ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED MARALLA WEST WIND ENERGY FACILITY:

FAUNA & FLORA SPECIALIST STUDY FOR EIA

PRODUCED FOR WSP

ON BEHALF OF BIOTHERM ENERGY (PTY) LTD

BY

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CONTENTS

1 INTRODUCTION

BioTherm Energy (Pty) Ltd is proposing to develop a wind energy facility of up to 140MW between Sutherland and Laingsburg along the boundary of the Northern and Western Cape. The facility to be known as the Maralla West Wind Energy Facility would comprise up to 56 wind turbines with associated infrastructure such as access roads and grid connection infrastructure. WSP Environmental are conducting the required environmental authorization process for the Maralla West Wind Energy development and have appointed Simon Todd Consulting to provide the terrestrial fauna and flora input for the development.

The scoping report for the development has been accepted by DEA and the study is now in the EIA phase. As such, this terrestrial fauna and flora specialist 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.

2 STUDY APPROACH

2.1 SCOPE OF STUDY

The specific terms of reference for the scoping study includes the following:

- 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 (including assessment of 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.

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 how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order 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 Maralla West WEF will have an energy export capacity of up to 140MW. It is anticipated that the facility will comprise the following components:

- Up to 56 wind turbines generators with a generating capacity of between 2 and 4MW each. The turbines will have a hub height of up to 120m and rotor diameter of up to 150m.
- Concrete foundation to support the turbines

- Onsite 132kV Substation, with the transformers for voltage step up from medium voltage to high voltage. Substation will occupy an area of 150mx 150m
- The medium voltage collector system will comprise of cables (1kV up to and including 33kV) that will be run underground, expect where a technical assessment suggest that overhead lines are applicable, in the facility connecting the turbines to the onsite substation
- A laydown area for the temporary storage of materials during the construction activities. The laydown area will be a maximum of 4ha in size
- Permanent laydown for turbine crane platforms
- Haul roads between 4 – 6m wide. Double width roads required in strategic places for passing
- Temporary site compound for contractors
- Operations and maintenance compound area including O&M building, car park and storage area

2.4 LIMITATIONS & ASSUMPTIONS

The site was visited twice specifically for this assessment, in the autumn to gain an initial assessment of the site and identify potentially sensitive areas for additional study in the wet season site visit which took place in early September 2016, during the peak of the spring flowering season at the site. As such, the site has been visited at the most appropriate time and there are consequently few limitations resulting from the timing of the site visit.

Apart from the above site visits, the area has also been visited in the past at different times of the year for a variety of other assessments. The facility lies within the original project area of the Mainstream Sutherland WEF which the consultant sampled in 2011. In addition, it lies adjacent to the ACED Komsberg West WEF which was sampled in 2015. This information is used to inform the current study as appropriate and as the area has been sampled numerous times at different seasons, this significantly reduces the uncertainty associated with the current assessment.

The lists of amphibians, reptiles and mammals for the site are based on those observed at the site and on adjacent projects as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

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 *Biodiversity Assessment of the Central Karoo District Municipality* (Skowno et al. 2009) as well as the Biodiversity Sector Plan for the Namakwa District (Desmet & Marsh 2008).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 3220DB 3220DD 3221CA 3221CC 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 (2016).
- 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.

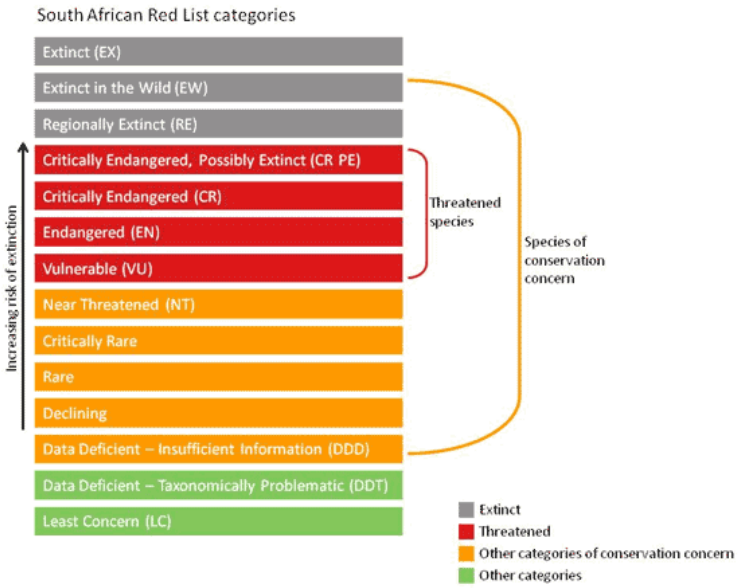

Figure 1. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

3.2 SITE VISIT

A preliminary site visit to the study area was conducted on the 4th of April 2016 and a follow-up site visit on the 8th and 9th of September 2016. The primary purpose of the initial site visit was to investigate and identify sensitive features within the site as well as provide a preliminary characterization of the habitats and ecosystems within the site for the Scoping phase. The follow-up site visit was in the wet season and was used to verify the sensitivity and characteristics of areas identified as potentially sensitive, especially the highest-lying ground which is of limited extent and most vulnerable to cumulative impact.

Apart from the above site visits, the area has also been visited in the past at different times of the year for a variety of other assessments. The facility lies within the original project area of the Mainstream Sutherland WEF which the consultant sampled in 2011. In addition, it lies adjacent to the ACED Komsberg West WEF which was sampled in 2015. This information is used to inform the current study as appropriate and as the area has been sampled numerous times at different seasons, this significantly reduces the uncertainty associated with the current assessment.

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, thereby minimizing impact and secondary mitigation requirements.

The ecological sensitivity of the different units identified in the mapping procedure were 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 may occur 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. The impacts of development within these areas is dependent on the size and location of the footprint in relation to sensitive features and should proceed with caution as additional specific mitigation and avoidance is usually required to reduce impacts within these areas to acceptable levels. High sensitivity areas are also usually more sensitive to cumulative impact and the total footprint within these areas should be kept low.
- **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.

4 BASELINE DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map, the majority of the footprint is restricted to the Central Mountain Shale Renosterveld vegetation type, while there is a small extent of Tanqua Escarpment Shrubland in the lower-lying valleys of the northwest of the site (Figure 2).

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. The Komsberg area is 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 and Roggeveld Shale Renosterveld (Clark *et al.* 2011).

Tanqua Escarpment Shrubland occurs as a narrow belt on northwest-facing slopes of the Klein-Roggeveldberge and on southwest-facing and west-facing slopes of the Roggeveld Escarpment at altitudes of 620-100m (Mucina & Rutherford 2006). This vegetation type usually occupies steep flanks below an escarpment overlooking a basin, supporting succulent shrubland of medium height with *Tylecodon* (botterboom) and *Euphorbia tanica* (melkboom) (Mucina & Rutherford 2006). This vegetation type is classified as Least Threatened, and only a very small portion is formally conserved in the Tankwa Karoo National Park. Levels of transformation are however low but it is part of the Hantam-Roggeveld Centre of Endemism and is one of the least studied vegetation types of the country (Mucina & Rutherford 2006).

