FAUNA & FLORA SPECIALIST STUDY
EIA PHASE IMPACT ASSESSMENT REPORT

Impact Assessment for the Proposed Paulputs Wind Energy Facility and Associated Grid Connection Infrastructure near Pofadder, Northern Cape Province.

Report prepared for:

Arcus Consulting (Pty) Ltd

Report prepared by:

3Foxes Biodiversity Solutions[

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Glencairn
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Draft 2.0

i. EXECUTIVE SUMMARY

Paulputs Wind Energy Facility (RF) (Pty) Ltd is proposing to develop a 300 MW wind farm consisting of up to 75 turbines near Pofadder in the Northern Cape Province. A grid connection, comprising a 132kV transmission power line up to 25 km long, will be constructed to connect the wind farm to the Eskom Grid. Paulputs Wind Energy Facility (RF) (Pty) Ltd has appointed Arcus Consultancy Services South Africa (Pty) Ltd to undertake the required application for environmental authorisation process for the wind farm development. The development is currently in the EIA Phase and Arcus has appointed 3Foxes Biodiversity Solutions to conduct a specialist terrestrial ecology EIA study of the development site as part of the required EA application.

This ecological specialist EIA study details the ecological characteristics of the site and provides an assessment of the likely ecological impacts associated with the development of the Paulputs WEF and associated grid connection. Several site visits with associated field assessments as well as a desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map which has been used to guide development at the site as well as set limits of acceptable change associated with the development.

The whole Paulputs WEF site is located within the Bushmanland Arid Grassland vegetation type, which is an extensive vegetation type considered to be generally low sensitivity. The resolution of national vegetation map is however coarse and there are several different vegetation communities and habitats present in the area which have not been mapped. In order to address this shortcoming a more detailed habitat map for the site was developed based on the results of the field assessment. Of particular relevance is the presence of numerous washes (i.e. minor ephemeral drainage areas) as well as several rocky outcrops which are considered sensitive and largely unsuitable for development. The abundance of listed fauna in the area is low and there while there are some habitats present that are considered to be of high faunal value, these occupy a small proportion of the site. Under the final layout assessed, there would not be a direct impact on the rocky outcrops and other high-value ecosystems, and there are no turbines within the washes. In terms of the limits of acceptable change within the different sensitivity categories provided for the development, the final development footprint is well within these limits and as such no limits of acceptable change have been exceeded by the development.

A part of the site is located within a CBA 1, which raises the suitability of development within this part of the site into question. Correspondence with Northern Cape Department of Nature Conservation (DENC) indicates that this area has been identified as a CBA based on the presence of *Aloidendron dichotomum* within the site. This species was confirmed present at the site at a low density, both within and outside of the area demarcated as a CBA. With the appropriate avoidance, direct impact on this species can be well-mitigated. Although the development would result in some habitat loss across the site, this is not likely to affect the local population of *Aloidendron dichotomum*. A more direct threat

would likely be poaching and harvesting of young trees by construction or operational phase personnel on the site. Specific mitigation should be implemented during construction and operation to reduce this risk, including setting up and implementing a long-term population monitoring programme within the site for this species. The final development footprint within the CBA is estimated at 15ha which is within the recommended 20ha footprint limit provided to the developer for this area and as such is considered acceptable.

Impact Statement – Paulputs WEF Development

The footprint of the Paulputs WEF is located within typical, low-sensitivity habitat with a low abundance of species of conservation concern. The post-mitigation impacts associated with the development would be of low significance. The contribution of the Paulputs WEF to cumulative impact in the area would be low and is considered acceptable. Overall, there are no specific long-term impacts likely to be associated with the development of the Paulputs WEF that cannot be reduced to a acceptable significance and no limits of acceptable change were exceeded by the development. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

Impact Statement – Grid Connection

The Paulputs WEF grid connection options are acceptable and would generate low post-mitigation impacts on fauna and flora. There are no specific long-term impacts likely to be associated with the development of the Paulputs WEF Grid Connections that cannot be reduced to a low significance. The contribution of the power line and substation components to cumulative impact in the area would be low and is considered acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

ii. CONTENTS

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iii. 2014 EIA Checklist:

Requirements of Appendix 6 – GN R326 of NEMA EIA Regulations as amend (7 April 2017)	Please indicate where it is addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pg 6
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	See Attached
c) an indication of the scope of, and the purpose for which, the report was prepared; (ca) an indication of the quality and age of base data used for the specialist report; (cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6 Section 7 Section 8
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 7
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 8
g) an identification of any areas to be avoided, including buffers;	Section 8.6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 8.6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 11/12
k) any mitigation measures for inclusion in the EMPr;	Section 11/12
l) any conditions for inclusion in the environmental authorisation;	Section 14
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11/12
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (ia) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 14
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

iv. Short CV/Summary of Expertise – Simon Todd

Simon Todd Pr.Sci.Nat
Director & Principle Scientist
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Glencairn
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Ecological Solutions for People & the Environment

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. 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 of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

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.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Paulputs 300MW PV Project and Grid Connection. Fauna & Flora Specialist Assessment. Gaea Environmental 2018.
- Proposed PV Facility on Konkoonsies – Fauna and Flora Specialist Assessment. EScience Associates 2012.
- Biotherm Energy – Konkoonsies II Solar Facility: Fauna and Flora Preconstruction Walk-Through Study. Savannah Environmental 2015.
- Proposed Konkoonsies II Solar On-Site Substation and Konkoonsies II to Paulputs MTS Power Line: Fauna & Flora Specialist Report For Basic Assessment. Savannah Environmental 2015.
- Specialist Vegetation Assessment, Konkoonsies. Limarco 77 (PTY) LTD. 2012.
- Proposed Southern Cross Solar Energy Facility: Southern Farm 425. Fauna & Flora Specialist Report. Savannah Environmental 2012.
- Proposed Tutwa Solar Energy Facility: Portion 4 of Narries 7. Fauna & Flora Specialist Report. Savannah Environmental 2012.
- Proposed Khoi-Sun Solar Facility - Fauna & Flora Specialist Report For Impact Assessment, Cape Eaprac 2012.

v. LIST OF ABBREVIATIONS

CBA	Critical Biodiversity Area
ESA	Ecological Support Area
IUCN	International Union for Conservation of Nature
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National protected area expansion strategy
SANBI	South African National Biodiversity Institute
SCC	Species of conservation concern

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Paulputs Wind Energy Facility and associated Grid Connection

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	3Foxes Biodiversity Solutions			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	100%
Specialist name:	Simon Todd			
Specialist Qualifications:	BSc (Zool. & Bot.) BSc Hons (Zool.) MSc (Cons. Biol.)			
Professional affiliation/registration:	SACNASP Pr.Sci.Nat 400425/11			
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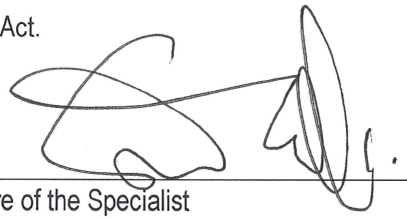
Postal code:	7975	Cell:	0823326502	
Telephone:		Fax:		
E-mail:	Simon.Todd@3foxes.co.za			

2. DECLARATION BY THE SPECIALIST

I, _____Simon Todd_____, declare that –

- I act as the independent specialist in this application;
- I will 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;
- 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 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;
- all the particulars furnished by me in this form 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

3Foxes Biodiversity Solutions

Name of Company:

12/07/2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _____Simon Todd_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

3Foxes Biodiversity Solutions

Name of Company

12/07/2019

Date

I certify that the DEPONENT has acknowledged that he/she knows and understands the contents of this affidavit, that he/she does not have an objection to taking the oath and that he/she considers it to be binding on his/her conscience, and which was sworn to and signed before me and that the administering oath complied with the regulations contained in Government Gazette No. R 1258 of 21 July 1972, as amended.

Signature of the Commissioner of Oaths

BRANCH MANAGER
Post Office
12 JUL 2019
VISHOEK 7974

SIGNATURE — FULL NAMES: DOMINIQUE GOUWS

Commissioner of Oaths

Designation: BRANCH MANAGER ex officio: Republic of South Africa

Date: 2019-07-12

Date

Place: Vishoek MAN Rd Vishoek

Business Address:

1. INTRODUCTION

1.1. *Scope and Objectives*

Paulputs Wind Energy Facility (RF) (Pty) Ltd is proposing to develop a 300 MW wind farm near Pofadder in the Northern Cape Province. The development would consist of up to 75 wind turbines of between 3-6 MW each, with a maximum total capacity of 300MW. A 132kV transmission power line approximately 15-25 km long, would also be constructed to connect the wind farm to the Eskom 220/132kV Paulputs MTS or the existing 132 kV overhead powerline. Paulputs Wind Energy Facility has appointed Arcus Consulting (Pty) Ltd to undertake the required application for environmental authorisation process for the wind farm development. The development is currently in the EIA Phase and Arcus has appointed 3Foxes Biodiversity Solutions to conduct a specialist terrestrial ecology scoping study of the development site as part of the required EA applications.

The purpose of the Paulputs Wind Farm Terrestrial Ecology EIA Report is to describe and detail the ecological features of the proposed project site, provide an assessment of the ecological sensitivity of the site and identify the likely impacts associated with the development of the site as a wind energy facility with grid connection. A site visit as well as a desktop review of the available ecological information for the area were conducted in order to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map which should be used to inform the layout of the development. The information and sensitivity map presented here provides an ecological baseline that can be used in the planning phase of the development to ensure that the potential negative ecological impacts associated with the development can be minimised. The full scope of study is detailed below.

1.2. *Terms of Reference*

The scope of the study includes the following activities

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

- the nature of the impact, which shall include a description of what causes the effect, what will be affected, and how it will be affected
- the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
- the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity), or permanent
- the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (Impact will occur regardless of any preventable measures)
- the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight, or have no effect
- the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
- the status which will be described as either positive, negative or neutral
- the degree to which the impact can be reversed
- the degree to which the impact may cause irreplaceable loss of resources
- the degree to which the impact can be mitigated

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

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.

- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for faunal related issues.

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

- Preconstruction
- Construction
- Operational Phase

1.3. *Relevant Aspects of the Development*

The Project Applicant, Paulputs Wind Energy Facility (RF) (Pty) Ltd is proposing to develop a 300 MW wind energy facility on several properties east of Pofadder in the Northern Cape Province. The total extent of site is 11 813 ha. A maximum of 75 turbine positions will be built if a 3 MW turbine is to be used, and fewer turbines will be required with larger machines to achieve the desired total output. The on-site substation will cover approximately 4 hectares (three alternative locations will be considered, and because EA is sought for all three, a worst case ~12 ha for all three sites has been assessed). A 132kV transmission power line between 15-25 km long, will be constructed to connect the development to the Eskom 220/132kV Paulputs MTS Substation (currently proposed for upgrade to 400/132kV) or the existing 132 kV overhead powerline.

The development will consist of the following:

- Up to 75 wind turbines with a maximum hub height of up to 140m and maximum rotor diameter of 180m. The tip height of the turbines will be up to 230m;
- Concrete turbine foundations and turbine hardstands. It is assumed that for each turbine, the turbine base and crane pad will cover a maximum of 0.8 hectares each, multiplied by a maximum of 75 turbines = 60 hectares.
- The area to be covered by road infrastructure is estimated at 80 km of roads at 6-12 m wide (including drainage/construction), giving rise to a total road footprint of approximately 64 hectares.
- Cabling between the turbines, to be laid underground where practical;
- Substation, offices and laydown areas = approximately 12 hectares.
- Based on the footprints provided the total footprint of the development is calculated at approximately 219 ha.
- An overhead 132kV power line (assessed as a 300m power line corridor), with a servitude of 32m, to connect the wind farm to the existing Paulputs Substation or directly to the Eskom 132kV line approximately 5km north of the site. Four options are included in the assessment:
    1. OHPL Connecting Substation Options A, B, C
    2. OHPL Option A - Direct to Paulputs SS
    3. OHPL Option B - Via Collector Substation

4. OHPL Option C - Connect to Eskom 132kV

2. APPROACH AND METHODOLOGY

2.1. *Assessment Philosophy & Rationale*

This assessment is conducted according to the 2017 EIA Regulations (Government Notice Regulation 326) in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005). This includes adherence to the following broad principles:

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

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

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

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

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

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

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

Community and ecosystem level

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

Species level

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

Fauna

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

Other pattern issues

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

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

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

2.2. *Source of Information*

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

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina & Rutherford 2006 and 2012 Powrie update) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant species recorded for the broad area around the site was extracted from the SANBI POSA database hosted by SANBI. The species list was derived from a considerably larger area than the study site, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself or the immediate area has not been well sampled in the past.
- The 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 (2018).

Ecosystem

- Critical Biodiversity Areas (CBAs) were extracted from the Northern Cape Critical Biodiversity Areas Map (Oosthuysen & Holness 2016).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA) (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and Animal Demography Unit (ADU) Virtual Museum spatial database (http://vmus.adu.org.za/).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Apart from the literature sources, additional information on fauna was extracted from the ADU web portal http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of 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 (2018).

2.3. *Site Visit & Field Assessment*

A preliminary site visit occurred over two days on the 9th-11th of November 2018. The information collected on this field assessment was used to inform the scoping phase and the initial sensitivity mapping and layout of the development. Follow-up EIA-phase site visits took place on the 24th of February 2019 as well as the 5th and 6th of April 2019 as well as the 1st and 2nd of June 2019. During the site visits, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site such as rocky outcrops and quartz patches were also marked for field inspection and were verified and assessed during the site visits. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded. Additional information on faunal presence at the site was collected through searching for reptiles within areas likely to harbour reptiles as well as through casual observation of fauna at the site while conducting the other field work. A total of 13 camera traps were also put out across the site during the initial site visit and were retrieved during the final site visit. This information is used to better inform the study in terms of the faunal community present on the site and potential areas of significance for larger vertebrates. Numerous site visits have also been conducted to the adjacent properties around the Paulputs substation and information from this area is also used to inform the current study where appropriate.

