Proposed Hugo Wind Energy Facility near De Doorns, Western Cape

Animal Species Specialist Assessment Report

PREPARED FOR
FE Hugo & Khoe (Pty) Ltd

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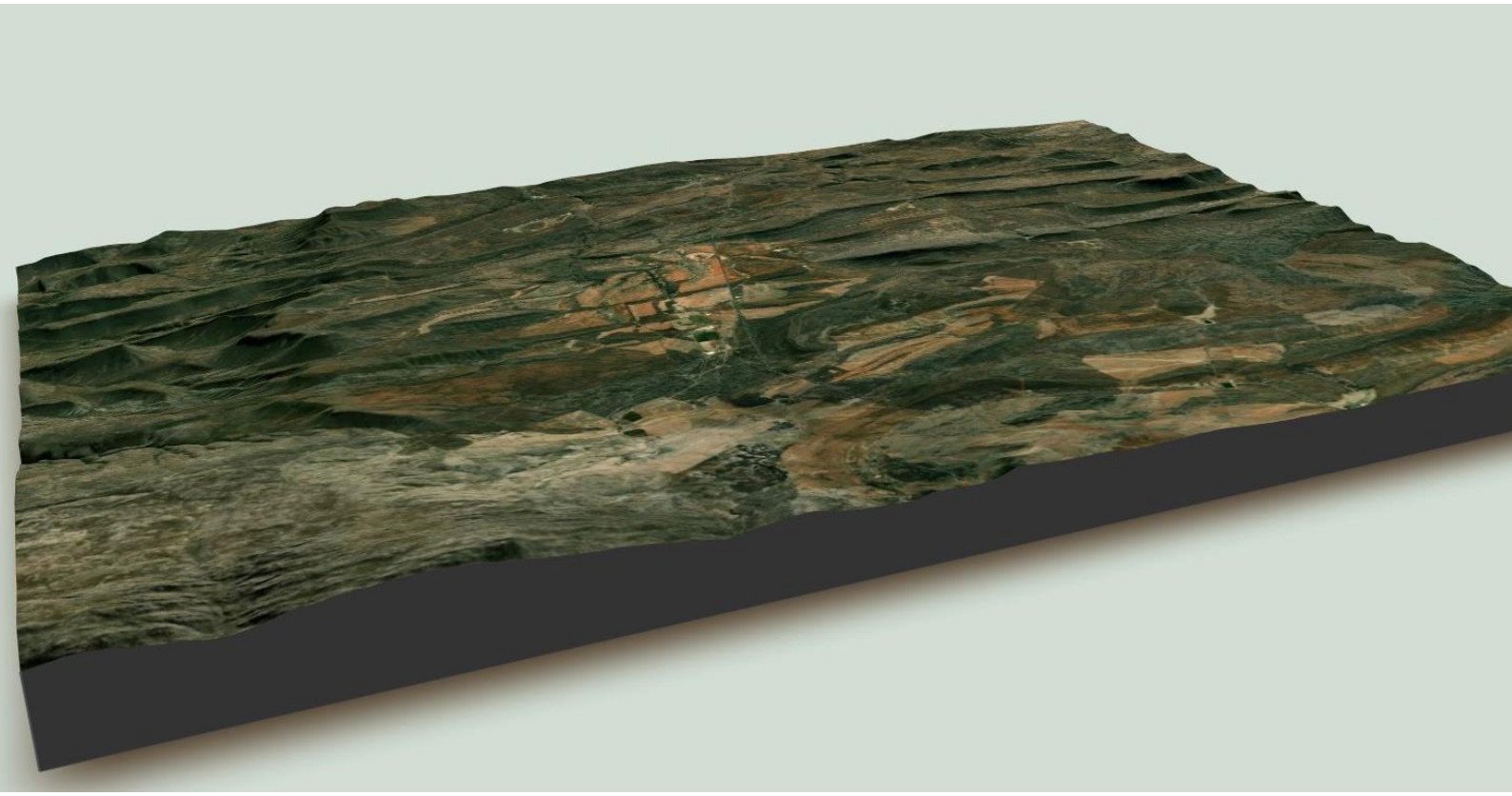

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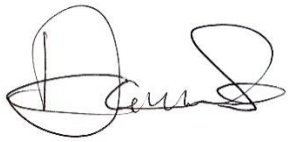

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronyms	Description
BESS	Battery Energy Storage System
DFFE	Department of Forestry, Fisheries & the Environment
EIA	Environmental Impact Assessment
EWT-DCP	Endangered Wildlife Trust Drylands Conservation Programme
ha	Hectare
kV	Kilovolt

Acronyms	Description
OTL	Overhead Transmission Line
REF	Renewable Energy Facility
SCC	Species of Conservation Concern
Solar PV	Solar Photovoltaic
-ve / +ve	Negative / Positive
WEF	Wind Energy Facility
WTG	Wind Turbine Generator

EXECUTIVE SUMMARY

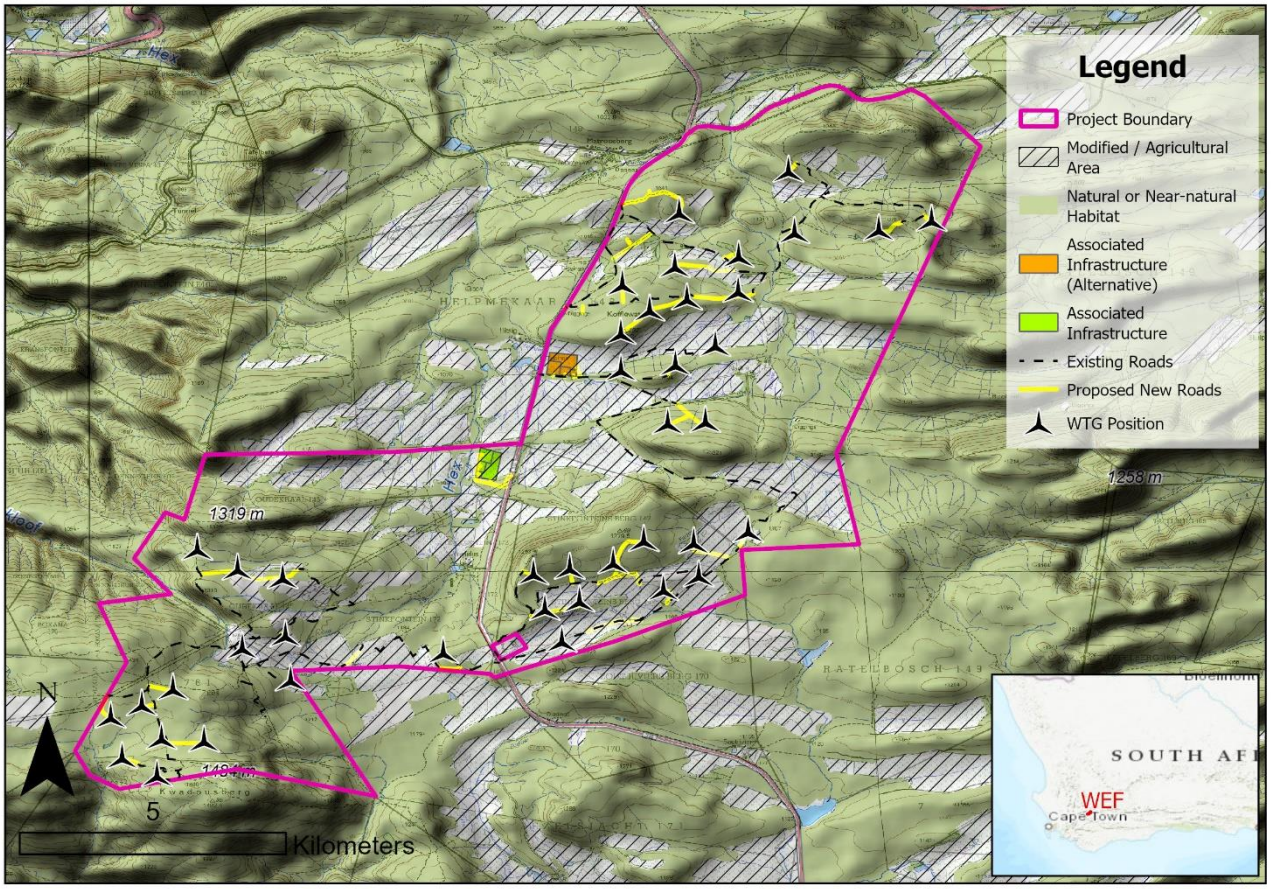
- The proposed Hugo Wind Energy Facility comprises up to 48 Wind Turbine Generators (WTGs) and associated infrastructure near De Doorns in the Western Cape;
- Current impacts exist across large portions of the proposed site, notably through intensive agricultural activity;
- Two (2) non-avian Species of Conservation Concern (SCCs) were identified as relevant sensitivity features in the animal species theme output of the Screening Tool, namely the Least Concern Caledon Copper (*Aloeides caledoni*, a butterfly) and Critically Endangered Riverine Rabbit (*Bunolagus monticularis*), both listed as 'Medium' sensitivity indicating the potential to occur on the study site;
- Two (2) additional non-avian animal SCCs were determined relevant to the proposed development, namely the Vulnerable Leopard (*Panthera pardus*) and Near Threatened Grey Rhebok (*Pelea capreolus*);
- A camera trap survey was conducted at 11 sampling locations in and around the proposed development area between 17 February 2022 and 23 December 2022, resulting in 1 832 camera trap days;
- A total of 2 778 independent records of 3 269 animals representing 66 species were recorded across the study area, including 63 records of Riverine Rabbit and 46 records of Grey Rhebok confirmed on site, while Caledon Copper and Leopard were not confirmed on site, both were assumed to be present for the purposes of the assessment;
- Riverine Rabbit was regularly recorded at three (3) sampling locations placed in natural/ near-natural vegetation and recovered vegetation on previously modified land;
- The animal sensitivity of the site was mapped through consideration of existing impacts, potential impacts of the proposed development and important ecological processes that should be acting across the site and broader area;
- Conservation objectives for all animal SCCs relevant to the project highlight the importance of dispersal corridors across the landscape to maintain genetic diversity and long-term studies on population dynamics;
- Ecological corridors across the site are obstructed by agricultural activity, particularly for Riverine Rabbit,
- The proposed development presents an opportunity to provide a land-use alternative to agricultural activity that is more compatible with conservation objectives for animal SCCs;
- Impacts can be minimized through in-situ biodiversity rehabilitation, specifically through the restoration of strategic, currently modified areas to improve habitat connectivity for animal SCCs relative to the present condition;
- Valuable research on animal SCCs can be achieved simultaneously with improvements to ecological connectivity through the establishment of long-term monitoring programmes in the study area;
- The proposed development is acceptable from an animal perspective on condition that strategic areas of existing agricultural land be appropriately rehabilitated.

1. INTRODUCTION

1.1 BACKGROUND

ERM Southern Africa Pty Ltd (ERM) was appointed by FE Hugo & Khoe Pty Ltd to conduct a Terrestrial Animal Species Specialist Assessment for the proposed establishment of the Hugo Wind Energy Facility (WEF) and associated infrastructure in the Western Cape Province. The Hugo WEF project site is located ~10 km east of De Doorns (Figure 1).

FIGURE 1 LOCATION AND CONTEXT OF THE PROPOSED HUGO WIND ENERGY FACILITY



1.2 PROJECT DESCRIPTION

The proposed Hugo WEF will comprise up to 48 turbines with a maximum output capacity of up to 360 MW. The proposed development will also comprise access roads and internal roads, a Battery Energy Storage System (BESS), an Operations and Maintenance (O&M) building and a temporary site office. Internal 33 kV underground/overhead cabling along the proposed roads and a 132 kV Overhead Transmission Line (OTL) will also be installed to connect the WEF to the national electrical grid network. The grid connection will form part of a separate application process, however cumulative impacts thereof have been considered herein.

1.3 TERMS OF REFERENCE

This report follows the requirements of The National Gazette, No. 43855 of 30 October, 2020 (as amended): "*Protocol for the Specialist Assessment and Minimum report Content Requirements for Environmental Impacts on Animal Species*" ('The Protocol') and the Species Environmental Assessment Guideline referred to therein[1]. The Protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on terrestrial animal species for activities requiring environmental authorization.

The terms of reference for this report were therefore to:

- Details of animal Species of Conservation Concern (SCCs) found or suspected to occur on the site (excluding bats and birds), regarding:
    - National population;
    - Local Conservation Interventions and/ or Species Management Plans; and
    - Study area population
- Discuss the presence or likelihood of additional animal SCCs not identified by the screening tool;
- Map the sensitivity of the site as it relates to animal SCCs in sufficient detail to inform the impact assessment, including the identification of areas unsuitable for development (if any);
- Identify any dynamic ecological processes occurring within the broader landscape that could potentially be impacted by the proposed development;
- Determine the potential impact of the proposed development on the habitat and long-term viability of animal SCC population(s);
- Identify impact management measures, actions and outcomes to mitigate the potential impact of the proposed development on the habitat and long-term viability of animal SCC population(s);
- Discuss the potential contribution of the proposed development to cumulative impacts on the habitat and long-term viability of animal SCC population(s) in the broader landscape; and
- Provide a reasoned opinion regarding the acceptability and compatibility of the development with the long-term viability of animal SCC population(s).