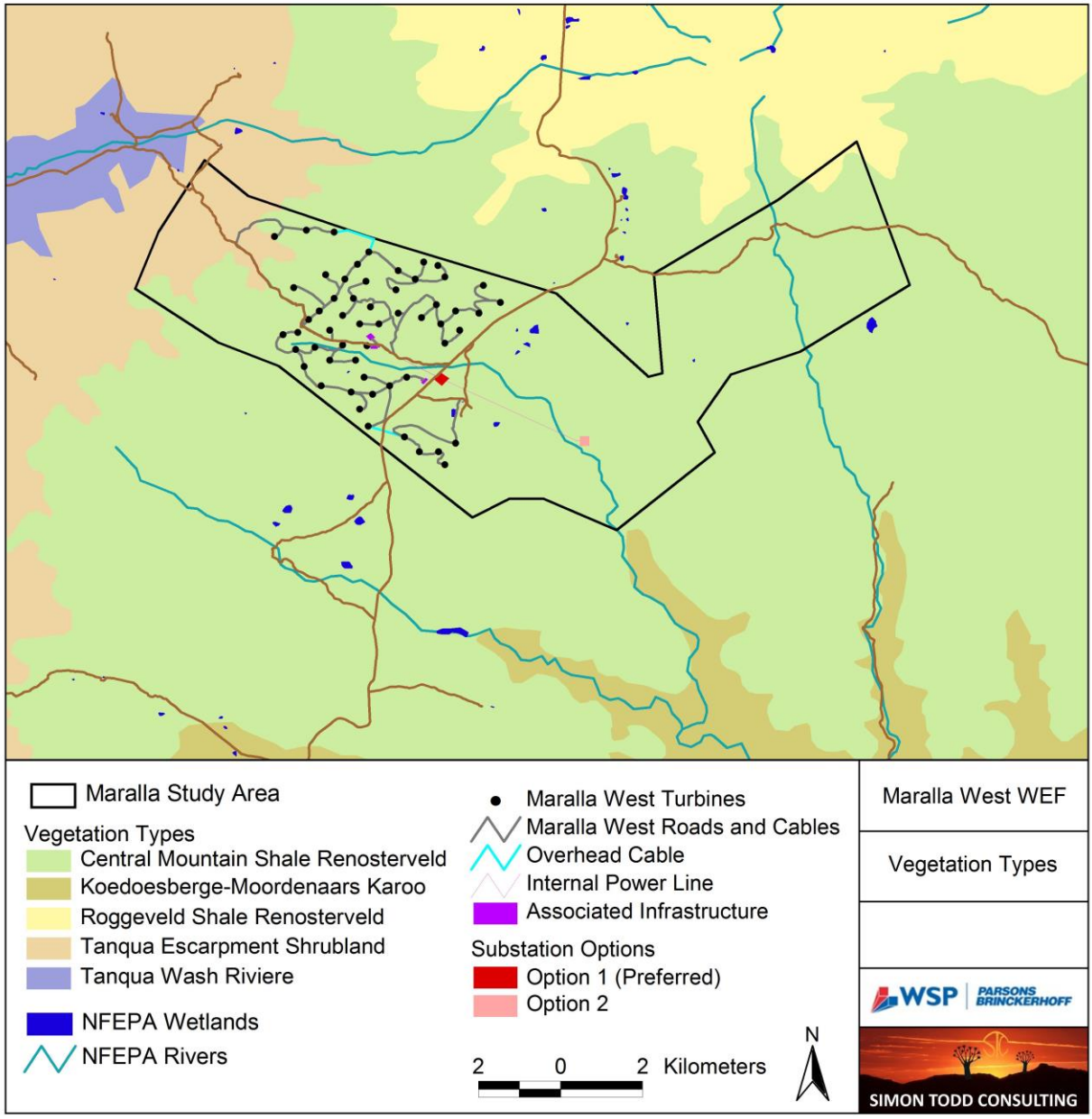

Figure 2. Vegetation map (Mucina and Rutherford 2006) of the Maralla West study area. The majority of the site falls within the Central Mountain Shale Renosterveld, with the lower elevation areas in the west representing Tanqua Escarpment Shrubland.

4.2 SITE DESCRIPTION

The main features of the site are briefly described below. The site consists of three basic regions, the rugged mountainous terrain around the westerly margins of the site, the mid-elevation slopes that form a basin around the Komsberg River which drains it, and the lower elevation plains that are basically free from development in the eastern parts of the site. The majority of the site consists of low shrublands falling within the Central Mountain Shale Renosterveld vegetation type, with a small extent of Tanqua Escarpment Shrubland in the low-lying western part of the site. Although there are some transformed areas at the site, these are of limited extent and do not influence the location of turbines at the site.

Central Mountain Shale Renosterveld at High Elevation

Image 1. Typical high-elevation plateau areas in the rugged western part of the site, showing proposed turbine locations along the edge of the west-facing escarpment.

The high elevation ridges and plateaus of the Maralla West site consists of a low shrubland dominated by unpalatable shrubs such as *Pteronia glomerata*, *Pteronia ciliata*, *Ruschia spinosa*, Euryops *lateriflorus*, *Oedera genistifolia*, *Lycium cinereum*, *Felicia filifolia* subsp. *filifolia*, *Chrysocoma ciliata* and *Rosenia spinescens*, with occasional areas of *Elytropappus rhinocerotis* and *Merxmeullera stricta*. There are occasional rock pavements present which contain specialised plant communities not found elsewhere, composed of species such as *Crassula deltoidea*, *Crassula tetragona* subsp. *connivens*, *Stomatium villetii*, *Adromischus liebenbergii liebenbergii*, *Adromischus filicaulis* subsp *marlothii*, *Pelargonium abrotanifolium*, *Tylecodon ventricosus* and *Nenax microphylla*. There are also occasional rocky outcrops which are also frequently home to a variety of species such as *Diospyros austro-africana* var. *austro-africana*, *Stachys rugosa*, *Euphorbia eustacei*, *Pelargonium hystrix* and *Pelargonium denticulatum*.

