

TERRESTRIAL BIODIVERSITY THEME ASSESSMENT FOR THE KLIPKRAAL 4 WEF



PRODUCED FOR SIVEST ON BEHALF OF THE AURA DEVELOPMENT COMPANY



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NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) – REPORTING REQUIREMENTS FOR SPECIALIST THEMES

GN 1150 of 30 October 2020: Terrestrial Biodiversity Specialist Assessment Report (Very High or High Sensitivity)	Section of Report
3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;	P5
3.1.2 a signed statement of independence by the specialist;	P7
3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.1.4 a description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 2
3.1.5 a description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	Section 2
3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 2
3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	Section 2
3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	Section 3.3
3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;	Section 3
3.1.10 a discussion on the cumulative impacts;	Section 3, Section 5
3.1.11 impact management actions and impact management outcomes proposed	Section 3, Section 5
3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	Section 6
3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above [of GN 1150 of 30 October 2020] that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	Section 2.4

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SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD



Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

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- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
 - 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
 - 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Nuweveld North, East and West WEFs. Fauna & Flora Specialist Study for EIA. Zutari 2021.
- Beaufort West PV Facility. Fauna & Flora Assessment. SiVest Environmental 2022.
- San Solar PV Facility, Kathu. Fauna & Flora Assessment. Savannah Environmental 2022.
- Soventix Phase 3 PV Facility, De Aar. Fauna & Flora Assessment. Ecologes Environmental Consultants, 2022.
- Sadawa PV Facilities, Tankwa Karoo. Fauna & Flora Assessment. Savannah Environmental 2021.
- Kotulo Tsatsi PV 1 Facility near Kenhardt. Fauna & Flora Assessment. Savannah Environmental 2021.
- Hyperion 2 PV Facility, Kathu. Fauna & Flora Assessment. Savannah Environmental 2021.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:  _____

Name of Specialist: ____ Simon Todd _____

Date: ____ 20 January 2023 _____

1 INTRODUCTION

Aura Development Company (Pty) Ltd is proposing to develop the Klipkraal 4 Wind Energy Facility 3 on a ca. 1330 ha site situated about 30km southeast of Fraserburg, within the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape. The development would have a maximum output of 240MW and a maximum of 30 turbines.

3Foxes Biodiversity Solutions has been appointed by SiVest on behalf of Aura Development Company to undertake a terrestrial biodiversity assessment of the proposed project in terms of the Environmental Impact Assessment Regulations, 2014, as amended, including the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020). The DFFE Screening Tool indicates that the Terrestrial Biodiversity Theme for parts of the affected area includes areas mapped as Very High sensitivity, with the result that a full terrestrial biodiversity assessment is required. To these ends, this Terrestrial Biodiversity Assessment for the Klipkraal 4 WEF and associated infrastructure, addresses the potential impacts of the development on Terrestrial Biodiversity and must be included in the EIA for the development and any mitigation and monitoring measures as identified, must be incorporated into the EMP for the development.

1.1 SCOPE OF STUDY

In terms of GN 320 (20 March 2020) and GN 1150 (30 October 2020) of the NEMA EIA Regulations of 2014 (as amended), prior to the commencement of a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the Screening Tool. In terms of the findings of the Screening Tool, the site contains areas of Very High sensitivity for the Terrestrial Biodiversity Theme due to the presence of areas of CBA 2, ESAs and FEPA Priority Subcatchments within the study area. In terms of the Assessment Criteria, this implies the following outcome:

1. An applicant intending to undertake an activity identified in the Scope of this Protocol, on a site identified as being of “very high sensitivity” for terrestrial biodiversity on the national web based environmental screening tool must submit a Terrestrial Biodiversity Impact Assessment.
2. The Terrestrial Biodiversity Impact Assessment should meet the following terms of reference:
 - 2.1 The assessment must be undertaken by a SACNASP registered specialist, on the preferred development site.
 - 2.2 Description of the preferred site - the following aspects, as a minimum, must be considered in the baseline description:

-
- 2.2.1 A description of the ecological drivers/processes of the system and how the proposed development will impact these;
 - 2.2.2 Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site;
 - 2.2.3 The ecological corridors that the development would impede including migration and movement of flora and fauna;
 - 2.2.4 The description of any significant landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;
 - 2.2.5 A description of terrestrial biodiversity and ecosystems on the proposed development site, including –
 - a) Main vegetation types;
 - b) Threatened ecosystems, including Listed Ecosystems as well as locally important habitat types identified;
 - c) Ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and
 - d) Species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified.
- 2.3 Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification;
- 2.4 The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify:
- 2.5 Terrestrial Critical Biodiversity Areas (CBAs), including:
- 2.5.1 The reasons why an area has been identified as a CBA;
 - 2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;
 - 2.5.3 The impact on species composition and structure of vegetation with an indication of the extent of clearing activities;
 - 2.5.4 The impact on ecosystem threat status;
 - 2.5.5 The impact on explicit subtypes in the vegetation;
 - 2.5.6 The impact on overall species and ecosystem diversity of the site; and

2.5.7 The impact on populations of species of special concern in the CBA.

2.6 Terrestrial Ecological Support Areas, including;

2.6.1 The impact on the ecological processes that operate within or across the site;

2.6.2 The extent the development will impact on the functionality of the ESA; and

2.6.3 Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna.

2.7 Protected Areas as defined by the National Environmental Management: Protected Areas Act, 2004 including:

2.7.1 An opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan;

2.8 Priority Areas for Protected Area Expansion, including:

2.8.1 The way in which in which the development will compromise or contribute to the expansion of the protected area network.

2.9 Strategic Water Source Areas (SWSA) including:

2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area, and

2.9.2 The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses).

2.10 Freshwater Ecosystem Priority Area (FEPA) sub catchments, including:

2.10.1 The impacts of the development on habitat condition and/or species in the FEPA sub catchment.

2.11 Indigenous Forests, including:

2.11.1 Impact on the ecological integrity of the forest;

2.11.2 Extent of natural or near natural indigenous forest area lost.

3. The findings of the Terrestrial Biodiversity Impact Assessment must be written up in a Terrestrial Biodiversity Impact Assessment Report. This report must include as a minimum the following information:

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- 3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;
 - 3.2 A signed statement of independence by the specialist;
 - 3.3 Duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
 - 3.4 A description of the methodology used to undertake the impact assessment and site inspection, including equipment and modelling used where relevant;
 - 3.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;
 - 3.6 Areas not suitable for development, to be avoided during construction and operation (where relevant);
 - 3.7 Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;
 - 3.8 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMP; and
 - 3.9 A motivation where the development footprint identified as per section 2.3 were not considered stating reasons why these were not being not considered.
 - 3.10 A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected.
4. The findings of the Terrestrial Biodiversity Impact Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMP. A signed copy of the Assessment must be appended to the Basic Assessment Report or Environmental Assessment Report.

The above Terms of Reference and reporting requirements are achieved in this study and report.