2. METHODS

2.1 DESKTOP STUDY

The output of the Screening Tool was supplemented with outputs from biodiversity databases such as the various atlassing projects of the Virtual Museum[2], iNaturalist[3] and the GBIF[4] network to determine which additional species may occur in the area. Conservation status was cross-

[1] 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.
[2] http://vmus.adu.org.za/vm_projects.php
[3] https://www.inaturalist.org/
[4] http://gbif.org

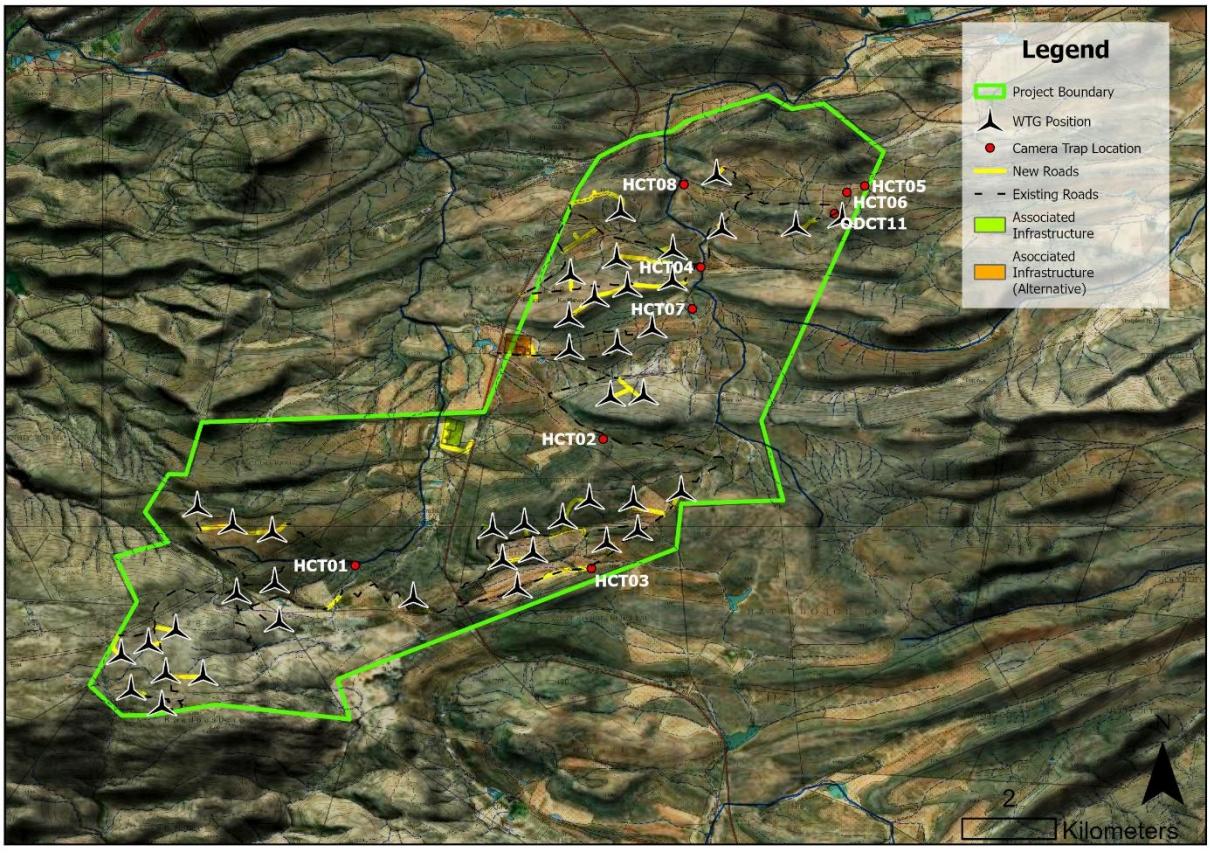
referenced with National[5] and International[6] databases. Publicly available data and published literature were consulted and referenced throughout, where relevant.

2.2 SITE SURVEY

Nine (9) sampling sites were selected across the proposed site to maximize the likelihood of detecting animal SCCs, and investigate the potential utilization of the site by these species (particularly Riverine Rabbit). Camera traps were deployed based on the specialist's prior experience in faunal surveys for these species and included sites representative of natural or near-natural habitat, modified habitat and along a topographic gradient (Figure 2, Appendix A). Two (2) additional sites positioned in a nearby site were surveyed simultaneously and included in the analyses given their proximity to the proposed site (c. 8.5 km between sampling sites) and availability of similar habitat types.

- **Duration:** 44 weeks
- **Date:** 17 February 2022 – 23 December 2022
- **Season:** Late summer, autumn, winter, spring and early summer
- **Relevance:** Sampling was conducting through a wide-range of conditions experienced over the monitoring period, increasing confidence in the outcome of the assessment
- **Effort:** Camera traps were deployed across the site for a combined 1 832 camera trap days. Camera trap deployment duration ranged from 90 nights (HCT05) to 307 nights (HCT06).

FIGURE 2 CAMERA TRAP SAMPLING SITES



[5] http://speciesstatus.sanbi.org/
[6] https://www.iucnredlist.org/

Spartan Lumen Dual Flash Scouting Cameras (Model: SR3-CX S39) were utilized in the study to provide high-quality, full-colour, night-time images (i.e. using white-flash) to facilitate positive differentiation between Riverine Rabbit and hares. Passive Infrared (PIR) sensor sensitivity was set to "normal" using the in-camera settings, with a trigger interval (quiet period) of 5 seconds.

2.3 DATA ANALYSES

An initial, automated batch classification was on raw image data in R[7] using MegaDetector to classify images into 'blank' (i.e. false-triggers) or animal detections. Automatic classifications were manually validated prior to manual species identification. Data was captured following the Camera Trap Metadata Standard (CTMS)[8] and explored following modified methods obtained from the Wildlife Coexistence Lab[9]. Camera Trap labelled ODCT11 was excluded from image analyses as it was set to record video rather than static images and records were therefore considered separately.

2.4 SENSITIVITY MAPPING

The 2020 South African National Land-Cover (SANLC) dataset, 2022 Red List of Ecosystems (RLE) for terrestrial realm for South Africa, publicly available satellite imagery, normalized difference vegetation index (NDVI), Screening Tool output and field observations of vegetative cover were considered in combination with camera trap survey data to delineate habitats relevant to the impacts of the proposed development type and animal SCCs.

2.5 IMPACT RATING

Significance ratings of the potential impacts were determined following the methods outlined in Appendix B. The impact assessment considered the results of the monitoring programme in the context of the receiving environment, the conservation status of the species observed/expected, the susceptibility of species to the potential impacts and the species' utilization of the proposed development site.

2.6 ASSUMPTIONS AND LIMITATIONS

Inventory surveys of animal species occurring across a site are difficult to achieve within the time-frames associated with an EIA. To compile a comprehensive site-specific list would require extensive sampling. For assessment purposes, it is considered more important to identify species and processes of conservation value that may be impacted upon. Therefore, this assessment attempts to identify threatened and other significant species, important habitats, and ecological processes. Camera trap survey design was focused to meet the study objectives, and full species inventories were not the primary objective of this study, but rather the confirmation of presence. A study[10] on the camera trapping of mammals in open scrubland suggested that reliable estimates of species richness can be achieved when cameras are spaced 1 x 1 km apart and left

[7] R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
[8] Forrester, T., T. O'Brien, E. Fegraus, P. Jansen, J. Palmer, R. Kays, J. Ahumada, B. Stern and W. McShea. (2016). An Open Standard for Camera Trap Data. Biodiversity Data Journal. 4:e10197. https://doi.org/10.3897/BDJ.4.e10197
[9] Department of Forest Resources Management, University of British Columbia, 2424 Main Mall, Vancouver, BC, Canada V5T 1Z4
[10] Colyn, R.B., Radloff, F.G.T. & O'Riain, M.J. Camera trapping mammals in the scrublands of the Cape Floristic Kingdom—the importance of effort, spacing and trap placement. Biodivers. Conserv. 27, 503–520 (2018). DOI: 10.1007/s10531-017-1448-z

in the targeted area until a survey effort of 1 000 days is realized. More elusive species may require between 1 600 and 3 000 camera trap days or a change in sampling intensity and number of deployment sites. The spatial and temporal deployment of the camera trap survey therefore unlikely resulted in a complete species inventory of the study area, however the 1 832 camera trap days was considered sufficient for the purposes of this study.

It is not possible to confirm the absence of a species with certainty, particularly rare or low-density species or species with short, not-fully understood activity windows (e.g. some insect species). If species were not detected, they were nonetheless assumed to be present for assessment purposes. Presence confirmation was considered more significant than absence. However, at locations where presence was confirmed, they were generally detected and recorded relatively soon after camera trap deployment and regularly thereafter throughout the deployment period. This indicates that they are relatively common within areas of suitable habitat, and it is considered unlikely that they were present at sites where they were not detected. Not all patches of suitable habitat were monitored, it is assumed that if e.g., a Riverine Rabbit (*Bunolagus monticularis*) was detected within a certain habitat type or patch, that the species is present throughout that habitat type or patch. Current distribution and habitat suitability models for Riverine Rabbit largely utilize abiotic factors and sighting records and are likely subject to refinement as research on this poorly understood species improves.

While independent image captures were determined through the exclusion of multiple images of the same individual taken during the same instance, independent captures may nevertheless represent the same individual taken at different times and therefore the number of independent captures does not indicate the population size at a location in this study.

3. RESULTS

A total of 3 873 images of 4 513 animals were recorded by camera traps during the study. These represented 66 positively identified species. The most frequently recorded species across the study were sheep (*Ovis aries*), accounting for 1 232 (32%) of images. Cape Spurfowl (*Pternistis capensis*, 13%), hare sp. (*Lepus* sp. 9%), Black-backed Jackal (*Canis mesomelas,* 8.5%) and African Wildcat (*Felis lybica,* 4.6%) were also frequently recorded. However, multiple images of the same individual animals were recorded when they lingered in front of the camera trap sensor. A total of 2 778 independent records of 3 269 animals were recorded, with sheep, Cape Spurfowl, Black-backed Jackal and hare sp. nevertheless accounting for the bulk of independent records.

3.1 SPECIES OF CONSERVATION CONCERN

Two non-avian SCCs were included in the Screening Tool output, with Insecta-*Aloeides caledoni* and Mammalia-*Bunolagus monticularis* listed as 'Medium' sensitivity. The desktop study revealed two SCCs potentially present in the study site that were not included in the Screening Tool output, namely Grey Rhebok (*Pelea capreolus*) and Leopard (*Panthera pardus*). Both Riverine Rabbit and Grey Rhebok were confirmed as present within the study site, while Leopard was considered to have a high probability of utilizing at least parts of the study site on occasion. The Caledon Copper (*Aloeides caledoni*) is considered Least Concern and unlikely to occur in areas identified for development. Riverine Rabbit is considered the primary SCC relevant to the proposed development.

TABLE 1 SPECIES OF CONSERVATION CONCERN CONFIRMED OR POTENTIALLY PRESENT ACROSS THE STUDY AREA

Family	Common Name	Scientific Name	Status	Habitat	Source	Probability	Justification
Leporidae	Riverine Rabbit	*Bunolagus monticularis*	Critically Endangered	Low-lying scrub	Screening Tool	Confirmed	N/A
Bovidae	Grey Rhebok	*Pelea capreolus*	Near Threatened	Scrub, rocky hills and modified fields	Desktop Study	Confirmed	N/A
Felidae	Leopard	*Panthera pardus*	Vulnerable	Scrub and rocky slopes	Desktop Study	High	Site located near suitable habitat of wide-ranging species
Lycenidae	Caledon Copper	*Aloeides caledoni*	Least Concern	Rocky cliffs and mountain peaks	Screening Tool	Low-Medium	Small area of rocky, quartzite ridges present

3.1.1 RIVERINE RABBIT

3.1.1.1 POPULATION

Our current knowledge about Riverine Rabbit ecology and population is inadequate, albeit improving. A study[11] investigating the ecology of the species was published some 35 years ago, and remains the basis for most of our conservation efforts to-date. Notably, the study associated the species closely with seasonal drainage lines and looser soils of the karoo, features that are under increasing utilization by farmers for fodder crops and livestock grazing. Increasing threats to the perceived preferred habitat of the species informed their conservation status.

Population estimations based on the extent and carrying capacity karoo's riparian zones indicated a population size of 1 435 individuals[11]. A more recent population estimate of 157 – 207 mature individuals[12] was derived from a MaxEnt[13] species distribution model, with no subpopulation estimated to contain more than 50 mature individuals. This estimate remains the primary support and basis for their current, Critically Endangered conservation status.

However, the species distribution model incorporated presence only data that was derived from existing records and transect surveys between 2000 and 2010, primarily conducted during the day, on foot or horseback.