Central Mountain Shale Renosterveld at Lower Elevations

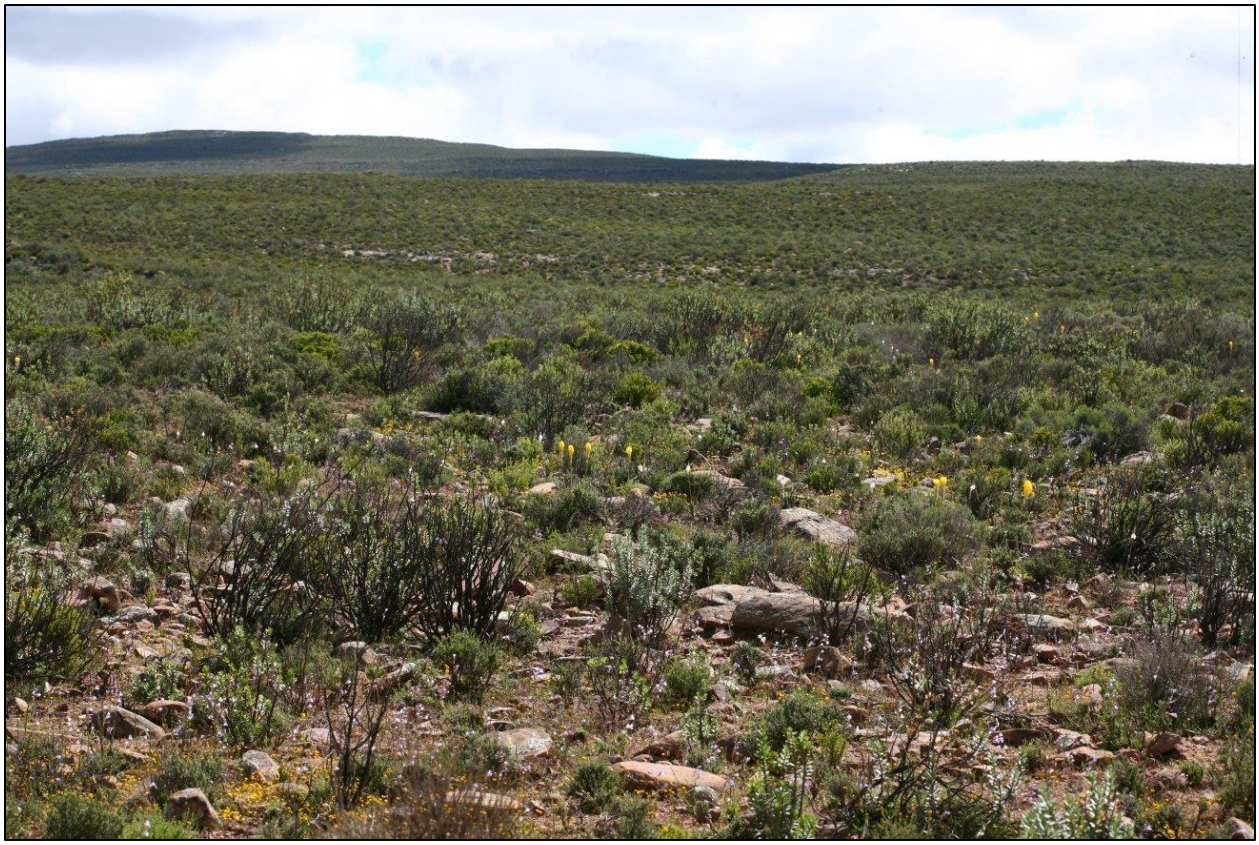

Image 2. Central Mountain Shale Renosterveld at lower elevation, showing an area in the foreground that has recently burnt and the high abundance of geophytes in the renosterveld in these areas.

At lower elevations, the Central Mountain Shale Renosterveld is probably more diverse than at the higher elevations, but this is due mostly to a larger variety of ubiquitous species and more ephemerals and weedy species. Common and dominant shrub species include Euryops lateriflorus, *Eriocephalus microphyllus* var. *microphyllus*, *Eriocephalus purpureus*, *Chrysocoma ciliata*, *Dimorphotheca cuneata*, *Hirpicium alienatum*, *Asparagus capensis*, *Tripteris sinuata*, *Tripteris aghillana* var. *integrifolia*, *Ursinia pilifera*, *Amphiglossa tomentosa*, *Ruschia intricata*, *Pteronia ciliata*, *Pteronia sordida*, *Pteronia glauca*, *Pentzia incana*, *Tetragonia fruticosa*, *Wiborgia sericea*, *Elytropappus rhinocerotis* and *Oedera genistifolia* with occasional grasses *Ehrharta calycina* and *Merxmeullera stricta* and succulents such as *Tylecodon wallachii* and *Crassula tetragona* subsp. *connivens*. Geophytes are also common and include species such as *Hesperantha cucullata*, *Moraea pallida*, *Moraea ciliata*, *Moraea miniata*, *Gladiolus venustus*, *Ixia rapunculoides*, Bulbinella elegans, *Bulbinella cauda-felis*, *Oxalis obtusa*, *Babiana cuneata* and *Romulea tortuosa* subsp*. tortuosa*.

Image 3. Looking out over the central part of the Maralla West site, showing the relatively homogenous nature of the landscape and vegetation in the central part of the site.

Drainage Lines & Wetlands

The main drainage feature of the site is the Komsberg River which runs through the site in an easterly direction. Within the site there are many small to medium-sized tributaries which may be affected by the development. The small tributaries do not have well developed riparian vegetation, while in the lower-lying areas, some fairly large wetlands with dense reed beds are present. Dominant and common species associated with the drainage lines include *Pseudoschoenus inanis*, *Kniphofia sarmentosa*, *Athanasia minuta* subsp. *inermis*, *Felicia filifolia*, *Lycium cinereum*, *Lycium pumilum*, *Euryops imbricatus*, *Dicerothamnus rhinocerotis*, *Phragmites australis*, *Conyza scabrida*, *Euryops oligoglossus* subsp. *racemosus*, *Mentha longifolia* subsp. *capensis* and *Artemisia afra*. Trees are restricted to the larger drainage lines and includes species such as a *Searsia lancea, Salix mucronata*, *Diospyros lycioides* and *Acacia karoo*.

The drainage systems of the site are vulnerable to disturbance and development impact to these areas should be kept to a minimum, this includes minimizing the number of river crossings

and limiting the development footprint near to drainage lines and wetlands. Some of the current crossings are in sensitive areas and if these roads are going to be upgraded as access roads for the development, some rerouting of some short sections of access road may be required to reduce impact to these features.

Image 4. Left a small drainage line, without well-developed riparian vegetation showing some signs of degradation and loss of stability and right, a dense reed bed along one of the larger drainage lines, showing *Kniphofia sarmentosa* in flower in the foreground and dense *Pseudoschoenus inanis* reed beds in the background.

Image 5. The dense reed beds of *Pseudoschoenus inanis* are an important feature of the area as they prevent erosion damage and frequently contain populations of *Brunsvigia josephinae* (VU) as can be seen here in the foreground.

4.3 Listed & Protected Plant Species

According to the SANBI SIBIS database, 514 indigenous species have been recorded from the four quarter degree squares around the site. This includes 22 species of moderate to high conservation concern. Species that can be confirmed present include *Boophone disticha* (Declining), *Brunsvigia josephinae* (VU), *Eriocephalus grandiflorus* (Rare), *Adromischus phillipsiae* (Rare), *Drimia altissima* (Declining). *Cliffortia arborea* (VU) is present in the area along the base of cliffs along the escarpment, but was not observed within the site itself and if present it is not likely that it would be affected by the development as it usually occurs on very steep terrain. In general, the abundance of listed species within the study area is concentrated within certain habitats such as the drainage lines or high-lying ridges, while the lower plains of the site have a lower abundance of such species.

Table 1. Numbers of the species within the different conservation status categories as indicated below, data derived from the SANBI SIBIS database.

Status/ IUCN Red List Category	No. Species
Critically Endangered (CR)	**0**
Endangered (EN)	**1**
Vulnerable (VU)	**5**
Near Threatened (NT)	**3**
Rare	**12**
Declining	**1**
Data Deficient - Insufficient Information (DDD)	**2**
Data Deficient - Taxonomically Problematic (DDT)	**5**
Least Concern	**485**
Total	**514**

4.4 Critical Biodiversity Areas & Broad Scale Ecological Processes

Although the east of the broader Maralla site lies within the Western Cape, the Maralla West development area is restricted to the Northern Cape and falls within the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008). This biodiversity assessment identifies 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 2.2 come into effect. The CBA map for the general area surrounding the site is depicted below in Figure 3.