1.2 PROJECT LOCATION

The Klipkraal Wind Energy Facility 4 is part of the Klipkraal Cluster and is located approximately 30 km southeast of Frasersburg in the Northern Cape. The layout and location of the Klipkraal Wind Energy Facility 4 is illustrated below in Figure 1 and includes up to 30 potential turbine locations with a maximum output of 240 MW.

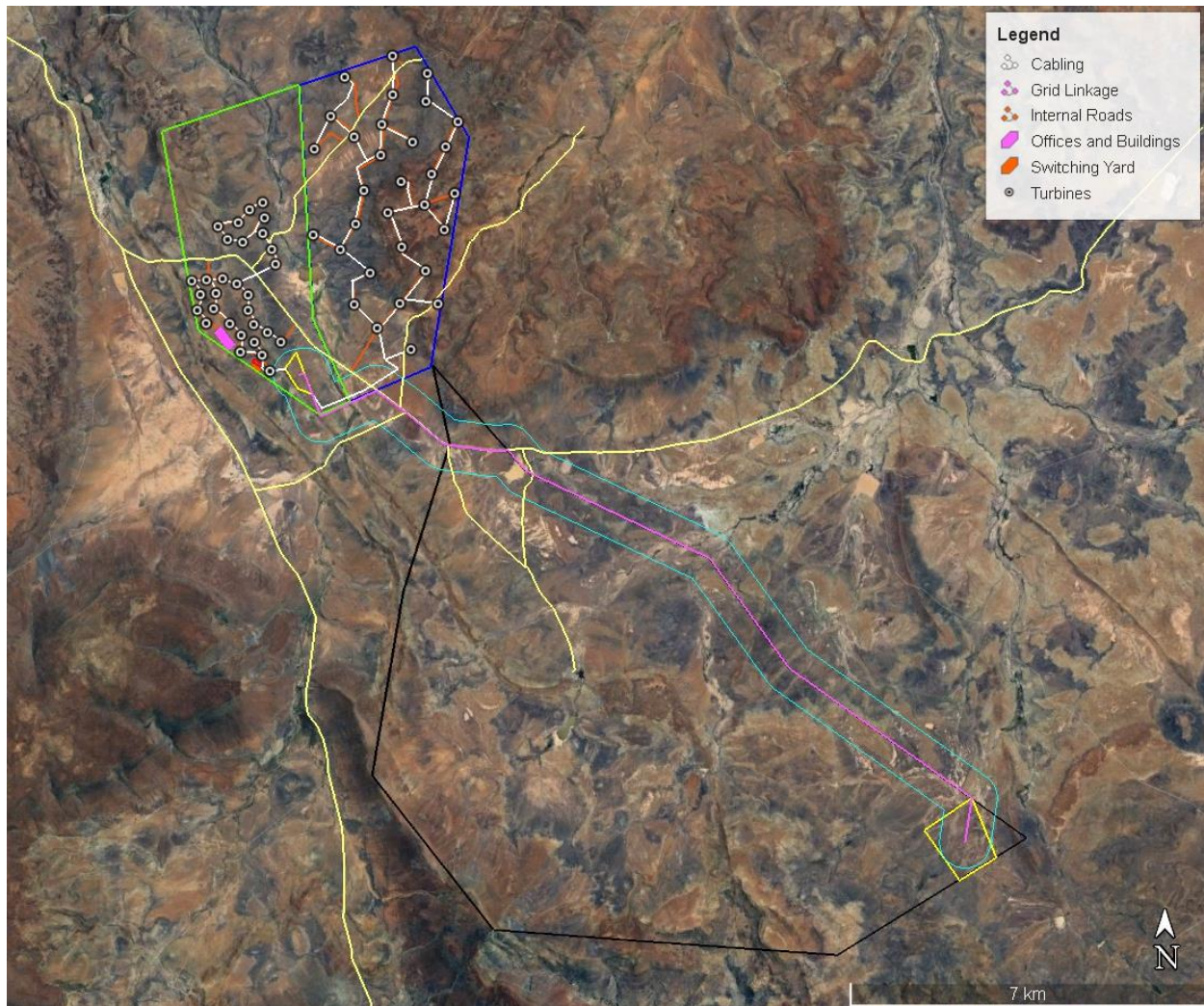


Figure 1. Satellite image showing the location of the proposed Klipkraal 4 Wind Farm, southeast of Fraserburg, as well as the adjacent Klipkraal 5 Wind Farm, east of the Klipkraal 4.

1.3 PROJECT DESCRIPTION

The Klipkraal 4 Wind Energy Facility is part of the Klipkraal Cluster and is located approximately 30 km southeast of Fraserburg in the Northern Cape. The layout and location of the Klipkraal Wind Energy Facility 3 is illustrated above in Figure 1 and includes up to 30 potential turbine locations with a maximum output of 240 MW. The estimated total permanent footprint of the Klipkraal 4 Wind Energy Facility is estimated at 120ha. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV/400kV overhead power line. A Battery Energy Storage System (BESS) will be located next to the onsite 33/132kV substation.

2 METHODOLOGY

2.1 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 (2018 update).
- Information on plant and animal species recorded for the wider area was extracted from the South African Biodiversity Information Facility (SABIF)/ SANBI Integrated Biodiversity Information System (SIBIS) database hosted by the South African National Biodiversity Institute (SANBI). Data was extracted for a significantly 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 not been well sampled in the past.
- The International Union for Conservation of Nature (IUCN) conservation status 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 (2021).

Ecosystem:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel *et al.* 2011) as well as the 2018 NBA.
- Critical Biodiversity Areas (CBAs) and ESAs in the study area were obtained from the Northern Cape CBA Map as available from the SANBI BGIS Portal.
- There are no threatened ecosystems within the site, which was verified through inspection of the ecosystem status maps as included in the 2018 NBA.
- Strategic Water Source Areas (SWSAs) for the site were extracted from the SWSAs map available on the SANBI BGIS data portal (Water Research Commission. 2017 Surface and Groundwater SWSA [Vector] 2017).

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 (ReptileMap, Frogmap and MammalMap) <http://vmus.adu.org.za>.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) 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 an assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates *et al.* 2013) and amphibians on Minter *et al.* (2004) as well as the IUCN (2020).

2.2 SITE VISITS & FIELD ASSESSMENT DATES

The Klipkraal 4/5 cluster site was visited on two occasions for the current study, 05 September 2021 and 30-31 June 2022. During the site visits, the wind farm site was extensively investigated in the field. Potentially sensitive features within the site were investigated, validated and characterised in the field including any pans, rocky outcrops and major drainage features that were observed in the field or from satellite imagery of the site. Particular attention was paid to the integrity of habitats present as well as the broader ecological context in terms of connectivity and broad-scale ecological processes likely to be operating at the site.

In terms of the actual sampling approaches that were used, the vegetation of the site was characterised through walk-through surveys distributed across the site, in which plant species lists for the different habitats observed were compiled. Specific attention was paid to the possible presence of species of conservation concern (SCC) as well as other species which are considered to be of ecological significance. Sensitive plant habitats such as wetlands, rock pavements and rocky slopes were specifically investigated and checked for the presence of plant SCC.