2.4. *Sensitivity Mapping & Assessment*

An ecological sensitivity map of the site was produced by integrating the results of the site visit with the available ecological and biodiversity information in the literature and various spatial databases as described above. As a starting point, mapped sensitive features such as wetlands, drainage lines, rocky

hills and pans were collated and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then identified from the satellite imagery of the site and delineated. All the different layers created were then merged to create a single coverage. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the scale as indicated below.

Limits of acceptable change are also indicated below and refer to the extent of on-site habitat loss within each sensitivity category that is considered acceptable before significant ecological impact that is difficult to mitigate and which may compromise the development is likely to occur. This provides a guide for the developer in terms of ensuring that the spatial distribution of impact associated with a layout is appropriate with respect to the sensitivity of the site. In addition, it provides a benchmark against which impacts can be assessed and represents an explicit threshold that when exceeded indicates that potentially unacceptable impacts may have occurred. In terms of this latter criterion, exceeding the limits of acceptable change for either High or Very High sensitivity areas is considered to represent an immediate fatal flaw, while the limits within either Low or Medium sensitivity areas could potentially be exceeded, provided that the total footprint in these two areas combined does not exceed the overall combined acceptable loss within these classes. However, in the latter case, this would raise significant concern regarding the suitability of the development and the exact spatial configuration of the development and the likely impacts on ecological processes would need to be considered.

Sensitivity	Acceptable Loss	Description
Low	5%	Units with a low sensitivity where there is likely to be a low impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures.
Medium	2%	Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impacts such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
High	1%	Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
Very High/No-Go	Zero Loss	Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible. Where these features need to be traversed, existing roads or disturbance footprints should be used.

2.5. *Assumptions and Limitations*

The current study consists of a detailed field assessment conducted across several site visits as well as a desktop study, which serves to significantly reduce the limitations and assumptions required for the study. In addition, the adjacent farms around the Paulputs Substation have been previously assessed by the consultant for several different projects, with the result that area is well known and has been sampled at different times of the year over a period of several years. For the current assessment, sampling took place in the wet season, but conditions were still relatively dry during each of the site visits and the majority of vegetation across the site was relatively dry and in a dormant state. As a result, some plant species were not visible at the time and only the lists of the perennial species are considered reliable. While this poses some limitations for the study, the different habitats present could still be easily discerned based on the vegetation present and this is not likely to significantly affect the sensitivity mapping of the site or the characterisation of the plant communities present. As, while there are a variety of annuals and geophytes present in the area, these are almost all common and widespread species and the species of concern that may be present are either larger perennials or smaller succulents that are less vulnerable to seasonal and inter-annual variations in moisture availability. Thus, the dry conditions over the study period is seen to pose some limit to the number of annuals and geophytes that were encountered in the field survey, but the consequence of this is not seen as being of high significance for the study and is not considered to impose a serious limitation on the study.

Many fauna are difficult to observe in the field and their potential presence at a site must be evaluated based on the literature and available databases. However, many remote areas have not been well-sampled with the result that the species lists derived for such areas do not always adequately reflect the actual fauna present. In order to reduce this limitation, and ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site and are likely to include a much wider array of species than actually occur at the site. In addition, the camera trapping that was conducted at the site provides a reliable baseline of larger vertebrates present at the site and provides an actual indication of the fauna present and their levels of activity and distribution across the site. This is considered to be a cautious and conservative approach to the assessment and is considered significantly more reliable and robust than relying on available information alone.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. *National Vegetation Types*

The whole of the WEF site lies within the Bushmanland Arid Grassland vegetation type (Figure 1). Other vegetation types that occur in the wider area include Lower Gariep Broken Veld to the north of the site

and which is marginally intruded into by the grid connection Option C and Bushmanland Sandy Grassland and Eastern Gariep Plains Desert which occur far to the south and would not be impacted.

The footprint of the facility as well as the power line options apart from the distal end of Option C are restricted to the Bushmanland Arid Grassland vegetation type. This vegetation unit is the second most extensive vegetation type in South Africa and occupies an area of 45 478 km^2 and extends from around Aggeneys in the east to Prieska in the west. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact and as a result it is classified as Least Threatened. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is relatively few given the extensive nature of the vegetation type. Although Mucina & Rutherford provide a description of this vegetation unit, this is not repeated here as the actual vegetation as observed at the site is described in the next section.

Lower Gariep Broken Veld occupies an area of 4538 km^2 along the hills, mountain and rocky plains along the Orange River from Onseepkans in the west to as far as Prieska in the east. Less than 1% of Lower Gariep Broken Veld has been transformed and about 4% is conserved within the Augrabies Falls National Park and it is classified as Least Threatened. There are a variety of listed and protected species that are associated with this vegetation type and it should be considered relatively sensitive at a broad level. Listed and protected species commonly associated with this vegetation type include *inter alia* *Dinteranthus wilmotianus*, *Lithops bromfieldii*, *Aloe claviflora*, *Larryleachia marlothii*, *Adenium oleifolium* and *Aloidendron dichotomum*. As this vegetation type is present only towards the Eskom 132kV line along grid connection Option C, impact on this vegetation type would be minimal.

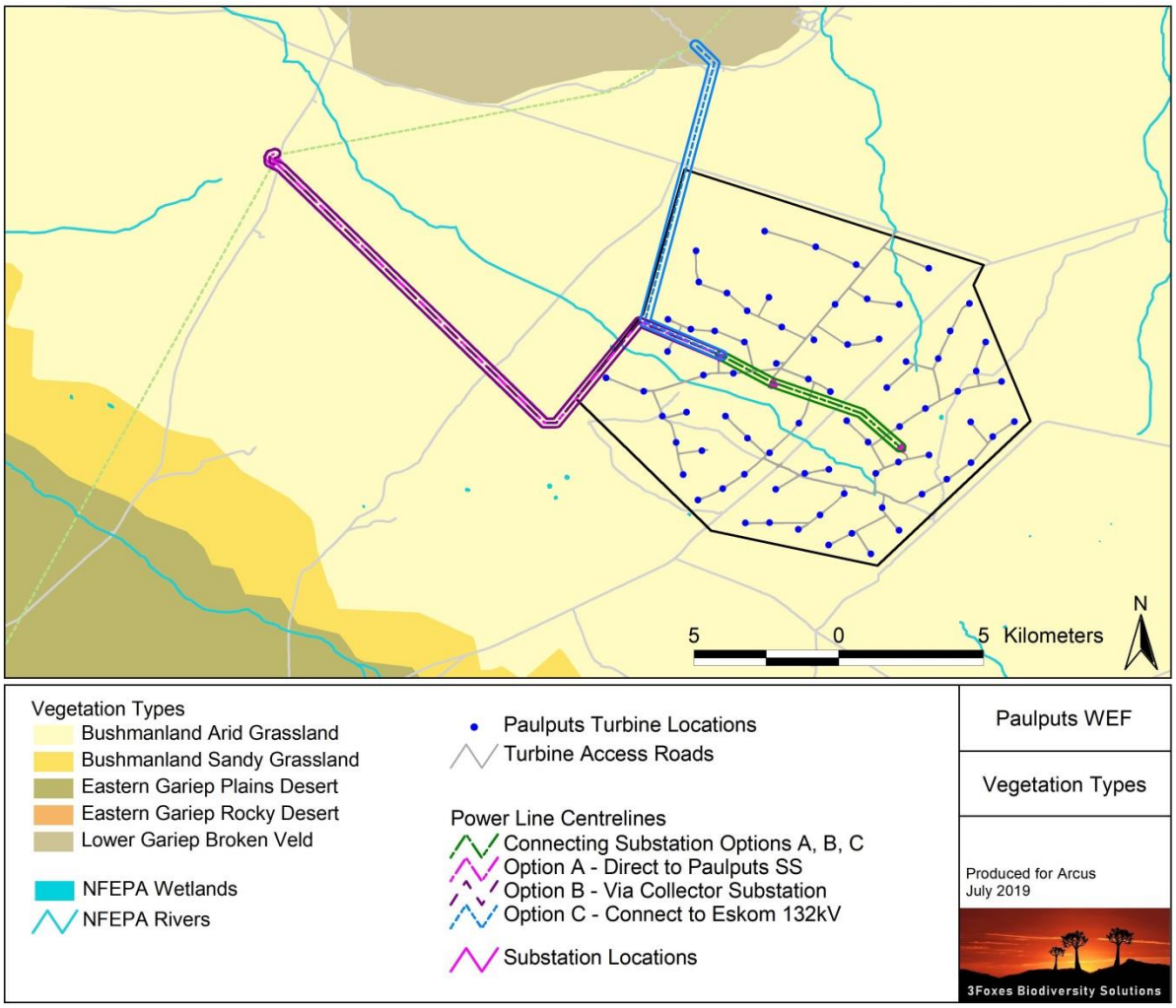


Figure 1. National Vegetation Types (Mucina & Rutherford 2006) for the wider study area around the Paulputs WEF site, showing that the site and power line corridors fall entirely within the Bushmanland Arid Grassland vegetation type.

3.2. *Habitats and Plant Communities*

A habitat map for the site is illustrated below in Figure 2. The majority of the site and footprint occur on the open plains of the site with some areas of gravelly hills, rocky outcrops, washes and towards the Paulputs substation, some dunes along the grid connection route to Paulputs Substation. The different habitats are described below, with characteristic species and discussion on their sensitivity.

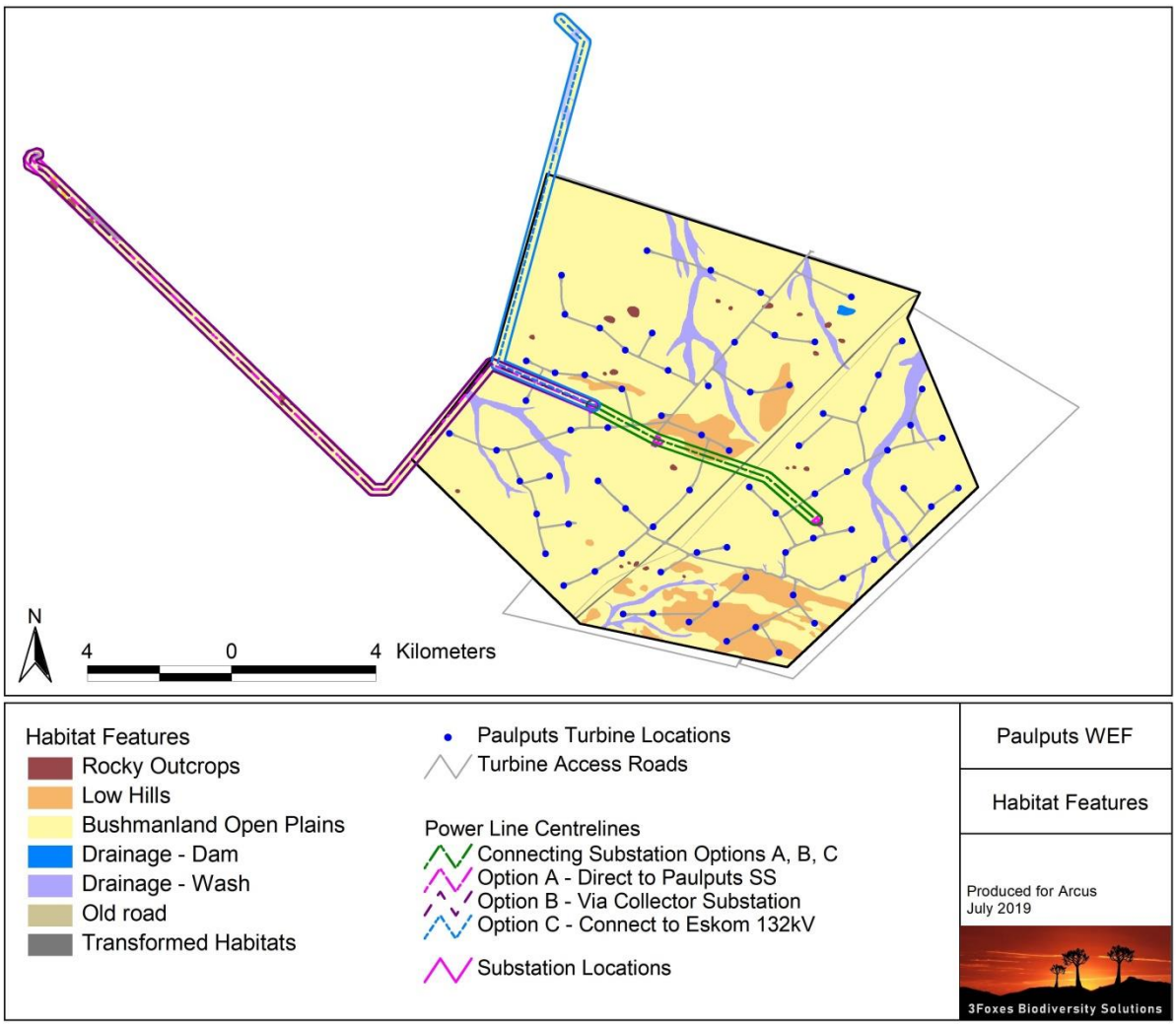


Figure 2. Habitat map for the wider Paulputs WEF site and power line corridors. The different habitats mapped are described below.