Within the Maralla West study area, there are several small scattered CBAs associated with steep south-facing slopes. These are considered important for biodiversity especially in face of climate change as these are the coolest slopes which represent refuge areas where many species can persist under a drying or warming climate. Many of these areas have generally been mapped as high sensitivity in this study as well and while there are some turbines in the CBAs, this would not compromise the overall ecological functioning of the area as these areas have been identified as CBAs for broad-scale ecological purposes and not due to a known presence of important biodiversity features within these areas. The small footprint of the turbines would not significantly impact the potential functioning of these areas as refuge areas for flora.

In addition, the majority of the Maralla West development area lies within a NPAES Focus Area. This area was identified as a priority area as part of the Western Karoo Focus 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 described above for the south-facing CBAs. While development of an area as a wind farm may have a significant impact on the perceived value of the area for conservation, the actual impact on biodiversity may be low and in many cases this impact is likely to be significantly less than the prevailing land use, which can have significant deleterious effects. As such, the impact of the development on the NPAES is one largely of perception related to our vision of what should constitute a conservation area, rather than a consideration of the actual minimal loss in long-term biodiversity value associated with development of wind energy which occupies than 0.5% of the surface area of the Komsberg region. In other words, it is unreasonable to consider wind farm development incompatible with biodiversity maintenance when many of our national parks contain tar roads, rest camps, power lines and other infrastructure of similar extent and nature to wind farms.

The NPAES is currently being revised to align with provincial priorities, which have unfortunately not been finalized as yet. Consequently, it is difficult to evaluate the true potential impact of the development on future protected area expansion as on the one hand the current NPAES is outdated and is being replaced and on the other hand, the development which would also only happen in the future is one of a large number of wind energy developments in the area that may or may not be built under the REIPPP. However, as indicated above, there is little to suggest that wind energy development on extensive sites cannot happen in a biodiversity compatible manner and as such, these areas should not be excluded as possibilities for future conservation expansion.

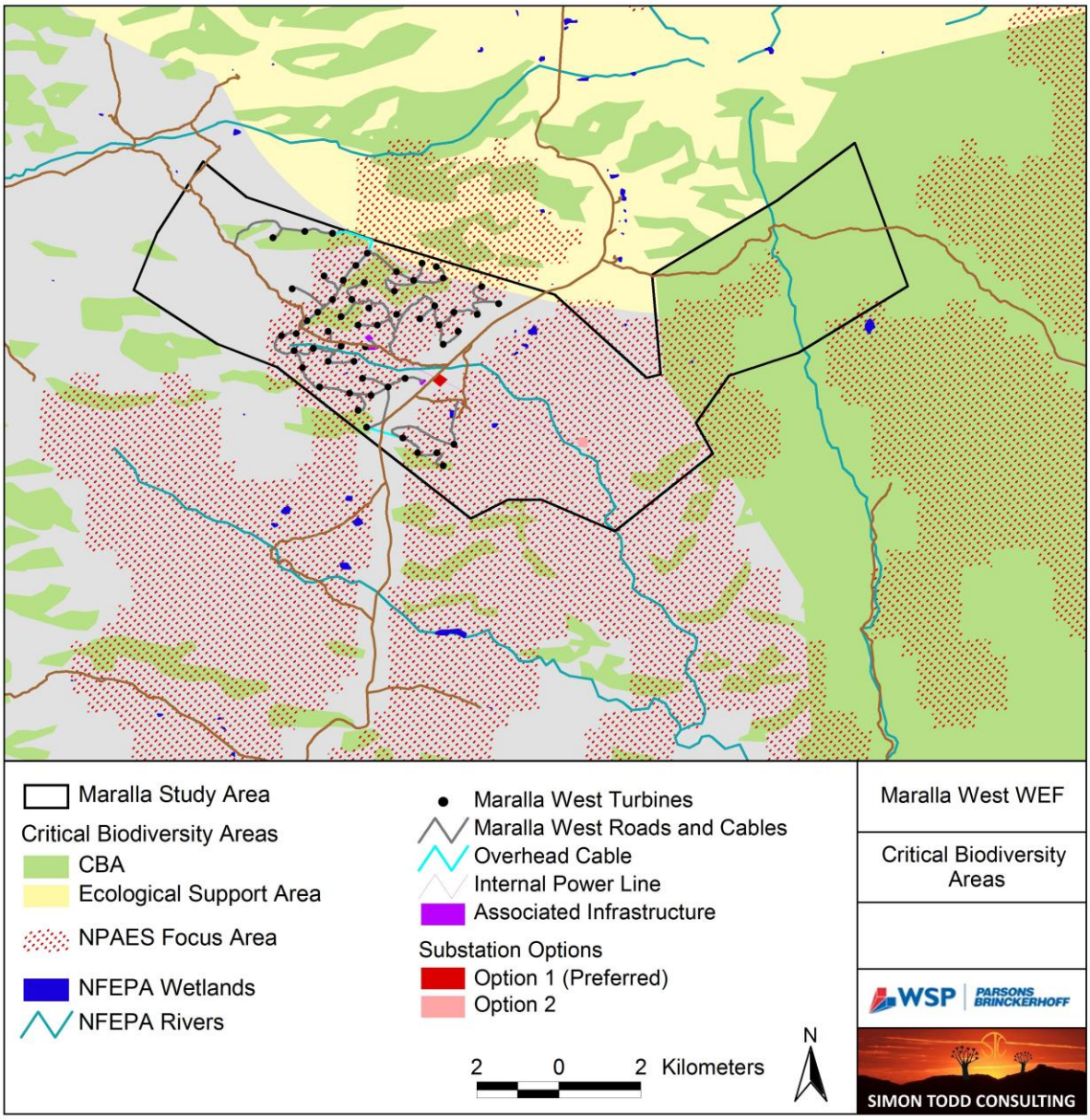

Figure 3. Critical Biodiversity Areas map of the proposed Maralla West study area and the surrounding area, including the NPAES Focus Areas in the area which are part of the Western Karoo Focus Area.

4.5 CUMULATIVE IMPACT

The Roggeveld area has a high degree of climatic and topographic diversity, with numerous vegetation types and habitats represented within a relatively small area, driving biological diversity in the area and resulting in the area being recognized as a center of endemism and

diversity. The Roggeveld/Komsberg area has however also become a focus of wind energy development and there are a large number of wind energy projects in the area. In order to understand cumulative impacts in the area adequately, specific consideration of the actual habitats affected by development is required as impact is not spread evenly, but tends to be focused on specific environments associated with high wind resources. In addition, each facility tends to impact somewhat different vegetation types or plant communities. There has however been significant cumulative impact on the Central Mountains Shale Renosterveld vegetation type, 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 is within renewable energy development application areas. Given this potential impact, specific consideration of cumulative impact on Central Mountains Shale Renosterveld is provided here in context of the potential contribution of the Maralla West site to this impact.