In terms of fauna sampling, camera trapping was used extensively across the Klipkraal Cluster site to determine the presence and distribution of Riverine Rabbit as well as other fauna. This is further detailed in the Riverine Rabbit species assessment. The presence of the Karoo Padloper is less easily determined due to the narrow windows of activity associated with this species, but searches within potentially suitable habitat were conducted at numerous locations deemed to have potentially suitable habitat across the site. Since this species was not detected, but still considered likely to be present, all areas of suitable habitat across the site were mapped. This is further detailed in the Karoo Padloper Species Assessment.

2.3 FIELD SAMPLING APPROACH

In order to characterise the biodiversity of the site, a number of sampling techniques were used, these are summarized below and are also detailed in the Plant Species Compliance Statement for the site as well as the Karoo Dwarf Tortoise Assessment for the Klipkraal 4 WEF. However, this includes direct sampling of the vegetation through vegetation surveys as well as the use of camera traps distributed across the Klipkraal cluster study area.

Vegetation & Ecosystems

Sensitivity mapping of the site was conducted by the consultant based on the identification of important/sensitive habitats using satellite imagery of the site as well as the information collected on-site during the site verification and field assessment. The identification of potentially sensitive areas included the mapping of wetlands and drainage features, steep slopes, mountains, rocky hills and larger areas of rock pavements. In terms of the actual sampling approaches that were used, the vegetation of the site was characterised through walk-through surveys distributed across the site, in which plant species lists for the different habitats observed were compiled. Specific attention was paid to the possible presence of species of conservation concern (SCC) as well as other species which are considered to be of ecological significance. Sensitive plant habitats such as wetlands, rock pavements and rocky slopes were specifically investigated and checked for the presence of plant SCC. The information collected on-site was used to identify no-go areas and sensitive features that would need to be avoided in order to minimise the potential impact of the development on sensitive habitats and associated species of concern. As a result, the final layout of the development would in effect be a mitigated layout avoiding or minimising the impact on the sensitive features of the area.

Riverine Rabbit Habitat Delineation

As the Riverine Rabbit is key species of conservation concern within the broader site, the identification and mapping of potentially suitable habitat for this is considered an important element of risk mitigation at the site. In addition, the presence of this species at the site was confirmed through camera trapping. A total of 36 camera traps were located across the Klipkraal cluster site, located largely within riparian habitats. This species was confirmed present at one camera location within the Klipkraal 4 WEF site. As such, the Klipkraal 4 WEF site is considered high sensitivity for this species and areas of suitable habitat have been mapped and buffered by 300-500m from development.

In order to assess the availability, distribution and extent of potential Riverine Rabbit habitat within the site, satellite imagery was used to delineate and map areas of possible habitat. Such areas can be reasonably easily delineated from satellite imagery due to the specific habitat requirements of the Riverine Rabbit. According to the IUCN 2016 Mammal Red List Assessment "*The Riverine Rabbit inhabits dense riparian growth along the seasonal rivers in the central Karoo (Nama-Karoo shrubland). Specifically, it occurs in riverine vegetation on alluvial soils adjacent to seasonal rivers.*" Such areas are readily visible on satellite imagery and can be mapped with a relatively high degree of accuracy and reliability. Within the greater Klipkraal study area, areas of habitat are restricted to the major drainage lines of the study site including the Sout and Damfontein se Rivier and their major tributaries. Apart from areas deemed to be potentially suitable Riverine Rabbit habitat, all major and minor drainage features of the site were mapped and included into the overall sensitivity mapping of the site.

Karoo Dwarf Tortoise Habitat Delineation

In order to assess the availability, distribution and extent of potential Karoo Dwarf Tortoise habitat within the Klipkraal 4 WEF, satellite imagery was used to delineate and map areas of potential habitat. Such areas can be reasonably easily delineated from satellite imagery due to the specific habitat requirements of the Karoo Dwarf Tortoise. According to the IUCN 2018 Red List Assessment for this species (Hofmeyr et al. 2018), *Chersobius boulengeri* is habitat specialist that occurs in association with dolerite ridges and rocky outcrops of the Nama and Succulent Karoo. The tortoises usually take shelter under rocks in vegetated areas or in rock crevices (Boycott and Bourquin 2000), but few rocky sites over the range offer suitable retreats for the species. Populations are considered to be relatively isolated within areas of suitable habitat and movement between such patches is expected to be low. As such, suitable areas of habitat can be relatively easily recognised and mapped from satellite imagery. In addition, it is also possible to at least some degree differentiate likely high-quality habitat associated with dolerite outcrops and ridges from lower quality shale and mudstone slopes that appear to be less favoured (refer to the Karoo Dwarf Tortoise Species assessment for more details).

2.4 SAMPLING LIMITATIONS AND ASSUMPTIONS

Conditions at the time of the initial survey were acceptable in terms of the vegetation condition for the field assessment as there had been some rain prior to the field assessment and vegetation sampling. The sampling period did however occur at the end of a prolonged drought in the broader region with the result that recovery of the vegetation in some parts of the site was relatively poor. However, by the second field assessment, the vegetation had further improved and it is considered that there are few limitations and assumptions required with regards to the vegetation of the site and the presence of plant SCC within the PV development footprint. It is highly unlikely that there are any significant vegetation features present that would not have been observed during the study. Given the amount of time spent on the site, the consultants' knowledge of the area and the favorable conditions at the time of the site visits, there are few limitations and assumptions required with regards to the vegetation of the site and the presence of plant SCC within the site.

A number of limitations and assumptions are also inherent in the study regarding the fauna of the site including the following:

- Camera trapping for fauna was conducted across the greater Klipkraal cluster site with 30 camera traps for a period of 9 weeks. This confirmed the presence of the Riverine Rabbit within the Klipkraal 4 site with the result that areas of suitable habitat are considered high sensitivity for this species. It is assumed that since no other mammalian fauna of concern were camera trapped at the site, that there are indeed no such other species using the site on a regular basis.
- It is assumed that there are no Riverine Rabbits resident in areas outside of the riparian habitat which is typically associated with this species in the Upper Karoo. This is

considered to be a reasonable assumption as this species is strongly associated with riparian vegetation within the study area. It is only in the southern population that Riverine Rabbits can usually be found outside of riparian areas.

- It is assumed that the Karoo Dwarf Tortoise is potentially present in all areas mapped as optimal habitat for this species. Clearly this is not the case in reality as not all areas of suitable habitat would be occupied. As such, the assessment is designed to assess the worst-case scenario with regards to the distribution of the tortoise within the site.
- It is assumed that there are no Karoo Dwarf Tortoises resident in areas outside of the rocky hills habitat typically associated with this species. This is considered to be a reasonable assumption as this species is known to be strongly associated with rocky hills and does not occur within areas without sufficient shelter.

