains or alluvial terraces which are the known favoured habitat of the Riverine Rabbit. As a result, it is highly unlikely that this species occurs at the site and an impact on this species is therefore not considered likely.

The major impact of the development on mammals is likely to occur during the construction phase when a lot of noise and disturbance would be generated. There is little that can be done to avoid this impact as disturbance cannot be avoided at this time. In the longer term, the noise generated by the turbines would have a potential impact on species which use sound to find their prey or avoid their predators. This might include such species as the Bat-eared Fox which uses hearing to detect prey underground, golden moles which use minute vibrations in the soil to detect prey as well as rodents such as gerbils which have expanded auditory bullae and large ears to help them avoid predators such as owls at night. Furthermore, studies have shown that in the face of increased background noise, fauna spend more time being vigilant and less time on foraging and other activities which ultimately represents habitat degradation for such species. This effect occurs over a much larger area than the direct footprint of the development and the affected area in the current context is likely to amount to several thousand hectares. Although the extent of this impact depends on wind conditions and type of turbine, as an indicative evaluation of this impact, there would be 3300ha of the site within 500m of a wind turbine and there would be a significant increase in background noise within this area when the turbines were operating.

Reptiles

There is a wide range of habitats for reptiles present at the site, including rocky uplands and cliffs, open flat and lowlands and riparian areas. As a result the site is likely to have a rich reptile fauna which is potentially composed of 7 tortoise species, 16 snakes, 15 lizards and skinks, two chameleons and 11 geckos. The only currently listed species which may occur at the site is the Karoo Padloper *Homopus boulengeri* which is listed as Near Threatened.

Species observed in the immediate area (Figure 10) or on-site include Karoo Tent Tortoise *Psammobates tentorius tentorius*, Angulate Tortoise *Chersina angulata*, Marsh Terrapin *Pelomedusa subrufa*, Puff Adder *Bitis arietans*, Karoo Girdled Lizard *Cordylus polyzonus*, Southern Rock Agama *Agama atra*, Cape Skink *Mabuya capensis* and Cape Cobra *Naja nivea*. Tortoises were relatively abundant at the site and a large number of Angulate Tortoises, *Chersina angulata* were observed as were several Karoo Tent Tortoises, *Psammobates tentorius tentorius*. Tortoises may be negatively impacted by the development as they are vulnerable to collisions with motor vehicles and predation by avian predators while traversing

open areas. Attractive species such as tent tortoises are also vulnerable to collection for use as pets or trade, and the increased accessibility resulting from the new roads that will be constructed as part of the development would raise the risk for these species.

In general, the major impact associated with the development would be habitat loss and fragmentation for reptiles, with the potential for increased levels of predation being a secondary impact which may occur as a result of vegetation clearing for roads and turbine pads. There do not appear to be any reptiles which are specifically restricted to the higher-lying ridges of the site and which would be particularly vulnerable to impact as a result.

Figure 10: Common reptiles at the Brandvalley site include the Angulate Tortoise left and the Karoo Girdled Lizard right.

Amphibians

Although there are no perennial rivers at the site, the larger drainage lines in the area were observed to contain rocky, sheltered pools that are likely to contain water on a near-perennial basis. In addition, there are a number of earth farm dams at the site which would also represent important breeding sites for water-dependent species. The amphibian diversity at the site is however likely to be relatively low as the site lies within the distribution range of only nine frog and toad species. No species of conservation concern are known from the area and all the species which may be present are quite widespread species of low conservation concern.

The Karoo Dainty Frog, *Cacosternum karooicum* is listed as Data Deficient reflecting the little-known distribution and ecology of this species. To date, the Karoo Dainty Frog has been recorded from a few scattered locations across the Karoo in the Western and Northern Cape, but it is likely that it occurs more widely across the karoo in general. The site also falls within the distribution of two other regional endemic species, the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The Cape Sand Frog occurs in lowlands and valleys in fynbos and Succulent Karoo throughout most of the Western Cape and

into Namaqualand. The Raucous Toad is more widely distributed and occurs throughout much of South Africa inland and along the east coast into Gauteng and Mpumalanga. There do not therefore appear to be any range-restricted species which occur at the site which would be vulnerable to population-level impacts.

In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams which occur in the area. As these are widely recognized as sensitive habitats, impacts to these areas are avoided largely at the design phase of the development and a minimum amount of infrastructure has been located in the vicinity of these features. Consequently, direct impacts on amphibians at the site are likely to be fairly low. Amphibians are however highly sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

4.8 SITE SENSITIVITY ASSESSMENT

The ecological sensitivity map of the site is depicted in Figure 10 below. The high-lying areas within the central, northern and western part of the site are considered the most sensitive areas. Although the large basin which forms the central part of the site is considered relatively low sensitivity, there are few turbines in this area and the majority of the turbines are in fact within the higher sensitivity areas. In terms of the higher sensitivity areas, the northern extension of the site in the Snydersberg area is considered the most sensitive area due to the high elevation of this area as well as the current low levels of human impact the likely presence of a number of species of conservation concern in this area.