Currently, there are three preferred bidders in the area; the Karusa 142 MW and Soetwater 142MW wind farms which lie immediately west of the site and the 138MW Kareebosch Wind Farm further west of the site. These are the only farms which at this point are certain to be built. The total extent of direct habitat loss from these developments can be estimated at approximately 60ha each, resulting in 180ha of direct habitat loss in the vicinity of the Maralla West site. This is less than 2km^2 of the total mapped extent of 1236km^2 of Central Mountains Shale Renosterveld. Therefore, it is clear that direct transformation from preferred bidders is not yet a significant concern in the area. In terms of assessing future potential impacts, there are a number of approved facilities in the area as well as a number which are under appeal. Not all of these are considered directly relevant for the current project. The developments on the plateau such as the Gunstfontein and Mainstream Sutherland projects are within the Roggeveld Shale Renosterveld vegetation type which is associated with the escarpment and is not impacted by the developments below the escarpment. As such, these are not considered in detail here as the environment is not the same and there is little impact shared across the edge of the escarpment.

In terms of the approved projects and those under appeal, of most relevance for the Maralla West project is the associated Maralla East project and then the adjacent Great Karoo and Komsberg East and Komsberg West projects. The Great Karoo and Komsberg West site occupy a broadly similar environment to the combined Maralla development, however, the Komsberg East site is significantly drier and does not contain similar habitats to the current site. Further afield, there is also the Kareebosch wind farm to the west, adjacent to the preferred bidder Roggeveld Wind Farm as well as the Brandvallei and Rietkloof projects to its south. Assuming that each of these projects is approximately 140MW and would require approximately 30km of new roads, the total expected extent of direct habitat loss from these developments would be approximately 540ha of total habitat loss. Even in a worst case scenario, where all

developments are built, the total extent of habitat loss would be 720ha which would contribute habitat loss of less than 0.5% to the Central Mountains Shale Renosterveld vegetation type and significantly less to all other affected vegetation types. This is not highly significant and it is clear that cumulative impacts due to direct habitat loss in the area is not likely to lead to significant biodiversity loss, despite the high level of development in the area.

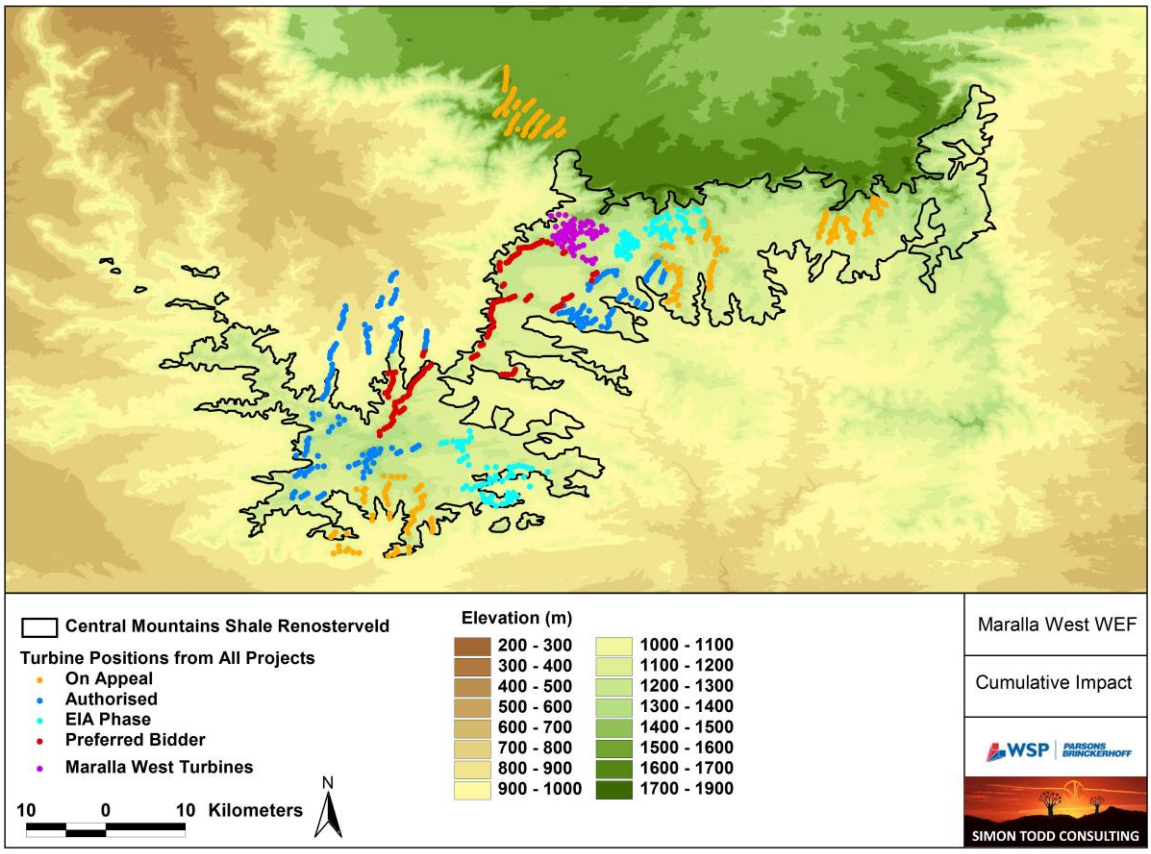

Figure 4. Elevation map of the area around the Maralla West site, showing the approved or planned turbine locations of all current projects in the area, as well as the extent of Central Mountain Shale Renosterveld, which receives the brunt of development in the Komsberg area.

As mentioned at the beginning of this section, cumulative impacts need to be considered in context of the habitats affected as the total extent to habitat loss as detailed above may be misleading. Due to the distribution of wind resources, turbines tend to be located on the high-lying areas and as the total extent of habitat available declines with altitude, the proportional impact may increase with elevation, leading to significant impact within the higher-elevation ridges which are targeted for development. In order to assess this problem, the elevation of all approved and planned turbines was extracted and compared to the elevation distribution of the Central Mountain Shale Renosterveld vegetation type. This relationship is illustrated below in

Figure 5. It is clear that the low to middle elevations of Central Mountain Shale Renosterveld experience little impact from wind turbines, but those areas above 1250m bear the brunt of development, with areas above 1400m being disproportionately affected. As a large proportion of the listed and endemic species of the Komsberg area are associated with moist lowland habitats, this would reduce the overall impact of development on these species. However, there is also a suite of species that are associated with the high-lying ridges and these may be disproportionately affected by development. However, many of these are associated with areas of exposed bedrock or sheltered rocky outcrops along the sides of the hills, and these areas can be avoided at preconstruction through fine-scale adjustment of the development footprint following walk-through of the final layout. It is not possible to accurately identify these areas during an EIA as these habitats occur at a very fine scale and are mostly just a few square meters in extent.