3 KLIPKRAAL 4 WEF BASELINE DESCRIPTION

3.1 VEGETATION TYPES

According to the VegMap, the Klipkraal 4 Wind Energy Facility footprint falls within the Eastern Upper Karoo and Western Upper Karoo vegetation types (Figure 2). The results of the field assessment confirm that this is an oversimplification of the vegetation of the site and based on the fieldwork on the site and site verification, there are also some dolerite hills present that can be considered to represent the Upper Karoo Hardeveld vegetation type, while the areas of riparian vegetation along the larger drainage systems of the site can be considered to represent the Southern Karoo Riviere vegetation type. The vegetation types of the site are fully described in the plant species compliance statement for the site and is not repeated here. However, of relevance to the current study, is that none of the vegetation types present within the site are threatened and all of them are still largely intact and have not experienced a large degree of transformation to date. The Southern Karoo Riviere vegetation type has experienced the highest degree of transformation and as estimated 12% has been lost to transformation for crop production. This loss is however not evenly distributed and the areas of extensive floodplains have been particularly impacted and as this is also the habitat associated with Riverine Rabbit, there has a disproportionate influence on this species with the result that any further habitat loss in these areas is considered highly undesirable.

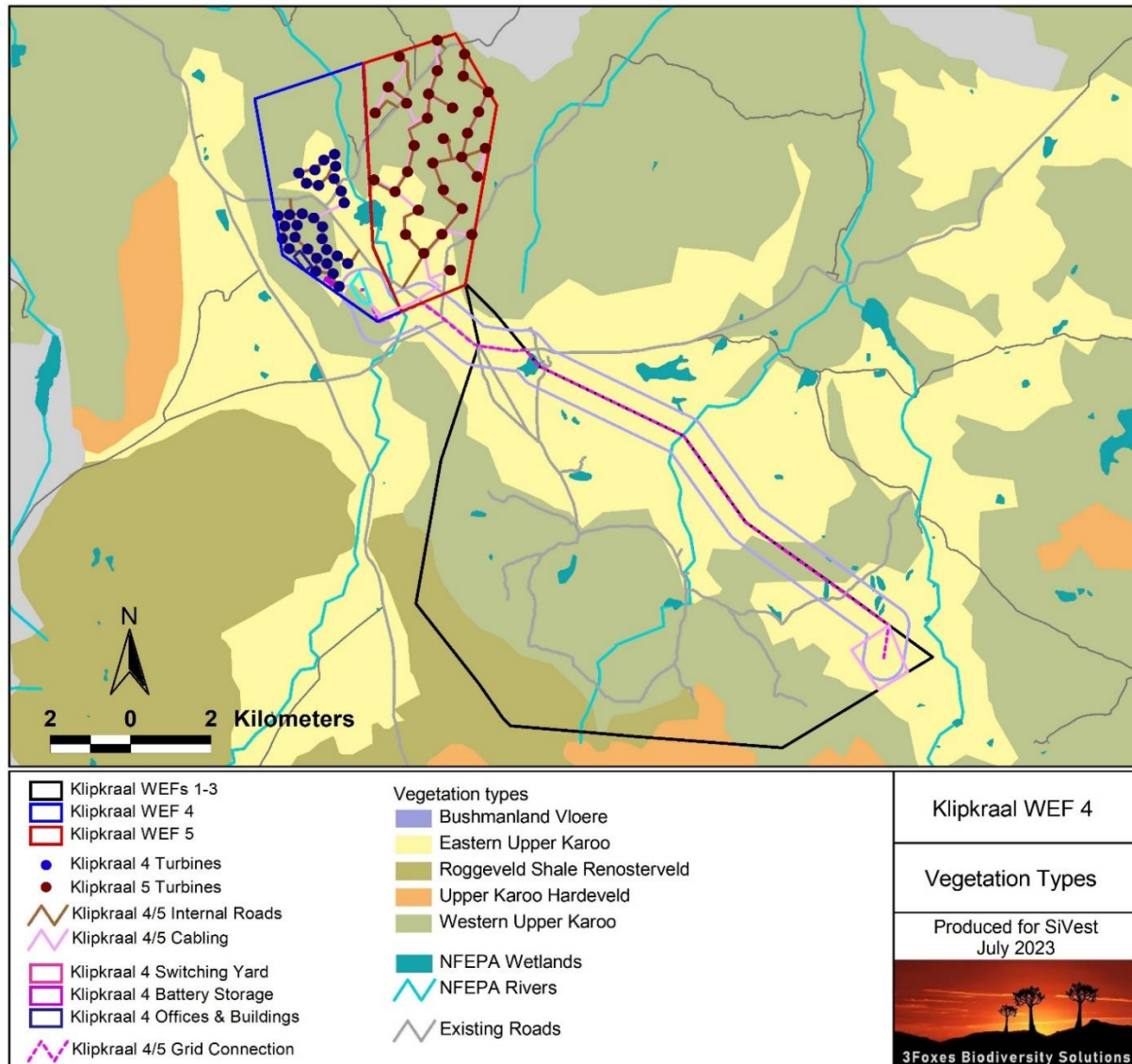


Figure 2. The national vegetation map (SANBI 2018 Update) for the Klipkraal 4 WEF and surrounding area.



Figure 3. Typical landscape present within the Klipkraal 4 WEF study area, corresponding with the Western Upper Karoo vegetation type.



Figure 4. Riparian area within the Klipkraal Wind Energy Facility with vegetation that can be considered allied with the Southern Karoo Riviere vegetation type.



Figure 5. Dolerite ridge from within the Klipkraal 4 site considered to represent the Upper Karoo Hardeveld vegetation type.

3.2 DFFE SENSITIVE PLANT SPECIES

According to the DFFE Screening Tool, there only sensitive species known from the site is Sensitive Species 484 which is classified as Rare. This small cryptic succulent occurs from the Roggeveld Escarpment to the Nuweveld Mountains. This species is a localised habitat specialist that occurs on seasonally wet clay flats which were not observed within the Klipkraal 4 site and as it was not observed, it is assumed absent from the site. As such, the site is confirmed as low sensitivity for the Plant Species Theme.

3.3 FAUNAL COMMUNITIES

As many as 70 mammals are listed for the wider study area in the MammalMap database, but many of these are introduced or conservation-dependent and approximately 48 can be considered to be free-roaming and potentially impacted by the development (Annex 2). This includes several red-listed species including the Riverine Rabbit *Bunolagus monticularis* (CR), Black-footed Cat *Felis nigripes* (VU), Grey Rhebok *Pelea capreolus* (NT), Mountain Reedbuck *Redunca fulvorufula* (EN) and Brown Hyena *Hyaena brunnea* (NT). Based on the camera trapping conducted on the site, the Grey Rhebok is confirmed present within the wider Klipkraal

site, but not within the Klipkraal 4 site. The camera trapping confirmed the presence of the Riverine Rabbit within Klipkraal 4 project area. The development would therefore potentially impact the Riverine Rabbit through habitat loss as well as disturbance and noise on the site. In addition, there would be a significant increase in traffic within and to and from the site related to the construction and to a lesser degree the operation of the Klipkraal 4 WEF, which would potentially have a negative impact through mortality of rabbits related to vehicle collisions. Hence, species-specific mitigation and avoidance for this species is included in this study to reduce these possible impacts.