Bushmanland Open Plains

The majority of the WEF site consists of open grassy plains dominated by perennial Stipagrostis species with scattered shrubs and occasional low trees. These areas are classified as Bushmanland Arid Grassland and are mostly reasonably representative of this vegetation unit. There is some variation in composition of this habitat across the site associated with changes in soil depth and texture, with grasses being more dominant on more sandy soils with a larger proportion of shrubs present in the vegetation in areas with shallow or gravelly soils. This habitat is considered low sensitivity as the abundance of species of conservation concern is relatively low, although some protected species including *Aloidendron dichotomum*, *Boscia foetida* and *Hoodia gordonii* occur within this habitat at low density. This is the dominant habitat across the majority of the study area as well as along the power line corridors. Characteristic and dominant species include grasses such as *Stipagrostis ciliata*, *Stipagrostis brevifolia*, *Stipagrostis anomala*, *Schmidtia kalahariensis* and *Enneapogon desvauxii*; shrubs such as *Rhigozum trichotomum*, *Lycium eenii*, *Phaeoptilum spinosum*, *Hermannia spinosa*, *Hermannia gariepina*,

Asparagus denudatus, *Tetragonia arbuscula*, *Aptosimum marlothii*, *Aptosimum spinescens*, *Indigofera heterotricha* and *Eriocephalus microphyllus* var. *pubescens* as well as low trees including *Boscia foetida* subsp. *foetida* and *Parkinsonia africana*.

Figure 3. Typical vegetation on the open plains of the site. The vegetation is dominated by *Stipagrostis* grasses with occasional scattered shrubs and low trees such as *Rhigozum trichotomum* and *Boscia foetida*.

Figure 4. Some parts of the site have shallow gravelly soils where the cover is lower but no specific associated species were observed with the result that these areas are not considered more sensitive than the more typical grassy areas.

Figure 5. Although there are not many *Aloidendron dichotomum* present at the site, it occurs at a low density across the site. It is likely that the individuals present can be avoided by the development and a significant impact on this species is not likely.

Rocky Hills

There are occasional, usually small, rocky outcrops present across the site. These are considered sensitive features, especially for fauna and should be avoided as much as possible. These are however of limited extent and do not pose a significant limitation for the development. Species observed on the rocky outcrops include *Chascanum garipense*, *Tricholaena capensis subsp. capensis*, *Montinia caryophyllacea*, *Forsskaolea candida*, *Sericocoma avolans*, *Microloma incanum*, *Rogeria longiflora*, *Coccinia rehmannii*, *Codon royenii*, *Cissampelos capensis*, *Hermannia minutiflora*, *Enneapogon scaber*, C*ommiphora gracilifrondosa* and *Aloidendron dichotomum*.

Figure 6. Typical rocky outcrop within the Paulputs WEF site. These are considered especially important for fauna but also have a suite of associated plant species.

Drainage Features

There are no well-developed drainage features within the site, although there are numerous washes present which occasionally receive runoff from adjacent areas, but do not flow for more than a few hours at a time. In terms of vegetation, these have a higher proportion of larger woody species than the surrounding plains. Species present in the washes include *Boscia foetida*, *Pappea capensis*, *Senegalia mellifera*, *Phaeoptilum spinosum*, *Sisyndite spartea*, *Montinia caryophyllacea*, *Stipagrostis brevifolia*, *Rhigozum trichotomum*, *Lycium bosciifolium*, *Kleinia longiflora*, *Parkinsonia africana* and *Citrullis lanatus*. As drainage lines are important from a hydrological perspective as well as faunal movement corridors and important habitat for fauna more generally, they are considered sensitive and should be avoided as much as possible.

Figure 7. The drainage features of the site are not very well developed but can be recognised as having a higher abundance of tall woody shrubs and low trees.

Dunes

Although there are no dunes within the wind farm itself, there are some dunes along the power line options towards the Paulputs Substation. Due to the vulnerability of these areas to disturbance, they are not considered suitable for development. Species present in the dunes include *Stipagrostis brevifolia*, *Stipagrostis anomala*, *Rhigozum trichotomum*, *Citrullus lanatus*, *Brachiaria glomerata*, *Cleome foliosa* var. *lutea*, *Limeum myosotis*, *Manulea schaeferi* and *Lycium bosciifolium*. The dunes are also important for fauna and provide a contrasting habitat to the surrounding plains, especially for species associated with loose sandy soils. As the development footprint in these areas would be low, the risk to this habitat would be low.

Figure 8. Dune vegetation along the power line Options A and B near to the Paulputs substation. The vegetation is usually dominated by species such as *Rhigozum trichotomum*, *Stipagrostis brevifolia* and *Brachiaria glomerata*.

3.3. *Listed and Protected Plant Species*

There are not a lot of plant species of high conservation concern known from the study area and surrounds, based on existing records for the area. The field assessment however revealed that there are numerous quartz outcrops in the wider area which are considered sensitive features as they usually contain a variety of specialised and protected plant species including various *Lithops*, *Conophytum* and *Anacampceros* species. Although there are some areas with quartz gravel on the surface present at the site, these are poorly developed and although they were thoroughly searched no species of significance were found to be associated with these areas. In terms of protected species observed on the site, the nationally protected tree *Vachelia erioloba* is present at a very low density on the site. Given the very low density of this species, an impact on this species is not likely and it can be easily avoided. The protected trees *Boscia foetida* subsp. *foetida* and *Boscia albitrunca* are also present at moderate density. Although there is some potential for impact on these species, previous experience on wind farms that have proceeded to construction where these species were present at a much higher density, suggest that individuals of these species can be well-avoided through a preconstruction walk-through and fine-scale routing of the access roads and turbine locations. As such, a significant impact on these species is not considered likely provided that the preconstruction walk-through is used to adjust the final development footprint to minimise impact on these and other listed and protected species. The protected succulent *Hoodia gordonii* is present on the site at a very low density and only a handful of

plants were observed across the site. Due to the low density of this species it is likely that it can be avoided and a long-term impact on this species is not likely.

Perhaps the species of greatest potential concern at the site is *Aloidendron dichotomum*. Although it is likely that individuals of this species can be avoided at the preconstruction stage, a greater long-term threat is likely to be illegal harvesting of young individuals associated with the greater access to the site resulting from the wind farm development. In order to limit, prevent and address any potential decline in this species, a long-term monitoring programme should be developed and initiated before construction. The programme should, at minimum, include the following parameters and activities:

- Size and GPS location of all *Aloidendron dichotomum* plants found on site. Photographs of all individuals present is also recommended for documentation purposes.
- Annual monitoring of size-class structure, including any new deaths, disappearances, and seedlings that have appeared.
- If any seedlings and young plants disappear, then the local populations should be supplemented with seedlings cultured from seed collected on-site.
- There should be signage present at all entrances to the site warning against the illegal collection of any fauna and flora.

It is important to note that a permit from DAFF would be required for any impacts on nationally protected tree species, while a permit from DENC would also be required for general clearing and any clearing or removal of provincially protected species. These permits would be informed by a preconstruction walk-through of the final development footprint.

3.4. *Faunal Communities*

Mammals

The site falls within the known distribution range of 43 terrestrial mammals, indicating that the site has moderate potential mammalian diversity. Diversity and activity levels as observed by the camera traps was however low and dominated by a few common species, mainly Cape Fox, Bat-eared Fox and Aardwolf (Figure 9). Usually herbivores such as Steenbok and Cape Hare dominate mammalian communities in semi-arid areas, but their low abundance in the current survey can likely to ascribed to the prolonged drought the area has experienced which may have depressed herbivore populations to a greater degree than the above species. Species observed either during the current camera trapping survey or previously on neighbouring properties include the South African Ground Squirrel, Hairy-footed Gerbil, Aardvark, Aardwolf, African Wild Cat, Cape Hare, Hewitts' Red Rock Rabbit, Yellow Mongoose, Cape Mongoose, Striped Polecat, Cape Fox, Bat-eared Fox, Black-backed Jackal, Small-spotted Genet, Steenbok, Springbok, Gemsbok and Meerkat. The only listed mammal which may occur at the site is the Black-footed cat *Felis nigripes*, which is listed as Vulnerable. Although there is a possibility that the Black-footed Cat occurs in the area as the habitat is broadly favourable for this species, it is widely distributed

across the arid and semi-arid areas of South Africa and the habitat loss that would result from the development would be minor in relation to the distribution of this species.

In terms of habitats of significance for fauna, the drainage lines and rocky hills are highlighted as the most important habitats for fauna at the site. These features are of limited extent and can be easily avoided by the development. The main long-term impact associated with the development would be habitat loss of about 219 ha with some additional disturbance caused by turbine noise and maintenance and operational activities. As the mammalian habitats of high value can be largely excluded from the development footprint, the overall significance of this loss would likely be relatively low.

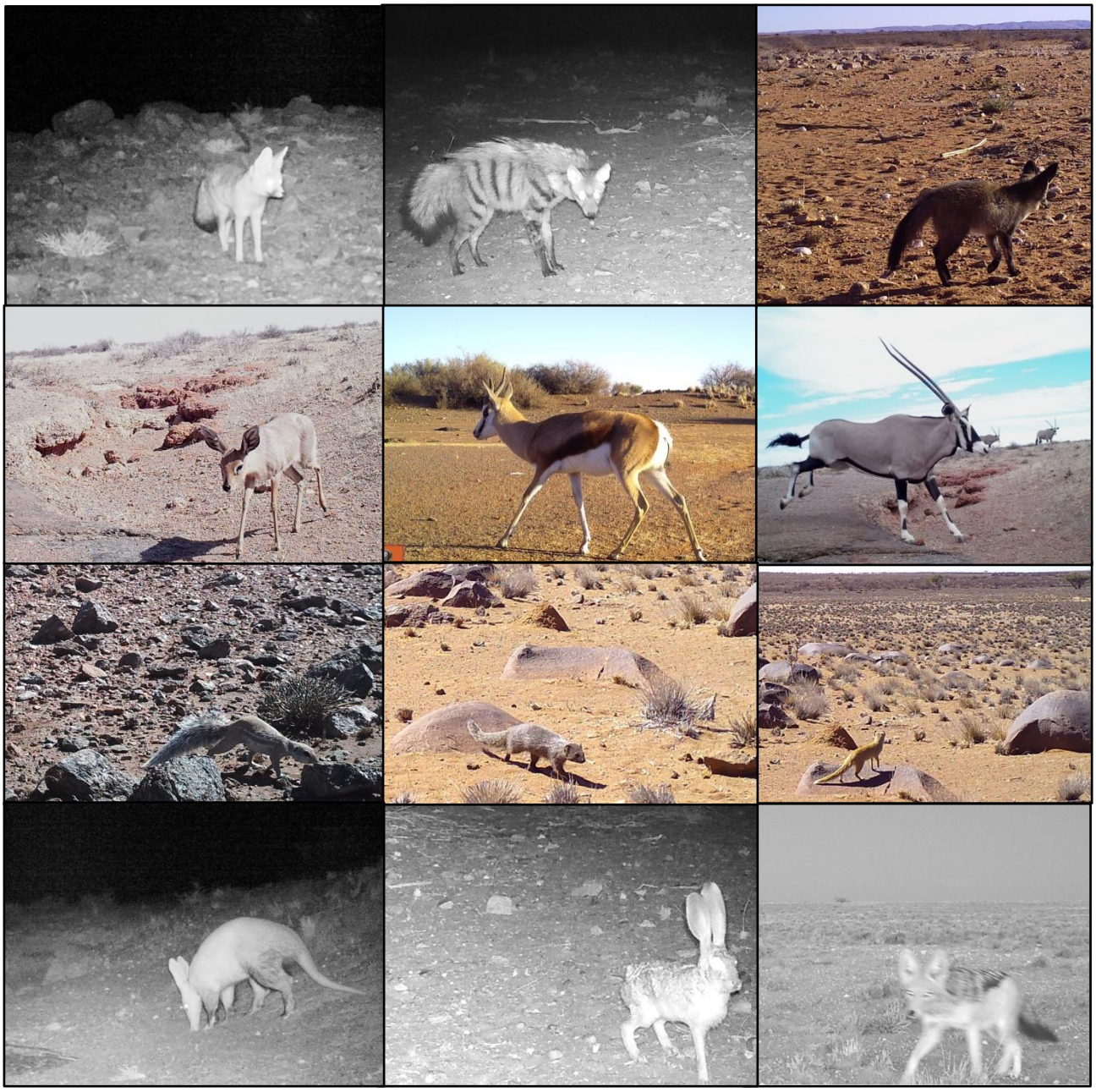


Figure 9. Common mammals observed with the camera traps include, left to right from the top, Cape Fox, Aardwolf, Bar-eared Fox, Steenbok, Springbuck, Gemsbok, Ground Squirrel, Cape Grey Mongoose, Yellow Mongoose, Aardvark, Cape Hare and Black-backed Jackal.

Reptiles

The site lies in or near the distribution range of at least 46 reptile species (Appendix 2), indicating that the site has potentially quite high reptile diversity and given the range of habitats available at the wider site, a large proportion of these are likely to occur in the area. Based on the distribution records and habitat requirements, the composition of the reptile fauna at the site potentially comprises 1 tortoise, 17 snakes, 19 lizards and skinks, 8 geckos and 1 chameleon. Species confirmed present in the area include the Namaqua Sand Lizard *Pedioplanis namaquensis*, Ground Agama *Agama aculeata*, Western Rock Skink *Mabuya sulcata*, Namaqua Dwarf Legless Skink *Acontias tristis*, Horned Adder *Bitis caudalis* and Karoo Sand Snake *Psammophis notostrictus*. The only listed species which may occur at the site is the Black Spitting Cobra, *Naja nigricollis woodi*, which is likely to occur in the vicinity of the rocky outcrops as well as other areas with sufficient cover. Although this species is a regional endemic, it is common within its range and the extent of habitat loss resulting from the development would be minimal. There are also numerous local endemic gecko species associated with the mountains of the Orange River valley, but as there is very little rocky habitat within the site, it is not likely that any of these species are present within the site.