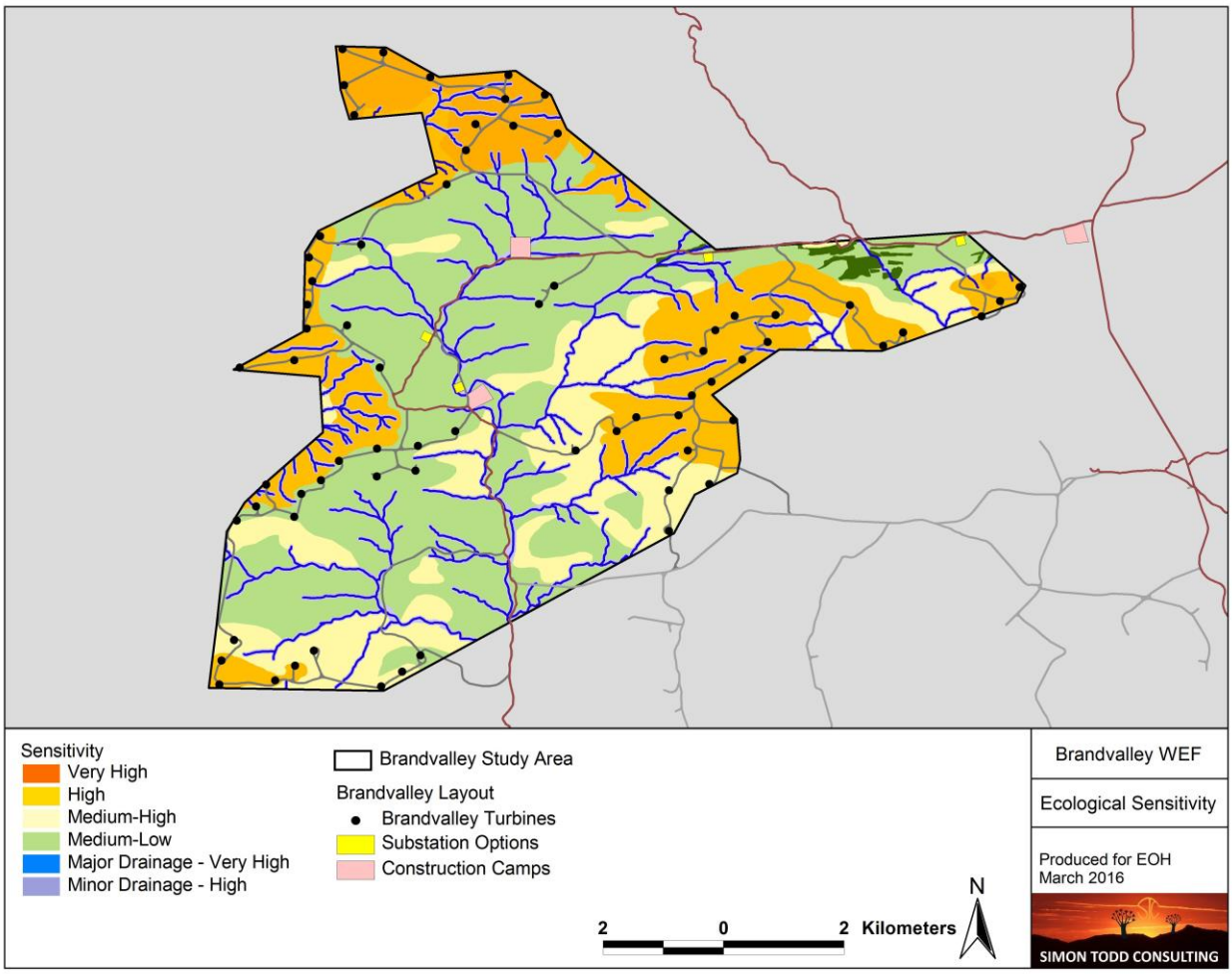


Figure 10. Ecological Sensitivity map of the Brandvalley WEF site, showing the distribution of turbines within the site. The recommendations for mitigation and avoidance for the various turbines is detailed below.

Turbines within High Sensitivity Areas

Development in these areas should be curtailed as much as possible and the footprint minimized. It may not be possible to effectively mitigate all impacts on fauna and flora in these areas due to the limited extent of this habitat and the likely presence of species of concern. Retaining all of these turbines under the current layout will contribute a significant proportion of the impact associated with the development and specific mitigation and avoidance and avoidance should be implemented in these areas to reduce the impact of the development to an acceptable level.

The following turbines are within the high parts of the site within an area considered to be high sensitivity.

- Turbines 35-46 (12 turbines)
- Alternative Turbine 47-64 (18 turbines)

- Alternative Turbines 66-67 (2 turbines)

The 12 turbines (35-46) within the Snydersberg area are considered to be within a particularly sensitive area where there is currently little disturbance and human activity. Turbines within these areas are considered potentially acceptable provided that specific mitigation is implemented to reduce and avoid impact on sensitive species and features. This includes a follow-up survey of these ridges in the wet season to identify any specific areas of concern that should be avoided as well as adjust turbine and road locations to minimize the impact on species of concern. This should preferably occur prior to the preconstruction walk-through of the facility to allow for more significant changes to the layout than is usually possible at the preconstruction phase. The best time of year varies from year to year, but August and September are usually the optimal months.

The following 5 turbines are within a high elevation area along the western margin of the site within an area considered to be high sensitivity.

- Alternative Turbine 28-32 (5 turbines)

The following 4 turbines are within a high elevation area along the southern margin of the site within an area considered to be high sensitivity.

- Alternative Turbine 5-8 (4 turbines)

These 9 turbines are located within potentially sensitive areas where development is considered potentially acceptable provided that specific mitigation is implemented to reduce and avoid impact on sensitive species and features. This includes a follow-up survey of these ridges in the wet season to identify any specific areas of concern that should be avoided as well as adjust turbine and road locations to minimize the impact on species of concern.

There are also a few additional turbines located within areas classified as high sensitivity including 14, 25 and 26 due to the steep slopes and other features of the area, but with proper route planning of the access roads, it is likely that impacts associated with these turbines can be mitigated to an acceptable level and additional wet-season surveys in these areas is not considered necessary.

Turbines within Medium Sensitivity Areas

The remaining 26 turbines are within lower sensitivity area, where impacts are likely to be lower and mitigation more effective at reducing the impacts on these areas. No specific additional wet-season surveys are deemed necessary in these areas. However, the whole final footprint of the development should be subject to a walk-through should it become a preferred bidder.

Other Infrastructure

It is also important to note that while the direct extent of habitat loss resulting from the turbines would be about 25ha, the access roads would create up to 120ha of habitat loss, indicating that the access roads are ultimately more of concern for the development than the turbines themselves.

In terms of the Construction Camps, Construction Camp Options 1 and 3 are considered acceptable and Option 2 is considered not viable as it impinges on several drainage lines. It would be preferable to retain the construction camp site near to the R354 and limit disturbance within the core of the site, which makes Construction Camp Alternative 1 the preferred alternative. Camp 3 is potentially acceptable, but the footprint would need to be adjusted a little to stay out of the drainage line buffer areas.

In terms of the on-site substation, only the Substation Option 4 is considered not acceptable in its current position as it is located within the immediate vicinity of a drainage line. However, it would be acceptable to relocate Substation Option 4 to somewhere else in the immediate area outside of the drainage line buffer areas. In terms of the remaining three options, Substation Option 1 is considered the preferred alternative from an ecological perspective as this site is the most disturbed and would be likely to generate the lowest overall impact on biodiversity. Substation Option 4 is the preferred option from the developers' side for technical reasons. Provided that the location is moved to a flat area outside of the drainage line buffer, such as to the area indicated for the Construction Camp 3, the then this is considered an ecologically acceptable option that would have low impact.