In terms of reptiles, there are as many as 60 reptiles known from the broader area, of which 14 are of confirmed occurrence, 45 of probable occurrence and four of possible occurrence. Species of potential concern include the local endemic, Braack's Pygmy Gecko and the Karoo Padloper. Braack's Pygmy Gecko *Goggia braacki* is a Western Cape endemic with a restricted distribution range. Most of its distribution is associated with a section of the Hoogland Mountains range within the Karoo National Park. It has not been recorded in the Klipkraal project study area, but it may possibly (not probably) be present within the area. The only threatened (Red Listed) reptile species present in the area is the Karoo Dwarf Tortoise (EN). This small tortoise is seldom observed, even when specifically targeted during herpetofaunal surveys as it is active for only very short parts of the day and may also aestivate for extended periods during unfavourable environmental conditions. They are associated with dolerite ridges and rocky outcrops of the southern Succulent and Nama Karoo biomes. Threats to this species include habitat degradation due to agricultural activities and overgrazing, and predation by the Pied Crows which in recent decades have expanded in distribution range. Although it was not observed at the site, it is known from the immediate area and it is considered likely that this species is present at the site, within areas of suitable habitat. Tortoises are however one of the few groups of reptiles that have been specifically studied with regards to their responses to wind energy development and no significant negative impacts have been detected within population's resident on wind farms, at least in other parts of the world (Agha *et al.* 2015, Lovich *et al.* 2011). As noise and turbine flicker are unlikely to significantly impact this species, habitat loss for this species is likely to be the major avenue of potential impact resulting from the wind farm development. Specific attention to potential habitat loss for this species was paid during the sensitivity mapping and all areas which represent highly favourable habitat for this species have been mapped as high sensitivity or no-go areas for turbines. There would however, still be some impact on the smaller ridges due to turbines and access roads and hence some degree of habitat loss for this species.

Table 1. Faunal species conservation concern known from the broad area, and their likely presence within the site.

Species	Wider area	Klipkraal 4 WEF
Grey Rhebok (NT)	Present on higher ground, especially the Nuweveld mountains.	Not observed within the Klipkraal 4 WEF site, but confirmed present within the wider site. The Klipkraal 4 WEF site is considered low sensitivity for this species.
Black-footed Cat (VU)	Previously recorded from within the Karoo National Park, but no recent records.	No recent records from the area and the regular presence of this species within the site is considered unlikely. The site is considered low sensitivity for this species.
Leopard (VU)	This species is generally confined to protected areas or mountainous terrain and may be present in the wider area.	The terrain within and near the site is highly unlikely to be attractive for this species which prefers rugged terrain with more cover than the site offers.
Riverine Rabbit (CR)	There are recent records from the area.	Confirmed present through camera trapping within the Klipkraal 4 WEF study area.
Karoo Dwarf Tortoise (NT)	Occasional records from the broad area. Associated with dolerite outcrops.	Potentially present as there is suitable habitat within the site and there are some records from similar habitat nearby.

3.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The CBA and FEPA Priority Catchment map for the study area is illustrated below in Figure 6. There is a River Corridor CBA 1 along the Sout River which flows through the Klipkraal 4 and Klipkraal 5 site, but no other CBAs within the site. The River Corridor represents a 500m buffer along the river and according to the lookup layer associated with the CBA layer, the attributes underlying the affected CBA include the following:

- Eastern Upper Karoo
- Roggeveld Shale Renosterveld
- Upper Karoo Hardeveld
- Western Upper Karoo
- Namakwa CBA 2 and associated

- All natural wetlands
- All Rivers
- FEPA catchment
- FEPA 500m
- Landscape structural elements

In terms of the above features, it is clear that the primary feature of concern is the Sout River which drives the CBA which is aimed at water resource protection and the maintenance of ecological processes along the river. Under the layout provided for Klipkraal 4, there are five turbines within the CBA along the South River. With mitigation, the impact of these on the riparian corridor and ecological functioning along the Sout River can be reduced to an acceptable level as this section of the river is not considered particularly sensitive and vulnerable to disruption. The whole of the Klipkraal 4 is however within a priority FEPA Subcatchment. The footprint of the Klipkraal 4 development is estimated at 120 ha and the size of the FEPA subcatchment is 20 767 ha and as such, the development footprint occupies approximately 0.6% of the subcatchment. While there is potential for the development to degrade the value of the FEPA subcatchment through erosion and siltation of the Sout River and downstream ecosystems, there is also potential to mitigate these potential impacts effectively through erosion control measures and other responsible construction and management practices.

