SUN GARDEN PV FACILITY NEAR RIEBEEK EAST:

FAUNA & FLORA SPECIALIST IMPACT ASSESSMENT REPORT

PRODUCED FOR SAVANNAH ENVIRONMENTAL

3Foxes Biodiversity Solutions

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CONTENTS

a) COMPLIANCE WITH APPENDIX 6 OF THE EIA REGULATIONS, 2014 AS AMENDED

Requirements of Appendix 6 – GN R326 2014 EIA Regulations, 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- b) 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;	6
c) a declaration that the specialist is independent in a form as may be specified by the competent authority;	7
d) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
e) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.3
f) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
g) 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 3
h) an identification of any areas to be avoided, including buffers;	Section 3
i) 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 3
j) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.3
k) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 3
l) any mitigation measures for inclusion in the EMPr;	Section 7
m) any conditions for inclusion in the environmental authorisation;	Section 5
n) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
o) 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, activities or portions thereof should be authorised, any avoidance, management and	Section 6

mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
p) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main Report
q) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main Report
r) any other information requested by the competent authority.	
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

Short CV/Summary of Expertise – Simon Todd

ECOLOGICAL SPECIALIST SERVICES

Assessment/Management/Research

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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, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

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

Tertiary Education:

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

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.

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

A selection of recent work is as follows:

Strategic Environmental Assessments

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

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

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

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

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

Recent Specialist Ecological Studies in the Vicinity of the Current Site

Environmental Impact Assessment for the Proposed Komsberg East and Komsberg West Wind Farms and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment. Arcus Consulting 2014.

Proposed Rietkloof & Brandvallei Wind Farms and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment Report. EOH 2016.

Proposed Gunstfontein Wind Farm and Associated Grid Connection Infrastructure: Fauna & Flora Specialist Impact Assessment Report. Savannah Environmental 2016.

Mainstream South Africa Dwarsrug Wind Energy Facility: Fauna & Flora Specialist Impact Assessment Report. Sivest 2014.

Phezukomoya and San Kraal Wind Energy Facilities and associated grid connection. Fauna and Flora specialist studies. Arcus Consulting 2018.

Kokerboom Wind Energy Facilities (1-4) and associated grid connections. Fauna and Flora specialist studies. Aurecon 2017.

SPECIALIST DECLARATION

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

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

Signature of the specialist: 

Name of Specialist: ____Simon Todd_____

Date: ____01 November 2021_____

EXECUTIVE SUMMARY

Sun Garden (Pty) Ltd is proposing the development of a commercial solar PV facility and associated infrastructure on a site located approximately 36km south-east of Somerset East and 28km south-west of Cookhouse within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province. The entire extent of the site falls within the Cookhouse Renewable Energy Development Zone (REDZ) and within the Eastern Corridor of the Strategic Transmission Corridors. The facility is known as the Sun Garden Solar PV Facility. Savannah Environmental has appointed 3Foxes Biodiversity Solutions to provide a terrestrial fauna and flora specialist impact assessment study of the proposed development as part of the required BA process.

A site visit and desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the site and inform an ecological sensitivity map for the site, which has been used to guide development at the site. The Sun Garden PV Facility site falls largely within the Albany Broken Veld vegetation type and it is only the grid connection that traverses some Kowie Thicket and Southern Karoo Riviere vegetation types. The northern, lower slopes and plains of the site consist of low shrublands considered to be low sensitivity with few fauna or flora of concern likely to be present. The upper, southern slopes of the PV site are fairly steep and contain a higher proportion of woody species and are considered medium sensitivity. In terms of fauna, the PV area does not have any habitats present that would be of particularly high value and no specific impacts of high magnitude on fauna are expected. However, given the size of the facility (350ha) and the location within an ESA it is recommended that specific measures are put in place with regards to the design of the fence around the facility to facilitate the movement of smaller fauna in and out of the PV area. It is therefore recommended that there should be regular (at least every 50m) access points along the boundary fence of the facility to allow smaller fauna to enter the facility area. These should be constructed as boxed gaps in the fence of dimensions 20cm x 40cm and should be orientated in both directions.