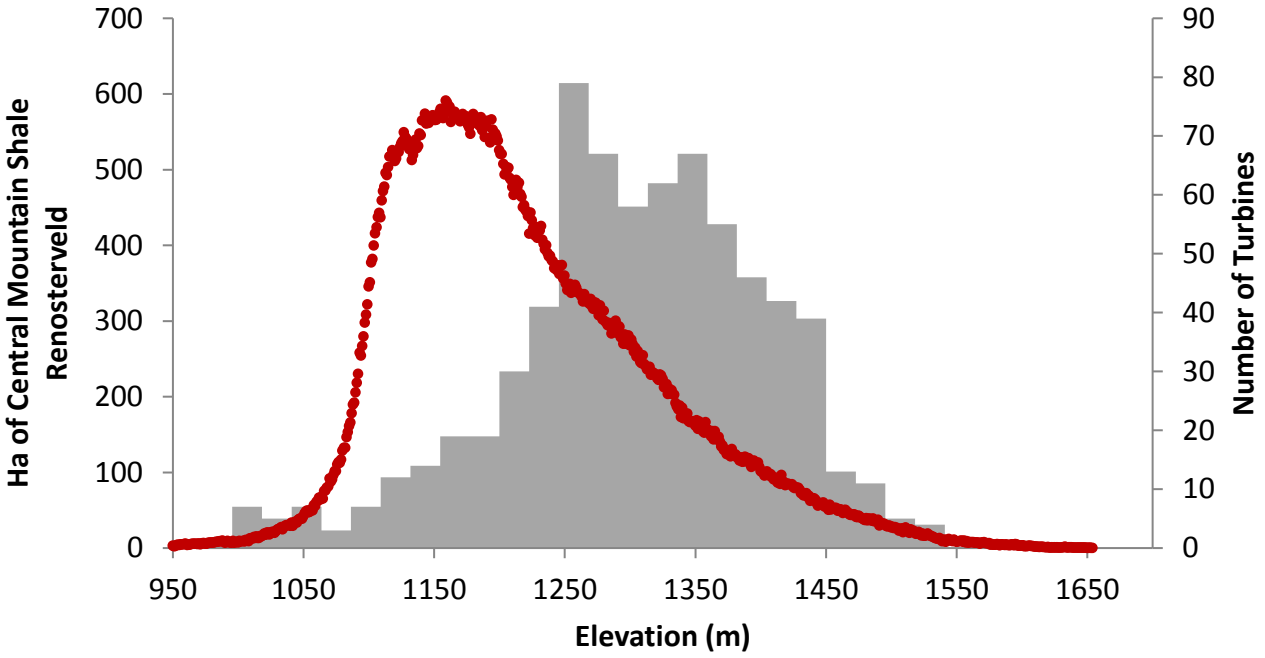

Figure 5. Graph showing the elevation distribution of Central Mountain Shale Renosterveld in red, showing that the majority of the extent of this vegetation occurs at around 1200m elevation and trails off after that, with very little habitat above 1500m. The grey bars indicate the number of turbines within each elevation class and show that most turbines are distributed between 1250m and 1450m.

Finally, it is appropriate to consider the direct extent of habitat loss with regards to impacts on flora as above, however, this is not appropriate for fauna which may experience greater habitat

loss than the direct footprint and may also be vulnerable to disruption of landscape connectivity. The results of camera trapping in the area indicate that the higher-lying ridges are diverse in terms of fauna and are certainly used more by certain species than the lower-lying areas. In addition, there may be seasonal shifts in habitat use and may species may move to higher-elevation areas in the summer when these areas are cooler and also likely to retain greater forage or prey availability than lower-lying areas which are likely to experience greater livestock impact. Species restricted to the higher-lying ridges includes species such as Klipspringer which favour areas with steep slopes or cliffs available that can be used as refuges. The high-lying areas are also used extensively by Grey Rhebok, but it is likely that this species moves up and down the slopes seasonally. As these areas currently experience little human disturbance, they are also used extensively by predators such as caracal and black-backed jackal. How these species and their movements will be affected by wind energy development is not clear as this has not been investigated in South Africa. However, from casual observations, it is highly likely that some species will quickly adapt to the presence of wind turbines, while others are less likely to do so, especially those that are vulnerable to human disturbance or noise. Furthermore, the increased access to these ridges that the new roads will allow may increase livestock use of these areas or human activity and increased persecution of certain species.

Therefore, in terms of cumulative impact, direct impacts on plant species are likely to be localized and with appropriate avoidance and preconstruction mitigation, this can likely be reduced to an acceptable level across all projects. Impacts on fauna are potentially more significant but not well known and much more uncertain and depend to a large degree on the specific species involved and their sensitivity to wind energy development. For example, if a species avoids the area within 250m of a turbine, the total extent of habitat loss across all projects could be as much as 10 000ha for such species, while if this is only 100m, then the extent of habitat loss would be less than 1700ha, which is significantly less of a threat than the first scenario. For isolated wind farms, this is not a significant issue as impacts will be localized, however, where there is heavy wind energy development such as in the Komsberg area, additional pre-and post-construction monitoring of fauna is warranted to inform our knowledge of these impacts.

4.6 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.

Although large antelope such as eland, would once have occurred in the area, these are confined to game farms and conservation areas today. However smaller antelope are abundant in the area and regularly seen at the site. Both Duiker and Steenbok are common, 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 as they will quickly become habituated to the turbines. Grey Rhebok *Pelea capreolus* are common at the site and tend to move from the lowlands to the uplands on a season basis. This species is however relatively tolerant of human disturbance if it is not persecuted and will likely not suffer a large extent of habitat loss as a result of the development. Klipspringer *Oreotragus oreotragus* are present along the higher-lying ridges and are somewhat more specialized in their habitat requirements, being 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 are 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 alien fallow deer is also common in the area, but is not of concern, given its' status.

Despite trapping and hunting by the local landowners, medium sized carnivores such as jackal and caracal remain relatively common in the area, as are baboons and even an occasional Leopard may move through 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*. Although of limited extent, there are also deeper soils along the larger drainage lines such as Komsberg River and its' tributaries which support a higher vegetation density and support species associated such as Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy-footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*.

The Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered and is regarded as one of the most threatened mammals 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 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. In the longer term, the noise

generated by the turbines would have a potential impact on species which avoid human disturbance or those species use sound to find their prey or avoid their predators.

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 or on-site include Karoo Girdled Lizard *Cordylus polyzonus*, Southern Rock Agama *Agama atra*, Cape Skink *Mabuya capensis* and Cape Cobra *Naja nivea*, Marsh Terrapin *Pelomedusa subrufa*, Puff Adder *Bitis arietans*. Tortoises are abundant in the area and consist mostly of Angulate Tortoises, *Chersina angulata* with occasional observations of Karoo Tent Tortoises, *Psammobates tentorius tentorius* as well. 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 dev elopment 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.

Image XX. The of Karoo Tent Tortoise *Psammobates tentorius tentorius* and Southern Rock Agama *Agama atra* are common reptiles observed at the Maralla site.

Amphibians

Amphibian diversity at the site is low, with only 9 species recorded from the broader area. The Roggeveld and other drainage lines and their vicinity are the most important areas for frogs at the site. Some of the larger drainage systems contain rocky, sheltered pools that contain water on a near-perennial basis and some species which depend on permanent water are present. 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.

As the drainage lines and lowlands would not be targeted for development, 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.

The Komsberg River is ephemeral and only contains water after rain, but it flows for long enough in the winter for frogs to use the pools for breeding purposes, as these young toad tadpoles illustrate.