In the absence of updated estimates, the riverine rabbit remains critically endangered, but it has become increasingly evident that these estimates are misleading. Camera trap surveys have revealed records outside the supposed range, with a higher frequency than would be expected from such a small population size. Indeed, the latest genetic evidence[14] indicates a high degree

[11] Duthie, A.G., Skinner, J.D. & Robinson, T.J. 1989. The distribution and status of the riverine rabbit, Bunolagus monticularis, South Africa. Biological Conservation. 47: 195–202.
[12] Collins, K. and Toit, J.T. 2016. Population status and distribution modelling of the critically endangered riverine rabbit (*Bunolagus monticularis*). African Journal of Ecology 54: 195–206.
[13] MaxEnt uses a machine-learning technique called Maximum Entropy Modelling for modelling species distributions and niches.
[14] Matthee, C.A., Wet, N. De & Robinson, T.J. 2021. Conservation genetics of the critically endangered riverine rabbit, *Bunolagus monticularis*: structured populations and high mtDNA genetic diversity. Journal of Mammalian Evolution.

of mitochondrial DNA (mtDNA) diversity, suggesting an effective population size closer to 5 000 individuals.

3.1.1.2 CONSERVATION AND SPECIES MANAGEMENT PLANS

The degree of geographic genetic structure and high mtDNA diversity within (and between) subpopulations indicate that the southern population, representatives of which were confirmed on site, exhibit a stable demographic profile. The high mtDNA haplotypic diversity underscores the importance of subpopulation connectivity in maintaining genetic diversity through time[14]. Matthee (*et al.* 2021) argue that successful conservation of Riverine Rabbit is contingent on reducing human transformation of their habitat and, importantly, protection of sufficient connectivity throughout the species' range. In the broader area, Riverine Rabbit populations in the Anysberg Nature Reserve (c. 60 km east) and Sanbona Wildlife Reserve (c. 75 km south-east) are recognised as being important for the conservation of the species. The primary conservation interventions include protected area expansion, private landowner conservation stewardship programmes, and active habitat restoration. The Drylands Conservation Programme of the Endangered Wildlife Trust (EWT-DCP) coordinates conservation efforts on the Riverine Rabbit and its habitat. EWT-DCP promotes integrated land management practices that can sustain Riverine Rabbit while providing employment for communities and facilitating ecosystem restoration on landowners' farms.

3.1.1.3 STUDY AREA

Riverine Rabbit were recorded at HCT01, HCT02 and HCT04, with detection rates of one independent record occurring on average every 10.8, 6.8 and 9.5 days at each sampling location respectively. Riverine Rabbit occurrence was not correlated with distance from road, but records were absent from modified agricultural land and from sampling locations with a high number of sheep records. Notably, however, Riverine Rabbit occurrence coincided with natural, or near-natural and recovered land types with elevated mean NDVI values (Figures C-4 and C-5, Appendix C). Riverine Rabbit occurrence in previously modified lands that have recovered through the regrowth of surrounding natural vegetation is encouraging. A large 2021[15] study, utilizing 150 camera traps in the Sanbona Wildlife Reserve, found that Riverine Rabbit occurrence was conditional on hare absence and was negatively affected by terrain ruggedness. Areas of natural, or near-natural and recovered vegetation associated with flatter areas exist throughout the site, however some connectivity between patches has been removed through agricultural activity and modified into cropland.

[15] Woodgate, Z., Distiller, G., O'Riain, M.J. 2021. Hare today, gone tomorrow: the role of interspecific competition in shaping riverine rabbit occurrence. Endang Species Res 44:351-361. https://doi.org/10.3354/esr01106

FIGURE 3 RIVERINE RABBIT RECORDED AT A) HCT01, B) HCT02 AND C) HCT04, WITH D) LEPUS SP. RECORDED SYMPATRICALLY WITH RIVERINE RABBIT AT HCT04

The general ecology and geographic distribution of the species are insufficiently understood to provide an appropriate population estimate, but it is likely that the site holds a viable population. Habitat connectivity of the site is, however, compromised by agricultural impacts that currently exist across the site.

3.1.1.4 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

Habitat destruction, direct and indirect mortality and disturbance impacts are potential impacts associated with the proposed development that require mitigation. The considered placement of temporary and associated infrastructure will reduce the potential impacts. Following avoidance and reduction measures, the *in-situ* biodiversity restoration and rehabilitation of existing agricultural fields, following the mitigation hierarchy, are recommended as likely to improve habitat availability and ecological connectivity relative to the status-quo. The overall size of the development footprint is small in comparison to the project boundary and total area that can be enhanced for the conservation of Riverine Rabbit.

3.1.2 GREY RHEBOK

3.1.2.1 POPULATION

The lack of comprehensive data prevents an accurate estimate of current population size. The conservation status listing of Near Threatened is considered precautionary (for criterion A) as reliable, long-term population trend data are lacking particularly outside of protected areas. Grey Rhebok are fairly common in the karoo and fynbos regions.

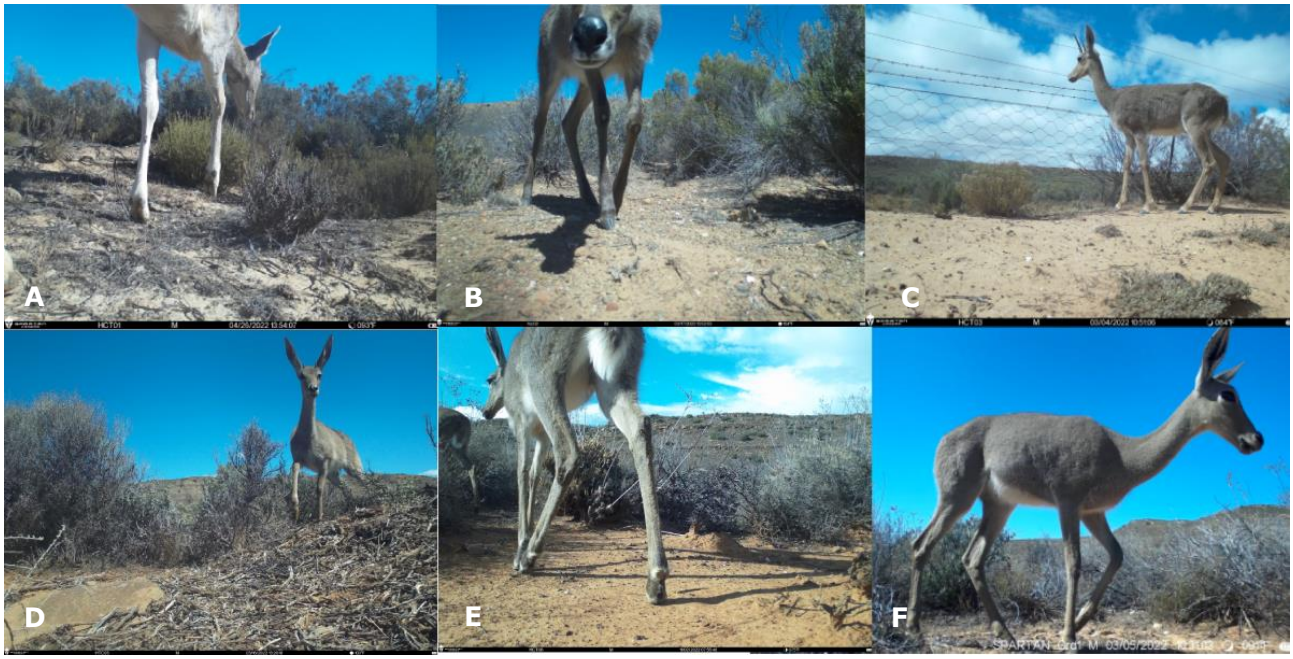
3.1.2.2 CONSERVATION AND SPECIES MANAGEMENT PLANS

The primary intervention at this stage is to investigate the causes of the decline to inform additional, appropriate interventions. Assess subpopulation trends on private lands and establish long-term monitoring sites. Private landowner conservancies encouraged to reduce the edge effects of small areas of natural habitat and provide suitably large, open areas with adequate protection such that vulnerability to poaching is reduced[16].

3.1.2.3 STUDY AREA

Grey Rhebok are associated with the rocky hills of mountain fynbos and the little Karoo in the southern parts of their range. In the Western Cape, they are often observed on agricultural lands. Grey Rhebok were recorded at all sampling locations except for HCT04, HCT07 and HCT08.

FIGURE 4 GREY RHEBOK DETECTIONS AT SAMPLING SITES A) HCT01, B) HCT02, C) HCT03, D) HCT05, E) HCT06 AND F) ODCT11. THE SHEEP FENCE AT HCT03 (C) REPRESENTS AN EXISTING BARRIER TO MOVEMENT ACROSS THE SITE FOR THIS SPECIES



3.1.2.4 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

Grey Rhebok are quite widespread and free-roaming, and although the number of locations is unknown, they are unlikely to be affected by any single threat. The species can become relatively habituated to anthropogenic disturbance, often feeding in open agricultural fields despite nearby traffic. Several existing, agricultural fences present across the site are barriers to unimpeded movement. The proposed development could improve animal movement if wildlife-friendly corridors are implemented. As a relatively mobile species, Grey Rhebok are not strictly dependent on any particular habitat. Suitable habitat is therefore widely available in the immediate vicinity of the proposed development and individuals will unlikely be permanently displaced if movement across the area is not prevented.

[16] Taylor, A., Cowell, C., Drouilly, M., Schulze, E., Avenant, N., Birss, C., Child, M.F. 2016. A conservation assessment of *Pelea capreolus*. In Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T., editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

3.1.3 LEOPARD

3.1.3.1 POPULATION

The Leopard is an adaptable, widespread species that may nonetheless have threatened subpopulations. Leopard population size and trends are notoriously difficult to estimate, due to their secretive nature and the high financial costs involved in population monitoring. A maximum population size of 11 631 individuals is estimated for South Africa[20].

The Western Cape is thought to support an estimated maximum of 588 individuals, 93 of which are expected to be in the Langeberg[17]. With large home ranges which span up to 910 km^2 in the Western Cape, density estimates range from 0.25 – 2.3 individuals per 100 km^2 in this region. Density estimates of 0.64 per 100 km^2 have been recorded across a mixed-use landscape of protected areas, farmland and urban areas in the Overberg and 1.89 per 100 km^2 in the Langeberg[18].

As anthropogenic land-use and human–carnivore conflict have increased, the population became increasingly fragmented, resulting in semi-isolated to isolated sub-populations surrounded by non-leopard habitat[19]. Genetic work from Leopard in the Western Cape detected significant population clustering, with low emigration and immigration between subpopulations[20]. Low gene flow indicates that the subpopulation in the broader area may be functioning as a sink population.

3.1.3.2 CONSERVATION AND SPECIES MANAGEMENT PLANS

Given the low leopard density and the prevalence of transformed land intermixed with patches of more suitable leopard habitat, prioritizing and preserving connectivity for leopards is vital in a shared landscape[18]. Ecological corridors should be developed in partnership with private landowners through an inclusive and multifaceted conservation strategy which also incorporates monitoring and rapid mitigation of emerging threats to leopards.

3.1.3.3 STUDY AREA

While the Langeberg's leopard densities on agricultural land have been estimated to be equal to the densities found in Garden Route's natural vegetation[17], no Leopard were recorded across the study area. A crude extrapolation using the size of the site and estimated densities would indicate that the study area could support 0.52 – 1.56 individuals[21].

3.1.3.4 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

The large home-range sizes of individuals in the region make it unlikely that the relatively small development footprint associated with a WEF would have a significantly negative impact on the

[17] Devens, C.H., Hayward, M.W., Tshabalala, T., Dickman, A., McManus, J.S., Smuts, B., Somers, M.J. 2021. Estimating leopard density across the highly modified human-dominated landscape of the Western Cape, South Africa. Oryx. 2021;55(1):34-45. doi:10.1017/S0030605318001473
[18] Hinde, K., Wilkinson, A., Tokota, S., Amin, R., O'Riain, M.J., Williams, K.S. 2023. Leopard density and the ecological and anthropogenic factors influencing density in a mixed-use landscape in the Western Cape, South Africa. PLoS ONE 18(10): e0293445. https://doi.org/10.1371/journal.pone.0293445
[19] McManus, J.S., Dalton, D.L., Kotzé, A., Smuts, B., Dickman, A., Marshal, J.P., Keith, M. 2015. Gene flow and population structure of a solitary top carnivore in a human-dominated landscape. Ecol Evol. Jan;5(2):335-44. doi: 10.1002/ece3.1322
[20] Swanepoel, L.H., Balme, G., Williams, S., Power, R.J., Snyman, A., Gaigher, I., Senekal, C., Martins, Q., Child, M.F. 2016. A conservation assessment of *Panthera pardus*. In Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T., editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
[21] 82.6 km^2 * 0.64 (mixed use Overberg) to 82.6 * 1.89 (Langeberg)

long-term viability or persistence of the species in the area. In contrast, reduced human-carnivore conflict and improvement of movement corridors across the site may provide a significant positive impact to the long-term viability of the population. The strategic restoration of agricultural areas to improve movement corridors would improve the opportunity for gene flow between the Langeberg/Cederberg and Anysberg populations. A land-use less reliant on livestock production may also reduce human-carnivore conflict pressures.

3.1.4 CALEDON COPPER

3.1.4.1 POPULATION

A species endemic to the Eastern Cape and Western Cape. There are six widely separated subpopulations, none of which are threatened. It is currently known to occur at Touw's River, Matjiesfontein and Beaufort West. The short flight-period and the localized nature of its colonies suggest that this taxon has been overlooked in its area of distribution and it is likely that many additional colonies will be found.