In terms of cumulative impacts, there are numerous existing, planned and authorised wind energy projects in the wider area, raising the potential for cumulative impacts. It is however only the adjacent planned Aeoulus WEF and Redding WEF that occur in a broadly similar environment to the Sun Garden PV project. These two wind energy projects would have a cumulative footprint of approximately 200ha, while the current Sun Garden and adjacent Solaris Fields PV project would have a combined footprint of approximately 700ha. Overall, while there would be some local impact on landscape connectivity and habitat loss, the contribution of the Sun Garden PV Facility to cumulative impact at 350ha is considered acceptable.

Perhaps the greatest area of potential concern regarding the Sun Garden PV facility would be the location of parts of the facility on fairly steep slopes (>5%) with soils that appear to have high erodibility. The panels would generate a lot of run-off and combined with the high levels of disturbance that would occur after construction, the potential for erosion problems at the site are very high. Consequently, specific mitigation measures to reduce and manage erosion and runoff at the site are recommended. This may include the construction of runoff ponds to capture and manage runoff from the facility. However, if such ponds are constructed, care should be taken to ensure that these are fauna-friendly particularly with regards to allowing fauna to escape the ponds should they fall in as this has been demonstrated to be a significant issue at other renewable energy facilities where such ponds occur.

Impact Statement

There are no impacts associated with the Sun Garden PV Facility and associate infrastructure that cannot be mitigated to an acceptable level and as such, the assessed layout is considered acceptable. With the application of relatively simple mitigation and avoidance measures, the impact of the Sun Garden PV Facility on the local environment can be reduced to an acceptable magnitude. The contribution of the Sun Garden PV Facility 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 Sun Garden PV Facility that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. The following conditions should be included in the EA for the development:

- The permitter fence of the facility must have access points for smaller fauna at least every 50m of fence. These should be a minimum of 40cm x 20cm in size and should be orientated both vertically and horizontally.
- The facility must have a detailed runoff and erosion management plan that takes account of the vulnerability of the area to erosion damage. This should be developed with input from a specialist with specific experience in this regard.

1 INTRODUCTION

Sun Garden (Pty) Ltd is proposing the development of a commercial solar PV facility and associated infrastructure on a site located approximately 36km south-east of Somerset East and 28km south-west of Cookhouse within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province. The entire extent of the site falls within the Cookhouse Renewable Energy Development Zone (REDZ) and within the Eastern Corridor of the Strategic Transmission Corridors. The facility is known as the Sun Garden Solar PV Facility. Due to the location of the project site within the REDZ, a Basic Assessment (BA) process is being undertaken in accordance with GN114 as formally gazetted on 16 February 2018. Sun Garden (Pty) Ltd has appointed Savannah Environmental as the independent Environmental Assessment Practitioner (EAP) to undertake the required environmental authorisation process for the proposed Sun Garden PV Facility. Savannah Environmental has, in turn, appointed 3Foxes Biodiversity Solutions to provide a terrestrial fauna and flora specialist impact assessment study of the proposed development as part of the BA process.

The purpose of the terrestrial fauna and flora specialist Basic Assessment study is to describe and detail the ecological features of the proposed site, provide an assessment of the ecological sensitivity of the site, and identify and assess the likely impacts associated with the proposed development of a solar PV facility on the site. A desktop review of the available ecological information for the area as well as a number of site visits and a field assessment is used to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map that presents the ecological constraints for development at the site. Impacts are assessed for the construction, operation, and decommissioning phases of the development. Cumulative impacts on the broader area are also considered and assessed. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the Environmental Management Programme (EMPr) for the development. The full scope of study is detailed in Section 1.1 below.