In terms of the access roads, the northern existing access through Ou Mure is the preferred access as there is an existing access through this area. The Alternative access route through Fortuin is not preferred as there is not an established access route through this area. All access roads should strive to stick to existing routes and should be engineered so as to minimize erosion impacts on the surrounding areas and along the sides of the roads. This would require the use of features to dissipate the energy in the water and ensure that large volumes of water do leave the road or gutters at speed.

4.9 MITIGATED LAYOUT

In response to the findings of this study the developer has implemented avoidance and mitigation within the high sensitivity parts of the site in order to minimize the negative effects of the development within these areas. This includes dropping certain turbines from the layout and reducing the extent and size of the access roads in the sensitive areas. The revised layout is depicted below in Figure 11. Two turbines have been dropped from the layout and the access roads have been re-routed to align with existing farm roads where possible. The overall impact of the mitigation is not immediately apparent from the map, but in terms of footprint, this

has been reduced from 163 347 m^2 to 99 300 m^2 which is equivalent to an overall reduction in footprint of 39% within the affected sensitive area. Further mitigation would require dropping additional turbines from the layout which would have implications for the output of the facility as the remaining turbines are within a high-wind resource area. Apart from the above reduction in footprint, a preconstruction walk-through with micro-siting of turbines and access roads would be important in further reducing the impact of the development within this area. A persistent concern would however be the impact of the wind turbines on fauna. It is recommended that pre- and post-construction monitoring of key fauna within this area be conducted to improve our understanding of the impacts of wind turbines on fauna and inform mitigation for future wind development in the country. The steps taken by the developer to reduce the footprint and the additional avoidance and monitoring requirements, represents an acceptable balance between the needs of the developer and the environment within this part of the site.

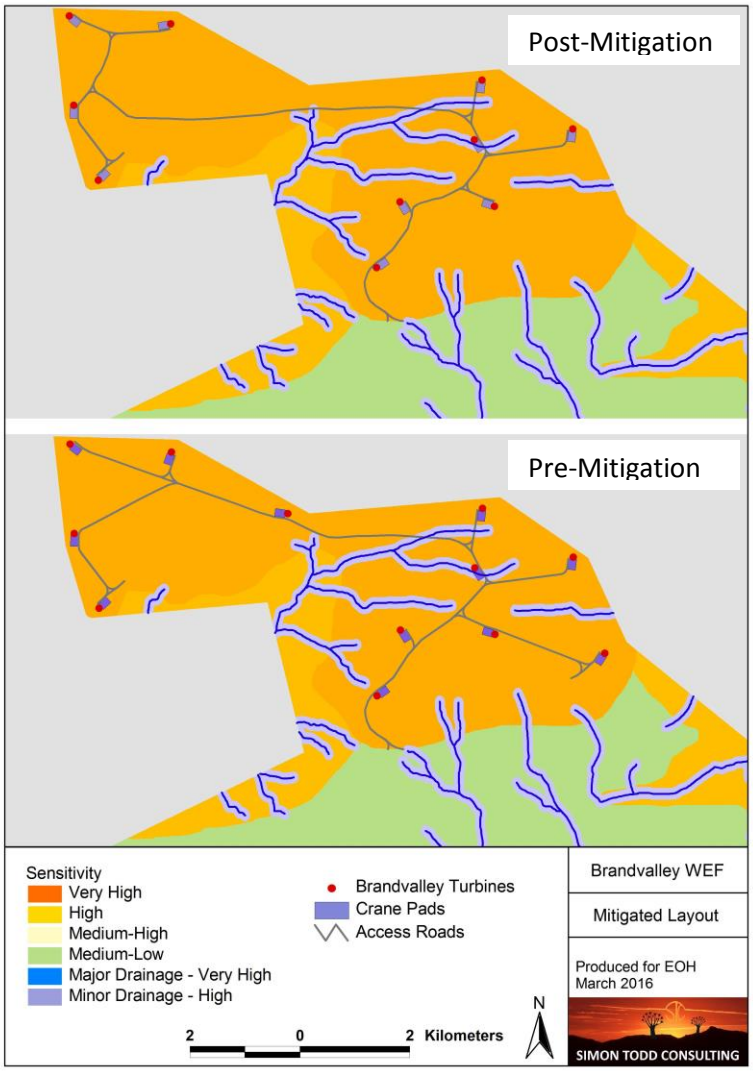


Figure 11. Pre and post-mitigation layout of the Snydersberg area, which is considered the most sensitive part of the site. Two turbines have been dropped from the layout and the overall footprint of the development decreased by 39% within the affected area.

5 IMPACT ASSESSMENT

5.1 IDENTIFICATION OF POTENTIAL IMPACTS AND ASSOCIATED ACTIVITIES

Potential ecological impacts resulting from the development of the Brandvalley Wind Farm and associated infrastructure would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

Construction Phase

- Vegetation clearing for access roads, turbine pads, electrical trenches etc. is likely to impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
- Increased erosion risk could occur due to the loss of plant cover and soil disturbance created during the construction phase. Parts of the site are steep and risk of erosion would be high. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems.
- Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, dust, pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operational Phase

- The operation of the facility will generate noise and disturbance which may deter some fauna from the area.
- The presence of the facility will disrupt the connectivity of the landscape for some usually smaller fauna species such as certain reptiles which will avoid traversing the cleared areas and may impact their ability to disperse or maintain gene flow between subpopulations.
- The facility will require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants, herbicides or pesticides.

Cumulative Impacts

- The cumulative loss of sensitive habitats may result in biodiversity loss and reduced future ability to meet conservation targets for these habitats.
- Transformation of intact habitat with CBAs could compromise the ecological functioning of the CBAs and would contribute to the fragmentation of the

landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

5.2 IDENTIFICATION OF IMPACTS TO BE ASSESSED

The likely impacts on the terrestrial ecology of the site resulting from the development of the Brandvalley Wind Farm are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarized below before the impacts are assessed.

Impact 1. *Impacts on vegetation and listed or protected plant species*

The development would require vegetation clearing for turbines, roads and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species are also highly likely to be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be relatively low.

Impact 2. *Direct Faunal Impacts*

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Many of these impacts can however be effectively managed or mitigated. During the operational phase, noise generated by the operation of the turbines is likely to negatively affect at least some fauna. This impact although likely, is not well documented and would also be difficult to mitigate.

Impact 3. *Increased Erosion Risk*

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion, especially as many parts of the site are steep. The soil disturbance associated with the development will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be a key element of mitigation measures at the site. Furthermore, if the eroded material were to enter streams and rivers at the site it could have significant impact on these systems through siltation of pools and changes in the chemistry and turbidity of the water.