3.1.4.2 CONSERVATION AND SPECIES MANAGEMENT PLANS

No conservation actions recommended. Research is needed into the taxonomy of the widely scattered populations, life history, ecology, population size, distribution and trends[23].

3.1.4.3 STUDY AREA

This rare, low-density butterfly is generally confined to higher altitude rocky features, such as cliffs and mountaintops. While the host-plant is currently unknown, it has been recorded from Overberg Sandstone Fynbos (FFs12)[22], North Swartberg Sandstone Fynbos (FFs23), Karoo Escarpment Grassland (Gh1), Matjiesfontein Quartzite Fynbos (FFq3) and Matjiesfontein Shale Renosterveld (FRs6)[23]. The study area includes Matjiesfontein Shale Renosterveld and Matjiesfontein Quartzite Fynbos. Many other species in the genus utilize *Aspalathus* species as their larval food plants, which are relatively common towards the east of the study area.

3.1.4.4 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

While the utilization of hilltops, ridges and slopes for wind energy development presents a novel impact to habitats otherwise avoided by anthropogenic activities (e.g. agriculture), rocky cliffs and ridges within the relevant vegetation types are largely avoided by the proposed development. The size of the total construction footprint relative the overall size of the study area makes it highly unlikely that impacts associated with the proposed development type poses an existential threat to the viability and persistence of the species over the long-term.

4. SITE SENSITIVITY

4.1 CURRENT IMPACTS

Current impacts to animals across the site include roadkill through vehicle collisions along the well-used R318 that bisects the site (Figure 5A). Regular vehicular traffic along this route

[22] Mucina, L. & Rutherford, M.C., 2006, 'Vegetation of South Africa, Lesotho and Swaziland', Strelitzia 19, South African National Biodiversity Institute, Pretoria
[23] Pringle, E.L. 2020. Conservation Assessment: *Aloeides caledoni*. In Mecenero et al. 2020. Conservation Assessments: Hesperiidae; Lycaenidae: Alaena – Capys. Metamorphosis 31(4): 44 – 45 DOI: https://dx.doi.org/10.4314/met.v31i4.2

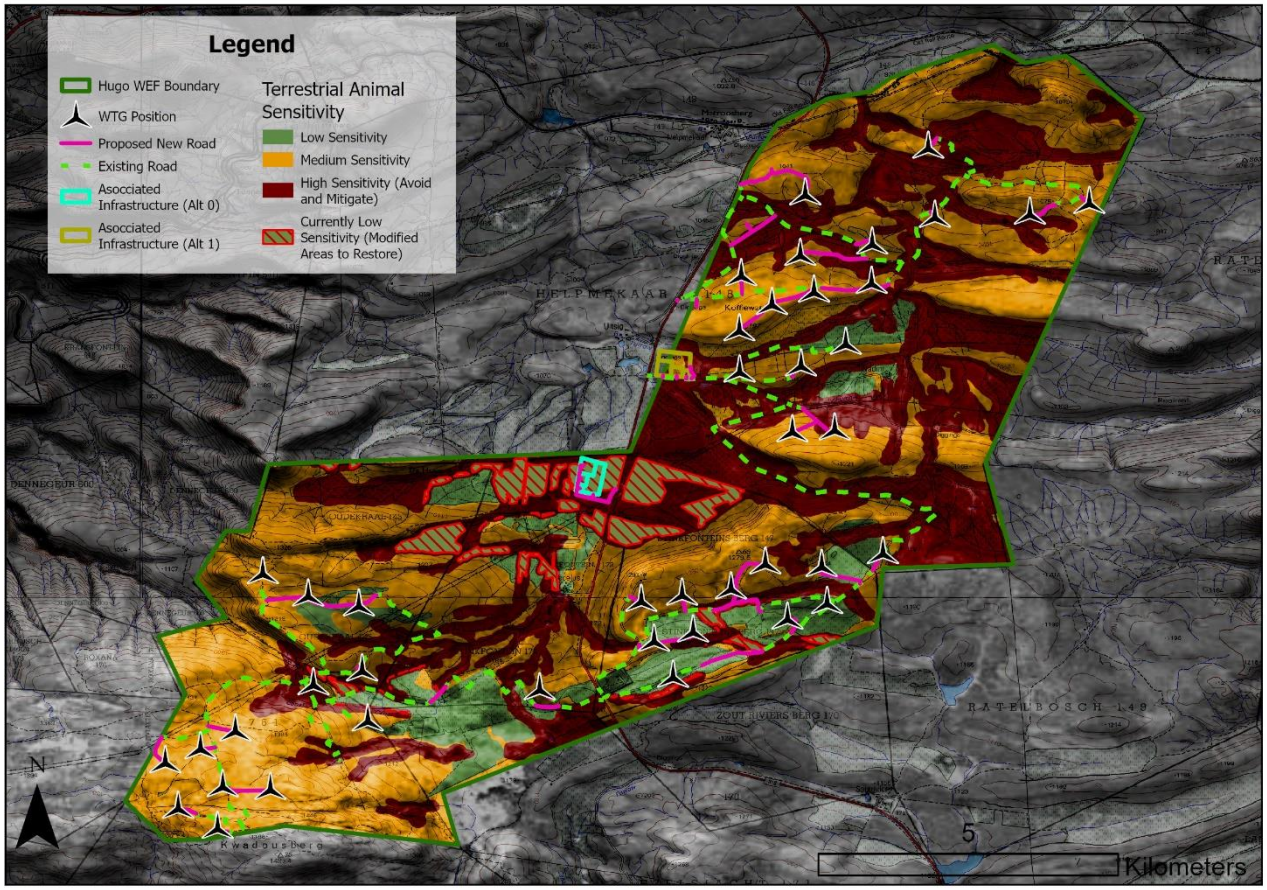
includes large goods vehicles and agricultural equipment. Modification of large portions of land across the proposed development area has occurred for agricultural activity, including regular ploughing and removal of vegetative cover. Existing land-use practices include livestock farming, with several fences across the site restricting the movement of species between habitat patches.

FIGURE 5 EXISTING IMPACTS OBSERVED IN AND AROUND THE STUDY AREA

4.2 SENSITIVITY MAPPING

In practice, the sensitivity mapping exercise resulted in drainage lines, alluvial fans and plains, gently undulating-to-flat natural/near-natural and recovered scrub to be categorized as high sensitivity for animal SCCs. Heavily modified agricultural fields were categorized as low sensitivity, except in areas where their presence was undesirable from an overall ecological connectivity perspective and a high sensitivity categorization was retained. Areas of remaining natural/near-natural scrub were categorized as medium sensitivity based on their condition and connectivity across the site (Figure 6).

FIGURE 6 SITE SENSITIVITY MAP FOR ANIMAL SPECIES OF CONSERVATION CONCERN



5. IMPACT ASSESSMENT

5.1 CONSTRUCTION PHASE

5.1.1 DIRECT HABITAT LOSS

Direct habitat loss can result from vegetation clearing and fire frequency. The removal of vegetation will be required for the construction of roads, turbine hard-stands, laydown areas and site offices. Artificially altered fire regimes may reduce habitat suitability for SCCs by changing vegetative communities and habitat structure. None of the proposed WTG bases are in areas of high sensitivity for animal SCCs. Approximately 70% of the internal roads will be following existing tracks. However, both existing and newly proposed roads traverse areas identified to be of high sensitivity.

Approximately 27 ha of land within high sensitivity areas is associated with new roads and an increased width of existing tracks (up to 12 m). It is recommended that mitigation action specific to the restoration and rehabilitation of several strategic areas that are currently highly modified through agricultural activity be initiated during the construction phase and continue through to the operational phase. These areas have been identified by this study to improve habitat availability and connectivity between patches for faunal SCCs across the site and broader area.

An area of approximately 260 ha has been identified here for restoration. This would result in a significant increase in habitat availability, reduced edge effects and improved connectivity

between existing habitat patches known to support SCCs. These factors have been identified in the literature to be of high conservation priority for all relevant SCCs listed. A net-gain, *in-situ* habitat restoration exercise is considered to be a highly desirable, positive impact if appropriately implemented.

Impact Phase: Construction					
Nature of the impact: Direct habitat loss through vegetation clearing or fire during construction					
Impact Status: Negative, Positive with mitigation					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Site	Medium term	Recoverable	Moderate	Highly Probable
Score	1	3	3	3	4
With Mitigation	Local	Medium term	Recoverable	Moderate	Highly Probable
Score	2	3	3	3	4
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative (40)			Moderate Positive (44)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to reduce residual risk or enhance opportunities:

- The production of an appropriate rehabilitation and restoration plan with the aims of improving and monitoring habitat availability and connectivity, in consultation with specialists and relevant stakeholders (e.g., CapeNature, Endangered Wildlife Trust) prior to construction;
- Strategic rehabilitation and restoration of currently modified areas within areas of high sensitivity to be initiated concurrently with the construction phase;
- Minimization of development footprint and utilization of existing roads and existing modified areas for temporary laydown areas and site buildings;
- Rehabilitate disturbed areas that are not required by the operational phase of the development;
- All construction vehicles should adhere to clearly defined and demarcated roads, no off-road driving should be allowed;
- An environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as avoiding fire hazards, littering, appropriate handling of pollution and chemical spills, minimizing wildlife interactions, remaining within demarcated construction areas;
- 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 open fires to be permitted outside of designated areas.

Residual impact	Some residual impact is likely; however, available habitats are widespread and the size of the development footprint is relatively small compared to the total project area. *In-situ* habitat restoration would result in a net-gain.

5.1.2 INDIRECT HABITAT LOSS

Indirect habitat loss includes the potential for reduced connectivity between habitat patches and restricted movement of animal SCCs, altered flow regimes and overgrazing. Construction activities and novel infrastructure (such as perimeter fencing and roads) may exclude species from portions of suitable habitat by restricting their movement across the landscape. Changes to water flow characteristics such as runoff, sedimentation and infiltration from compacted or hard surfaces could alter the vegetative community composition, soil depth and habitat suitability. Areas used during construction becoming unavailable for livestock grazing may concentrate livestock towards areas of high habitat suitability for animal SCCs.

As above, a restoration and rehabilitation programme initiated concurrently with the construction phase is recommended to result in a net-gain, positive impact to indirect habitat loss by improving connectivity and facilitating improved faunal movement across the site.

Impact Phase: Construction

Nature of the impact: Exclusion of animal SCCs from areas that remain outside of the immediate development footprint.

Impact Status: Negative, Positive with mitigation

	E	D	R	M	P
Without Mitigation	Local	Medium term	Recoverable	Moderate	Probable
Score	2	3	3	3	3
With Mitigation	Local	Medium term	Recoverable	Moderate	Highly Probable
Score	2	3	3	3	4
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative (33)			Moderate Positive (44)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to reduce residual risk or enhance opportunities:

- The production of an appropriate rehabilitation and restoration plan with the aims of improving and monitoring habitat availability and connectivity, in consultation with specialists and relevant stakeholders (e.g., CapeNature, Endangered Wildlife Trust) prior to construction;
- Strategic rehabilitation and restoration of currently modified areas within areas of high sensitivity to be initiated concurrently with the construction phase;
- Fencing and road designs to allow for passage of animals (e.g., appropriately sized culverts in roads and wildlife friendly fencing);
- Appropriate water runoff control measures to be constructed on all hard surfaces;
- Appropriate erosion control measures to be constructed on all servitudes and access roads in the project area;
- Rehabilitate existing servitude and access roads in the project area with sufficient erosion control measures to prevent the loss of soil and the degradation of vegetation.

Residual impact	Net-gain of available habitat and connectivity through restoration of potential movement corridors currently modified by agricultural activity.

5.1.3 DISTURBANCE/DISPLACEMENT

The increase in construction activity, sound, movement of machinery and operation of equipment may disturb and/ or displace animal SCCs from the vicinity of construction potentially influencing movement, foraging activity, breeding and impacting energy budgets. The probability of disturbance and displacement for animal SCCs relevant to the study area would be greatly reduced through the avoidance of construction activities between dusk and dawn given the nocturnal nature of species that may be particularly sensitive to disturbance.

Impact Phase: Construction

Nature of the impact: The displacement or disturbance of fauna due to construction activities

Impact Status: Negative

	E	**D**	**R**	**M**	**P**
Without Mitigation	Site	Short term	Recoverable	High	Highly Probable
Score	1	2	3	4	4
With Mitigation	Site	Short term	Recoverable	Moderate	Low Probability
Score	1	2	3	3	2

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Moderate Negative (40)	Low Negative (18)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Mitigation measures to reduce residual risk or enhance opportunities:

- Restrict construction activity to daylight hours;
- Minimize activity that occurs between dusk and dawn;
- Pre-construction baseline animal monitoring programme, with focus on areas identified for the construction footprint during the design phase (e.g., road network);
- Avoidance of highly sensitive habitats for laydown areas and temporary site offices
- Clearly demarcated construction areas and no unauthorized personnel to be permitted beyond demarcated areas;
- Adequate noise reduction measures (where possible) on heavy machinery;
- Construction areas and site buildings should be lit with as little light as practically possible, with lights directed downwards where appropriate to reduce the disturbance and foraging activities of nocturnal species;
- No dogs or cats other than those of the landowners permitted on site as these animals cause unnecessary disturbance such as chasing fauna

Residual impact	None

5.1.4 DIRECT MORTALITY

Increased access to the site from construction activities could increase the possibility of illegal collection of animals and increased poaching opportunities. Animals may also become entangled or entrapped in temporary fencing or excavations. Increased frequency of vehicle movement associated with construction activity increases the possibility of vehicles colliding with animals resulting in roadkill fatalities. Tortoises, snakes and amphibians are particularly susceptible to collisions; however, many other species are also at risk such as Aardwolf, Bat-eared Fox, rabbits/hares, Steenbok and porcupine, particularly at night. Many of these impacts can, however, be effectively managed or mitigated against.