The rocky outcrops are the most important habitat in the area for reptiles as they provide cover and structure for a wide variety of lizards, geckos, skinks and snakes. This habitat is however of very limited extent and it is likely that it can be avoided by the development. The open plains habitat of the site that would be impacted by the development has relatively low reptile diversity and the overall extent of habitat loss associated with the development would not represent significant habitat loss for the species present. The overall impact of the development on reptiles is likely to be local in nature and there are no species that would be particularly affected by the development.

Figure 10. Notable reptiles observed at the Paulputs site include the Namaqua Dwarf Legless Skink *Acontias tristis* and the Horned Adder *Bitis caudalis*.

Amphibians

The site lies within or near the range of six amphibian species, indicating that amphibian diversity at the site is not likely to be very high. The only areas where some naturally occurring standing water may occur is on some rocky basement areas which occur along the power line corridors, where there may be rock potholes and crevices that contain water after rain. These are the only areas that offer potential breeding sites for those species which require water for their tadpoles such as toads and the marbled rubber frog. These areas aside, the only other areas where amphibians may be present are occasional earth dams that may occasionally have water and the dunes and larger drainage lines where burrowing species such as Sand Frogs may be present. Overall abundance and diversity of amphibians at the site is likely to be very low and as a result, long-term impacts on amphibians are likely to be very low.

3.5. *Critical Biodiversity Areas*

An extract of the Northern Cape Critical Biodiversity Areas map for the study area is depicted below in Figure 11. While most of the site is identified as "other natural areas" which are areas that have not been identified as being important for biodiversity conservation, there are also some ecological support areas associated with the larger drainage systems of the site as well as a large CBA 1 in the centre of the site which currently has a number of turbines in this area. Development within CBAs can have negative impacts on biodiversity pattern and process and is generally considered undesirable. It is however important to identify the reason an area is identified as a CBA as well as verify the features of potential concern in the field.

Although the CBA layer does not include the underlying reasons areas have been selected as CBAs, correspondence with DENC indicates that this area has been selected as a CBA due to the presence of *Aloidendron dichotomum* on the site. This species is currently listed as Vulnerable based on the potential threat that climate change poses to the distribution of this species. *Aloidendron dichotomum* is indeed confirmed present on the site at a low density. However, this species is widespread on the site and occurs both within and outside of the CBA and the largest populations are in fact outside of the area demarcated as CBA. In this regard it is important to recognise that the CBA maps are based on the best available existing information and the *Aloidendron dichotomum* populations were likely recorded in the vicinity of the N14 and so the CBA reflects this fact rather than the actual presence of important local populations of this species. Indeed, there are large, healthy populations of this species in the area, outside of the area affected by the development. Within the site, there are occasional trees scattered very widely across the plains, but with local small concentrations on some of the low rocky ridges at the site as well as on the gravel plains towards the northern boundary of the site. With the appropriate avoidance, direct impact on this species can be entirely avoided. The development

would however result in some habitat loss across the site. However, this is not likely to affect the local population of *Aloidendron dichotomum*. A more direct threat would likely be poaching and harvesting of young trees by construction or operational phase personnel on the site.

It is also important to consider the impact that the development may have on connectivity within the CBA and the wider landscape as well as the impact that development within the CBA would have on the ability to meet vegetation and habitat targets elsewhere in the area. In this regard, the isolated nature of the CBA is significant as this indicates that the CBA's primary purpose is to protect a specific feature within the site, that being the local population of *Aloidendron dichotomum*. The CBA has not been identified as being part of a wider corridor aimed at maintaining the connectivity and functioning of the landscape. Although this is still an important ecological function of the landscape regardless of its' CBA status, there do not appear to be any features of major significance within the site that indicate that it is of above average significance for landscape connectivity or faunal movement through the area. Furthermore, the presence of the wind farm would not compromise most of these functions in any case as it would not prevent fauna from moving through the area. In terms of meeting targets elsewhere, the development would certainly not compromise this ability as the affected Bushmanland Arid Grassland vegetation type is widely available in the area and there are extensive areas where this target could be met elsewhere and in fact probably areas with higher biodiversity value than the current WEF site which is generally unremarkable.

Overall, provided that impact on *Aloidendron dichotomum* can be avoided within the CBA and within the site more generally, development within the CBA area is considered acceptable from an ecological stand point. However, as this area still contributes to meeting targets, represents habitat for *Aloidendron dichotomum* and is currently in a moderate condition, the overall extent of the development footprint in this area should be limited. It is recommended that the footprint within the CBA should be maintained at less than 30ha as this would not be likely to have a significant negative impact on the functioning of this area.

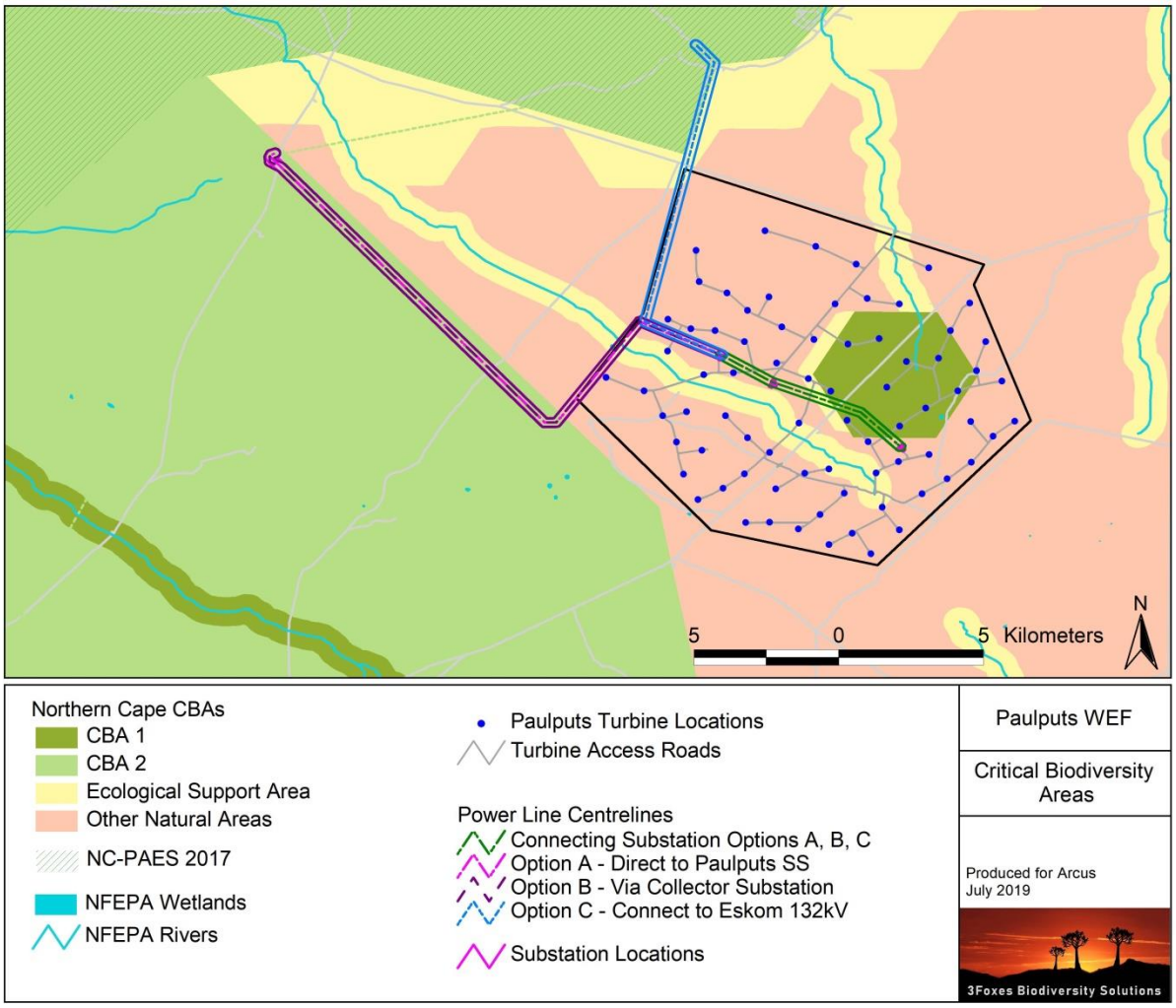


Figure 11. Extract of the Northern Cape Critical Biodiversity Areas map for the wider study area, showing that the majority of site falls outside of CBAs, although there is an isolated area of CBA 1 within the site.

In terms of the potential impact of the development on protected area expansion strategy focus areas, there are no focus areas within the wind farm and as such, no impact on national or provincial conservation expansion priorities would occur as a result of the wind farm itself. The only focus area in the vicinity of the site is north of the site and would be marginally impacted by the power line Option C development but as the footprint of the power line within the focus area would be very low, this would not compromise the ecological or conservation value of the focus area.

3.6. *Current Transformation Baseline & Cumulative Impact*

There are several other existing renewable energy developments in broader proximity to the current site (Figure 12). This includes the Biotherm 10MW Konkoonies PV plant northwest of the site as well as the two CSP plants west of Paulputs substation. As these already existing and operational, they are considered to form part of the transformation baseline for the area. The footprint of these existing plants is approximately 800ha. There is also the larger 75MW PV plant on Konkoonsies that is a preferred

bidder and is currently under construction and would have a footprint of approximately 200ha. The total existing footprint of renewable energy in the area is thus approximately 1000ha. The juwi Paulputs PV project also recently received authorisation and consists of 3x100MW PV plants which would occupy approximately 600ha in total. Thus, there is an additional potential 600ha of development around the Paulputs Substation that would potentially be built in the future. It is clear that a node of wind and solar energy development is starting to develop around the Paulputs substation. However, the wider surrounding landscape is still overwhelmingly intact and has experienced little other transformation to date.

The contribution of the current development to direct habitat loss would be less than 220 ha and given the extensive nature of the receiving landscape, this additional habitat loss is not considered highly significant. While the broader landscape is still little-impacted by transformation, the concentration of development around the substation is a potential concern. However, the impact of the current development on the more sensitive features of the area, in particular the dune systems, quartz areas and rocky hills has been minimised. The overall cumulative impacts associated with the current development are considered to be acceptable and of low significance.

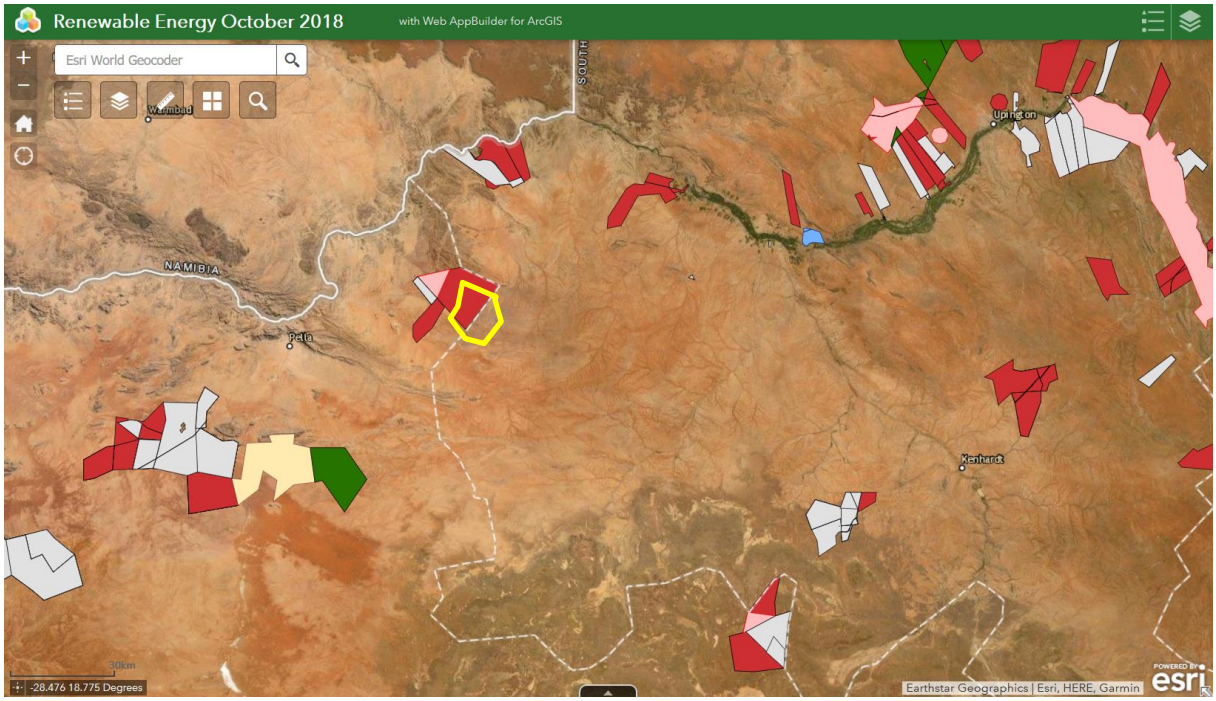


Figure 12. Map of DEA-registered renewable energy projects in the wider area around the Paulputs site, showing that there are several other projects in the immediate vicinity of the site as well as concentrations of projects in the Pofadder region as well as towards Upington. The different colours indicate different technologies, with red indicating solar, and the pale peach wind energy, with grey being unknown area. However these are frequently depicted incorrectly on the DEA database

3.7. *Site Sensitivity Assessment*

The sensitivity map for the site and the power line corridors is illustrated below in Figure 13. The majority of the site consists of open grassy plains considered to be low sensitivity. There are also some low gravelly hills within the development footprint which are considered to be moderate sensitivity and which are also considered suitable for development. Sensitive features present which should not be impacted include the rocky outcrops within the site and the bedrock pans which occur along the power line corridors. Features where the development footprint should be minimised include the washes within the site and the dunes which occur along the power line corridors. **Under the layout assessed, these recommendations have been met and the development would have low impact on the higher sensitivity features of the site**. In terms of the limits of acceptable change, these are listed in Table 1 below and the footprint within each sensitivity category is well within the previously stated limits**. As such, there are no limits of acceptable change that have been exceeded and no fatal flaws associated with the development in this regard**.