Impact 4. *Alien Plant Invasion*

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion.

Cumulative Impact 1. *Impacts on Critical Biodiversity Areas and broad-scale ecological processes*

Large parts of the site are within Critical Biodiversity Areas and a significant amount of habitat loss may be generated within these areas. While CBAs are not necessarily no-go areas, development within CBAs is not encouraged as such development may compromise the ecological functioning of the CBA or result in direct biodiversity loss within the CBA if not approached carefully and managed effectively. This impact can result from the presence of the facility as well as habitat loss within the CBAs. In addition, the presence of the wind turbines and daily operational activities at the site may deter certain species from the area, resulting in a loss in broad-scale landscape connectivity. In this regard it is important to note that while the development footprint is low in comparison with the total extent of the site, this impact should be considered in context of the impact on the affected ridges and their specific habitats which may be much more restricted, as well as the presence of the other similar developments in the area.

6 ASSESSMENT METHODOLOGY

The assessment methodology will be in accordance with the recent revised 2014 EIA regulations. The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

The methodology is described in the main EIA report and is not repeated here. The specialist has added one factor not included in the Assessment methodology: the ***Degree of confidence in prediction,*** which refers to the degree of confidence in the predictions, based on the availability of information and specialist knowledge.

7 ASSESSMENT OF IMPACTS

An assessment of the likely extent and significance of each impact identified above is provided below for each phase of the development as relevant.

7.1 PLANNING & CONSTRUCTION PHASE

Impact 1. *Impact on vegetation and listed plant species due to transformation within the development footprint.*

There are listed and protected species confirmed present at the site and it is highly likely that some of these species would be impacted by transformation during construction and site clearing. Although a preconstruction walk-through can reduce this impact, there is still likely to be some unavoidable impact on vegetation and listed plant species. Overall, after mitigation, which includes relocating turbines out of the Very High sensitivity areas, the impact is likely to be of **Moderate** significance.

	Temporal Scale	Spatial Scale	Severity	Likelihood	Significance	Confidence
Without Mitigation	Permanent	Study Area	Moderate	Definite	High	High
With Mitigation	Permanent	Study Area	Slight	Probable	Moderate	High
Can the impact be reversed?			No – some transformation is an unavoidable outcome of the development and this cannot easily be reversed.			
Will impact cause irreplaceable loss of resources?			Yes, some loss of rare habitats or species may occur.			
Can impact be avoided, managed or mitigated?			Possibly, through avoidance, but some residual impact is likely			
Will this impact contribute to any cumulative impacts?			Yes. Transformation for roads, turbines and other infrastructure will contribute to cumulative transformation and habitat loss in the area, however, the total extent of transformation is considered to be low to moderate (<200ha).			

<u>Mitigation measures:</u>

- Development within the Very High Sensitivity areas should proceed with caution with specific attention to avoiding impact on plant species of conservation concern that may be present.
- Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are be avoided where possible.
- Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
- Minimise the development footprint as far as possible and rehabilitate disturbed areas that are

no longer required by the operational phase of the development.

- A large proportion of the impact of the development stems from the access roads and the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible, as informed by a preconstruction walk-though survey.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.

Impact 2. *Direct faunal impacts due to construction phase noise and physical disturbance.*

The construction phase will involve a lot of disturbance at the site due to the operation of heavy machinery, human presence and noise from blasting and machinery. This will deter larger fauna from the area and smaller fauna may suffer direct habitat loss or be killed if they are unable or too slow to move away from construction activities. As the construction activities cannot be avoided, it is not possible to mitigate some of these impacts. They are however transient and disturbance levels will subside significantly in the operational phase. Construction phase faunal disturbance is considered to have a **Moderate** significance after mitigation.

	Temporal Scale	**Spatial Scale**	**Severity**	**Likelihood**	**Significance**	**Confidence**
Without Mitigation	Medium Term	Study Area	Severe	Definite	Medium	High
With Mitigation	Medium Term	Localised	Moderate	Probable	Medium	High
Can the impact be reversed?			Construction phase disturbance will be transient, but some habitat loss would be long term.			
Will impact cause irreplaceable loss of resources?			Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.			
Can impact be avoided, managed or mitigated?			Possibly, through avoidance, but some residual impact is likely			
Will this impact contribute to any cumulative impacts?			Yes. Construction phase disturbance will contribute towards cumulative faunal impacts in the area, this will however be transient and localised.			

Mitigation measures:

- Preconstruction walk-through of the facility to identify areas of faunal sensitivity.
- During construction any fauna directly threatened by the construction activities should be

removed to a safe location by the ECO or other suitably qualified person.

- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
- No fires should be allowed within the site as there is a risk of runaway veld fires.
- No fuelwood collection should be allowed on-site.
- No dogs or cats should be allowed on site apart from that of the landowners.
- If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled and vehicles which need to roam around the site should be accompanied by the ECO or security personnel.
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.

Impact 3. *Soil erosion risk as a result of clearing and disturbance within the development footprint and adjacent affected areas*

During and immediately after construction, the disturbed areas within the site will be highly vulnerable to erosion. It is a common misconception that erosion in semi-arid environments is a low risk factor, however, this is false as these areas are often exposed to high intensity rainfall events and the vegetation cover is low, leaving the soils exposed and vulnerable to erosion. Erosion results in soil loss and a decline in biodiversity and productive potential from the affected areas and may also result in the siltation and degradation of aquatic systems which receive the eroded soils. With the implementation of erosion control and avoidance measures, this impact can however be effectively reduced to a **Low** level.

	Temporal Scale	**Spatial Scale**	**Severity**	**Likelihood**	**Significance**	**Confidence**
Without Mitigation	Medium Term	Study Area	Severe	Definite	Medium	High
With Mitigation	Short Term	Localised	Moderate	Probable	Low	High
Can the impact be reversed?			With appropriate mitigation the impact can be			

	ameliorated
Will impact cause irreplaceable loss or resources?	The loss of large amounts of topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

Mitigation measures:

- Runoff management and erosion control should be integrated into the project design.
- Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided.
- Dust suppression and erosion management should be an integrated component of the construction approach.
- Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.
- Regular monitoring for erosion problems along the access roads and other cleared areas.
- Erosion problems should be rectified on a regular basis.
- Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

7.2 OPERATIONAL PHASE

Impact 1. *Faunal impacts due to operational activities of the wind farm such as noise, and human presence during maintenance activities.*

Although disturbance during the operational phase will be significantly lower than during the construction phase, it is also higher than the background pre-development levels of noise and this will impact some species, especially those that use sound to find their prey or avoid their predators. This includes species such as Bat-eared Fox, gerbils and golden moles and potentially other species such as owls and frogs. Although the severity of this impact is moderate, it cannot be well mitigated as the primary source of noise in the area would be from the turbines themselves. It is difficult to quantify the extent of this impact, but it is likely to extend 500m or more from turbines depending on wind conditions. The overall significance of this impact is likely to be **Medium**.