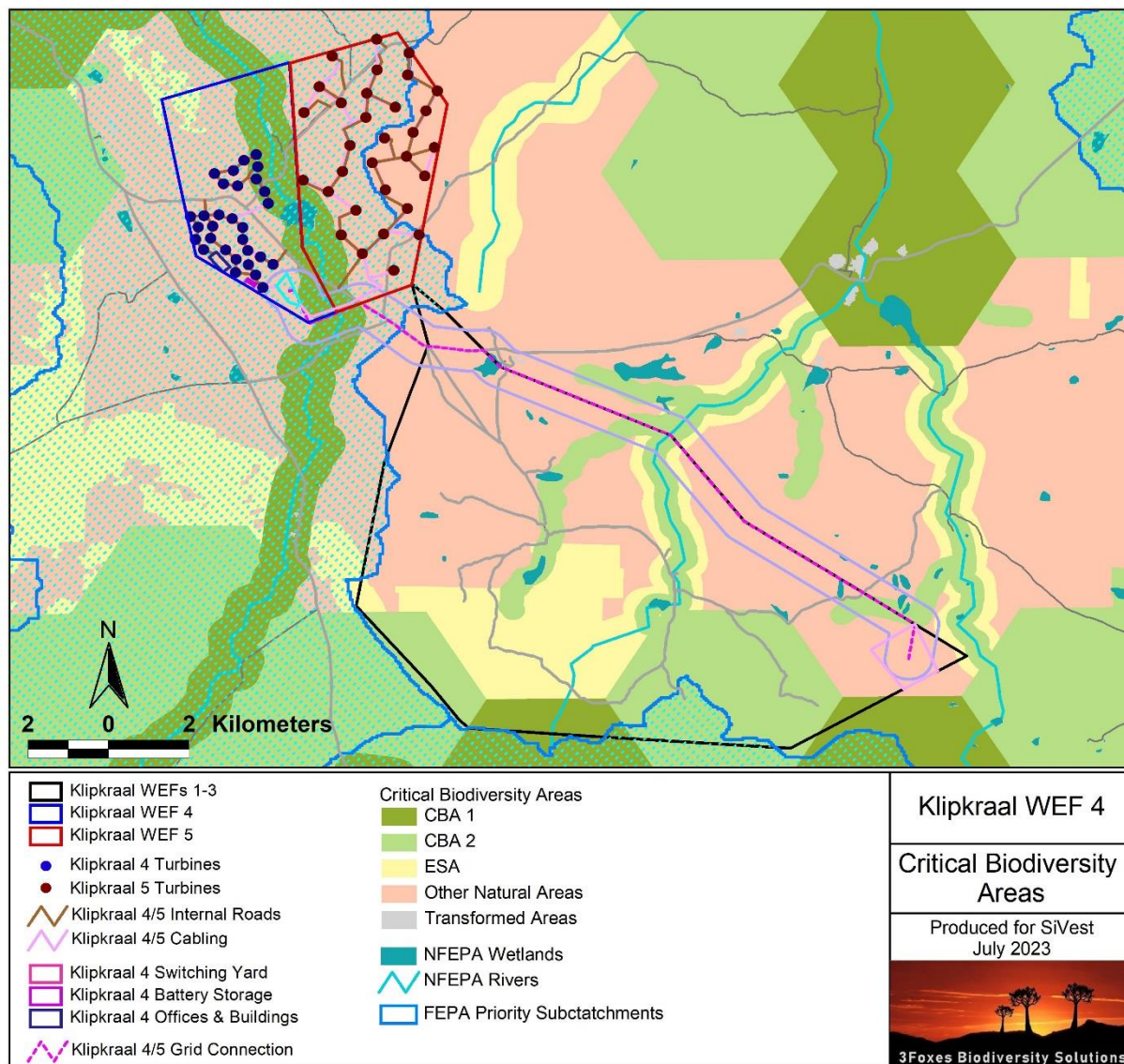


Figure 6. Extract of the Northern Cape CBA map for the Klipkraal 4 WEF and surrounds.

3.5 CUMULATIVE IMPACTS

In terms of cumulative impacts in and around the site, there are no built wind energy facilities within 30 km of the site. The only planned facility within 30 km of the site is the Hoogland 3 WEF which is located approximately 30 km east of the Klipkraal site and which would have a footprint of approximately 150 ha. As such, the major contributor to cumulative impact would be the other projects which form part of the Klipkraal Cluster. This would amount to as many as five additional projects with an estimated total footprint of approximately 600 ha. The Klipkraal 4 WEF would add an additional 120 ha to this total. While it is clear that the Klipkraal suite of projects would create a node of wind energy development, there are few other approved projects in the area,

with the result that cumulative impacts, when considered at a broader scale are still relatively low when considered along the Nuweveld Mountains and the Great Escarpment as a whole.

In terms of specific cumulative impacts, impacts on the Riverine Rabbit and Karoo Dwarf Tortoise would be a potential concern. However, the contribution of the Klipkraal 4 WEF to cumulative impact on these two species would be low as the total footprint within the associated habitats would be low and would not be likely to impact the viability of local populations of these species. As the broader area is still largely intact, and most direct impacts are associated with the relatively short, transient, construction phase, cumulative impacts associated with the current project are considered low and acceptable. There do not appear to be any ecological processes or corridors that would be specifically disrupted by the Klipkraal 4 WEF. In addition, should all the planned projects in the area be built, the overall extent of habitat loss would not be significant relative to the overall extent of the affected vegetation types. As such, the contribution of the Klipkraal 4 WEF to habitat loss would not change the overall threat status of any vegetation types or special habitats and the overall level of cumulative impact in the area is considered acceptable.

4 KLIPKRAAL 4 WEF CONSTRAINTS

In order to ensure the maintenance of ecological processes within the site and the minimisation of impacts on terrestrial biodiversity, a constraints map for the site was produced (Figure 7). This has been used to inform the wind farm layout and ensure that impacts on the sensitive features of the site are maintained within acceptable limits. There are numerous constraints operating across the site, associated firstly with the major drainage features of the site with associated Riverine Rabbit habitat and secondly with the mountains, slopes and dolerite outcrops of the site which are ecologically significant in their own right, but also represent Karoo Dwarf Tortoise habitat. The areas mapped as Very High sensitivity are considered no-go areas for wind turbines but may be traversed by overhead cables or turbine access roads where required, subject to review. The areas mapped as High sensitivity represent other sensitive features such as minor drainage lines or slopes deemed to be sub-optimal as Karoo Dwarf Tortoise habitat. These areas should also be avoided by turbines as much as possible, but some habitat loss in these areas is considered acceptable. Under the layout provided for the assessment, there are no turbines in areas mapped as Very High and low impact on the High sensitivity areas. As a result, the development of the Klipkraal 4 WEF would avoid significant impact on the major ecological features of the site and as such, the development is considered acceptable and would generate an acceptable impact on fauna, flora and terrestrial biodiversity generally. There are however some recommendations regarding the relocation of some turbines with regards to proximity to Riverine Rabbit habitat or Karoo Dwarf Tortoise habitat and those recommendations are contained within the species assessment reports for those species and it is assumed here that those changes will be implemented in the final layout.