Impact Phase: Construction

Nature of the impact: Direct impact to fauna caused by construction activities, such as increased risk of injury or mortality from collision with vehicles due to increased traffic, the increased possibility of illegal hunting, poaching, persecution or harvesting of fauna

Impact Status: Negative

	E	D	R	M	P
Without Mitigation	Site	Short term	Recoverable	High	Highly Probable
Score	1	2	3	4	4
With Mitigation	Site	Short term	Recoverable	High	Low Probability
Score	1	2	3	4	2

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Moderate Negative (40)	Low Negative (20)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Mitigation measures to reduce residual risk or enhance opportunities:

- All construction vehicles should adhere to clearly defined and demarcated roads, no off-road driving should be permitted;
- No movement of construction vehicles between dusk and dawn;
- Implementation and enforcement of speed limits (30 km/h);
- Roadkill monitoring and recording programme;
- Induction toolbox talk to construction personnel to increase awareness about animal SCCs present and roadkill risks;
- No unauthorized movement of personnel;
- No unauthorized access to the construction site;
- No trenches or excavations to be left uncovered overnight;
- Trenches, excavations and cattle grids to have slopes to allow for animals to escape should they fall in;
- No hunting permitted;
- No dogs or cats permitted (other than those of the landowner);
- The collection, hunting or harvesting of animals at the site should be strictly forbidden;

- Any fauna directly threatened by the construction activities should be removed to a safe location by the environmental control officer or other suitably qualified person

Residual impact	None

5.1.5 INDIRECT MORTALITY

Mortality of animal SCCs can result indirectly from construction phase activity through increased predator presence or competition and decreased predator detection. Waste from construction camps and carcasses associated with roadkill can attract species such as crows, which depredate on various animals including juvenile rabbits. Increased noise from construction activities may also mask natural sounds and reduce the ability for animals to detect the presence of predators. Foraging efficiencies may also be altered. Appropriate construction scheduling and management plans can significantly mitigate these impacts.

Impact Phase: Construction

Nature of the impact: Mortality of animal SCCs as an indirect result of construction activities

Impact Status: Negative

	E	**D**	**R**	**M**	**P**
Without Mitigation	Site	Short term	Recoverable	High	Highly Probable
Score	1	2	3	4	4
With Mitigation	Site	Short term	Recoverable	High	Low Probability
Score	1	2	3	4	2

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Moderate Negative (40)	Low Negative (20)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Mitigation measures to reduce residual risk or enhance opportunities:

- Waste management programme to prevent trash buildup attracting species such as crows;
- Roadkill to be immediately reported to the environmental control officer, removed and suitably disposed of to prevent scavenging (e.g., buried);
- Construction activity to be minimized during the night to reduce noise pollution during periods when Riverine Rabbit are most active.

Residual impact	None

5.2 OPERATIONAL PHASE

5.2.1 DIRECT HABITAT LOSS

Artificially altered fire regimes may reduce habitat suitability/availability by changing vegetative communities and habitat structure.

Impact Phase: Operational					
Nature of the impact: Direct habitat loss through altered fire regimes					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long term	Recoverable	High	Highly Probable
Score	2	4	3	4	4
With Mitigation	Local	Long term	Recoverable	High	Low Probability
Score	2	4	3	4	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative (52)			Low Negative (26)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to reduce residual risk or enhance opportunities:

- Waste management programme to prevent trash buildup attracting species such as crows;
- Roadkill to be immediately reported to the environmental control officer, removed and suitably disposed of to prevent scavenging (e.g., buried);
- Construction activity to be minimized during the night to reduce noise pollution during periods when Riverine Rabbit are most active.

Residual impact	None

5.2.2 INDIRECT HABITAT LOSS

Novel infrastructure (e.g., perimeter fencing) may exclude species from portions of suitable habitat by restricting animals' movement across the landscape. Altered hydrology, infiltration rates, sedimentation, erosion and spread of invasive species may reduce habitat suitability/availability by changing vegetative communities and habitat structure. Previously used areas may become unavailable for grazing and may alter grazing patterns, potentially concentrating livestock in areas of high habitat suitability for various SCCs.

Impact Phase: Operational

Nature of the impact: Effective reduction in available habitat through restriction of animal movement, reduced habitat integrity or increased competition

Impact Status: Negative

	E	D	R	M	P
Without Mitigation	Local	Long term	Recoverable	High	Highly Probable
Score	2	4	3	4	4
With Mitigation	Local	Long term	Recoverable	High	Low Probability
Score	2	4	3	4	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative (52)			Low Negative (26)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to reduce residual risk or enhance opportunities:

- Wildlife friendly road and fence crossings to be frequently serviced to facilitate passage of fauna across the site (e.g., road culverts to be cleared of debris);
- Livestock grazing pressure must be reduced in natural, near-natural and recovered areas;
- Flow and erosion control measures to be continually monitored for efficacy and remedied if pooling, sedimentation or erosion is observed;
- Previously disturbed areas such as road verges, lay-down areas and areas utilized by temporary construction facilities must be regularly monitored to detect the establishment of alien species and those species should be eradicated before they spread;
- Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned, the use of herbicides should be avoided as far as possible

Residual impact	None

5.2.3 DISTURBANCE/DISPLACEMENT

Operational activities may disturb and/ or displace certain animal SCCs from the vicinity of infrastructure.

Impact Phase: Operational

Nature of the impact: Disturbance and/ or displacement of animals due to routine operational activity

Impact Status: Negative

	E	D	R	M	P
Without Mitigation	Local	Long term	Reversible	High	Highly Probable
Score	2	4	1	4	4

With Mitigation	Local	Long term	Reversible	High	Low Probability
Score	2	4	1	4	2
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative (44)		Low Negative (22)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to reduce residual risk or enhance opportunities:

- Minimized lighting;
- Minimize activity that occurs between dusk and dawn;
- Adequate noise reduction measures (where possible) on machinery;
- Wind Turbine Generators should not spin below a certain cut-in speed, i.e., no free-spinning of WTG blades permitted;
- Speed limits should be strictly enforced to reduce unnecessary noise;
- No dogs or cats other than those of the landowners should be allowed on site as these animals cause unnecessary disturbance such as chasing fauna;
- Long-term animal monitoring programme;
- Establishment of stewardship programme to research and conserve Riverine Rabbit with collaboration with appropriate stakeholders (e.g., CapeNature, EWT)

Residual impact	Elevated background noise levels

5.2.4 DIRECT MORTALITY

Increased frequency of vehicle movement associated with operational activity increases the possibility of vehicles colliding with animals, resulting in roadkill fatalities. Animals may become entangled or entrapped in fencing or cattle grids.

Impact Phase: Operational					
Nature of the impact: Direct mortality through collision, entrapment and illegal collecting or poaching of animals					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long term	Reversible	High	Highly Probable
Score	2	4	1	4	4
With Mitigation	Local	Long term	Reversible	High	Low Probability
Score	2	4	1	4	2
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative (44)		Low Negative (22)		

Was public comment received?	No
Has public comment been included in mitigation measures?	No

Mitigation measures to reduce residual risk or enhance opportunities:

- Strictly enforced speed limits;
- Strictly controlled site access;
- Minimized movement of personnel vehicles at night;
- Wildlife friendly road crossings (including culverts that allow animal movement below the road surface);
- Signage, education and awareness induction training about relevant animal SCCs to personnel;
- Wildlife-friendly fencing and cattle grids

Residual impact	None

5.2.5 INDIRECT MORTALITY

Operational activities can attract species such as crows, which depredate on various animals such as tortoises and juvenile rabbits. Associated infrastructure such as transmission pylons may provide perching or nesting platforms for predatory species such as Martial Eagle and/ or Jackal Buzzard, and/ or crows which prey on various animal SCCs. Increased noise from wind turbine generators and operational activities may mask natural sounds and reduce the ability for animals to detect the presence of predators.

Impact Phase: Operational

Nature of the impact: Indirect mortality from increased predator densities and/ or reduced predator avoidance ability

Impact Status: Negative

	E	D	R	M	P
Without Mitigation	Site	Long term	Irreversible	High	Highly Probable
Score	1	4	5	4	4
With Mitigation	Site	Long term	Recoverable	Low	Probable
Score	1	4	3	2	3

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Moderate Negative (56)	Low Negative (30)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Mitigation measures to reduce residual risk or enhance opportunities:

- Overhead Transmission Lines to be of a type and design that reduces nesting opportunities (e.g., solid pylon design)
- Nest and perch deterrents on transmission line pylons
- Waste management programme to be implemented
- Roadkill to be reported and immediately removed for adequate disposal that prevents scavenging (e.g., buried)
- Operational studies on sound and animal populations (e.g., Riverine Rabbit) across the site
- No spinning wind turbine generators at wind speeds below a certain cut-in speed (i.e. no free-spinning blades)

Residual impact	Elevated background noise levels

5.3 DECOMMISSION PHASE

As per construction phase.

5.4 ECOLOGICAL PROCESSES

Impacts on broad-scale ecological processes include the obstruction or enhancement of corridors and connectivity between individuals of SCC populations, animal dispersal and gene flow. While ecological processes such as fire regimes, hydrology and connectivity have been considered across several of the impacts previously assessed, opportunity exists to enhance connectivity of the east with more elevated areas in the south and west of the study area. The establishment of corridors across the study site, through the rehabilitation of currently modified agricultural land, would allow access of SCCs in the area to potential climate refugia.

Impact Phase: All

Nature of the impact: Impacts of all phases of the proposed development on ecological processes of the area

Impact Status: Negative, Positive with mitigation

	E	D	R	M	P
Without Mitigation	Local	Long term	Recoverable	High	Highly Probable
Score	2	4	3	4	4
With Mitigation	Local	Long term	Recoverable	High	Probable
Score	2	4	3	4	3

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Moderate Negative (52)	Moderate Positive (39)
Was public comment received?	Yes	
Has public comment been included in mitigation measures?	Yes, identification and improvement of potential corridors is the primary aim of recommended mitigation measures	

Mitigation measures to reduce residual risk or enhance opportunities:

- *In-situ* habitat restoration designed to improve connectivity between natural/near-natural patches and facilitate animal SCC movement across the site (do be done by a specialist in consultation with appropriate stakeholders);
- Restoration and rehabilitation of currently modified agricultural land;
- Partner with the Drylands Conservation Programme of the Endangered Wildlife Trust to enhance the ecosystem processes across the site, e.g. through the Biodiversity Stewardship Programme and/ or the provision of research support;
- Initiation of formal, long-term research programmes across the site to investigate various aspects of Riverine Rabbit ecology with appropriate academic institutions, CapeNature or the Endangered Wildlife Trust;
- Site-specific Environmental Management Programme.

Residual impact	Enhancement of ecological processes

5.5 CUMULATIVE IMPACTS

The assessment of cumulative impacts considers the potential contribution of the proposed development to the combined effects of surrounding land-use, approved/proposed developments and associated impacts on ecological processes and the long-term persistence and viability of relevant animal SCC populations. The Screening Tool lists four solar photovoltaic developments approved within 30 km of the proposed site (Table 2).