1.1 SCOPE OF STUDY

The scope of the study includes the following activities:

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

- an indication of the methodology used in determining the significance of potential environmental impacts;
- an assessment of the significance of direct, indirect and cumulative impacts of the development;
- a description and comparative assessment of all alternatives including cumulative impacts;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr);
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- a description of any assumptions uncertainties and gaps in knowledge; and
- 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; and
    - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations for the study included the following:

- Disclose any gaps in information (and limitations in the study) or assumptions made.
- Identify recommendations for mitigation measures to minimize impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal or flora related issues.
- The assessment of the potential impacts of the development and the recommended mitigation measures provided have been separated into the following project phases:
    - Pre-construction
    - Construction
    - Operation
    - Decommissioning

1.2 ASSESSMENT APPROACH & PHILOSOPHY

This assessment is conducted according to the 2014 EIA Regulations (Government Notice Regulation 982) in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as the recently promulgated notice issued in terms of NEMA, *"National Environmental Management Act, 1998 (Act No. 107 Of 1998): Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of section 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation [G 43110 – GN 320]*". The applicable site verification

report as required, is included under Annex 5 of this report and the required *Protocols for the assessment and reporting of environmental impacts on terrestrial animal species, plant species and terrestrial biodiversity are* provided in Annex 6-8. It should however be noted that this assessment does not need to be aligned with the protocols, since the DEA has indicated that irrespective of whether an EA application for a development has been submitted, if an assessment started before the protocols came into effect on 9 May 2020 the protocols are not applicable and the assessment should adhere Appendix 6 of the EIA regulations. Since this assessment commenced in 2019, the study should comply with Appendix 6. However, the content of this report is aligned to be compliant to Appendix 6 and the relevant protocols.

In terms of NEMA, this report assesses how the proponent intends to comply with the principles contained in Section 2 of 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.

1.3 RELEVANT ASPECTS OF THE DEVELOPMENT

Sun Garden (Pty) Ltd is proposing the development of a commercial solar PV facility and associated infrastructure on a site located approximately 36km south-east of Somerset East and 28km south-west of Cookhouse within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province. The entire extent of the site falls within the Cookhouse Renewable Energy Development Zone (REDZ) and within the Eastern Corridor of the Strategic Transmission Corridors. The facility is known as the Sun Garden Solar PV Facility.

A preferred project site with an extent of ~4037ha has been identified by Sun Garden (Pty) Ltd as a technically suitable area for the development of the Sun Garden Solar PV Facility. The project site consists of four affected properties:

- Portion 10 of the farm Britzkraal No 253, Division of Somerset East

- Portion 8 (a Portion of Portion 7) of the farm Britzkraal No 253, Division of Somerset East
- Portion 7 of the farm Britzkraal No 253, Division of Somerset East
- Portion 1 of farm Bothas Hoop 358

A development envelope for the placement of the solar facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~500ha in extent and the much smaller development footprint of ~350ha will be placed and sited within the development envelope. The development footprint will contain the following infrastructure to enable the solar facility to generate up to 400MW:

- Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.
- Cabling between the project components, lain underground where practical.
- A 132/33kV on-site collector substation to be connected to a proposed 400kV Main Transmission Substation (MTS) located to the north-east of the site via a new 132kV overhead power line (twin turn dual circuit line). The development of the proposed 400kV Main Transmission Substation will be assessed as part of the separate BA process in order to obtain Environmental Authorisation.
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Temporary laydown areas.
- Access roads to the site and between project components with a width of approximately 4,5m. The main access points will be 8m wide.
- A temporary concrete batching plant.
- Staff accommodation (temporary).
- Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre.

The new 132kV overhead power line to connect the wind farm to the proposed 400kV Main Transmission Substation will follow a route north-east of the project site to complete the connection. The power line will therefore cross properties located to the north-east of the project site. The majority of these properties form part of the project sites of the adjacent proposed wind farms which forms part of the cluster of renewable energy facilities proposed. The power line is being assessed within a 300m grid connection corridor which will provide for the avoidance of sensitive environment areas and features and allow for the micro-siting of the power line within the corridor.