	Temporal Scale	Spatial Scale	Severity	Likelihood	Significance	Confidence
Without Mitigation	Long Term	Study Area	Moderate	Definite	Medium	High

With Mitigation	Long Term	Localised	Moderate	Probable	Medium	High
Can the impact be reversed?			The impact will persist for the lifespan of the facility, but will be reversed if the turbines are removed and disturbed areas rehabilitated.			
Will impact cause irreplaceable loss or resources?			No, this is unlikely			
Can impact be avoided, managed or mitigated?			Partially. Some management is possible, but residual impact from the wind turbines and general disturbance will persist.			
Will this impact contribute to any cumulative impacts?			Yes. The presence and operation of the facility will contribute towards faunal habitat loss and disturbance in the area. For most fauna this is considered to be relatively low.			

Mitigation measures:

- Management of the site should take place within the context of an Open Space Management Plan.
- No unauthorized persons should be allowed onto the site.
- Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone expect landowners with the appropriate permits where required.
- If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.

Impact 2. *Following construction, the site will be highly vulnerable to soil erosion*

Areas disturbed during construction will remain vulnerable to disturbance for some time into the operational phase and will require regular maintenance to ensure that erosion is minimised. With mitigation, this impact can however be reduced to a **Low** level.

	Temporal Scale	Spatial Scale	Severity	Likelihood	Significance	Confidence
Without Mitigation	Long Term	Study Area	Severe	Probable	Medium	High
With Mitigation	Medium Term	Localised	Moderate	May occur	Low	High
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated			
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources.			
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be mitigated			
Will this impact contribute to any cumulative impacts?			Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.			

Mitigation measures:

- Erosion management at the site should take place according to the Erosion and Rehabilitation Plan.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.

Impact 3. *Following construction, the site will be highly vulnerable to alien plant invasion*

Disturbed areas are vulnerable to alien plant invasion and it is likely that road verges, crane pads and other cleared or disturbed areas will be foci for alien plant invasion. Uncontrolled invasion can result in invasion into the intact rangeland and where woody species are involved, this can result in loss of biodiversity and a decline in ecosystem services. With regular clearing and management, this impact can be reduced to a **Low** significance level.

	Temporal Scale	Spatial Scale	Severity	Likelihood	Significance	Confidence
Without Mitigation	Permanent	Study Area	Severe	Probable	Medium	High
With Mitigation	Short Term	Study Area	Moderate	May occur	Low	High

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	With mitigation there would not be loss of resources
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.

Mitigation measures:

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous shrub layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled.
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

7.3 DECOMMISSIONING

Impact 1. *Faunal Impacts due to Decommissioning Phase activities such as noise and disturbance due to the presence of construction staff and the operation of heavy machinery*

Decommissioning will require the use of heavy machinery on-site and will generate a lot of noise and disturbance which would have a negative impact on fauna. This impact would however be relatively short-lived and would ultimately result in the removal of the development and rehabilitation of the site and as such the ultimate impact of decommissioning on fauna would be **Low** after mitigation.

	Temporal Scale	Spatial Scale	Severity	Likelihood	Significance	Confidence
Without Mitigation	Short Term	Study Area	Severe	Probable	Medium	High
With Mitigation	Short Term	Study Area	Moderate	May occur	Low	High

Can the impact be reversed?	Yes. This impact will be transient and restricted to the decommissioning period.
Will impact cause irreplaceable loss or resources?	No, this is unlikely
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.
Will this impact contribute to any cumulative impacts?	Yes. The noise and activity will contribute towards disturbance in the area, but this will be transient and the contribution would be low to moderate

Mitigation measures:

- Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact.

Impact 2. *Soil Erosion Risk Following Decommissioning will be high*

Decommissioning will result in a lot of disturbance which will leave the site vulnerable to erosion. As a result the site should be monitored for erosion problems for at least 2 years after decommissioning. With mitigation, this impact can be reduced to a **Low** significance.

	Temporal Scale	**Spatial Scale**	**Severity**	**Likelihood**	**Significance**	**Confidence**
Without Mitigation	Long Term	Study area	Severe	Probable	Medium	High
With Mitigation	Medium Term	Localised	Slight	Probable	Low	High
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated			
Will impact cause irreplaceable loss or resources?			The loss of large amounts of topsoil would potentially be an irreplaceable loss of resources.			
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be mitigated			
Will this impact contribute to any cumulative			Yes. Erosion will contribute towards cumulative			

impacts?	habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.
Mitigation measures: • Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.	

Impact 3. *Alien plant invasion will be highly likely within disturbed areas following decommissioning*

Decommissioning will leave the site vulnerable to alien plant invasion and alien plants should be monitored and managed for at least two years following decommissioning or until an adequate cover of perennial plants has been established in disturbed areas. With mitigation, this impact can be reduced to a **Low** significance.

	Temporal Scale	**Spatial Scale**	**Severity**	**Likelihood**	**Significance**	**Confidence**
Without Mitigation	Long Term	Study area	Severe	Probable	Medium	High
With Mitigation	Medium Term	Localised	Slight	Probable	Low	High
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated			
Will impact cause irreplaceable loss or resources?			With mitigation there would not be loss of resources			
Can impact be avoided, managed or mitigated?			With appropriate control measures, alien plants can be controlled and reduced to very low impact			
Will this impact contribute to any cumulative impacts?			Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.			
Mitigation measures: • Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.						

- Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned.
- Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

7.4 CUMULATIVE IMPACTS

Impact 1. *Impact on CBAs and Broad-Scale Ecological Processes due habitat loss and the presence and operation of the facility*

Cumulative impacts are a significant concern at the site due to the large amount of wind energy development in the area. Furthermore, large parts of the development are within CBAs and the loss of habitat within the CBAs may impact the ecological functioning of the CBAs and result in increased habitat fragmentation and reduced landscape connectivity. In order to reduce the cumulative impact of the development, the turbines within the Very High sensitivity areas should be relocated and the footprint of the development should be kept as low as possible. Overall, the cumulative impact of the development is considered to be **Medium** after mitigation and cannot be reduced to a low level as the impact results from the presence of the facility.