TABLE 2 RENEWABLE ENERGY DEVELOPMENTS WITH AN APPROVED ENVIRONMENTAL AUTHORISATION OR APPLICATIONS UNDER CONSIDERATION WITHIN 30 KM OF THE PROPOSED AREA AS PER THE SCREENING TOOL

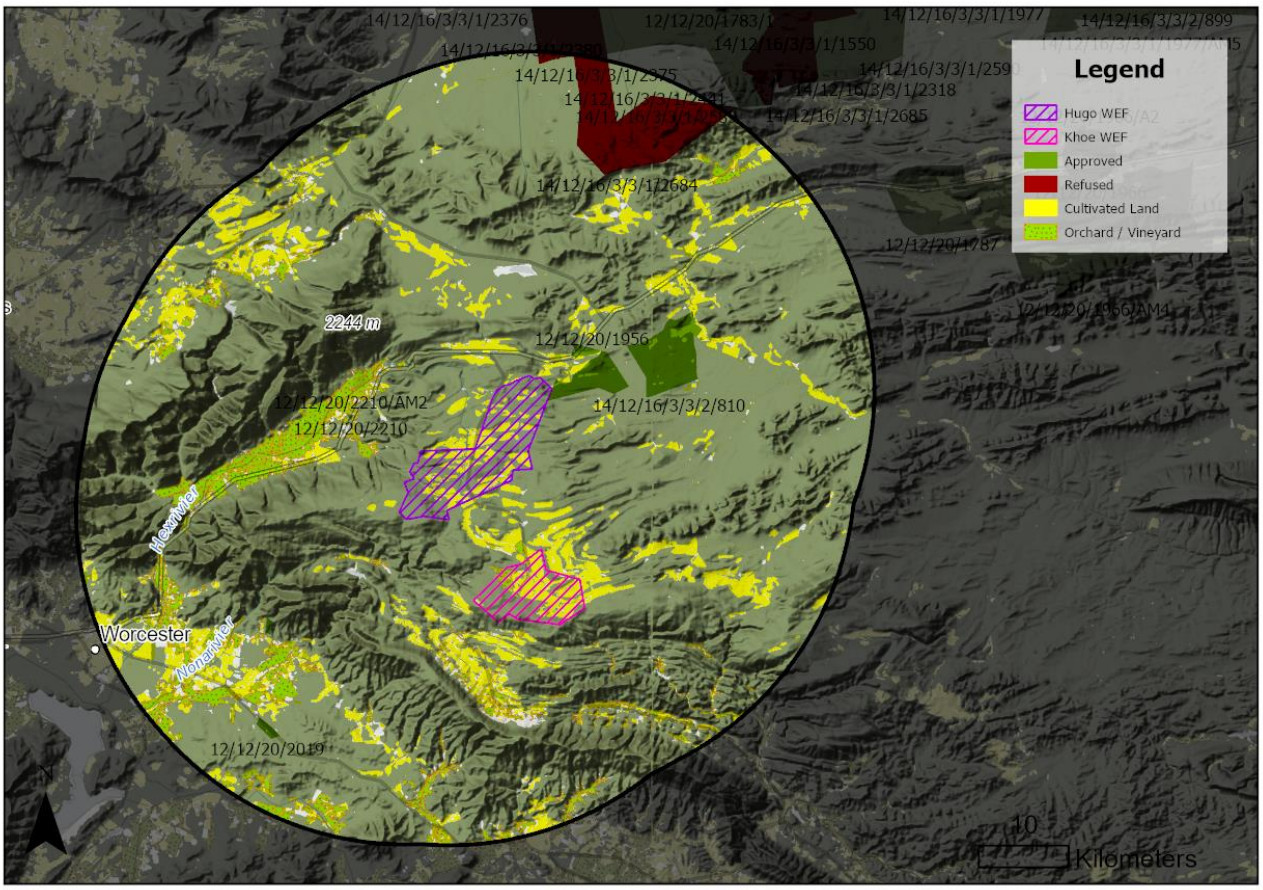
No.	EIA Reference No.	Classification	Status of application	Distance from proposed area (km)
1	12/12/20/2210	Solar PV	Approved	8.5
2	14/12/16/3/3/2/810	Solar PV	Approved	9.6
3	12/12/20/2019	Solar PV	Approved	27.4
4	12/12/20/1956	Solar PV	Approved	0

As the proposed Khoe WEF, located approximately 8 km to the south of the proposed Hugo WEF development, was assessed concurrently by the author, the potential impacts are well understood and the cumulative impacts were considered. The contributions of the proposed developments to cumulative impacts specific to Riverine Rabbit would likely be low as the total footprint within the preferred habitats of this species would be minimal relative to the extent of habitat available.

The existing extent of cultivated land, however, remains the most notable impact in the area for animals and restricts movement across the landscape. The proposed development introduces the potential to reduce some of the impacts to animal habitats imposed by vegetation clearing associated with agricultural activity and solar facilities. Agricultural activity and solar photovoltaic facilities generally require proportionally larger areas of habitat clearing compared to wind energy developments. The proposed development would not likely have a negative impact the long-term persistence or viability of local populations.

Provided appropriate mitigation measures are implemented to facilitate animal movement across the landscape, the proposed development is likely to improve ecological connectivity from the current condition.

FIGURE 7 RENEWABLE ENERGY APPLICATIONS AND LANDUSE WITHIN 30 KM OF THE PROPOSED DEVELOPMENT



Impact Phase: All					
Nature of the impact: Contribution of the proposed development to the cumulative impacts of landcover and land-use to the long-term persistence and viability of animal SCCs in the area					
Impact Status: Negative, Positive with mitigation					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Regional	Long term	Recoverable	High	Highly Probable
Score	3	4	3	4	4
With Mitigation	Regional	Long term	Recoverable	High	Probable
Score	3	4	3	4	3
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative (56)			Moderate Positive (42)	

Was public comment received?	No
Has public comment been included in mitigation measures?	No

Mitigation measures to reduce residual risk or enhance opportunities:

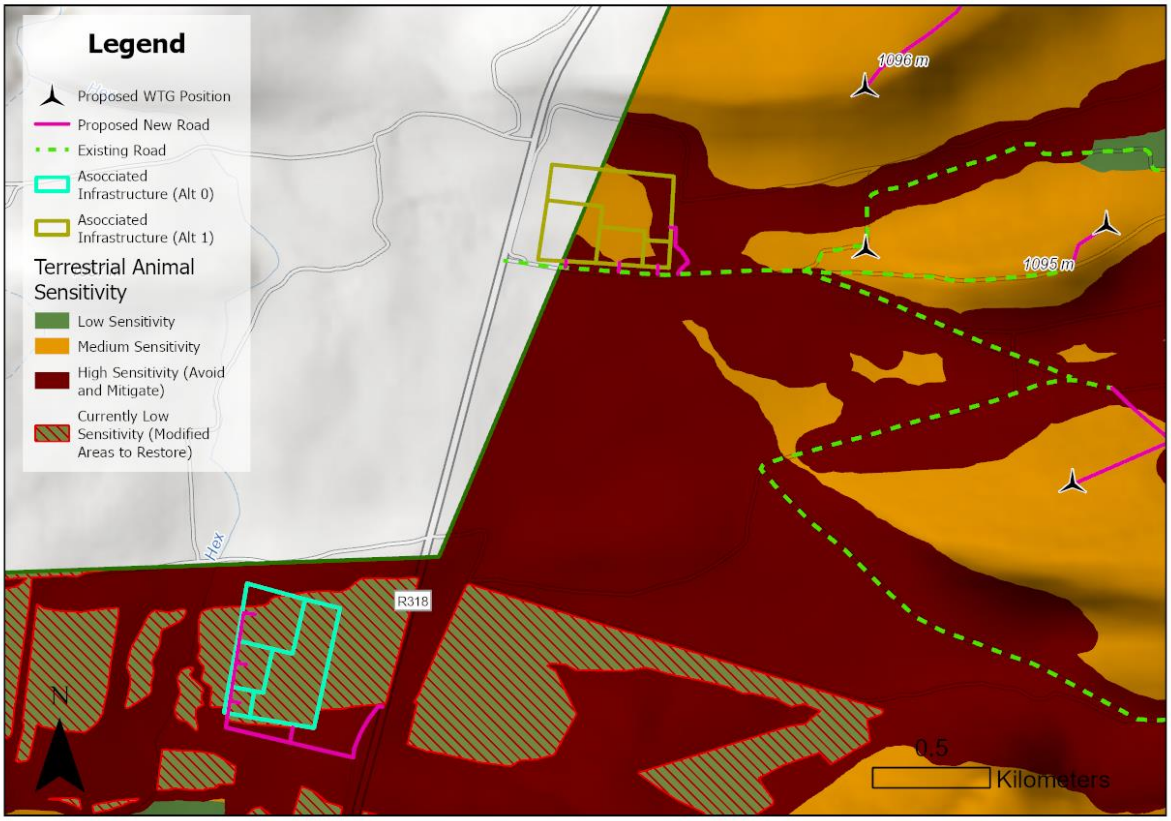
- Implement mitigation measures as detailed above

Residual impact	Improvement in habitat connectivity for relevant animal SCCs

5.6 ALTERNATIVE LAYOUT

The layout of the WTG placements was an iterative process informed by various site sensitivities and therefore no alternative layouts for those project components were assessed in this report. Two alternative layouts for the associated infrastructure were considered here (**Error! Reference source not found.**8). While Alternative 0 is positioned largely on land currently modified by agricultural activity and would have a negligible negative impact on animals compared to the status quo, it is recommended that these areas form part of the restoration and rehabilitation actions proposed by this study to improve ecological connectivity across the site. Alternative 1 is therefore the preferred position for the associated infrastructure from an animal perspective, as it is least likely to interfere with the rehabilitation potential and wildlife corridor improvement of the site.

FIGURE 8 ALTERNATIVE POSITIONS FOR THE PROPOSED INFRASTRUCTURE ASSOCIATED WITH THE WIND ENERGY FACILITY



5.7 NO-GO ALTERNATIVE

The 'No-Go' alternative considers that the proposed development is not constructed. Most of the potential impacts associated with the development itself and assessed above would therefore not be imposed on the faunal community of the receiving environment.

From an animal perspective, however, the proposed development presents an opportunity to afford some level of long-term protection for (and/or improvement of) the habitats present across the proposed development area. Protection and remediation of the site from activities less compatible with the persistence and rehabilitation of habitats/corridors (e.g., agricultural activity) is highly desirable given the animal SCCs concerned.

Furthermore, the 'No-Go' alternative reduces the opportunity to progress the de-carbonization transition of the economy and achieve various climate change mitigation targets outlined by (amongst others) the South Africa's Low Emission Development Strategy, The National Development Plan, The National Climate Change Response Policy, Integrated Resource Plan the National Climate Change Adaptation Strategy and ultimately South Africa's commitment to the Paris Agreement.

5.8 OPPORTUNITIES

Several key opportunities exist to improve the conservation of animal SCCs in the broader area. These opportunities become clear in the context of specific high-priority conservation objectives identified by the literature for the SCCs relevant to the study area, including:

- Riverine Rabbit

> ***"Successful conservation of Riverine Rabbit is contingent on reducing human transformation of their habitat and, importantly, protection of sufficient connectivity throughout the species' range"***
>
> – Matthee (et al. 2021)[14]

- Grey Rhebok

> ***"Assess subpopulation trends on private lands and establish long-term monitoring sites [...] Private landowner conservancies encouraged to reduce the edge effects of small areas of natural habitat and provide suitably large, open areas with adequate protection such that vulnerability to poaching is reduced"***
>
> – Taylor *et al.* (2016)[16]

- Leopard

> ***"Given the low leopard density and the prevalence of transformed land intermixed with patches of more suitable leopard habitat, prioritizing and preserving connectivity for leopards is vital in this shared landscape. Ecological corridors should be developed in partnership with private landowners through an inclusive and multifaceted conservation strategy which also incorporates monitoring of and rapid mitigation of emerging threats to leopards"***
>
> – Hinde *et al.* (2023)[18]

The proposed development, if conscientiously integrated with conservation objectives, can be a vehicle that drives meaningful biodiversity benefits. Agriculture in the semi-arid karoo drylands is characterized by a complex formula that determines production and profitability. The formula includes farm size, stocking density and the supplementation of natural grazing with feedstuffs[24] (amongst others), with profitability contingent on input costs. Supplementary feedstuffs inputs can be purchased or grown, with karoo drainage lines preferred by farmers for the production of short-rotation fodder crops (e.g., lucerne). Market fluctuations influence the management of these areas to maximize profitability. The proposed development therefore presents a land-use alternative more compatible with conservation objectives for privately owned land in the area than agricultural activities.

Large areas of the study area are currently heavily modified by agricultural activity. Movement corridors across the site and between remaining habitats are therefore obstructed. The proposed development presents an obvious opportunity to improve habitat connectivity for Riverine Rabbit, Grey Rhebok and Leopard through the restoration of key movement corridors.

[24] Conradie, B., & Piesse, J. 2015. Productivity benchmarking of free-range sheep operations for Laingsburg, South Africa. Agrekon, 54(2), 1–17.DOI: 10.1080/03031853.2015.1065186

Similarly, the proposed development area provides opportunity to significantly contribute to improving research on animal SCCs through the provision of resource opportunities and support thereof. The position of the proposed site (abutting the mountains to the north and west, and seemingly outside of Riverine Rabbit's core range) provides an ideal opportunity to better understand the potential impacts of renewable energy developments with reduced risk. This information will be critical in future impact assessments as these development proposals expand towards core areas.

6. IMPACT STATEMENT

It is the specialist's considered opinion, based on the above assessment, that the sum of the potential benefits outweigh the drawbacks, with the equation balance ***supporting the approval*** of the proposed development from an animal perspective.

However, this opinion is conditional on the implementation of all recommended mitigation measures, and explicit agreements being in place with the developer and landowners regarding the restoration and rehabilitation of strategic areas currently modified through agricultural activity.

7. SPECIALIST DETAILS

I, Dr Owen Rhys Davies (Pr. Sci. Nat. SACNASP 117555), have conducted sampling and surveys for biological research projects for 17 years, including survey design and various field sampling techniques for flora and fauna, including mammals, bats, reptiles, amphibians, freshwater fish, insects and birds. I obtained my post-graduate qualifications studying the effects of agricultural land-use on ecology at different scales and focused my doctoral thesis on molecular ecology and biogeography. As camera trap technology has improved over my 10 years of consulting experience, I have continued to refine Riverine Rabbit survey methods by incorporating new technologies with an increased understanding of their ecology, gained since first successfully targeting the species in 2016[25].