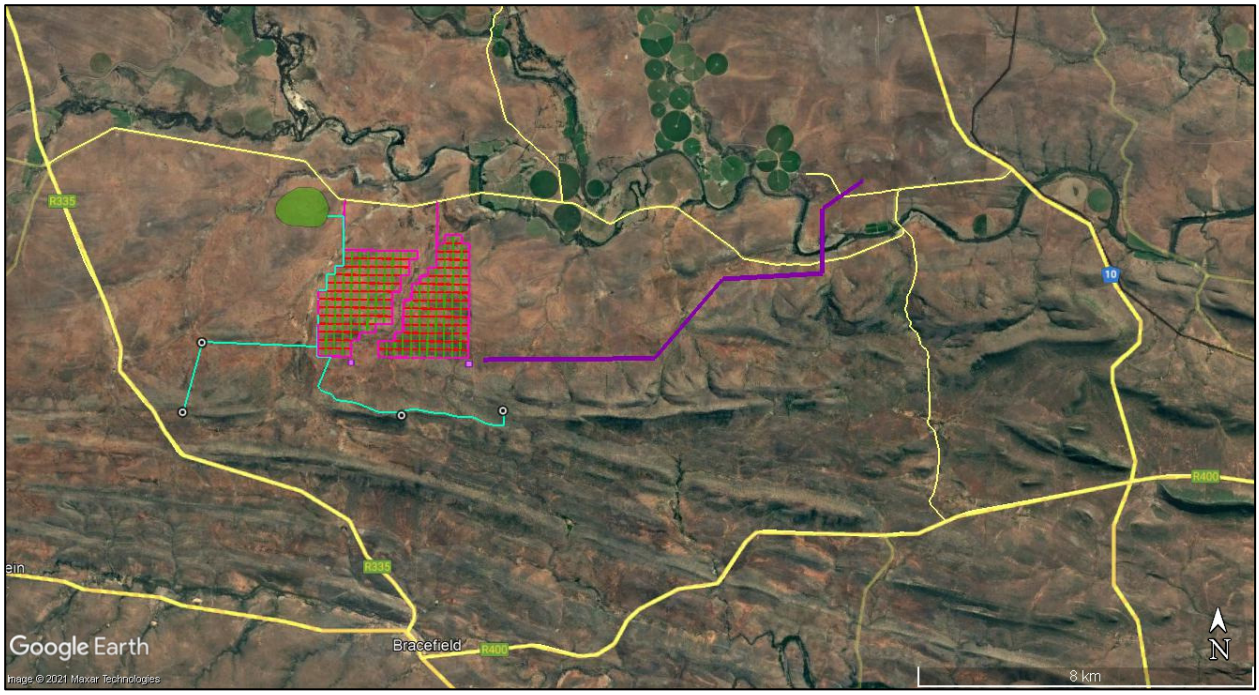


Figure 1. Location map of the Sun Garden PV Facility and the adjacent Solaris Fields PV Facility located between the N10 and the R335.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

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

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2012 and SANBI 2018 update).
- Information on plant and animal species recorded for the wider area was extracted from the SABIF/SIBIS database hosted by SANBI. Data was extracted for a significantly larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2021).

Ecosystem:

- Freshwater and wetland information was extracted from the 2018 NBA and the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Critical Biodiversity Areas in the study area were obtained from the 2019 Eastern Cape Biodiversity Plan (Desmet & Hawley 2019).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases (ReptileMap, Frogmap and MammalMap) http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as an assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2018).

2.2 Site Visits & Field Assessment

The Sun Garden site was visited and sampled several times for the current study. An initial site visit which also included the broader area took place from the 30th June to 3rd of July 2020 and an additional specific field assessment to characterise the affected area in greater detail took place on the 8th of October 2021. In addition, the site falls within the project area of a previously assessed wind farm (Spitskop) that was sampled in January 2013. During the site visits, the different biodiversity features, habitat, and landscape units present at the site were identified, mapped and characterised in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded.

2.3 Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by integrating the results of the site visits with the available ecological and biodiversity information in the literature and various spatial databases as described above. As a starting point, sensitive features such as wetlands, drainage lines, rocky hills or quartz outcrops were mapped and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then

identified and delineated based on the results of the field assessment and satellite imagery of the site. 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.