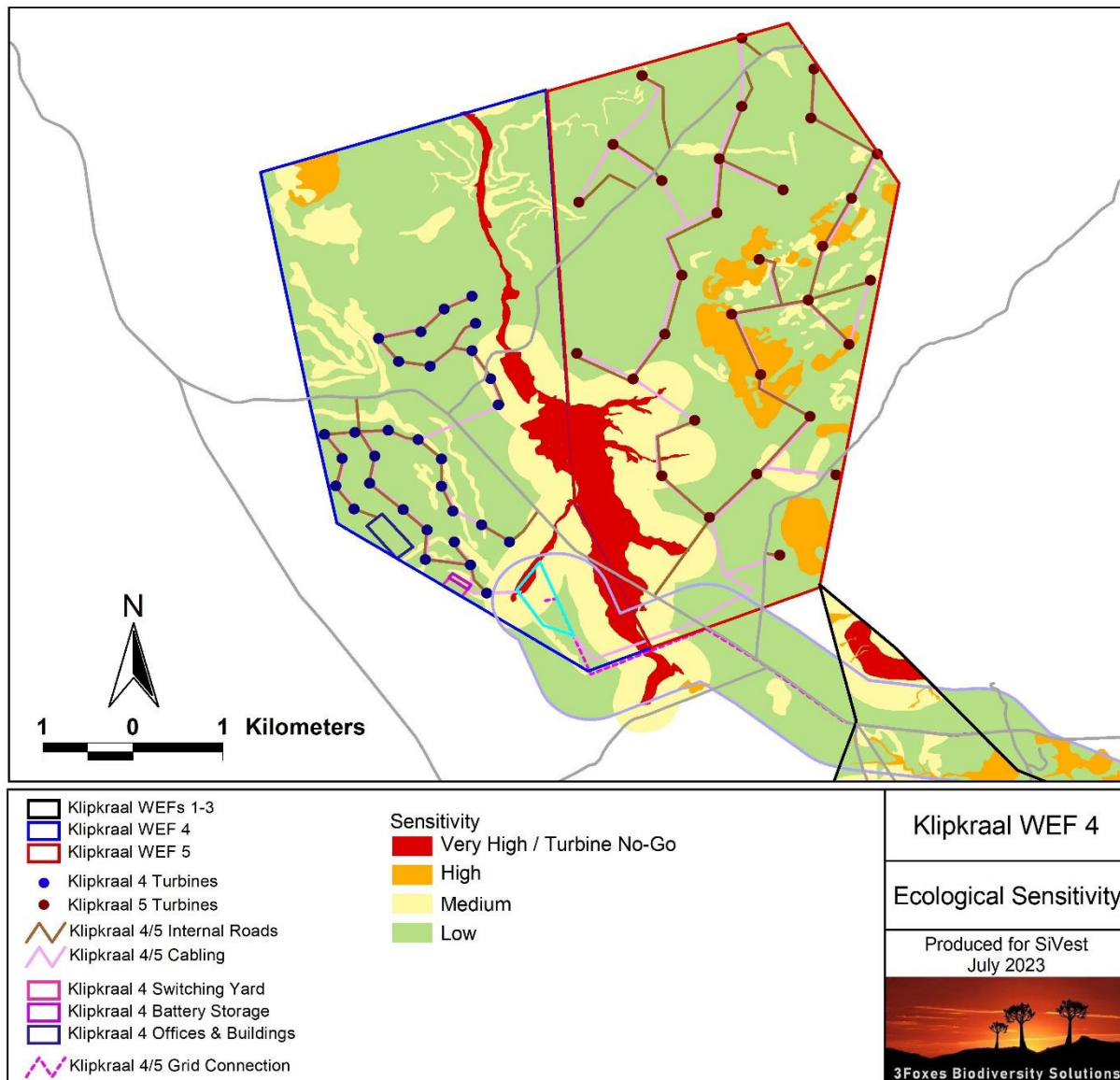


Figure 7. Ecological constraints map for the Klipkraal 4 WEF for turbines.

5 IMPACTS AND ISSUES IDENTIFICATION

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The development of the Klipkraal 4 WEF would result in a number of potential impacts on Terrestrial Biodiversity during the construction and operational phases of the development. During construction, the major impact would likely be habitat loss and anthropogenic disturbance while during the operational phase, direct disturbance would be much reduced although there may be some potential impact from operational and maintenance activities. The following impacts are identified as the major impacts that are likely to be associated with the development of the

Klipkraal 4 WEF on Terrestrial Biodiversity. These are not the only impacts associated with the facility and impacts on the Karoo Dwarf Tortoise and Riverine Rabbit are assessed in the associated species assessments.

Impact 1. Impacts on CBAs and ESAs

The development would result in some impact on the CBAs and ESAs within the site through habitat loss and disturbance. The noise generated by the turbines would generate disturbance for some fauna, which would decrease the value of the area for the affected fauna. In addition, the development would cause general habitat fragmentation and pose some impact on broad-scale ecological processes in the area. These impacts cannot be entirely mitigated and there is likely to be some residual impact on broad-scale ecological processes due to the presence and operation of the wind energy facility.

Impact 1. Impacts on FEPA Priority Subcatchments

The whole of the development footprint lies within a FEPA Priority Subcatchment associated with the Sout River which is a tributary of the Sak River. The development would potentially have some impact on this subcatchment and the delivery of ecosystem services and ecosystem integrity within the site and downstream. While this is a potential negative impact on the FEPA Priority subcatchment, the potential for mitigation is also good and it is considered that the development is ultimately compatible with the goals of the FEPA Priority subcatchment provided that the correct mitigation is applied.

Impact 2. Cumulative impacts on broad-scale ecological processes

The development of the Klipkraal 4 WEF infrastructure would result in habitat loss and an increase in overall cumulative impacts on fauna and flora in the area. The contribution of the Klipkraal 4 WEF to cumulative impact at less than 120ha is not considered very high, given the avoidance of the sensitive features of the site, but would contribute to a growing node of development in the area. The wind farm would however likely remain porous for most species and while some species would likely avoid the inner parts of the wind farm, it is likely that most species would at least be able to move through the wind farm area for migration or movement purposes if required.

6 ASSESSMENT OF IMPACTS ON TERRESTRIAL BIODIVERSITY– KLIPKRAAL 4 WEF

An assessment of the likely significance of the impacts identified above is made below for the impacts of the Klipkraal 4 WEF on Terrestrial Biodiversity.

6.1 CONSTRUCTION PHASE IMPACT ON BROAD-SCALE ECOLOGICAL PROCESSES

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Construction Phase impact on broad-scale ecological processes	Impacts on broad-scale ecological processes as a result of construction phase activities, including disturbance and habitat loss.	2	2	2	2	2	3	30	-	Medium	See Below.	1	1	2	2	2	2	16	-	Low
Recommended Mitigation Measures	<ol style="list-style-type: none"> 1) Locate temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. 2) Minimise the development footprint in areas mapped as high sensitivity (i.e. near watercourses and other ecologically significant features). 3) Clearly demarcate riparian areas near to the development footprint as No-Go areas with appropriate signage and barriers. 4) Appropriate design of roads and other infrastructure to minimise faunal impacts and allow fauna to pass over, through or underneath these features as appropriate. 5) The fencing around substations or other infrastructure should not have any electrified strands within 30cm of the ground as this may result in tortoises being electrocuted. Alternatively, guard wires or mesh can be placed outside of the fence to prevent tortoises from accessing the electrified fence. 6) Appropriate design of roads and other infrastructure to minimise faunal impacts and allow fauna to pass over, through or underneath these features as appropriate. 7) Monitoring of construction activities to ensure that the development footprint within sensitive areas is restricted to the authorised development footprint. 																			

6.2 CONSTRUCTION PHASE IMPACT ON FEPA SUBCATCHMENTS

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION									SIGNIFICANCE	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION									SIGNIFICANCE
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S			E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S	
Construction Phase																						
Construction Phase impact on FEPA Subcatchments	Impacts on ecosystem services within FEPA Priority Subcatchments as a result of construction phase activities, including disturbance and soil erosion.	2	2	2	2	2	3	30	-	Medium	See Below.	1	2	2	2	2	2	18	-	Low		
Recommended Mitigation Measures	<ol style="list-style-type: none"> 1) Disturbance within or near the drainage lines should be kept to a minimum and any disturbance in these areas should be rehabilitated as quickly as possible. 2) An erosion monitoring programme should be put in place for at least 3 years after construction. Any problems observed should be rectified as soon as possible using the appropriate revegetation and erosion control works. 																					

6.3 CONSTRUCTION PHASE IMPACT ON CBAS AND ESAS

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Construction Phase impact on CBAs and ESAs	Impacts on CBAs and ESAs as a result of construction phase activities, including disturbance and habitat loss.	2	3	2	2	2	3	33	-	Medium	See Below.	2	2	2	2	2	2	20	-	Low
Recommended Mitigation Measures	<ol style="list-style-type: none"> 1) The development footprint within the CBAs and ESAs should be minimized as far as possible. 2) Should access roads, internal cables and overhead lines traverse drainage lines and riparian areas mapped as CBAs these should be micrositied by a suitably qualified ecological and aquatic specialist before construction in that area starts to ensure any potential impacts are minimised 3) Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. The current layout depicts that the substations, camps and lay-down areas are in low sensitivity areas, and this is therefore acceptable. 4) Avoid impact to restricted and specialised habitats such as pans, wetlands and rock pavements. The final development footprint to be authorised should be checked for such sensitive features in the field, such that there is a high degree of confidence that the final layout avoids such features so that significant changes to turbines or roads are not required at the preconstruction phase. 																			