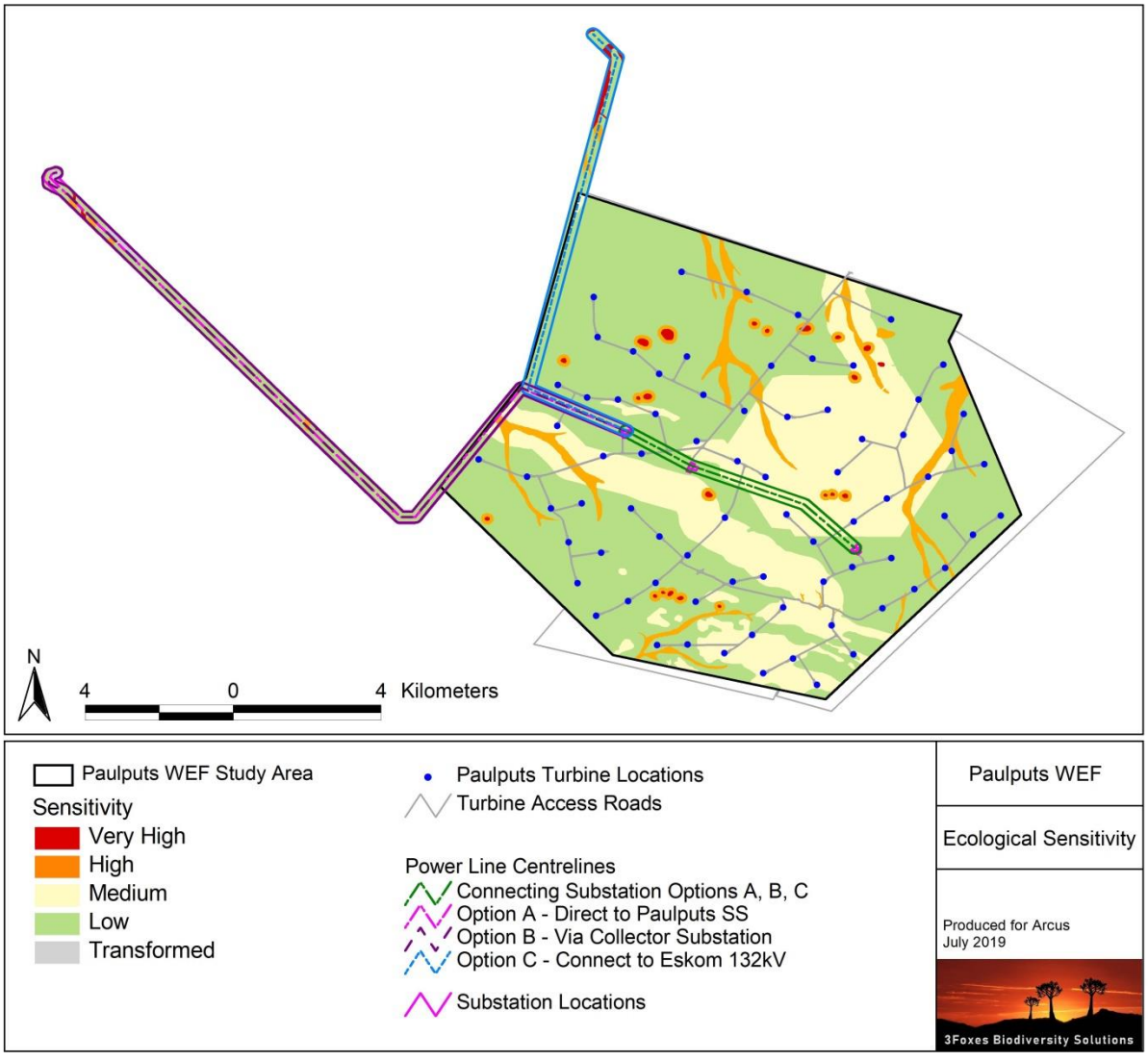


Figure 13. Ecological sensitivity map for the Paulputs WEF study area and power line corridors.

Diversity of fauna and flora within the site is relatively low and the affected habitats are not considered to be of broader ecological significance as it is typical of the area and is widely available. There are however some protected plant species within the site, most notably, *Hoodia gordonii*, *Aloidendron dichotomum* and *Boscia foetida* subsp. *foetida*. The abundance of these species within the site is low and is likely that impact on these species can be reduced to a very low level and it is not likely that the local populations of these species would be compromised by the development. The CBA within the site is due to the presence of *Aloidendron dichotomum* within the CBA planning unit. However, this species is distributed widely across the site and the broader area and is not concentrated or restricted to the CBA. As *Aloidendron dichotomum* occurs at a very low density within the site, any individuals within the site can be avoided by the footprint of the development. Apart from the potential impact on *Aloidendron dichotomum*, the overall footprint within the CBA is low and the overall ecological functioning of the CBA would not be compromised by the development. **As such, the impact of the development on that part of the site which is a CBA is considered acceptable**.

In terms of the two basic power line routes and four alternatives, each is considered potentially acceptable. Although there are some sensitive features along the power line routes such as drainage lines, it is likely that these can be avoided through adjustment of the final power line route within the assessed corridor. As such all four alternatives are considered acceptable and there are no major differences between them apart from their starting positions and to a lesser consequent degree their length.

Table 1. The total extent of the different sensitivity categories within the site and the estimated footprint of the wind farm within each class. The total footprints are all within acceptable limits.

Sensitivity	Total Extent (Ha)	Acceptable Loss		Total Footprint
		%	Ha	
Low	7475	5	373.75	146.66
Medium	3649	2	72.98	65.33
High	747	1	7.47	7.24
Very High	40	0	0	0
Total	**11911**			**219.23**

4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A clearing and translocation permit would be required from DENC before construction commences. A preconstruction walk-through would be required to inform the permit application. In addition, if there are any nationally protected trees within the development footprint a destruction permit from DAFF would also be required. Both *Acacia erioloba* and *Boscia albitrunca* are present at the site and could potentially be affected. The provincially protected tree species *Boscia foetida subsp. foetida* and

Aloidendron dichotomum are also present within the site and may be impacted. As the footprint of the power line is more flexible and the exact position of the pylons would only be determined at a later stage, it is assumed that the majority of protected species within the power line corridors could be avoided at the preconstruction stage following a walk-through of the final route and micro-siting of the final pylon positions.

5. IDENTIFICATION OF IMPACTS AND RISKS

5.1. *Overview of key impacts resulting from the proposed development*

In this section each of the potential impacts identified as being likely to be associated with the development is explored with reference to the features and characteristics of the site and the likelihood that each impact would occur given the characteristics of the site and the extent and nature of the development.

Impacts on vegetation and protected plant species

Several protected species occur at the site which may be impacted by the development, most notably *Hoodia gordonii*, *Aloidendron dichotomum* and *Boscia foetida*. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development. As this impact is certain to occur it will be assessed for the construction phase as this is when the impact will occur, although the consequences will persist for a long time after construction.

Direct faunal impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction as well as operation and this impact will therefore be assessed for the construction phase and operational phase.

Impact on CBAs and future conservation options

Part of the site lies within a CBA 1 and the development may impact on the biodiversity within the CBA. Furthermore, the loss of unprotected vegetation types on a cumulative basis from the broad area may impact the country's ability to meet its conservation targets. Although the receiving vegetation type in the study area is classified as Least Threatened and is still more than 98% intact, there may be other features of conservation significance in the area that may be targets for conservation. This impact is therefore assessed in light of the current development as well as any other developments in the surrounding area which would also contribute to cumulative impacts.

Impact on broad-scale ecological processes

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. Due to the presence of a number of other renewable energy developments in the area, this is a potential cumulative impact of the development that is assessed.

5.2. *Overview of key Environmental Management Actions and limits of acceptable changes to the Environment due to the proposed development*

The key action that should be implemented to ensure that the development has relatively low impact on the receiving environment is planning-phase avoidance to ensure that the development footprint is restricted to the lower sensitivity areas of the site as far as possible. A number of higher sensitivity areas have identified in the area and these should be avoided as much as possible. The final development footprint within the different sensitivity categories are well-within the stated limits of acceptable change and as such, there are no fatal flaws in this regard and the development is considered acceptable from an ecological perspective.

A variety of additional mitigation and avoidance measures that should be implemented during the construction and operational phases of the development are highlighted below.

6. ASSESSMENT OF IMPACTS

Impacts associated with the Wind Farm component of the development are assessed below for the Construction, Operational and Decommissioning phases of the development. Impacts associated with the grid connection are assessed in the next section of the report.

6.1. *Construction Phase*

Construction Phase Impact 1.
Impact description: ***Impacts on vegetation and plant species of conservation concern***
Several protected species occur at the site which may be impacted by the development, most notably *Hoodia gordonii*, *Aloidendron dichotomum* and *Boscia foetida*. The abundance of these species in the development footprint is however low and it is likely that most individuals can be avoided with the result that it would not compromise the viability of the local populations of these species. Apart from the potential impact on protected species, there would be a more general loss of intact vegetation within the development footprint. Although the development would have some local impact on the availability of the affected habitat type, the Bushmanland Arid Grassland is a very extensive vegetation type and the loss of the vegetation within the development footprint is not considered to have broader significance.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	H	Negative	M	H	H
With Mitigation	M	H	M	Negative	M	H	H
Can the impact be reversed?			No, this is an inevitable outcome of the development that cannot be avoided				
Will impact cause irreplaceable loss or resources?			No, there are no species of high conservation concern at the site and the affected habitats are widespread and not of high concern.				
Can impact be avoided, managed or mitigated?			Partially. Habitat loss associated with the development cannot be avoided, but it can be reduced to some extent and restricted to the less sensitive parts of the site. While impact to habitats containing a high abundance of SCC can be avoided, there will inenvitably be some residual impact on plant SCC.				

Mitigation measures to reduce residual risk or enhance opportunities:

- No development of infrastructure within identified Very High sensitivity areas.
- Pre-construction walk-through of the development footprint to locate and identify protected species within the development footprint. All relevant clearing or translocation permits must be obtained before construction starts.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Environmental Control Officer (ECO) to provide supervision and oversight of vegetation clearing activities.
- All cleared areas that are not under hard infrastructure will need to be rehabilitated with locally occurring species.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.

Construction Phase Impact 2.

Impact description: ***Direct and indirect faunal impacts***

The construction of the development will result in habitat loss, noise and disturbance on site. This will lead to direct and indirect disturbance of resident fauna. Some slow-moving or retiring species such as many reptiles would likely not be able to escape the construction machinery and would be killed. There are also several species present at the site which are vulnerable to poaching and there is a risk that these species may be targeted. This impact would be caused by the presence and operation of construction machinery and personnel on the site. This impact would however be transient and restricted to the construction phase, with significantly lower levels of disturbance during the operational phase, although turbine noise is likely to have some impact on some species sensitive to ambient noise levels. Mitigation is required to reduce this impact, however as this is of limited overall effect in reducing all impacts, the reduction is not considered sufficient to reduce this impact to a low level.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	M	Negative	M	H	H
With Mitigation	L	L	M	Negative	M	H	H
Can the impact be reversed?			Yes. Construction phase disturbance will be transient and associated with the construction phase only although habitat loss will last for the duration of the operational phase.				
Will impact cause irreplaceable loss or resources?			No. No species of high conservation concern are likely to be compromised by the development.				
Can impact be avoided, managed or mitigated?			Partly. While there is some scope for avoidance of sensitive habitats, some disturbance and habitat loss is an inevitable consequence of development that cannot be avoided.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Avoidance of identified areas of high fauna importance such as rocky outcrops, drainage lines and dunes.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- 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.
- If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.
- Limit access to the site and ensure that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site.

6.2. *Operational Phase*

Operational Phase Impact 1.

Impact description: ***Direct and indirect faunal impacts***

Operational activities as well as the presence of the turbines and the noise they generate may deter some sensitive fauna from the area. Species which rely on hearing for predator avoidance or communication may be particularly susceptible although most animals are able to make some behavioral adjustments to compensate for increased background noise levels. This is a low-level continuous impact which could have significant cumulative impact on sensitive species.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	M	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	M	H

Can the impact be reversed?	No. Habitat loss and disturbance will persist for the lifetime of the facility. The habitat could be partly restored thereafter.
Will impact cause irreplaceable loss or resources?	No. No species of high conservation concern are likely to be compromised by the development.
Can impact be avoided, managed or mitigated?	No. The impacts results from the presence and operation of the facility and as such cannot be avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- Open space management plan for the development, which makes provision for favourable management of the facility and the surrounding area for fauna.
- Appropriate design of roads and other infrastructure where appropriate to minimise faunal impacts and allow fauna to pass through or underneath these features.
- No electrical fencing within 20cm of the ground as tortoises become stuck against such fences and are electrocuted to death.
- Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
- If any parts of the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs) as far as possible, which do not attract insects.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.

Operational Phase Impact 2.

Impact description: ***Impact on CBAs and future conservation options***

The development is partly located within an area that is a recognised area of biodiversity significance and has been classified as a Tier 1 CBA. The CBA has been delineated based on the presence of *Aloidendron dichotomum*, which is confirmed present at the site at low density both within and outside of the area demarcated as CBA. Under the current layout, the development will result in direct habitat loss equivalent to about 15 ha within the CBA as well as potentially affect specific features of conservation concern within the CBA. The impact on the CBA would result from the transformation of currently intact habitat and potentially the presence and operation of the facility. While the development of renewable energy projects around the Paulputs substation would reduce the conservation value of the area, it has not been identified as an area for conservation expansion under the national or provincial Protected Area Expansion Strategy and there are no features present in the immediate area that are not widely available elsewhere. As such, development in the CBA is considered acceptable provided that the potential impacts on *Aloidendron dichotomum* can be effectively mitigated.