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high potential impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is usually constrained to some degree and should only proceed with caution (such as specific consideration of the footprint within these areas and field verification of the acceptability of development within these potentially sensitive areas) as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.4 LIMITATIONS & ASSUMPTIONS

The current study is based on a detailed field assessment as well as an associated desktop study. The conditions at the time of the detailed October 2021 site visit were acceptable for the field assessment. There had been some rainfall preceding the site visit and while the area was still recovering from an extended drought, the majority of the vegetation was in an identifiable condition and there were numerous geophytes present. As a result, the vegetation surveys conducted at the site are considered reliable and the species lists obtained for the site are considered comprehensive, with few species that would not have been present at the time of the field assessment. As a result of the timing and favourable conditions associated with the site visits, there are few significant limitations with regards to the results of the field assessment for vegetation. The presence of some fauna is difficult to verify in the field as these may be shy or rare and their potential presence at the site must be evaluated based on the literature and available databases. In many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has

been sampled in the past. Many remote areas have not been well sampled with the result that the species lists derived for the area do not always adequately reflect the actual fauna and flora present at the site. 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.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 BROAD-SCALE VEGETATION PATTERNS

At a very broad-scale, the site lies within the Maputaland-Pondoland-Albany Biodiversity Hotspot (CEPF 2010). This hotspot spans an area of nearly 275,000 km² and includes portions of South Africa, Swaziland and Mozambique. The hotspot is the second richest floristic region in southern Africa (after the Cape Floristic Region) and also the second richest floristic region in Africa for its size. An estimated 8,100 species occur within Maputaland-Pondoland-Albany, of which at least 1,900 (23 percent) are unique, or endemic, to the region. At a habitat level, one type of forest, three types of thicket, six types of bushveld and five types of grassland are endemic to the hotspot. The current study area lies within the Albany Center of Endemism which is characterized by ecotones between the thicket, fynbos (from the Cape Floristic Region Hotspot) and the Succulent and Nama Karoo habitats. Albany Center is also home to much of the thicket biome, which is thought to be the most species-rich formation of woody plants within South Africa. It is characterized by a unique suite of plant forms: evergreen shrubs (predominantly), tall succulents, a wealth of climbers, and very little grass. Thicket is most extensive in the southeast of the country, principally along the coastal parts of the Gouritz, Gamtoos, Sundays and Great Fish River valleys. This broad context outlines the baseline sensitivity for the area and highlights the diversity of habitats and ecosystems which characterise this area and the need for responsible development in line with long-term biodiversity maintenance.

The national vegetation map (Mucina & Rutherford 2006, SANBI 2018 update) for the study area is depicted below in **Error! Reference source not found.**. The Sun Garden development area is restricted to the Albany Broken Veld vegetation type, with some Kowie Thicket and Southern Karoo Riviere vegetation types along the grid connection route. The different vegetation types and communities present in the affected area are illustrated below. In practice, the upper parts of the site are transitional and have a significant thicket element, while the lower parts of the site consist of open plains dominated by low shrubs.