	Temporal Scale	**Spatial Scale**	**Severity**	**Likelihood**	**Significance**	**Confidence**
Without Mitigation	Long Term	Regional	Severe	Probable	High	High
With Mitigation	Long Term	Study area	Moderate	Probable	Medium	High
Can the impact be reversed?			The impact would last for the lifetime of the development. (20-25 years).			
Will impact cause irreplaceable loss or resources?			Not likely			
Can impact be avoided, managed or mitigated?			To some extent, but the main impact results from the loss and transformation of habitat as well as the presence and operation of the facility which cannot be avoided but would be of local to regional significance only.			
Will this impact contribute to any cumulative impacts?			Yes. The development of the site will contribute to habitat loss and degradation of habitat within CBAs, especially within the higher-lying areas which have a limited extent and contain the			

	majority of species of concern.

Mitigation measures:

- Avoid development within the Very High sensitivity parts of the site.
- The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- An Open Space Management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent rangeland.
- Avoid impact to potential corridors such as the riparian corridors associated with the larger drainage lines within the facility area.

8 CONCLUSIONS & RECOMMENDATIONS

The Brandvalley site consists of a large high elevation basin fringed and broken by large hills. Although the interior of the site is considered moderately sensitive, there are relatively few turbines within this area and a large proportion of the development is located within the higher-elevation parts of the site, which have more favorable wind conditions, but which are also considered more sensitive. The northern-most extent of the site occupies a high elevation isolated plateau at 1300-1400m which is considered high sensitivity on account of the likely presence of species of conservation concern within this area as well as the ecological integrity and value of this area as an undisturbed extent of high-elevation habitat which is of limited total extent and not widely available in the broader area. In response to these findings, the developer has reduced the footprint of the development within this area by dropping two turbines from the layout and reducing the extent and size of access roads. The overall impact of this mitigation is to reduce the likely footprint of the development by 39% within the sensitive area. This is considered sufficient to reduce the impact of the development on flora to an acceptable level, although there is likely to be some residual impact on fauna. This is however a relatively small area and as impacts of wind turbines on fauna in South Africa is largely unknown, it is recommended that pre- and post-construction monitoring of key fauna within this area be conducted to improve our understanding of the impacts of wind turbines on fauna and inform mitigation for future wind development in the country. Such monitoring would only become a necessary requirement if the development was selected as a preferred bidder and was therefore certain to go ahead. This should be included in the authorization conditions for the development. The steps taken by the developer to reduce the footprint within the sensitive area and the additional avoidance and monitoring requirements, represents an acceptable balance between the needs of the developer and the environment within this part of the site and does not compromise the ideal of no net loss of biodiversity.

Although there are a number of other turbines within areas considered High Sensitivity, these are not considered as sensitive as the northern part of the site and provided that specific

mitigation and avoidance is implemented in these areas, then the impact would be reduced to acceptable level. It is recommended that a follow-up survey of these ridges is conducted in the wet season to identify any specific areas of concern that should be avoided as well as adjust turbine and road locations to minimize impact on species and habitats of concern.

Although there are large parts of the site which lie within CBAs, the data collected on-site is considered to be of greater significance than the CBA status as the CBA maps are made at a desktop level without extensive ground-truthing or validation. This is particularly important with regards to the parts of the site within the Northern Cape, the majority of which is not mapped as CBA, but was observed in the field to be clearly among the more sensitive parts of the site. Therefore, the CBA status of the site is considered as secondary to the actual assessed biodiversity status of the different parts of the site. Although the development will impact the connectivity of the landscape for some fauna and as much as 3300ha of the site will be within 500m of a wind turbine, there are several significant gaps in the turbine clusters and this is likely to allow affected fauna to move through the area relatively unimpeded.

Similarly, large parts of the site lie within a NPAES focus area, and the development may compromise the country's ability to meet conservation targets. Although the direct contribution of the current development would only be about 200ha, the density of renewable energy developments in the area is high and the cumulative impact of development may have an impact on future conservation options in the area. As the area is a center of plant diversity and endemism, impacts on flora are seen to be of greater significance than those in fauna. With mitigation, the impact of the development on flora can be reduced to a relatively low level and the potential for future rehabilitation of the area after decommissioning of the facility remains high and so in the long-term, the potential future conservation value of the area would remain largely intact.

While the higher-lying slopes in the northern parts of the site are considered high sensitivity, the site becomes progressively more arid and less sensitive towards the south. Overall and apart from the higher-lying ridges in the north, the site is considered less sensitive than either of the adjacent authorized wind energy facilities to the north which have an abundance of the higher elevation slopes and ridges with a high abundance of species of conservation concern. Due to the increasing aridity of the site towards the south, the affected habitat within these areas is not the same as within the north and within the other wind energy facilities, with the result that the overall cumulative impact is lower than it would otherwise have been. However, to keep the cumulative impacts at an acceptable level. it is important that the areas of very high sensitivity in the northern extent of the site are not developed.

Provided that the development footprint and associated impact within the higher elevation northern ridges can be managed, then the major impact of the Brandvalley development would be on ecological processes rather than on biodiversity pattern (biodiversity within the footprint).

While there are some ridges where the footprint should be actively managed and minimized, direct impacts on species and habitats within the rest of the site can be mitigated to a moderate to low level through design and preconstruction walk-throughs to inform the final approved layout.

Overall, after mitigation which includes a reduction of the footprint within the Snydersberg area as illustrated and pre- and post-construction faunal monitoring within this area, the impact of the Brandvalley Wind Energy Facility would be of moderate to low significance. While there are no impacts associated with the development that are considered to be of very high significance after mitigation, there are several impacts which are likely to remain of moderate significance after mitigation. Of particular concern would be erosion risk due to the presence of access roads on the steep slopes of the site as well as potential impacts on Critical Biodiversity Areas and broad-scale ecological processes. However, with mitigation and avoidance implemented, these impacts are considered acceptable.

Summary assessment for the Brandvalley Wind Energy Facility, before and after mitigation.

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	High	Medium
Faunal impacts due to construction activities	Medium	Medium
Increased erosion risk during construction	Medium	Low
Operational Phase Impacts		
Faunal impacts due to operational activities	Medium	Medium
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	Medium	Low
Decommissioning		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk after decommissioning	Medium	Low
Increased erosion risk following decommissioning	Medium	Low
Cumulative Impacts		
Impacts on broad-scale ecological processes	High	Medium

9 LITERATURE CITED

Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. (eds.). 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute, Pretoria.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.