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	M	H

Can the impact be reversed?	No. Habitat loss and disturbance will persist for the lifetime of the facility. The habitat could be partly restored thereafter.
Will impact cause irreplaceable loss or resources?	Potentially. It is not clear why the CBA 1 has been designated and depending on the nature of the features of concern present, irreplaceable loss could occur if these were significantly impacted.
Can impact be avoided, managed or mitigated?	Yes, potentially, the feature of concern could be verified in the field and mapped at a higher resolution and avoided as necessary.

Mitigation measures to reduce residual risk or enhance opportunities:

- Avoid all individuals of *Aloidendron dichotomum* within the site should be avoided by the layout. This would be checked and confirmed at the preconstruction phase walk-through of the facility.
- All personnel at the site should receive induction regarding the illegal harvesting of individuals of *Aloidendron dichotomum*.
- A monitoring programme should be set up before construction to monitor the health of local populations of *Aloidendron dichotomum* to ensure that these are not impacted during construction or operation. Should declines in the local population of this species occur as a result of illegal harvesting, then the local population should be supplemented with seedlings cultivated from locally-sourced seed.
- Avoid impact to restricted and specialised habitats such as loose dune areas or quartz patches where present.
- Minimise the development footprint as far as possible and ensure that the management plans for the facility are optimally implemented during the operational phase of the development to ensure that the indirect impacts associated with the development are kept to a minimum.

6.3. *Decommissioning Phase*

Impact Phase: Decommissioning

Impact description: Decommissioning phase faunal impacts

The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning would have some negative impacts on fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	M	H

Can the impact be reversed?	Yes, faunal disturbance would be transient and restricted to the actual decommissioning period.
Will impact cause irreplaceable loss or resources?	No. No species of high conservation concern are likely to be compromised by the decommissioning of the development.
Can impact be avoided, managed or mitigated?	Yes to a large extent. Although there would be some unavoidable disturbance at decommissioning, this would be transient and in the long-term the site would be returned to a less disturbed and more natural state.

Mitigation measures to reduce residual risk or enhance opportunities:

- Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and recycling plan, and as per the agreements with the land owners concerned.

Impact Phase: Decommissioning

Impact description: Increased soil erosion

The removal and clearing of the site infrastructure would create some soil disturbance which would leave these areas vulnerable to erosion. The disturbed areas should be rehabilitated at decommissioning with indigenous species sourced from the local environment to reduce this risk.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H

Can the impact be reversed?	Yes. This impact will not occur if appropriate avoidance measures are put in place.
Will impact cause irreplaceable loss or resources?	No. If this impact is addressed, then no significant loss of resources will occur.
Can impact be avoided, managed or mitigated?	Yes, with the appropriate mitigation, this impact can be avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- Using geotextiles and other active rehabilitation measures during and after decommissioning to limit soil loss and movement at the site.
- There should be regular monitoring for erosion for at least 5 years after decommissioning by the applicant or appointed entity to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and succulents from the local area.

6.4. *Cumulative Impact of the Paulputs WEF*

Cumulative Impact 1. Cumulative habitat loss and impact on broad-scale ecological processes

Impact Phase: Operation/Cumulative Impact

Impact description: Cumulative habitat loss and impact on broad-scale ecological processes.

There are several other renewable energy developments in the wider area and along with the current development, these would potentially generate significant cumulative impacts on habitat loss and fragmentation and negative impact on broad-scale ecological processes such as dispersal and climate change resilience. While

there are several existing and proposed renewable energy developments in the wider area (within 100km), those in closer proximity (within 35km) to the site are seen as the most important with regards to generating cumulative impact. The current footprint in the area stands at around 1000ha with the current development contributing approximately 219 ha of additional habitat loss to the area. Although a node of development is concentrating around the Paulputs substation, even with the current and other proposed developments, the overall extent of development in the wider area is still low and currently impacts on broad scale ecological processes are likely to remain low as the areas that are likely to be important for the maintenance of broad-scale ecological processes such as dispersal remain free of development.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	M	Negative	M	H	H
With Mitigation	L	H	L	Negative	L	M	H

Can the impact be reversed?	No. Habitat loss and disturbance will persist for the lifetime of the facility.
Will impact cause irreplaceable loss or resources?	No. No species or habitats of high conservation concern are likely to be compromised by the development.
Can impact be avoided, managed or mitigated?	Partly. Sensitive habitats can be avoided, but some contribution to cumulative impact in the area is inevitable and cannot be fully avoided or mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- Avoid impact to restricted and specialised habitats such as quartz patches and rocky outcrops.
- Minimise the development footprint as far as possible and ensure that the management plans for the facility are optimally implemented during the operational phase of the development to ensure that the indirect impacts associated with the development are kept to a minimum.

7. ASSESSMENT OF IMPACTS – GRID CONNECTION

The assessment below is for the grid connection component of the development, for the construction, operational and decommissioning phases of the development. As all four components of the grid connection are being applied for and are not considered alternatives, the assessment below is for the combined impact of all four Options. Should any of these Options not ultimately be built, this would not significantly affected this assessment, which would then be considered a worst-case scenario for the remaining constructed components.

7.1. *Construction Phase*

Construction Phase Impact 1.

Impact description: ***Impacts on vegetation and plant species of conservation concern***

Several protected species occur at the site which may be impacted by the grid connection component of the development, most notably *Hoodia gordonii*, *Aloidendron dichotomum* and *Boscia foetida*. The abundance of these species in the development footprint is however relatively low and it is likely that most individuals can be avoided with the result that the grid connection would not compromise the viability of the local populations of

these species. Apart from the potential impact on protected species, there would be a more general loss of intact vegetation within the development footprint which is estimated at less than 10ha, which is not considered highly significant given the broad distribution of the affected vegetation type.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	H	L	Negative	L	H	H

Can the impact be reversed?	No, this is an inevitable outcome of the development that cannot be avoided
Will impact cause irreplaceable loss or resources?	No, there are no species of high conservation concern at the site and the affected habitats are widespread and not of high concern.
Can impact be avoided, managed or mitigated?	No, habitat loss associated with the development cannot be avoided, but it can be reduced to a low extent and restricted to the less sensitive parts of the site.

Mitigation measures to reduce residual risk or enhance opportunities:

- No development of infrastructure within identified High sensitivity areas.
- Pre-construction walk-through of the development footprint to locate and identify protected species within the development footprint. All relevant clearing or translocation permits must be obtained before construction starts.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Environmental Control Officer (ECO) to provide supervision and oversight of vegetation clearing activities.
- All cleared areas that are not under hard infrastructure will need to be rehabilitated with locally occurring species.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.

Construction Phase Impact 2.

Impact description: ***Direct and indirect faunal impacts***

The construction of the grid connection will result in habitat loss, noise and disturbance on site. This will lead to direct and indirect disturbance of resident fauna. Some slow-moving or retiring species such as many reptiles would likely not be able to escape the construction machinery and would be killed. There are also several species present at the site which are vulnerable to poaching and there is a risk that these species may be targeted. This impact would be caused by the presence and operation of construction machinery and personnel on the site. This impact would however be transient and restricted to the construction phase, with significantly lower levels of disturbance during the operational phase.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence

Without Mitigation	L	L	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	M	H
Can the impact be reversed?			Yes. Construction phase disturbance will be transient and associated with the construction phase only although habitat loss will last for the duration of the operational phase.				
Will impact cause irreplaceable loss or resources?			No. No species of high conservation concern are likely to be compromised by the development.				
Can impact be avoided, managed or mitigated?			Partly. While there is some scope for avoidance of sensitive habitats, some disturbance and habitat loss is an inevitable consequence of development that cannot be avoided.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Minimise the development footprint within identified areas of high fauna importance such as rocky outcrops, drainage lines and dunes.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- 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.
- If trenches need to be dug for pylon foundations, electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.
- Limit access to the site and ensure that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site.

7.2. *Operational Phase*

Operational Phase Impact 1.

Impact description: ***Impact on CBAs and future conservation options***

The grid connection linking the different substation options traverses the CBA 1 on the site for a short distance, while the Option A and Option B grid connection to Paulputs traverse an extensive tract of CBA 2. This would result in some habitat loss as well as potentially affect specific features of conservation concern within the CBAs. The total footprint in these areas would however be low.

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	M	H
Can the impact be reversed?			No. Habitat loss and disturbance will persist for the lifetime of the facility. The habitat could be partly restored thereafter.				

Will impact cause irreplaceable loss or resources?	No, the power line would not generate significant footprint within the CBA, so as to compromise the functioning of the CBA>
Can impact be avoided, managed or mitigated?	Yes, features of concern in the power line corridor can be avoided through careful routing of the power line and placement of the pylons.
Mitigation measures to reduce residual risk or enhance opportunities: - Avoid impact to restricted and specialised habitats such as loose dune areas or quartz patches where present. - Minimise the development footprint as far as possible and ensure that the management plans for the facility are optimally implemented during the operational phase of the development to ensure that the indirect impacts associated with the development are kept to a minimum.	

7.3. *Decommissioning Phase*

Impact Phase: Decommissioning							
Potential impact description: Decommissioning phase faunal impacts The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning would have some negative impacts on resident fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	M	H
Can the impact be reversed?	Yes, faunal disturbance would be transient and restricted to the actual decommissioning period.						
Will impact cause irreplaceable loss or resources?	No. No species of high conservation concern are likely to be compromised by the decommissioning of the development.						
Can impact be avoided, managed or mitigated?	Yes to a large extent. Although there would be some unavoidable disturbance at decommissioning, this would be transient and in the long-term the site would be returned to a less disturbed and more natural state.						
Mitigation measures to reduce residual risk or enhance opportunities: - Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities. - All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. - All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.							

- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and recycling plan, and as per the agreements with the land owners concerned.

Impact Phase: Decommissioning

Potential impact description: Increased soil erosion

The removal and clearing of the site infrastructure would create some soil disturbance which would leave these areas vulnerable to erosion. The disturbed areas should be rehabilitated at decommissioning with indigenous species sourced from the local environment to reduce this risk.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	L	M	H
With Mitigation	L	L	L	Negative	L	L	H

Can the impact be reversed?	Yes. This impact will not occur if appropriate avoidance measures are put in place.
Will impact cause irreplaceable loss or resources?	No. If this impact is addressed, then no significant loss of resources will occur.
Can impact be avoided, managed or mitigated?	Yes, with the appropriate mitigation, this impact can be avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- Use of geotextiles and other active rehabilitation measures during and after decommissioning to limit soil loss and movement at the site.
- There should be regular monitoring for erosion for at least 5 years after decommissioning by the applicant or appointed entity to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and succulents from the local area.

7.4. *Cumulative Impact of the Paulputs Grid Connection*

Cumulative Impact 1. Cumulative habitat loss and impact on broad-scale ecological processes

Impact Phase: Operation/Cumulative Impact

Potential impact description: Cumulative habitat loss and impact on broad-scale ecological processes

There are several other renewable energy developments in the wider area and along with the current development, these would potentially generate significant cumulative impacts on habitat loss and fragmentation and negative impact on broad-scale ecological processes such as dispersal and climate change

resilience. While there are several existing and proposed renewable energy developments in the wider area (within 100km), those in closer proximity (within 30km) to the site are seen as the most important with regards to generating cumulative impact. The current footprint in the area stands at around 1000ha with the current WEF development contributing approximately 219 ha of additional habitat loss to the area and the grid connection less than 10ha. Although a node of development is concentrating around the Paulputs substation, even with the current and other proposed developments, the overall extent of development in the wider area is still low and currently impacts on broad scale ecological processes are likely to remain low as the areas that are likely to be important for the maintenance of broad-scale ecological processes such as dispersal remain free of development.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	M	Negative	L	M	H
With Mitigation	L	H	L	Negative	L	M	H
Can the impact be reversed?	No. Habitat loss and disturbance will persist for the lifetime of the facility.						
Will impact cause irreplaceable loss or resources?	No. No species or habitats of high conservation concern are likely to be compromised by the development.						
Can impact be avoided, managed or mitigated?	Partly. Sensitive habitats can be avoided, but some contribution to cumulative impact in the area is inevitable and cannot be fully avoided or mitigated.						

Mitigation measures to reduce residual risk or enhance opportunities:

- Avoid impact to restricted and specialised habitats such as quartz patches and rocky outcrops.
- Minimise the development footprint as far as possible and ensure that the management plans for the facility are optimally implemented during the operational phase of the development to ensure that the indirect impacts associated with the development are kept to a minimum.

8. CONCLUSION AND RECOMMENDATIONS

The whole Paulputs WEF site is located within the Bushmanland Arid Grassland vegetation type, which is an extensive vegetation type considered to be generally low sensitivity with a low abundance of species of concern. The resolution of national vegetation map is however coarse in the study area and there are several different vegetation communities and habitats present in the area which have not been mapped. In order to address this shortcoming a more detailed habitat map for the site was developed based on the results of the field assessment. Of particular relevance is the presence is numerous washes as well as several rocky outcrops which are considered sensitive and largely unsuitable for development. These features however occupy a small proportion of the site and do not pose a significant limitation for the development of the site as a wind farm. Under the final layout assessed, there would not be a direct impact on the rocky outcrops, and there are no turbines within the washes. In terms of the limits of acceptable change within the different sensitivity categories provided for the development, the final development footprint is within these limits and as such no limits of acceptable change have been exceeded by the development.