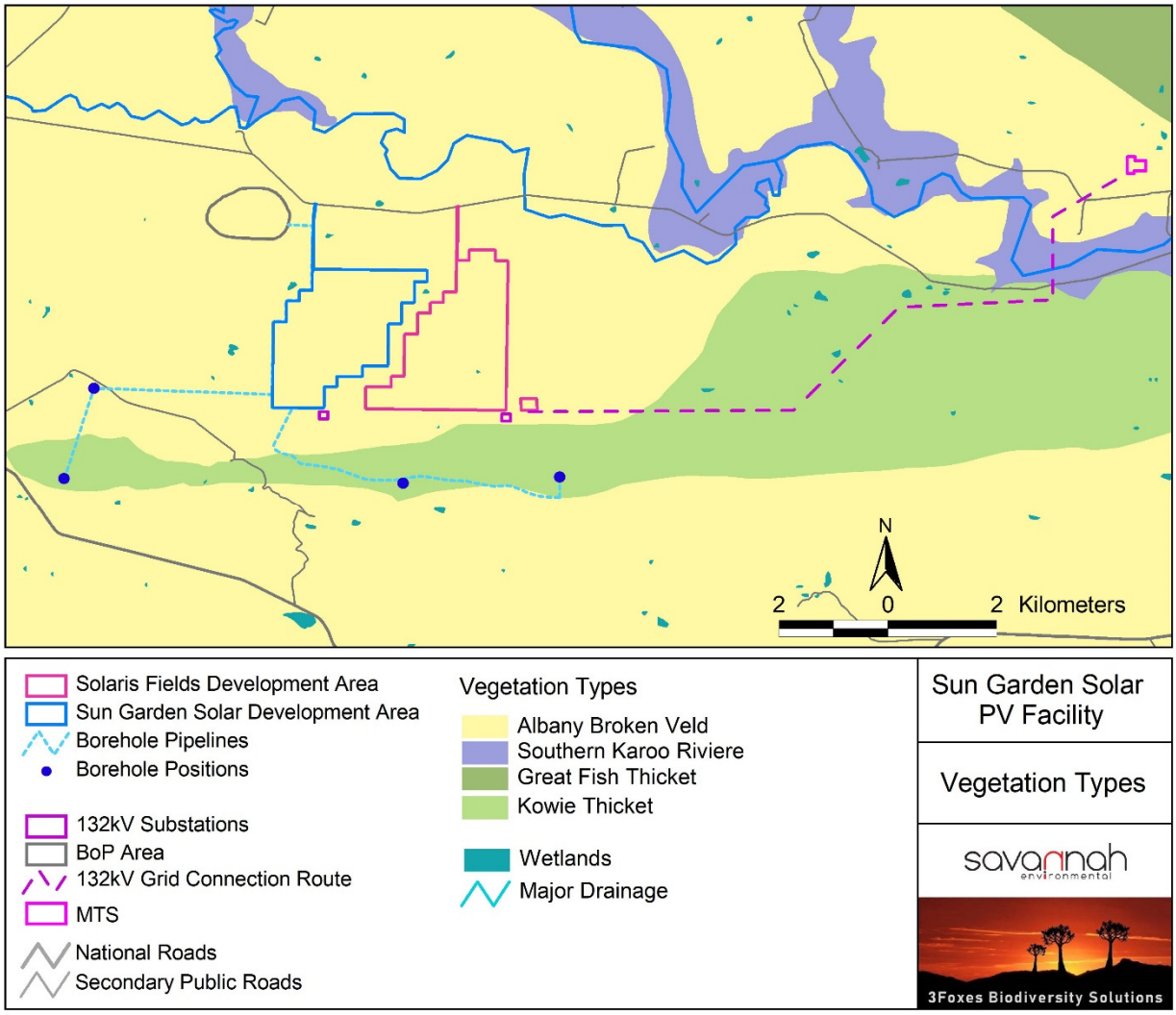


Figure 2. The 2018 update of the national vegetation map for the study area showing that the Sun Garden site falls entirely within the Albany Broken Veld vegetation type, with some Kowie Thicket and Southern Karoo Riviere along the grid connection route.

Albany Broken Veld

The whole of the Sun Garden PV development area consists of the Albany Broken Veld vegetation type. Albany Broken Veld is restricted to the Eastern Cape Province, from north of the Zuurberg Mountains and south of Middlewater, Redding and the area around the confluence of the Great and Little Fish Rivers and extending eastwards, north of the mountain ridges around Riebeeck East to the Carlisle Bridge area and south of these ridges in the upper Bushmans River Valley past Alicedale and up the New Years River Valley, including also some irregular linear patches east of Riebeeck East. Typical and characteristic species observed in the area include trees such as *Vachellia karroo*, *Euclea undulata*, *Pappea capensis*, *Schotia afra* var. *afra*, *Boscia oleoides*