4.7 SITE SENSITIVITY ASSESSMENT

The ecological sensitivity map of the site is depicted in Figure 6 below. The site is spread across the top of a watershed with the western margin of the site draining west into the Tankwa River system and the rest of the site draining east into the Komsberg River. Although most of the development is situated on the high ground, the access roads and some of the associated infrastructure occur in lower-lying areas in proximity to some significant wetlands. In the high-lying areas where many of the turbines are located, sensitive features include rock pavements, rocky outcrops and other localized edaphic features. The terrain is also extremely rugged in the west of the site and there are numerous steep slopes that will need to be negotiated. The central part of the site which forms a large basin around the Roggeveld River occurs at a lower elevation and is more homogenous in nature, with the dominant sensitive feature in this area being the larger drainage lines and wetlands of the site. Many of the listed and endemic geophytes of the Komsberg area are associated with areas of moist ground, usually clay soils associated with wetlands, seeps and drainage areas. These features have been mapped and buffered in the sensitivity map, but the various required river crossings will need to be specifically investigated during the preconstruction phase, should the development reach preferred bidder status.

In terms of the final layout provided for the assessment, there are 4 turbines within areas considered medium low sensitivity and 26 turbines within areas classified as Medium sensitivity. Impacts associated with these turbines are likely to be low as these are located within areas with few species or habitats of concern and the risk of significant impact is low. The remaining 26 turbines are located within areas classified as Medium High sensitivity where there is a somewhat greater risk due to the steeper slopes present or plant communities with a higher ecological value or prevalence of species of concern. There are no turbines within areas of High sensitivity, which is a direct result of avoidance by the developer and the iterative development of the final layout. Some of the turbines are however in close proximity to areas of High sensitivity and any features of concern within these areas are likely to be able to avoided at the preconstruction phase as the sensitivity map was produced at a fine scale and any features not mapped are likely to of small extent. As such, the proximity of the turbines to the higher sensitivity areas is considered acceptable at this stage and no additional buffer beyond those inherent in the sensitivity map is required.

In terms of potential impacts associated with the development and primary mitigation options, the steep nature of large parts of the site especially in the west is a potential concern which will significantly raise the risk of erosion problems, while the access routes also traverse some sensitive wetland areas in the lower-lying parts of the site. In terms of mitigating and avoiding these impacts, specific attention will need to paid to the access routes and ensuring that these avoid overly steep slopes and some re-routing of some short sections of road may be required at some of the wetland sites to ensure that the impact of the access roads on these features

can be minimized. Where present, the proposed roads follow existing tracks, but some of these are not well routed and it may be necessary to reroute some of these to reduce their impact. These are however specific localized issues and in general, the development footprint avoids the sensitive parts of the site and as such significantly reduces the impact of the development compared to an unmitigated layout.

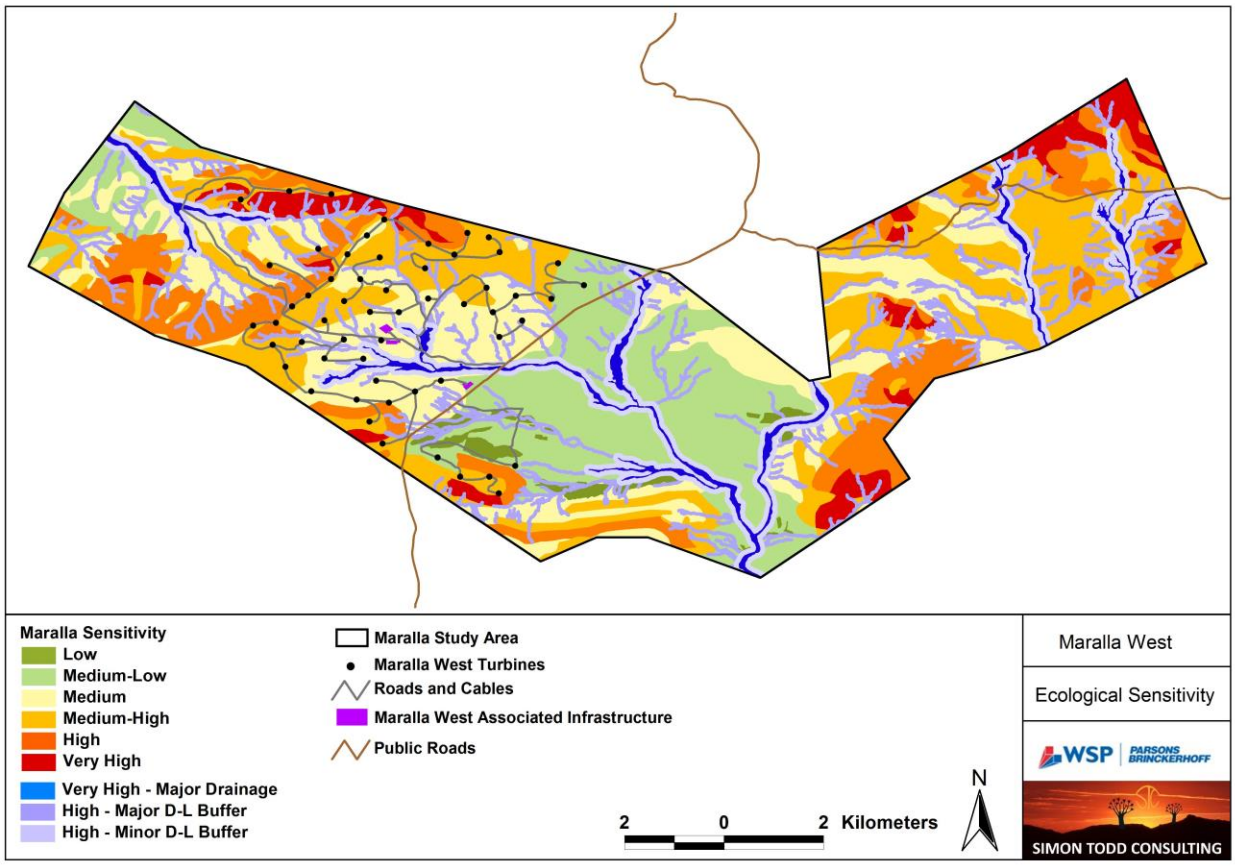

Figure 6. Ecological Sensitivity map of the Maralla West WEF site, showing the 56 turbine layout developed by the developer for assessment in the EIA.

5 IMPACT ASSESSMENT

The assessment methodology used here is in accordance with the revised 2014 EIA regulations and based on the assessment approach recommended by Hacking (2001). The impacts assessed below are those that were identified in the Scoping Study and are assessed for the Planning and Construction Phase, Operational Phase and Decommissioning Phase of the project, as well as for Cumulative impacts. The assessment is based on the development footprint as provided by the developer and the distribution of sensitive features and species at the site as identified in the field and mapped in the sensitivity map presented in this report. The assessment provided below is the summary assessment and the detailed assessment is

attached in the associated spreadsheet used to calculate the summary sensitivity scores presented below.

5.1 PLANNING & CONSTRUCTION PHASE IMPACTS

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
***IMPACT 1: Impacts on vegetation and protected plant species*:**		
Maralla West WEF	Medium	Medium
No-Go Option	Low	

Summary of impacts:

Vegetation Impacts:

Impacts on vegetation and protected plant species will occur due to vegetation clearing and disturbance associated with roads, turbines etc. Although some mitigation is possible especially with regards to avoidance of sensitive features, the development cannot avoid vegetation clearing within the footprint of infrastructure, with the result that this impact will remain **Medium** after mitigation.