The abundance of listed fauna in the area is low and there while there are some habitats present that are considered to be of high faunal value, these occupy a small proportion of the site and have been avoided. Long term impacts on fauna are likely to be low and restricted to some habitat loss and operational phase disturbance as a result of the presence and operation of the wind farm. A part of the site is located within a CBA 1, which raises the suitability of development within this part of the site into question. Correspondence with DENC indicates that this area has been identified as a CBA based on the presence of *Aloidendron dichotomum* within the site. This species was confirmed present at the site at a low density, both within and outside of the area demarcated as a CBA. With the appropriate avoidance, direct impact on this species can be well-mitigated. Although the development would result in some habitat loss across the site, this is not likely to affect the local population of *Aloidendron dichotomum*. A more direct threat would likely be poaching and harvesting of young trees by construction or operational phase personnel on the site. Specific mitigation should be implemented during construction and operation to reduce this risk, including setting up and implementing a long-term population monitoring programme within the site for this species. Overall, provided that impact on *Aloidendron dichotomum* can be avoided, then development within the CBA area is considered acceptable from an ecological stand point. However, as this area still contributes to meeting targets, represents habitat for *Aloidendron dichotomum* and is currently in a moderate condition, the overall extent of the development footprint in this area should be limited to ensure that its ecological function is not compromised. The final development footprint within the CBA is estimated at 15ha which is within the recommended 20ha footprint limit provided to the developer for this area and as such is considered acceptable.

Impact Statement – Paulputs WEF Development

The footprint of the Paulputs WEF is located within typical, low-sensitivity habitat with a low abundance of species of conservation concern. The post-mitigation impacts associated with the development would be of low significance. The contribution of the Paulputs WEF to cumulative impact in the area would be low and is considered acceptable. Overall, there are no specific long-term impacts likely to be associated with the development of the Paulputs WEF that cannot be reduced to a acceptable significance and no limits of acceptable change were exceeded by the development. As such, **there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding**.

Impact Statement – Grid Connection

The Paulputs WEF grid connection options are acceptable and would generate low post-mitigation impacts on fauna and flora. There are no specific long-term impacts likely to be associated with the development of the Paulputs WEF Grid Connections that cannot be reduced to a low significance. The contribution of the power line and substation components to cumulative impact in the area would be low and is considered acceptable. As such, **there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding**.

9. APPENDIX 1. LIST OF PLANTS

List of plant species known from the area around the site, based on observations from the site as well as records from the area from the SANBI POSA database.

Family	Species	Family	Species
ACANTHACEAE	*Acanthopsis disperma*	ACANTHACEAE	*Acanthopsis hoffmannseggiana*
ACANTHACEAE	*Barleria lancifolia subsp. lancifolia*	ACANTHACEAE	*Barleria lichtensteiniana*
ACANTHACEAE	*Barleria rigida*	ACANTHACEAE	*Blepharis mitrata*
ACANTHACEAE	*Blepharis pruinosa*	ACANTHACEAE	*Monechma divaricatum*
ACANTHACEAE	*Monechma incanum*	ACANTHACEAE	*Monechma spartioides*
ACANTHACEAE	*Petalidium lucens*	AIZOACEAE	*Aizoon canariense*
AIZOACEAE	*Galenia africana*	AIZOACEAE	*Galenia fruticosa*
AIZOACEAE	*Galenia sarcophylla*	AIZOACEAE	*Galenia secunda*
AIZOACEAE	*Tetragonia arbuscula*	AIZOACEAE	*Tetragonia reduplicata*
AIZOACEAE	*Trianthema parvifolia var. parvifolia*	AIZOACEAE	*Trianthema parvifolia var. rubens*
AMARANTHACEAE	*Amaranthus praetermissus*	AMARANTHACEAE	*Sericocoma avolans*
ANACARDIACEAE	*Rhus burchellii*	ANACARDIACEAE	*Searsia burchellii*
ANACARDIACEAE	*Searsia populifolia*	APOCYNACEAE	*Fockea sinuata*
APOCYNACEAE	*Hoodia gordonii*	APOCYNACEAE	*Microloma incanum*
APOCYNACEAE	*Microloma sagittatum*	APOCYNACEAE	*Pergularia daemia var. leiocarpa*
APOCYNACEAE	*Pergularia daemia subsp. garipensis*	ASPARAGACEAE	*Asparagus denudatus*
ASPARAGACEAE	*Asparagus exuvialis forma exuvialis*	ASPARAGACEAE	*Asparagus pearsonii*
ASPHODELACEAE	*Aloe claviflora*	ASPHODELACEAE	*Aloe dichotoma var. dichotoma*
ASTERACEAE	*Amellus tridactylus subsp. arenarius*	ASTERACEAE	*Arctotis leiocarpa*
ASTERACEAE	*Berkheya spinosissima subsp. namaensis var. namaensis*	ASTERACEAE	*Berkheya spinosissima subsp. spinosissima*
ASTERACEAE	*Dicoma capensis*	ASTERACEAE	*Didelta carnosa var. carnosa*
ASTERACEAE	*Dimorphotheca polyptera*	ASTERACEAE	*Dimorphotheca sinuata*
ASTERACEAE	*Eriocephalus ericoides subsp. ericoides*	ASTERACEAE	*Eriocephalus microphyllus var. pubescens*
ASTERACEAE	*Eriocephalus pauperrimus*	ASTERACEAE	*Eriocephalus spinescens*
ASTERACEAE	*Euryops dregeanus*	ASTERACEAE	*Felicia clavipilosa subsp. clavipilosa*
ASTERACEAE	*Foveolina dichotoma*	ASTERACEAE	*Gazania lichtensteinii*
ASTERACEAE	*Geigeria filifolia*	ASTERACEAE	*Geigeria vigintisquamea*
ASTERACEAE	*Gorteria corymbosa*	ASTERACEAE	*Helichrysum argyrosphaerum*
ASTERACEAE	*Helichrysum herniarioides*	ASTERACEAE	*Ifloga molluginoides*
ASTERACEAE	*Kleinia longiflora*	ASTERACEAE	*Myxopappus acutilobus*
ASTERACEAE	*Osteospermum pinnatum var. breve*	ASTERACEAE	*Osteospermum rigidum var. rigidum*
ASTERACEAE	*Pentzia pinnatisecta*	ASTERACEAE	*Pseudognaphalium luteo-album*
ASTERACEAE	*Pteronia leucoclada*	ASTERACEAE	*Pulicaria scabra*
ASTERACEAE	*Senecio niveus*	ASTERACEAE	*Senecio sisymbriifolius*
ASTERACEAE	*Tripteris microcarpa subsp. microcarpa*	ASTERACEAE	*Ursinia nana subsp. nana*
BIGNONIACEAE	*Rhigozum trichotomum*	BORAGINACEAE	*Codon royenii*
BORAGINACEAE	*Ehretia rigida subsp. rigida*	BORAGINACEAE	*Heliotropium curassavicum*
BORAGINACEAE	*Trichodesma africanum*	BRASSICACEAE	*Heliophila deserticola*
BRASSICACEAE	*Heliophila deserticola var. deserticola*	BRASSICACEAE	*Heliophila deserticola var. micrantha*
BRASSICACEAE	*Heliophila trifurca*	BURSERACEAE	*Commiphora gracilifrondosa*

BURSERACEAE	*Commiphora namaensis*	CAMPANULACEAE	*Wahlenbergia psammophila*
CAPPARACEAE	*Boscia albitrunca*	CAPPARACEAE	*Boscia foetida subsp. foetida*
CAPPARACEAE	*Cadaba aphylla*	CAPPARACEAE	*Cleome angustifolia subsp. diandra*
CAPPARACEAE	*Cleome foliosa var. lutea*	CAPPARACEAE	*Cleome oxyphylla var. oxyphylla*
CAPPARACEAE	*Maerua gilgii*	CHENOPODIACEAE	*Salsola armata*
CHENOPODIACEAE	*Salsola barbata*	CHENOPODIACEAE	*Salsola columnaris*
CHENOPODIACEAE	*Salsola glabrescens*	CHENOPODIACEAE	*Salsola kali*
CHENOPODIACEAE	*Salsola namibica*	CHENOPODIACEAE	*Salsola rabieana*
CHENOPODIACEAE	*Salsola zeyheri*	COLCHICACEAE	*Ornithoglossum viride*
COLCHICACEAE	*Ornithoglossum vulgare*	CONVOLVULACEAE	*Ipomoea cairica var. cairica*
CUCURBITACEAE	*Coccinia rehmannii*	CUCURBITACEAE	*Cucumis africanus*
CUCURBITACEAE	*Cucumis sagittatus*	CUCURBITACEAE	*Kedrostis africana*
CYPERACEAE	*Cyperus marginatus*	EBENACEAE	*Diospyros acocksii*
EUPHORBIACEAE	*Euphorbia gariepina subsp. balsamea*	EUPHORBIACEAE	*Euphorbia gariepina subsp. gariepina*
EUPHORBIACEAE	*Euphorbia glanduligera*	EUPHORBIACEAE	*Euphorbia inaequilatera var. inaequilatera*
EUPHORBIACEAE	*Euphorbia multiceps*	EUPHORBIACEAE	*Euphorbia rudis*
EUPHORBIACEAE	*Euphorbia spinea*	EUPHORBIACEAE	*Euphorbia virosa*
FABACEAE	*Acacia erioloba*	FABACEAE	*Acacia mellifera subsp. detinens*
FABACEAE	*Adenolobus garipensis*	FABACEAE	*Caesalpinia bracteata*
FABACEAE	*Cyamopsis serrata*	FABACEAE	*Hoffmannseggia lactea*
FABACEAE	*Indigastrum argyraeum*	FABACEAE	*Indigastrum argyroides*
FABACEAE	*Indigofera alternans var. alternans*	FABACEAE	*Indigofera heterotricha*
FABACEAE	*Indigofera hololeuca*	FABACEAE	*Indigofera pechuelii*
FABACEAE	*Indigofera sessilifolia*	FABACEAE	*Lebeckia spinescens*
FABACEAE	*Leobordea platycarpa*	FABACEAE	*Lessertia annularis*
FABACEAE	*Lessertia pauciflora var. pauciflora*	FABACEAE	*Lotononis rabenaviana*
FABACEAE	*Melilotus albus*	FABACEAE	*Melolobium candicans*
FABACEAE	*Parkinsonia africana*	FABACEAE	*Pomaria lactea*
FABACEAE	*Prosopis glandulosa var. glandulosa*	FABACEAE	*Prosopis velutina*
FABACEAE	*Ptycholobium biflorum subsp. biflorum*	FABACEAE	*Sutherlandia microphylla*
FABACEAE	*Tephrosia dregeana var. dregeana*	FABACEAE	*Trigonella hamosa*
FRANKENIACEAE	*Frankenia pulverulenta*	GERANIACEAE	*Monsonia parvifolia*
GERANIACEAE	*Monsonia umbellata*	GISEKIACEAE	*Gisekia africana var. africana*
GISEKIACEAE	*Gisekia pharnacioides var. pharnacioides*	HYACINTHACEAE	*Albuca acuminata*
HYACINTHACEAE	*Albuca setosa*	HYACINTHACEAE	*Dipcadi glaucum*
HYACINTHACEAE	*Dipcadi gracillimum*	IRIDACEAE	*Moraea venenata*
LAMIACEAE	*Stachys burchelliana*	LOASACEAE	*Kissenia capensis*
LOPHIOCARPACEAE	*Lophiocarpus polystachyus*	LORANTHACEAE	*Tapinanthus oleifolius*
MALVACEAE	*Hermannia gariepina*	MALVACEAE	*Hermannia grandiflora*
MALVACEAE	*Hermannia marginata*	MALVACEAE	*Hermannia minutiflora*
MALVACEAE	*Hermannia modesta*	MALVACEAE	*Hermannia spinosa*
MALVACEAE	*Hermannia stricta*	MALVACEAE	*Hibiscus elliottiae*
MALVACEAE	*Radyera urens*	MELIACEAE	*Nymania capensis*
MENISPERMACEAE	*Cissampelos capensis*	MESEMBRYANTHEMACEAE	*Aridaria noctiflora subsp. straminea*
MESEMBRYANTHEMACEAE	*Mesembryanthemum coriarium*	MESEMBRYANTHEMACEAE	*Mesembryanthemum crystallinum*
MESEMBRYANTHEMACEAE	*Mesembryanthemum inachabense*	MESEMBRYANTHEMACEAE	*Phyllobolus lignescens*
MESEMBRYANTHEMACEAE	*Prenia tetragona*	MESEMBRYANTHEMACEAE	*Psilocaulon articulatum*