Brownlie, S. 2005. Guideline for Involving Biodiversity Specialists in EIA Processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. 63 pp.

Clark, V.R., Barker, N.P., & Mucina, L. 2011. The Roggeveldberge – notes on a botanically hot area on a cold corner of the southern Great Escarpment, South Africa. *South African Journal of Botany* 77: 112-126.

Desmet, P and Marsh A. 2008. Namakwa District Biodiversity Sector Plan. Available from BGIS at http://bgis.sanbi.org/namakwa/project.asp.

De Villiers CC, Driver A, Clark B, Euston-Brown DIW, Day EG, Job N, Helme NA, Holmes PM, Brownlie S and Rebelo AB (2005) *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape.* Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.

Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Passmore, N.I. & Carruthers, V.C. 1995. *South African Frogs: A complete guide*. Witwatersrand University Press, Johannesburg. 322 pp.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Skowno, A.L. Holness S.D and P. Desmet. 2009. Biodiversity Assessment of the Central Karoo District Municipality. DEAP Report EADP05/2008, 52 pages.

10 APPENDICES:

Appendix 1. Listed Plant Species

List of plant species of conservation concern which are known to occur in the vicinity of the Brandvalley Wind Farm. The list is derived from the SIBIS:SABIF website. Those in red are confirmed present at the site, but not necessarily within the development footprint.

Family	Species	Threat status
AMARYLLIDACEAE	***Brunsvigia josephinae (Redouté) Ker Gawl.***	**VU**
	Strumaria karooica (W.F.Barker) Snijman	**Rare**
	Strumaria pubescens W.F.Barker	**Rare**
ANTHERICACEAE	*Chlorophytum lewisiae Oberm.*	**Rare**
APOCYNACEAE	***Duvalia parviflora N.E.Br.***	**VU**
	Hoodia pilifera (L.f.) Plowes subsp. pilifera	**NT**
ASPHODELACEAE	*Astroloba herrei Uitewaal*	**VU**
	Bulbine torta N.E.Br.	**Rare**
	Haworthia fasciata (Willd.) Haw.	**NT**
	Gasteria disticha	**CR**
	Haworthia serrata	**CR**
	Haworthia pulchella M.B.Bayer var. pulchella	**Rare**
ASTERACEAE	*Cineraria lobata L'Hér. subsp. lasiocaulis Cron*	**Rare**
	Antithrixia flavicoma	**VU**
	Euryops namaquensis	**VU**
	Eriocephalus grandiflorus M.A.N.Müll.	**Rare**
	Phymaspermum schroeteri Compton	**Rare**
	Pteronia hutchinsoniana Compton	**Rare**
	Relhania tricephala (DC.) K.Bremer	**NT**
COLCHICACEA	*Wurmbea capensis*	**VU**
CRASSULACEAE	*Adromischus humilis (Marloth) Poelln.*	**Rare**
	Adromischus phillipsiae (Marloth) Poelln.	**Rare**
	Adromischus mammillaris	**EN**
	Crassula alpestris Thunb. subsp. massonii (Britten & Baker f.) Toelken	**Rare**
EUPHORBIACEAE	*Euphorbia nesemannii R.A.Dyer*	**NT**
FABACEAE	*Amphithalea spinosa (Harv.) A.L.Schutte*	**VU**
	Amphithalea villosa Schltr.	**VU**
	Lotononis comptonii B.-E.van Wyk	**EN**
	Lotononis gracilifolia B.-E.van Wyk	**EN**
	Lotononis venosa B.-E.van Wyk	**VU**
GERANIACEAE	*Pelargonium denticulatum Jacq.*	**Rare**
	Pelargonium torulosum E.M.Marais	**Rare**
HYACINTHACEAE	*Lachenalia maximiliani Schltr. ex W.F.Barker*	**Rare**

IRIDACEAE	*Geissorhiza inaequalis L.Bolus*	**Rare**
	Geissorhiza karooica Goldblatt	**NT**
	Ixia linearifolia Goldblatt & J.C.Manning	**Rare**
	Ixia parva Goldblatt & J.C.Manning	**VU**
	Moraea aspera Goldblatt	**VU**
	Romulea eburnea J.C.Manning & Goldblatt	**VU**
	Romulea syringodeoflora M.P.de Vos	**VU**
MESEMBRYANTHEMACEAE	*Cleretum lyratifolium Ihlenf. & Struck*	**Rare**
	Lampranthus amoenus (Salm-Dyck ex DC.) N.E.Br.	**EN**
OXALIDACEAE	*Oxalis tenuipes T.M.Salter var. tenuipes*	**Rare**
POACEAE	***Ehrharta eburnea Gibbs Russ.***	**NT**
POLYGALACEAE	*Muraltia karroica Levyns*	**VU**
PROTEACEAE	*Leucadendron teretifolium (Andrews) I.Williams*	**NT**
	Protea convexa E.Phillips	**CR**
	Protea lepidocarpodendron (L.) L.	**NT**
RUTACEAE	*Acmadenia argillophila I.Williams*	**NT**
SCROPHULARIACEAE	*Globulariopsis wittebergensis Compton*	**Rare**
	Oftia glabra Compton	**Rare**
	Selago albomontana Hilliard	**Rare**

Appendix 2. List of Mammals

List of Mammals which potentially occur at the Brandvalley Wind Farm site. Taxonomy and habitat notes are derived from Skinner & Chimimba (2005), while conservation status is according to the IUCN 2016.