Mitigation Measures:

- Placement of turbines within the High and Very High Sensitivity areas should be avoided.
- 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: Faunal impacts due to construction activities		
Maralla West WEF	*Medium*	*Medium*
No-Go Option	*Low*	

Faunal Impacts:

Disturbance, transformation and loss of habitat during construction of the wind energy facility will have a negative effect on resident fauna, with many species moving away from the area and some individuals of smaller species not able to move away likely to be killed by construction activity. Although noise and disturbance cannot be avoided during construction, this will be transient, and disturbance levels during operation will be lower.

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: Increased Soil Erosion risk during construction		
Maralla West WEF	*Medium*	*Low*
No-Go Option	*Low*	

Soil Erosion Risk:

During and immediately after construction, the disturbed areas within the site will be highly vulnerable to erosion, especially on the many steep slopes of the site. Although the rainfall of the area is not high, 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.

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.

5.2 OPERATIONAL PHASE IMPACTS

Phase & Impact	Before Mitigation	After Mitigation
Operation Phase Impacts		
IMPACT 1: Faunal impacts due to operational activities of the wind farm such as noise, and human presence during maintenance activities.		
Maralla West WEF	Medium	Medium

No-Go Option	Low	

Summary of impacts:

Faunal Impacts During Operation:

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. .

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, disturbed areas will remain vulnerable to erosion for some time.		
Maralla West WEF	Medium	Low

No-Go Option	Low	

Soil Erosion during operation:

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.

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		
Maralla West WEF	Low	Low
No-Go Option	Low	

Alien Plant Invasion during operation:

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.

Mitigation Measures:

- Wherever excavation is necessary, 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 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.

5.3 DECOMMISSIONING PHASE IMPACTS

Phase & Impact	Before Mitigation	After Mitigation
Decommissioning Phase Impacts		
IMPACT 1: Faunal impacts due to decommissioning of the wind farm such as noise, and operation of heavy machinery on-site.		
Maralla West WEF	Medium	Low
No-Go Option	Low	

Summary of impacts:

<u>Faunal Impacts During Decommissioning</u>:

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. .

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: Following decommissioning, disturbed areas will remain vulnerable to erosion for some time.		
Maralla West WEF	Medium	Low
No-Go Option	Low	

Soil Erosion following Decommissioning:

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.

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: Following decommissioning, the site will be highly vulnerable to alien plant invasion		
Maralla West WEF	Medium	Low
No-Go Option	Low	

Alien Plant Invasion during 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.

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.

5.4 CUMULATIVE IMPACTS

Phase & Impact	Before Mitigation	After Mitigation
Cumulative Impacts		
IMPACT 1: Impact on CBAs and Broad-Scale Ecological Processes due habitat loss and the presence and operation of the facility		
Maralla West WEF	Medium	Low
No-Go Option	Low	

Summary of impacts:

Cumulative impacts on CBAs:

Cumulative impacts are a significant concern in the area due to the large amount of wind energy development in the area. Furthermore, large parts of the Maralla West 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. .

Mitigation Measures:

- Minimise the development footprint within the Higher 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 Komsberg River.

IMPACT 2: Impact on NPAES Focus Areas and future conservation options in the area		
Maralla West WEF	Medium	Low
No-Go Option	Low	

Summary of impacts:

Cumulative impacts on Conservation Options:

The majority of the site is within a NPAES Focus Area and the habitat loss resulting from this as well as the other wind energy developments in the area will contribute to cumulative impacts on the NPAES and this may have consequences for future conservation options in the area and the ability of the county to meet its conservation targets. However, as demonstrated in the

report, the direct effects of habitat loss are not likely to be highly significant and the major issue is on broad-scale ecological processes.

Mitigation Measures:

- Minimise the development footprint within the Higher 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 Komsberg River.

6 CONCLUSIONS & RECOMMENDATIONS

The Maralla West site consists of rugged high-lying areas in the north, west and south and moderate to low-lying more gently sloping areas in the central and eastern parts of the site. In the high-lying areas, the major issues facing development are the many steep slopes present which present a significant erosion risk, and the presence of numerous localized specialised habitats such as rock pavements, outcrops and gravel patches, which frequently contain species of concern. In the low-lying parts of the site, the vegetation is fairly homogenous, but the presence of some fairly large drainage lines and significant wetlands represents a challenge as impact to these areas needs to be minimised. The layout assessed has no turbines in the high sensitivity areas, but some of the access roads traverse some significant wetland areas and the optimal crossing points will need to be identified in the field at the preconstruction stage, should the development reach the preferred bidder status.

Due to the high development pressure from wind energy in the Komsberg area, cumulative impacts are a significant potential concern. However a thorough analysis of all projects in the area was conducted and it is clear that the total direct extent of habitat loss in the area is not sufficient to generate significant direct biodiversity loss as this amounts to less than 0.5% of the area. Direct cumulative impacts on plant species are likely to be localized and with appropriate avoidance and preconstruction mitigation, this can be reduced to an acceptable level across all projects. The contribution of the current project to this impact is moderate as the total footprint of the development will be less than 60ha, but it is also immediately adjacent to the preferred bidder Karusa and Soetwater projects which would increase cumulative impacts in the Komsberg area. Cumulative impacts on fauna are potentially more significant but it is difficult to assess this impact with any degree of certainty as there is no reliable information that can currently be used to assess these types of impacts in South Africa. For isolated wind farms, this is not a significant issue as impacts will be localized, however, where there are high levels of

wind energy development such as in the Komsberg area, additional pre-and post-construction monitoring of fauna is warranted to inform our knowledge of these impacts.

A summary of the impacts associated with the Maralla West WEF is provided below. Impacts on fauna and vegetation due the construction of the facility are considered moderate and cannot be mitigated to a low level as transformation and disturbance is required for the establishment of the facility. Faunal impacts during operation are also considered moderate, but this should be interpreted with some degree of caution as there is a lot of uncertainty with regards to terrestrial faunal impacts due to wind farms and the actual number of species affected is likely to be low. The major mitigation measure implemented by the developer, which has resulted in the final layout assessed, is a reduction in the number of turbines from the initial 125 turbines and 250MW down to the final 56 turbine 125MW layout as the various sensitivities associated with the site became apparent. The residual impact associated with the 56 turbine layout is considered acceptable and would be largely local in nature with no impacts of broader significance.

Overall, there are no impacts associated with the development of the Maralla West wind farm that cannot be reduced to an acceptable level. As such, there are no reasons to oppose the development on terrestrial ecological grounds and the site is considered suitable within the context of the area for the development of a wind farm.

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

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	Medium	Medium
Faunal impacts due to construction activities	Medium	Medium
Soil erosion 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 Phase Impacts		
Faunal impacts due to decommissioning activities	Medium	Low
Increased alien plant invasion risk	Medium	Low
Increased erosion risk	Medium	Low

Cumulative Impacts		
Impacts on CBAs and broad-scale ecological processes	Medium	Low
Impacts on NPAES Focus Areas and future conservation options	Medium	Low

7 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.

8 APPENDICES:

Appendix 1. Listed Plant Species

List of plant species of conservation concern which are known to occur in the vicinity of the Maralla West Wind Farm. The list is derived from the SIBIS:SABIF website. Those in red are confirmed present in the immediate area, 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 Maralla West 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 Maralla West 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 Maralla West site. 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