and *Cussonia spicata*. Common and dominant sharubs include *Grewia robusta*, *Lycium cinereum*, *Putterlickia pyracantha*, *Rhigozum obovatum*, *Rhus incisa* var. *effusa*, *Asparagus striatus*, *A. suaveolens*, *Becium burchellianum*, *Chrysocoma ciliata*, *Selago fruticosa*, *Eriocephalus ericoides* subsp. *ericoides*, *Felicia filifolia*, *F. muricata*, *Gnidia cuneata*, *Helichrysum dregeanum*, *Hermannia linearifolia*, *Indigofera sessilifolia*, *Pentzia incana* and *Rosenia humilis*. Succulents present include *Aloe ferox*, *Aloe striata*, *Cotyledon campanulata*, *Drosanthemum lique* and *Mestoklema tuberosum*. Forbs and herbs present include *Gazania krebsiana*, *Hermannia pulverata*, *Hibiscus pusillus*, *Bulbine frutescens* and *Drimia altissima*. Perennial and annual grasses present include *Aristida congesta*, *Eragrostis obtusa*, *Sporobolus fimbriatus*, *Tragus berteronianus*, *Cynodon incompletus*, *Digitaria eriantha*, *Ehrharta calycina*, *Eragrostis curvula*, *Setaria sphacelata* and *Tragus koelerioides*.

In practice the lower (northern) slopes of the site consist of open plains with few woody species present (Figure 3), while the upper slopes of the site (southern boundary) have a significantly higher woody species density and can be considered transitional with Kowie Thicket (Figure 4). There are also several small drainage lines and washes present which are characterised by the presence of woody species such as *Vachellia karroo* and *Searsia pallens*.

Figure 3. View over the open plains which characterise the central and northern parts of the Sun Garden PV site, with typical vegetation representative of the Albany Broken Veld vegetation type.

The open plains of the Sun Garden PV area consist of open plains with occasional scattered trees and shrubs. Dominant species include *Pentzia incana, Asparagus glaucus, Ruschia spinosa,*

Aloe striata, Aloe ferox, Rosenia humilis, Asparagus striatus, Chrysocoma ciliata, Nenax microphylla, Hermannia desertorum, Aristida adscensionis, Eragrostis lehmanniana, Eragrostis obtusa, Eragrostis curvula, Boophone disticha, Searsia rigida, Asparagus suaveolens, Pachypodium succulentum, Drimia anomala, Lycium cinereum, Barleria capensis, Ammocharis coranica, Sceletium tortuosum, Thesium hystrix, Blepharis mitrata, Tetragonia fruticosa, Aptosimum procumbens, Oropetium capense and *Ocimum burchellianum*. Overall, the open plains community is considered to be low sensitivity and contains few features or species of concern.

Figure 4. The Albany Broken Veld on the upper slopes of the Sun Garden PV site has a higher abundance of trees and woody species and there are areas with a high density of *Aloe striata*.

The upper slopes of the Sun Garden PV area have a higher density of trees and bush clumps, as well as some areas with a high density of *Aloe striata* (**Figure 4**). Trees and tall shrubs present include *Euclea undulata*, *Schotia afra*, *Searsia rigida*, *Azima tetracantha*, *Mystroxylon aethiopicum* subsp. *aethiopicum*, *Carissa bispinosa* and *Vachallia karroo*. The shrub and grass layer is dominated by *Pentzia incana*, *Drosanthemum lique*, *Cadaba aphylla*, *Asparagus striatus*, Asparagus sauveolens, *Lycium prunus-spinosa*, *Digitaria eriantha* and *Tragus koelerioides*. Due to the higher diversity and tree density, the upper slopes of the Sun Garden site is considered moderate sensitivity compared to the adjacent plains.