Scientific Name	Common Name	Status	Habitat	Likelihood
Afrosoricida (Golden Moles):				
Chlorotalpa sclateri	Sclater's Golden Mole	LC	Montane grasslands, scrub and forested kloofs of the Nama Karoo and grassland biomes	Low
Chrysochloris asiatica	Cape Golden Mole	LC	Coastal parts of the Northern and Western Cape	High
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus edwardii	Cape Rock Elephant Shrew	LC	From rocky slopes, with or without vegetation, from hard sandy ground bearing little vegetation, quite small rocky outcrops	Confirmed
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Confirmed
Lagomorpha (Hares and Rabbits):				
Bunolagus monticularis	Riverine Rabbit	CR	Confined to riparian bush on the narrow alluvial fringe of seasonally dry watercourses in the Central Karoo.	V.Low
Pronolagus saundersiae	Hewitt's Red Rock Hare	LR/LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	Confirmed
Lepus capensis	Cape Hare	LR/LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LR/LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	Confirmed
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed

Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	High
Acomys subspinosus	Cape Spiny Mouse	LC	Associated with rocky areas on mountain slopes in Fynbos	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Steatomys krebsii	Kreb's African Fat Mouse	LC		
Micaelamys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	Confirmed
Micaelamys granti	Grant's Rock Mouse	LC	Restricted to the karoo where they are associated with rocky terrain.	High
Parotomys brantsii	Brants's Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	Low
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	Confirmed
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Tatera afra	Cape Gerbil	LC	Confined to areas of loose, sandy soils of sandy alluvium. Common on cultivated lands.	Low
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Dendromus melanotis	Grey Climbing Mouse	LC	Often associated with stands of tall grass especially if thickened with bushes and other vegetation	High
Primates:				
Papio hamadryas	Chacma Baboon	LR/LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Confirmed
Eulipotyphla (Shrews):				
Myosorex varius	Forest Shrew	LC	Prefers moist, densely vegetated habitat	High

Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristatus	Aardwolf	LR/LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	Confirmed
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Panthera pardus	Leopard	SARDB NT	Wide habitat tolerance, associated with areas of rocky koppies and hills, mountain ranges and forest	Low/Moderate
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LR/LC	Occur in open arid associations	High
Genetta tigrina	Large-spotted genet	LR/LC	Fynbos and savanna particularly along riverine areas	Low
Suricata suricatta	Meerkat	LR/LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LR/LC	Semi-arid country on a sandy substrate	Confirmed
Galerella pulverulenta	Cape Grey Mongoose	LR/LC	Wide habitat tolerance	Confirmed
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	Confirmed
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	Confirmed
Aonyx capensis	Cape Clawless Otter	LC	Predominantly aquatic and do not occur far from permanenetpermanenet water	Medium
Ictonyx striatus	Striped Polecat	LR/LC	Widely distributed throughout the sub-region	Confirmed
Mellivora capensis	Ratel/Honey Badger	SARDB EN	Catholic habitat requirements	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LR/LC	Presence of bushes is essential	Confirmed
Pelea capreolus	Grey Rhebok	LC	Associated with rocky hills, rocky mountainsides, mountain plateaux with good grass cover.	Confirmed
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LR/LC	Inhabits open country,	Confirmed

Raphicerus melanotis	Cape Grysbok	LC	Thick scrub bush, particularly along the lower levels of hills	Medium
Oreotragus oreotragus	Klipspringer	LR/cd	Closely confined to rocky habitat.	Confirmed

Appendix 3. List of Reptiles.

List of reptiles which are known from the broad area around the Brandvalley Wind Farm site, according to the SARCA database, derived for the degree square 3220CD, DC and 3320AB, BA.

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern
Agamidae	*Agama*	*hispida*		Spiny Ground Agama	Least Concern
Atractaspididae	*Homoroselaps*	*lacteus*		Spotted Harlequin Snake	Least Concern
Chamaeleonidae	*Bradypodion*	*gutturale*		Little Karoo Dwarf Chameleon	Least Concern
Chamaeleonidae	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Least Concern
Colubridae	Dasypeltis	scabra		Rhombic Egg-eater	Least Concern
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern
Cordylidae	*Cordylus*	*minor*		Western Dwarf Girdled Lizard	Least Concern
Cordylidae	*Hemicordylus*	*capensis*		Graceful Crag Lizard	Least Concern
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern
Cordylidae	*Pseudocordylus*	*microlepidotus*	*namaquensis*	Nuweveldberg Crag Lizard	Least Concern
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Least Concern
Elapidae	*Naja*	*nigricincta*	*woodi*	Black Spitting Cobra	Least Concern
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not Listed
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*formosus*		Southern Rough Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*geitje*		Ocellated Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*kladaroderma*		Thin-skinned Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*maculatus*		Spotted Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*mariquensis*		Marico Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*oculatus*		Golden Spotted Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*purcelli*		Purcell's Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern
Gerrhosauridae	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern
Gerrhosauridae	*Tetradactylus*	*tetradactylus*		Cape Long-tailed Seps	Least Concern
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern
Lacertidae	*Pedioplanis*	*burchelli*		Burchell's Sand Lizard	Least Concern
Lacertidae	*Pedioplanis*	*laticeps*		Karoo Sand Lizard	Least Concern
Lacertidae	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern

Leptotyphlopidae	*Namibiana*	*gracilior*		Slender Thread Snake	Least Concern
Lamprophiidae	*Boaedon*	*capensis*		Brown House Snake	Least Concern
Lamprophiidae	*Prosymna*	*sundevallii*		Sundevall's Shovel-snout	Least Concern
Lamprophiidae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern
Lamprophiidae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Least Concern
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern
Scincidae	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern
Testudinidae	*Chersina*	*angulata*		Angulate Tortoise	Least Concern
Testudinidae	*Homopus*	*areolatus*		Parrot-beaked Tortoise	Least Concern
Testudinidae	*Homopus*	*boulengeri*		Karoo Padloper	Near Threatened
Testudinidae	*Homopus*	*femoralis*		Greater Padloper	Least Concern
Testudinidae	*Psammobates*	*tentorius*	*tentorius*	Karoo Tent Tortoise	Not listed
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern

Appendix 4. List of Amphibians

List of amphibians which potentially occur at the Brand Valley Wind Farm. Taxonomy and habitat notes are from du Preez and Carruthers (2009) and conservation status from the IUCN 2010. (Status: LC = Least Concern, DD = Data Deficient) and additional data is from the ADU Amphibian Database for Quarter degree squares: 3220CD, 3220DC, 3320AB, 3320BA.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Amietophrynus rangeri	Raucous Toad	Not Threatened	Rivers and stream in grassland and fynbos	Endemic	High
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	High
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	High
Amietia fuscigula	Cape River Frog	Not Threatened	Large still bodies of water or permanent streams and rivers.	Widespread	Confirmed
Cacosternum karooicum	Karoo Caco	DD	Dry kloofs and valleys in the Karoo	Endemic	High
Cacosternum karooicum	Karoo Dainty Frog	DD	Arid areas with unpredictable rainfall. Breeds in small streams as well as man-made dams.	Karoo Endemic	High
Tomopterna delalandii	Cape Sand Frog	Not Threatened	Lowlands in fynbos and Succulent Karoo	Endemic	High
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	High