[25] https://www.inaturalist.org/observations/175268842

APPENDIX A SAMPLING SITE DESCRIPTIONS

Name	Habitat	Likelihood of SCC	Photo
HCT01 *-33.507524°* *19.798668°* 130 nights	Drainage line, undisturbed natural or near-natural renosterveld scrub.	Very High	
HCT02 *-33.483268°* *19.846300°* 130 nights	Drainage line, historically disturbed ground with natural or near-natural recolonization.	High	
HCT03 *-33.508126°* *19.844055°* 175 nights	Drainage line on border of modified cultivated land. Against fence with hole allowing animal passage.	Low	

Name	Habitat	Likelihood of SCC	Photo
HCT04 *-33.449802°* *19.865011°* 305 nights	Drainage line, overgrazed natural or near-natural vegetation on lose, sandy, flood deposited soils.	High	
HCT05 *-33.434748°* *19.896485°* 90 nights	Lowland natural vegetation approximately 50 m beyond drainage line.	Low	
HCT06 *-33.435942°* *19.893119°* 307 nights	Mid-slope drainage line with grazed natural vegetation, on looser soil associated with a 'heuweltjie'.	Low	
HCT07 *-33.458315°* *19.863407°* 260 nights	Drainage line with overgrazed natural renosterveld scrub.	Moderate	

Name	Habitat	Likelihood of SCC	Photo
HCT08 *-33.434402°* *19.861780°* 129 nights	Drainage line with natural or near natural renosterveld scrub.	High	
ODCT11 *-33.440071°* *19.890655°* 306 nights	Hilltop plateau near drainage line with natural or near-natural vegetation.	Low	

APPENDIX B IMPACT SIGNIFICANCE RATING SYSTEM

The purpose of the assessment of impacts in an EIA is to evaluate the likely extent and overall significance that a potential impact may have on an identified receptor or resource. Another important aspect of the assessment of impacts is to quantify those impacts that are not scientific-based or evidence-based and include the opinions of others (i.e., the involvement and comment from I&APs).

A successful assessment of the potential significance of impacts will include the description and development of measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

A 7-step approach for the determination of significance of potential impacts was developed by ERM to align with the requirements of Appendix 3 of the EIA Regulations, 2014 (as amended). The approach is both objective and scientific based to allow appointed specialists and EAPs to retain independence throughout the assessment process.

ERM has adapted this 7-step approach from standard ranking metrics such as the Hacking Method[26]. The ERM 7-step approach complies with the method provided in the EIA guideline document (GN 654 of 2010) and considers international EIA Regulatory reporting standards such as the newly amended European Environmental Impact Assessment (EIA) Directive (2014/52/EU).

The 7-Step approach for determining the significance of impacts pre, and post mitigation, is described below:

- Step 1: Predict potential impacts by means of an appraisal of:
    - Site Surveys,
    - Project-related components and infrastructure,
    - Activities related with the project life-cycle,
    - The nature and profile of the receiving environment and potential sensitive environmental features and attributes,
    - Input received during public participation from all stakeholders, and
    - The relevant legal framework applicable to the proposed development
- Step 2: Determination of whether the potential impacts identified in Step 1 will be direct (caused by construction, operation, decommissioning or maintenance activities on the proposed development site or immediate surroundings of the site), indirect (not immediately observable or do not occur on the proposed development site or immediate

[26] Hacking, T. 2001. An innovative approach to structuring environmental impact assessment reports; Part 2: Ranking the significance of environmental aspects and impacts. 19. 56-59.

surroundings of the site), residual (those impacts which remain after post mitigation) and cumulative (the combined impact of the project when considered in conjunction with similar projects in proximity).

- Step 3: Description and determination of the significance of the predicted impacts in terms of the criteria below to ensure a consistent and systematic basis for the decision-making process. Significance is numerically quantified on the basis score of the following impact parameters:
  - Extent (E) of the impact: The geographical extent of the impact on a given environmental receptor.
  - Duration (D) of the impact: The length of permanence of the impact on the environmental receptor.
  - Reversibility (R) of the impact: The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change
  - Magnitude (M) of the impact: The degree of alteration of the affected environmental receptor.
  - Probability (P) of the impact: The likelihood of the impact actually occurring.

A widely accepted numerical quantification of significance is the formula:

S=(E+D+R+M)*P

Where: Significance=(Extent+Duration+Reversibility+Magnitude) * Probability

The following has also been considered when determining the significance of a potential impact:

- Nature (N) of the impact: A description of what causes the effect, what will be affected, and how it will be affected.
- Status (S) of the impact: described as either positive, negative or neutral
- Cumulative impacts.
- Inclusion of Public comment.

The significance of environmental impacts is determined and ranked by considering the criteria presented in the Table below. All criteria are rank according to 'Very Low', 'Low', 'Moderate', 'High' and 'Very High' and are assigned scores of 1 to 5 respectively.

Impact Criteria	Definition	Score	Criteria Description
Extent (E)	Site	1	Impact is on the site only
	Local	2	Impact is localized inside the activity area
	Regional	3	Impact is localized outside the activity area
	National	4	Widespread impact beyond site boundary. May be defined in various ways, e.g. cadastral, catchment, topographic

Impact Criteria	Definition	Score	Criteria Description
	International	5	Impact widespread far beyond site boundary. Nationally or beyond
Duration (D)	Immediate	1	On impact only
	Short term	2	Quickly reversible, less than project life. Usually up to 5 years.
	Medium term	3	Reversible over time. Usually between 5 and 15 years.
	Long term	4	Longer than 10 years. Usually for the project life.
	Permanent	5	Indefinite
Magnitude (M)	Very Low	1	No impact on processes
	Low	2	Qualitative: Minor deterioration, nuisance or irritation, minor change in species/habitat/diversity or resource, no or very little quality deterioration. Quantitative: No measurable change; Recommended level will never be exceeded.
	Moderate	3	Qualitative: Moderate deterioration, discomfort, Partial loss of habitat /biodiversity /resource or slight or alteration. Quantitative: Measurable deterioration; Recommended level will occasionally be exceeded.
	High	4	Qualitative: Substantial deterioration death, illness or injury, loss of habitat /diversity or resource, severe alteration or disturbance of important processes. Quantitative: Measurable deterioration; Recommended level will often be exceeded (e.g. pollution)
	Very High	5	Permanent cessation of processes
Reversibility (R)	Reversible	1	Recovery which does not require rehabilitation and/or mitigation.
	Recoverable	3	Recovery which does require rehabilitation and/or mitigation.
	Irreversible	5	Not possible, despite action. The impact will still persist, and no mitigation will remedy or reverse the impact.
Probability (P)	Improbable	1	Not likely at all. No known risk or vulnerability to natural or induced hazards
	Low Probability	2	Unlikely; low likelihood; Seldom; low risk or vulnerability to natural or induced hazards
	Probable	3	Possible, distinct possibility, frequent; medium risk or vulnerability to natural or induced hazards.
	Highly Probable	4	Highly likely that there will be a continuous impact. High risk or vulnerability to natural or induced hazards

Impact Criteria	Definition	Score	Criteria Description
	Definite	5	Definite, regardless of prevention measures.

The significance (s) of potential impacts identified according to the criteria above has been colour coded for the purpose of comparison. This colour coding will be used in impact tables.

Significance is deemed Negative (-)			Significance is deemed Positive (+)		
0 - 30	31 - 60	61 - 100	0 - 30	31 - 60	61 - 100
Low	Moderate	High	Low	Moderate	High

- Step 4: Determination of practical and reasonable mitigation measures based on specialists' inputs and field observations following the mitigation hierarchy (avoid, minimise, manage, mitigate, or rehabilitate).
- Step 5: Evaluation of predicted residual impacts after implementation of mitigation measures.
- Step 6: Determination of the significance of the impact taking into consideration the predicted residual impacts after implementation of mitigation measures.
- Step 7: Based on an acceptable significance of the impact, determination of the need and desirability of the proposed development and an opinion as to whether the development should proceed or not.

The Assessment of the significance of potential impacts is then populated in an Impact Summary Table.

APPENDIX C CAMERA TRAP SURVEY RESULTS

FIGURE C-1 CAMERA TRAP OPERATION OVERVIEW, SHOWING FUNCTIONING PERIODS AND ANIMAL RECORDS (RED)

FIGURE C-2 DISTRIBUTION OF CAMERA TRAP DETECTION RECORDS PER SPECIES ACROSS THE HOURS OF THE DAY, OVERLAYED WITH A ROUGH VISUALIZATION OF DAYLIGHT HOURS (YELLOW BLUR) TO HIGHLIGHT DIURNAL AND NOCTURNAL ACTIVITY

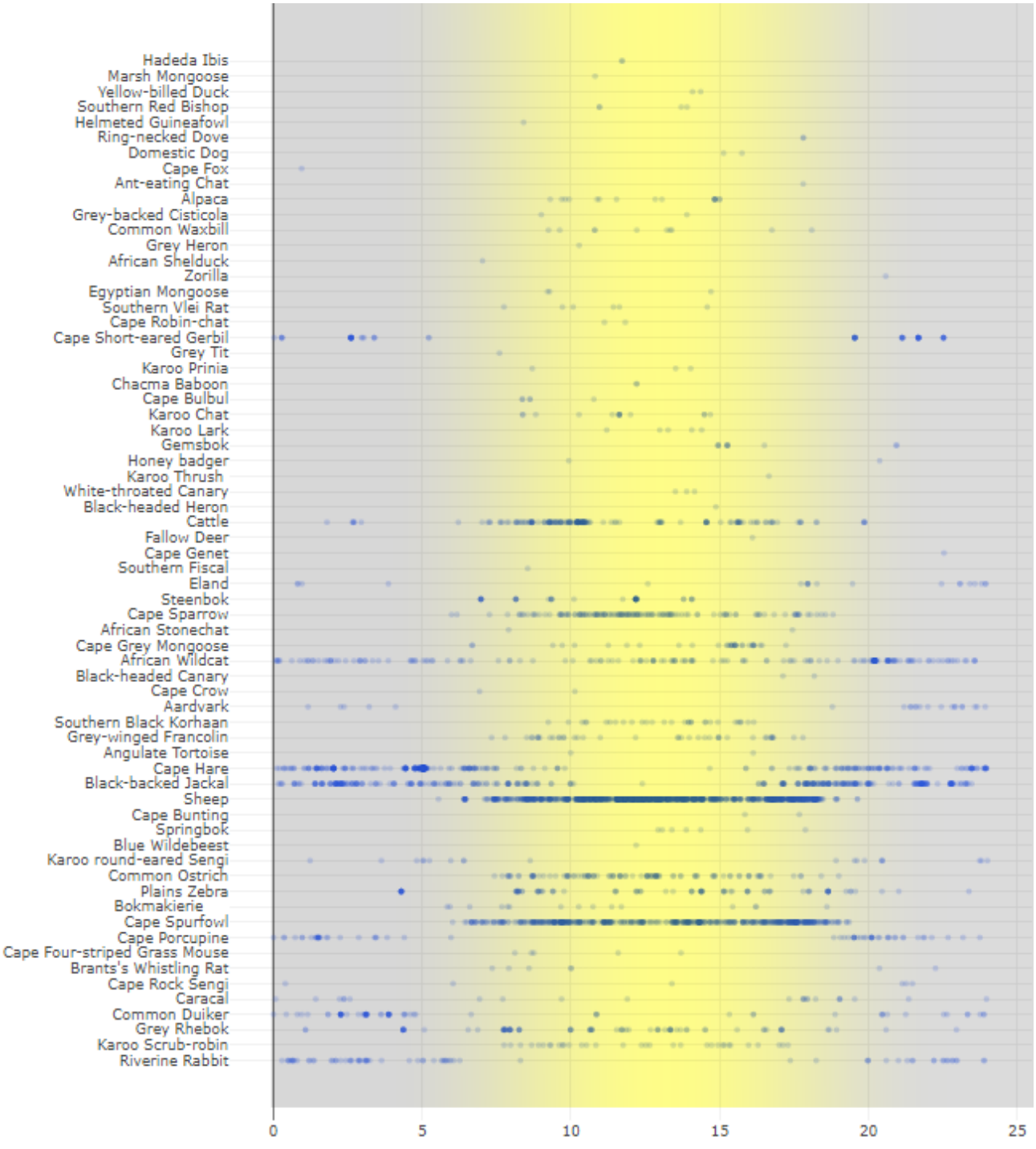


FIGURE C-3 NUMBER OF INDEPENDENT CAPTURES PER SPECIES (BLUE) AND OCCUPANCY ESTIMATES (ORANGE)