MESEMBRYANTHEMACEAE	*Psilocaulon coriarium*	MESEMBRYANTHEMACEAE	*Psilocaulon subnodosum*
MESEMBRYANTHEMACEAE	*Ruschia ferox*	MOLLUGINACEAE	*Hypertelis salsoloides var. salsoloides*
MOLLUGINACEAE	*Limeum aethiopicum var. aethiopicum*	MOLLUGINACEAE	*Limeum aethiopicum var. lanceolatum*
MOLLUGINACEAE	*Limeum aethiopicum subsp. aethiopicum var. aethiopicum*	MOLLUGINACEAE	*Limeum argute-carinatum var. kwebense*
MOLLUGINACEAE	*Limeum myosotis var. confusum*	MOLLUGINACEAE	*Limeum sulcatum var. gracile*
MOLLUGINACEAE	*Limeum sulcatum var. robustum*	MOLLUGINACEAE	*Mollugo cerviana var. cerviana*
MOLLUGINACEAE	*Pharnaceum brevicaule*	MOLLUGINACEAE	*Suessenguthiella scleranthoides*
MONTINIACEAE	*Montinia caryophyllacea*	NEURADACEAE	*Grielum humifusum var. parviflorum*
NEURADACEAE	*Grielum sinuatum*	NYCTAGINACEAE	*Phaeoptilum spinosum*
OXALIDACEAE	*Oxalis beneprotecta*	PASSIFLORACEAE	*Adenia repanda*
PEDALIACEAE	*Rogeria longiflora*	PEDALIACEAE	*Sesamum capense*
PLUMBAGINACEAE	*Dyerophytum africanum*	POACEAE	*Aristida adscensionis*
POACEAE	*Aristida congesta subsp. barbicollis*	POACEAE	*Cenchrus ciliaris*
POACEAE	*Cynodon dactylon*	POACEAE	*Enneapogon cenchroides*
POACEAE	*Enneapogon desvauxii*	POACEAE	*Enneapogon scaber*
POACEAE	*Eragrostis annulata*	POACEAE	*Eragrostis biflora*
POACEAE	*Eragrostis brizantha*	POACEAE	*Eragrostis nindensis*
POACEAE	*Eragrostis porosa*	POACEAE	*Leucophrys mesocoma*
POACEAE	*Odyssea paucinervis*	POACEAE	*Phragmites australis*
POACEAE	*Polypogon monspeliensis*	POACEAE	*Schmidtia kalahariensis*
POACEAE	*Setaria verticillata*	POACEAE	*Sporobolus nervosus*
POACEAE	*Stipagrostis anomala*	POACEAE	*Stipagrostis brevifolia*
POACEAE	*Stipagrostis ciliata var. capensis*	POACEAE	*Stipagrostis hochstetteriana var. hochstetteriana*
POACEAE	*Stipagrostis hochstetteriana var. secalina*	POACEAE	*Stipagrostis namaquensis*
POACEAE	*Stipagrostis obtusa*	POACEAE	*Stipagrostis uniplumis var. neesii*
POACEAE	*Stipagrostis uniplumis var. uniplumis*	POACEAE	*Tragus berteronianus*
POACEAE	*Tragus racemosus*	POACEAE	*Tricholaena capensis subsp. capensis*
POLYGALACEAE	*Polygala leptophylla var. leptophylla*	POLYGALACEAE	*Polygala seminuda*
POLYGONACEAE	*Persicaria decipiens*	PORTULACACEAE	*Anacampseros filamentosa subsp. tomentosa*
PORTULACACEAE	*Avonia albissima*	PORTULACACEAE	*Talinum arnotii*
POTTIACEAE	*Tortula atrovirens*	RHAMNACEAE	*Ziziphus mucronata subsp. mucronata*
RICCIACEAE	*Riccia cavernosa*	RUBIACEAE	*Kohautia caespitosa subsp. brachyloba*
RUBIACEAE	*Kohautia cynanchica*	SANTALACEAE	*Thesium lineatum*
SAPINDACEAE	*Pappea capensis*	SCROPHULARIACEAE	*Aptosimum elongatum*
SCROPHULARIACEAE	*Aptosimum junceum*	SCROPHULARIACEAE	*Aptosimum marlothii*
SCROPHULARIACEAE	*Aptosimum procumbens*	SCROPHULARIACEAE	*Aptosimum spinescens*
SCROPHULARIACEAE	*Diascia engleri*	SCROPHULARIACEAE	*Jamesbrittenia aridicola*
SCROPHULARIACEAE	*Jamesbrittenia ramosissima*	SCROPHULARIACEAE	*Lyperia tristis*
SCROPHULARIACEAE	*Manulea nervosa*	SCROPHULARIACEAE	*Manulea schaeferi*
SCROPHULARIACEAE	*Peliostomum leucorrhizum*	SCROPHULARIACEAE	*Selago albida*
SCROPHULARIACEAE	*Selago articulata*	SCROPHULARIACEAE	*Selago dinteri subsp. pseudodinteri*
SCROPHULARIACEAE	*Selago divaricata*	SCROPHULARIACEAE	*Veronica anagallis-aquatica*
SOLANACEAE	*Datura stramonium*	SOLANACEAE	*Lycium bosciifolium*
SOLANACEAE	*Lycium cinereum*	SOLANACEAE	*Lycium eenii*

SOLANACEAE	*Lycium oxycarpum*	SOLANACEAE	*Lycium pumilum*
SOLANACEAE	*Nicotiana glauca*	SOLANACEAE	*Nicotiana longiflora*
SOLANACEAE	*Solanum capense*	TAMARICACEAE	*Tamarix usneoides*
TECOPHILAEACEAE	*Cyanella lutea*	URTICACEAE	*Forsskaolea candida*
VERBENACEAE	*Chascanum garipense*	VISCACEAE	*Viscum capense*
VISCACEAE	*Viscum rotundifolium*	ZYGOPHYLLACEAE	*Augea capensis*
ZYGOPHYLLACEAE	*Sisyndite spartea*	ZYGOPHYLLACEAE	*Tribulus cristatus*
ZYGOPHYLLACEAE	*Tribulus pterophorus*	ZYGOPHYLLACEAE	*Tribulus terrestris*
ZYGOPHYLLACEAE	*Zygophyllum dregeanum*	ZYGOPHYLLACEAE	*Zygophyllum foetidum*
ZYGOPHYLLACEAE	*Zygophyllum microcarpum*	ZYGOPHYLLACEAE	*Zygophyllum prismatocarpum*
ZYGOPHYLLACEAE	*Zygophyllum retrofractum*	ZYGOPHYLLACEAE	*Zygophyllum rigidum*
ZYGOPHYLLACEAE	*Zygophyllum simplex*	ZYGOPHYLLACEAE	*Zygophyllum suffruticosum*

10. ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur in the broad vicinity of the study area. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the EWT/SANBI 2016 Red List.

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus rupestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	High
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Confirmed
Lagomorpha (Hares and Rabbits):				
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Low
Pronologus saunsersiae	Hewitt's Red Rock Rabbit	LC	Closely confined to rocky koppies, rocky kloofs and gorges.	Confirmed
Rodentia (Rodents):				
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Petromus typicus	Dassie Rat	LC	Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders	High
Pedetes capensis	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	Confirmed
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	Confirmed
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Thallomys paedulcus	Acacia Tree Rat	LC	Associated with stands of Acacia woodland	Low

Scientific Name	Common Name	Status	Habitat	Likelihood
Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	Confirmed
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	Confirmed
Gerbillurus tytonis	Dune Hairy-footed Gerbil	LC	Hot dry areas on shifting red sand dunes	High
Gerbilliscus leucogaster	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	Low
Gerbilliscus brantsii	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	Medium
Saccostomus campestris	Pouched Mouse	LC	Catholic habitat requirements, commoner in areas where there is a sandy substrate.	Medium
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Petromyscus collinus	Pygmy Rock Mouse	LC	Arid areas on rocky outcrops or koppies with a high rock cover	High
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	Low
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	Confirmed
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	Confirmed

Scientific Name	Common Name	Status	Habitat	Likelihood
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	Confirmed
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	Confirmed
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	Confirmed
Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	Confirmed
Rumanantia (Antelope):				
Oryx gazella	Gemsbok	LC	Open arid country	Confirmed
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed
Oreotragus oreotragus	Klipspringer	LC	Closely confined to rocky habitat.	Medium

11. ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur in the vicinity of the study area, based on records from the SARCA database, conservation status is from Bates et al. 2013.

Scientific Name	Common Name	Distribution	Status	Habitat	Likelihod
Tortoises and Terrapins:					
Psammobates tentorius verroxii	Bushmanland Tent Tortoise	Endemic	Data Deficient	Varied: usually arid karroid areas or rocky sandveld	Confirmed
Snakes:					
Rhinotyphlops schinzi	Schinz's Beaked Blind Snake	Endemic	Data Deficient	Semi-deseet and arid savanna	High
Leptotyphlops occidentalis	Western Thread Snake	Endemic	Data Deficient	Nambib Desert and Karoo scrub	High
Lamprophis capensis	Brown House Snake	Widespread	Data Deficient	Common in highveld grassland & arid karroid regions, but found everywhere & tolerant of urban sprawl	High
Pseudaspis cana	Mole Snake	Widespread	Data Deficient	Sandy scrubland in SW Cape, highveld grassland & mountainous & desert regions	High
Prosymna bivittata	Two-striped Shovel-snout			Acacia sanannah entering sandveld	Low
Dipsina multimaculata	Dwarf Beaked Snake	Endemic	Data Deficient	Rocky, sandy areas. Cape karroid areas.	High
Psammophis notostictus	Karoo Sand or Whip Snake	Widespread	Data Deficient	Arid scrubland & karroid regions	Confirmed
Psammophis leightoni	Cape Whip Snake	Endemic	Data Deficient	Coastal fynbos, desert and semi-desert	High
Dasypeltis scabra	Common/Rhombic Egg Eater	Widespread	LC	Absent only from true desert & closed-canopy forest	High
Telescopus beetzii	Namib Tiger Snake	Endemic	Data Deficient	Rocky, arid regions	High
Telescopus semiannulatus	Eastern Tiger Snake	Widespread	Data Deficient	Desert to Karoo, savanna and forest	Low
Aspidelaps lubricus	Coral Shield Cobra	Widespread	Data Deficient	Karroid & sandveld regions, entering dry valley plains in S and E Cape	High
Naja nivea	Cape Cobra	Widespread	Data Deficient	Arid karroid regions, particularly along river courses, entering well drained open areas along the southern coast	High
Naja nigricollis woodi	Black Spitting Cobra	Endemic	SARDB Rare	Namibia to Citrusdal in karroid scrub	Confirmed
Bitis arietans	Puff Adder	Widespread	Data Deficient	Absent only from desert & mnt tops	High

Scientific Name	Common Name	Distribution	Status	Habitat	Likelihod
Bitis xeropaga	Desert Mountain Adder	Endemic	Data Deficient	Mountain slopes and sparsely vegetated rocky hillsides	Low
Bitis caudalis	Horned Adder	Widespread	Data Deficient	Sandy regions, throughout Karoo	Confirmed
Worm Lizards					
Monopeltis infuscata	Dusky Spade-snouted Worm Lizard	Widespread		Dry and moist savannah	Low
Lizard and Skinks:					
Acontias tristis	Namaqua Dwarf Legless Skink	Endemic	Data Deficient	Sandy, arid soils	Confirmed
Mabuya capensis	Cape Skink	Widespread	Data Deficient	Very varied: arid karroid veld, moist coastal bush, montane grassland, etc	High
Mabuya occidentalis	Western Three-Striped Skink	Widespread	Data Deficient	Arid Savanna karroid veld and desert	High
Mabuya spilogaster	Kalahari Tree Skink	Widespread		Arid Savannah	High
Mabuya sulcata	Western Rock Skink	Widespread	Data Deficient	Karroid areas	Confirmed
Mabuya striata	Striped Skink	Widespread	Data Deficient	Varied, except desert areas, succulent karoo and fynbos	Low
Mabuya variegata	Variegated Skink	Widespread	Data Deficient	Extremely varied; desert, karroid veld, montane grassland, savanna, coastal bush & valley bushveld	High
Meroles suborbitalis	Spotted Desert Lizard	Endemic	Data Deficient	Varied, arid savanna to desert	High
Nucras tessellata tessellata	Striped Sandveld Lizard	Widespread	Data Deficient	Open arid savannah & karroid veld	High
Pedioplanis laticeps	Cape Sand Lizard	Endemic	LC	Coastal dunes and succulent karroid veld	Low
Pedioplanis lineoocellata	Spotted Sand Lizard	Endemic	Data Deficient	Very varied: karroid veld, valley bushveld & arid & mesic savannah	High
Pedioplanis namaquensis	Namaqua Sand Lizard	Widespread	Data Deficient	Karroid veld	High
Pedioplanis undata	Western Sand Lizard	Widespread	Data Deficient	Prefers arid, sparsely vegetated desert	High
Cordylus polyzonus	Karoo Girdled Lizard	Endemic	Data Deficient	Karroid regions, coastal renosterveld and succulent karoo	High
Platysaurus broadleyi	Broadley's Flat Lizard	Narrow Endemic	Data Deficient	Rocky, arid sanannah, between augrabies and Pella	Low
Agama aculeata	Ground Agama	Widespread	Data Deficient	Semi desert and savanna	Confirmed
Agama anchietae	Anchieta's Agama	Widespread	Data Deficient	Semi desert and arid savanna	High

Scientific Name	Common Name	Distribution	Status	Habitat	Likelihod
Agama atra	Southern Rock Agama	Endemic	Data Deficient	Semi-desert to fynbos, from sea level to mountain tops	Low
Chameleons:			Data Deficient		
Chamaeleo namaquensis	Namaqua Chameleon	Widespread	LC	Sandy regions (incl coastal dunes) with scrub vegetation	High
Geckos:			Data Deficient		
Chondrodactylus angulifer	Giant Ground Gecko	Endemic	LC	Gravel plains, interdune spaces & sandy flats	High
Lygodactylus bradfieldi	Bradfield's Dwarf Gecko	Widespread	Data Deficient	Arid savannah and succulent desert	High
Chondrodactylus bibronii	Bibron's Tubercled Gecko	Endemic	Data Deficient	Rocky outcrops, cliffs and large trees	High
Pachydactylus turneri	Turner's Thick-toed Gecko	Widespread	Data Deficient	Semi-desert and arid savannah	Low
Pachydactyus haackei	Haacke's Thick-toed Gecko	Endemic	Data Deficient	Large rock outcrops	Low
Pachydactylus rugosus	Rough Thick-toed Gecko	Endemic	Data Deficient	Semi-desert and succulent karroid veld	High
Pachydactylus serval	Western Spotted Gecko	Endemic	Data Deficient	Semi desert and succulent karroid veld	High
Ptenopus garrulus	Common Barking Gecko	Endemic	Data Deficient	Desert and semi-desert on various soil types, preferring flat stable sandy soils with sparse vegetation cover	High

12. ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in in the vicinity of the site according to the Frog Atlas of South Africa. Conservation status is from the Minter et al. 2004.

Scientific Name	Common Name	Status	Habitat	Distribution	Konkoonsies
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	Low
Vandijkophrynus robinsoni	Paradise Toad	Not Threatened	Natural springs and waterholes in the arid areas of the Richtersveld	Endemic	Low
Phrynomantis annectens	Marbled Rubber Frog	Not Threatened	Arid environments, closely associated with inselbergs and rocky areas	Widespread	High
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	Low
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	Low
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	Low