6.4 OPERATIONAL PHASE IMPACT ON CBAs AND ESAS

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL BEFORE MITIGATION									SIGNIFICANCE	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL AFTER MITIGATION									SIGNIFICANCE
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S			E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S	
Operational Phase																						
Operational Phase impact on CBAs and ESAs	Impacts on CBAs and ESAs during operation as a result of maintenance activities and turbine noise.	2	2	2	2	3	2	22	-	Low	See Below.	1	2	2	2	2	2	18	-	Low		
Recommended Mitigation Measures	<ol style="list-style-type: none"> Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. A log should be kept detailing and fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. These should be reviewed annually and used to inform operational management and mitigation measures. 																					

6.5 OPERATIONAL PHASE IMPACT ON FEPA SUBCATCHMENTS

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Operational Phase impact on FEPA Subcatchments	Impacts on ecosystem services within FEPA Priority Subcatchments as a result of presence and operation of the WEF.	2	2	2	2	3	3	33	-	Medium	See Below.	1	2	2	2	2	2	18	-	Low
Recommended Mitigation Measures	<ol style="list-style-type: none"> 1) Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. This should make provision for annual monitoring and rehabilitation. 2) All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 3) There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area. 4) Alien management at the site should take place according to the Alien Invasive Management Plan. 5) Regular (annual) monitoring for alien plants during operation to ensure that no alien invasive problems have developed as result of the disturbance, as per the Alien Management Plan for the project. 6) Woody aliens should be controlled on at least an annual basis using the appropriate best-practice alien control techniques as determined by the species present. 																			

6.6 OPERATIONAL PHASE IMPACTS ON ECOLOGICAL PROCESSES

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I/M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Operational Phase impact on broad-scale ecological processes	Impacts on broad-scale ecological processes as a result of operational phase activities, including disturbance turbine noise.	2	2	2	2	3	2	22	-	Low	See Below.	1	2	2	2	3	2	20	-	Low
Recommended Mitigation Measures	<ol style="list-style-type: none"> 1) All service vehicles on site should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. 2) Service staff should remain within the wind farm footprint areas and access routes and should not be allowed to wander into the veld. 3) No fauna including tortoises should be disturbed or removed from the veld. 4) A log should be kept detailing and fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. These should be reviewed annually by the Environmental Officer and used to inform operational management and mitigation measures. 																			

6.7 NO-GO ALTERNATIVE

Assuming that the project does not go ahead, the wind farm would not be built and the current land use would continue into the future. The area is currently used for extensive livestock which is considered to be largely compatible with long-term biodiversity maintenance. Many fauna species are to some degree negatively affected by farming including many predators which are targeted due to their negative impact on livestock, while some species may also be vulnerable to habitat loss or degradation and may experience depressed populations within the farming landscape. In terms of vegetation and plant species, extensive grazing may result in changes in composition towards less palatable species and a reduction in plant cover. It is however important to recognise that the development does not represent an alternative to extensive livestock farming, but rather an additional impact independent of the current land use. Overall, the no-go alternative is considered to result in a low negative impact on terrestrial biodiversity.

7 CONCLUSION & RECOMMENDATIONS

The Klipkraal 4 WEF is mapped as falling primarily within the Eastern Upper Karoo and Western Upper Karoo vegetation types. However, the site verification and field assessment confirmed the presence of Upper Karoo Hardeveld and Southern Karoo Riviere within the site as well. All of these vegetation types have only been impacted to a limited extent by transformation, and are classified as Least Threatened. In terms of fauna, there are several listed fauna which occur in the area and which would potentially be impacted by the development. Of greatest concern would be the Riverine Rabbit and Karoo Dwarf Tortoise. The Riverine Rabbit is confirmed present within the Klipkraal 4 site and the impacts on this species are assessed in the associated species assessment. There are confirmed areas of Karoo Dwarf Tortoise habitat within the site that have been classified in the sensitivity mapping as high or very high sensitivity depending on the habitat quality and associated likelihood that the Karoo Dwarf is present. The major sensitive features of the site including Riverine Rabbit habitat and optimal Karoo Dwarf Tortoise habitat have been mapped as high or very high sensitivity and would not be impacted by turbine footprint areas. Some impact to these areas from limited amounts of overhead cabling or turbine access roads are considered acceptable.

There is a CBA 1 that represents a river buffer along the Sout River and under the layout provided, there are five turbines within the CBA. With mitigation, the impact of these on the riparian corridor and ecological functioning along the Sout River can be reduced to an acceptable level as this section of the river is not considered particularly sensitive and vulnerable to disruption. The whole of the Klipkraal 4 is however within a priority FEPA Subcatchment. While there is potential for the development to degrade the value of the FEPA subcatchment through erosion and siltation of the Sout River and downstream ecosystems, there is also potential to mitigate these potential impacts

effectively through erosion control measures and other responsible construction and management practices. The development is therefore considered acceptable overall, subject to the mitigation and avoidance measures as suggested.

Impact Statement – Klipkraal 4 WEF Impact on Terrestrial Biodiversity

There are no impacts associated with the development of the Klipkraal 4 WEF on terrestrial biodiversity that cannot be mitigated to an acceptable level. As such, should all the proposed mitigation be implemented, the Klipkraal 4 WEF development is deemed acceptable from a terrestrial ecological impact perspective. In terms of cumulative impacts, the affected area has not been significantly impacted by renewable energy development to date and the contribution of the current wind farm development to cumulative impact is considered low and acceptable. It is thus the reasoned opinion of the specialist that the Klipkraal 4 WEF development should be authorised subject to the various mitigation and avoidance measures as indicated.

8 REFERENCES

- Agha M, Lovich JE, Ennen JR, Augustine B, Arundel TR, Murphy M, Meyer-Wilkins K, Bjurlin C, Delaney D, Briggs J, Austin M, Madrak SV, Price SJ. 2015. Turbines and terrestrial vertebrates: variation in tortoise survivorship between a wind energy facility and an adjacent undisturbed wildland area in the Desert Southwest (USA). *Environmental Management* 56, 332–341.
- 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. S. 2013. *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland*. Strelitzia 32. SANBI, Pretoria.
- Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.
- Department of Environmental Affairs and Tourism, 2007. *National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species*. Government Gazette, Republic of South Africa.
- Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.
- Lovich JE, Ennen JR, Madrak S, Meyer K, Loughran C, Bjurlin C, Arundel T, Turner W, Jones C, Groenendaal GM. 2011 Effects of wind energy production on growth, demography, and survivorship of a desert tortoise (*Gopherus agassizii*) population in southern California with comparisons to natural populations. *Herpetological Conservation and Biology* 6, 161–174.
- 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.
- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). *Technical Report for the National Freshwater Ecosystem Priority Areas project*. WRC Report No. K5/1801.

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

South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.2020.