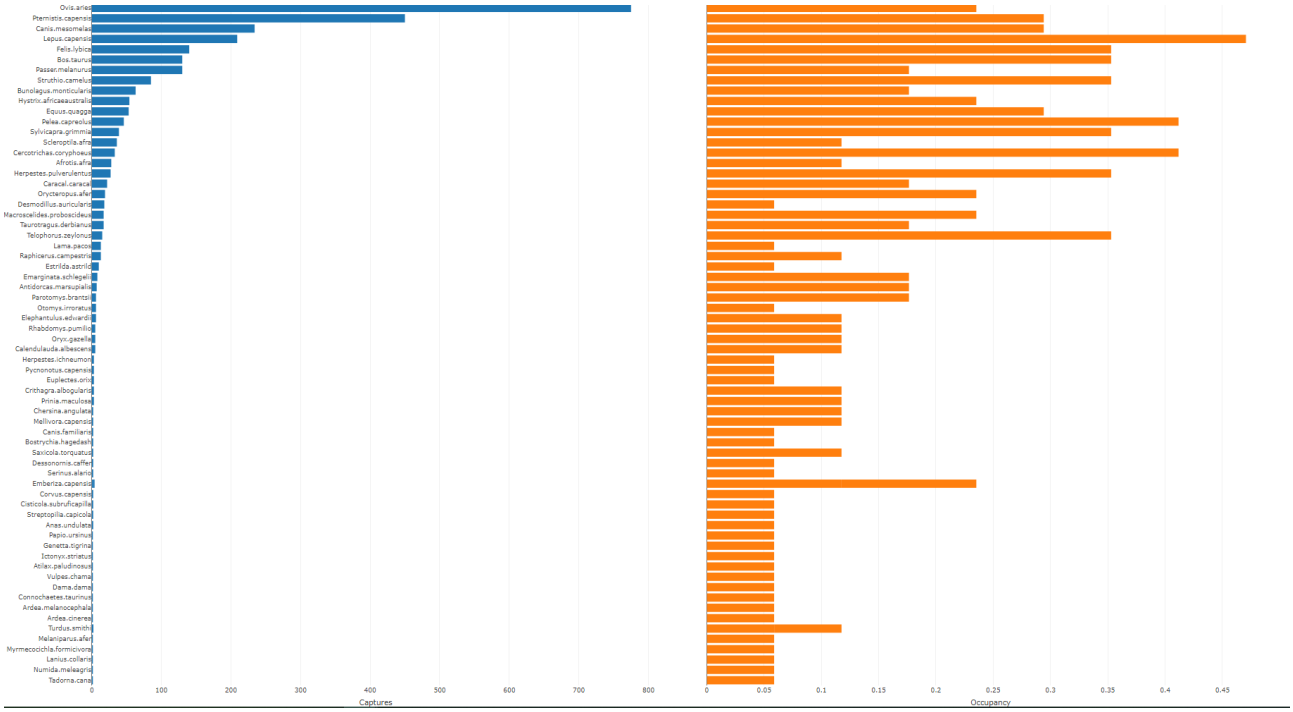


FIGURE C-4 CORRELATIONS BETWEEN RIVERINE RABBIT DETECTION LOCALITIES AND DISTANCE TO THE NEAREST ROADWAY (LEFT) AND MEAN NDVI VALUES (RIGHT)

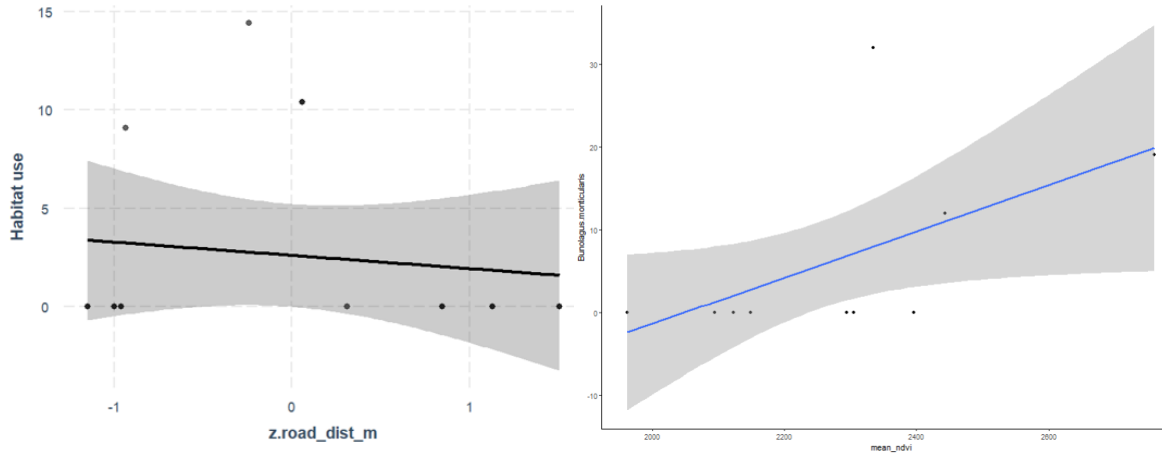


FIGURE C-5 RIVERINE RABBIT DETECTIONS PER HABITAT TYPE, INDICATING THE USE OF BOTH NATURAL/NEAR-NATURAL AREAS AND AREAS THAT HAVE RECOVERED FROM PREVIOUS AGRICULTURAL MODIFICATION

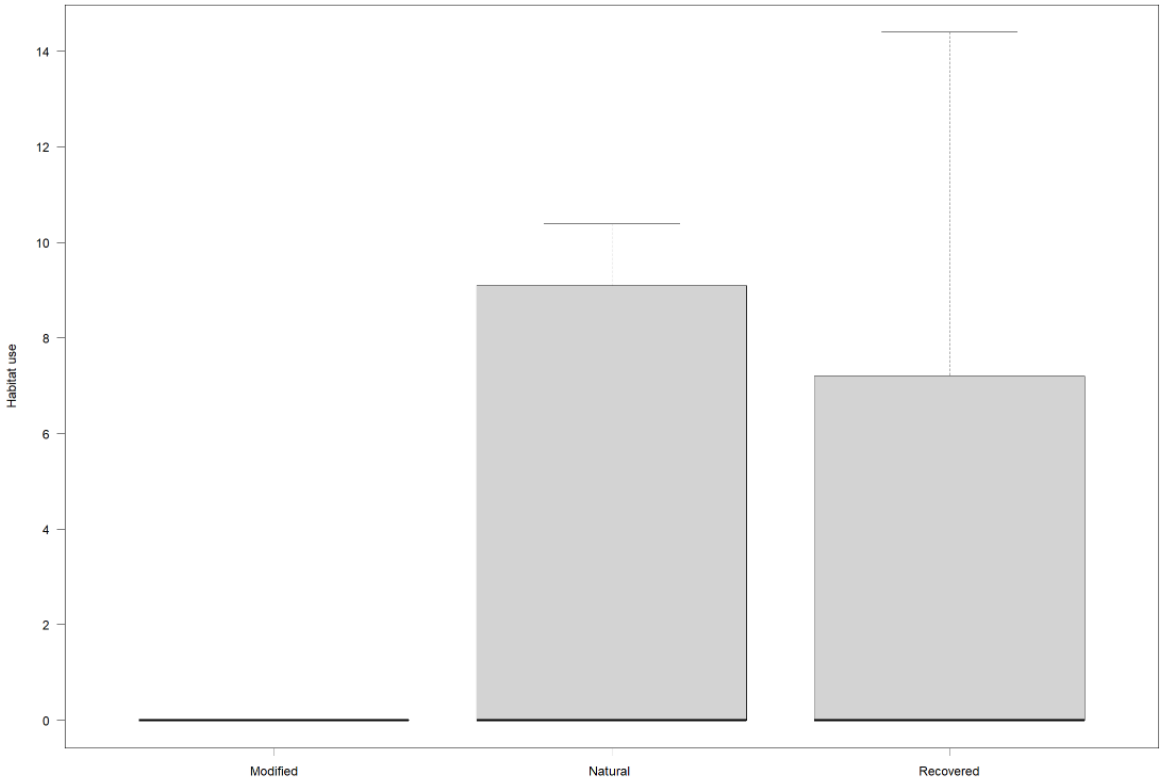


TABLE C-1 AVERAGE NUMBER OF DAYS PER INDEPENDENT DETECTION PER SPECIES ACROSS ALL SAMPLING LOCATIONS (E.G. *AFROTIS AFRA* WERE RECORDED ON AVERAGE EVERY 7 DAYS AT HCT03)

Species	HCT01	HCT02	HCT03	HCT04	HCT05	HCT06	HCT07	HCT08	KCT09	KCT10
Afrotis afra	0.0	0.0	7.0	101.7	0.0	0.0	0.0	0.0	0.0	0.0
Anas undulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
Antidorcas marsupialis	0.0	130.0	0.0	152.5	0.0	0.0	65.0	0.0	0.0	0.0
Ardea cinerea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0	0.0
Ardea melanocephala	0.0	0.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atilax paludinosus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0
Bos taurus	0.0	0.0	14.6	3.2	45.0	0.0	16.3	43.0	153.0	0.0
Bostrychia hagedash	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0

Species	HCT01	HCT02	HCT03	HCT04	HCT05	HCT06	HCT07	HCT08	KCT09	KCT10
Bunolagus monticularis	10.8	6.8	0.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0
Calendulauda albescens	0.0	0.0	0.0	0.0	0.0	153.5	0.0	43.0	0.0	0.0
Canis familiaris	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
Canis mesomelas	0.0	0.0	25.0	1.5	0.0	0.0	260.0	0.0	102.0	18.0
Caracal caracal	130.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	306.0	0.0
Cercotrichas coryphoeus	26.0	130.0	58.3	152.5	0.0	0.0	0.0	64.5	17.0	153.0
Chersina angulata	0.0	0.0	175.0	0.0	0.0	307.0	0.0	0.0	0.0	0.0
Cisticola subruficapilla	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
Connochaetes taurinus	0.0	130.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corvus capensis	0.0	0.0	87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crithagra albogularis	0.0	0.0	87.5	0.0	0.0	0.0	0.0	0.0	0.0	306.0
Dama dama	0.0	0.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desmodillus auricularis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0
Dessonornis caffer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0	0.0
Elephantulus edwardii	43.3	0.0	58.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emarginata schlegelii	0.0	0.0	0.0	0.0	0.0	61.4	260.0	64.5	0.0	0.0
Emberiza capensis	0.0	130.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equus quagga	0.0	26.0	0.0	10.9	6.9	307.0	0.0	21.5	0.0	0.0
Estrilda astrild	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.6
Euplectes orix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0
Felis lybica	0.0	0.0	43.8	76.3	0.0	19.2	0.0	129.0	4.9	5.9
Genetta tigrina	0.0	0.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Herpestes ichneumon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0	0.0
Herpestes pulverulentus	0.0	0.0	43.8	101.7	0.0	20.5	260.0	0.0	306.0	102.0
Hystrix africaeaustralis	130.0	0.0	6.0	23.5	0.0	0.0	0.0	0.0	0.0	27.8
Ictonyx striatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0	0.0
Lama pacos	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.5
Lanius collaris	0.0	0.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepus capensis	0.0	0.0	1.9	11.7	45.0	7.1	32.5	6.1	153.0	20.4
Macroscelides proboscideus	0.0	26.0	87.5	0.0	0.0	102.3	0.0	18.4	0.0	0.0
Melaniparus afer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.0	0.0	0.0

Species	HCT01	HCT02	HCT03	HCT04	HCT05	HCT06	HCT07	HCT08	KCT09	KCT10
Mellivora capensis	0.0	0.0	0.0	305.0	0.0	307.0	0.0	0.0	0.0	0.0
Myrmecocichla formicivora	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0
Numida meleagris	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0
Orycteropus afer	0.0	0.0	15.9	76.3	0.0	102.3	0.0	0.0	306.0	0.0
Oryx gazella	0.0	0.0	0.0	0.0	90.0	76.8	0.0	0.0	0.0	0.0
Otomys irroratus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	0.0
Ovis aries	0.0	0.0	25.0	0.0	0.0	0.0	52.0	0.0	1.1	0.6
Papio ursinus	0.0	0.0	0.0	0.0	0.0	307.0	0.0	0.0	0.0	0.0
Parotomys brantsii	130.0	0.0	87.5	0.0	0.0	102.3	0.0	0.0	0.0	0.0
Passer melanurus	0.0	0.0	35.0	0.0	0.0	0.0	0.0	0.0	30.6	2.7
Pelea capreolus	21.7	65.0	25.0	0.0	22.5	21.9	0.0	0.0	61.2	38.3
Prinia maculosa	0.0	0.0	0.0	0.0	0.0	0.0	260.0	0.0	153.0	0.0
Pternistis capensis	65.0	0.0	1.4	27.7	0.0	0.0	0.0	0.0	102.0	1.0
Pycnonotus capensis	0.0	0.0	0.0	0.0	0.0	102.3	0.0	0.0	0.0	0.0
Raphicerus campestris	0.0	0.0	175.0	0.0	0.0	25.6	0.0	0.0	0.0	0.0
Rhabdomys pumilio	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.0	0.0
Saxicola torquatus	0.0	0.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0
Scleroptila afra	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	76.5
Serinus alario	0.0	0.0	87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Streptopilia capicola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.0
Struthio camelus	0.0	65.0	0.0	4.3	45.0	153.5	65.0	32.3	0.0	0.0
Sylvicapra grimmia	65.0	0.0	58.3	13.9	15.0	76.8	0.0	0.0	153.0	0.0
Tadorna cana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0	0.0
Taurotragus derbianus	0.0	0.0	19.4	43.6	0.0	0.0	0.0	129.0	0.0	0.0
Telophorus zeylonus	0.0	43.3	58.3	0.0	45.0	307.0	0.0	0.0	61.2	306.0
Turdus smithi	0.0	0.0	0.0	305.0	0.0	0.0	0.0	0.0	0.0	0.0
Vulpes chama	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.0

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