Kowie Thicket

Although there is no Kowie Thicket within the PV area, a significant proportion of the grid connection route to the MTS runs through this vegetation type. Kowie Thicket is restricted to the Eastern Cape Province, where it occurs in the river valleys of the Bushmans, Kariega, Kowie, Kleinemonde and Kap Rivers from near the Great Fish River Mouth to Kenton-on-Sea, extending inland up these valleys past Grahamstown to just past Riebeeck East and Alicedale to north of the Zuurberg at elevations of up 700m. Dominant and characteristic species observed on the hills near the site include *Euphorbia triangularis*, *Aloe speciosa*, *Schotia afra* var. *afra*, *Acacia natalitia*, *Cussonia spicata*, *Elaeodendron croceum*, *Maytenus undata*, *Pappea capensis*, *Ptaeroxylon obliquum*, *Sideroxylon inerme*, *Azima tetracantha*, *Gymnosporia polyacantha*, *Allophylus decipiens*, *Carissa bispinosa* subsp. *bispinosa*, *Clausena anisata*, *Ehretia rigida*, *Euclea undulata*, *Grewia occidentalis*, *Gymnosporia heterophylla*, *Mystroxylon aethiopicum*, *Olea europaea* subsp. *africana*, *Putterlickia pyracantha*, *Rhus longispina*, *R. lucida*, *Crassula cultrata*, *Portulacaria afra*, *Cotyledon orbiculata*, *C.velutina*, C*.tetragona*, *Kalanchoe rotundifolia*, *Mestoklema tuberosum*, *Pelargonium peltatum*, *Sarcostemma viminale*, *Plumbago auriculata*, *Asparagus aethiopicus*, *Jasminum angulare*, *Rhoicissus digitata*, *Cynodon dactylon*, *C.incompletus*, *Eragrostis curvula*, *Sporobolus fimbriatus*, *Themeda triandra*, *Eragrostis obtusa*, *Panicum maximum*, *Sansevieria aethiopica* and *S.hyacinthoides*. These areas are considered generally more sensitive than the adjacent Albanly Broken Veld.

Figure 5. The power line route to the MTS traverses these north-facing slopes mapped as Kowie Thicket, but rather represent a transitional area between Kowie Thicket and Albany Broken Veld.

Southern Karoo Riviere

Although there are no significant drainage features within or near the Sun Garden PV area, the power line route to the MTS traverses the Little Fish River, which is characterised by the presence of the Southern Karoo Riviere vegetation type. The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least Threatened, it is associated with rivers and drainage lines and as such represents areas that are considered ecologically significant.

Figure 6. The Klein Fish River near the power line crossing point, representative of the Southern Karoo Riviere vegetation type. The river is lined by *Tamarix usneoides*, *Vachellia karoo* and *Searsia lancea*.

3.2 LISTED PLANT SPECIES

According to the SANBI POSA database, 300 species have been recorded from the broader study area, bounded by the N10 in the east and the R335 in the west and the R63 in the north and R400 in the south. Within this broad area, 277 records were returned, including three listed species as described below in Table 1. Of the three listed species, one is erroneous and does not occur in the Eastern Cape and another is not known from the study area and is not likely present. The

third, *Crassula decidua*, is poorly known but has been recorded from Cookhouse, Somerset East and Cradock, where it appears to be associated with low karroid vegetation or in amongst succulent *Euphorbia* shrubs close to rivers. As this habitat is not present within the affected area, it is highly unlikely that it would be impacted by the development. The development area was well investigated in the field, and it transitional unlikely that there are any species of high conservation concern that are present and which were not observed. As such, the impact of the development on plant species of concern is expected to be low.

Table 1. List of plant species of conservation concern that are known to occur in the wider area around the site and their potential to be present within the site based on their recorded distribution and habitat requirements.

Family	Genus	Species	Status	Comment
Aizoaceae	*Drosanthemum*	*crassum*	NT	This species is restricted to the Western Cape and the record for the study area is likely due to taxonomic changes or misidentified specimens.
Amaryllidaceae	*Crinum*	*campanulatum*	NT	Occurs in the Albany district, between Alexandria, Grahamstown, Bathurst and East London. As such, this species is highly unlikely to occur within the site. As it is associated with wetlands, there would also be minimal suitable habitat for this species within the site.
Crassulaceae	*Crassula*	*decidua*	NT	Occurs near Cookhouse, Somerset East and Cradock where it is associated with low karroid vegetation or in amongst succulent *Euphorbia* shrubs close to rivers.

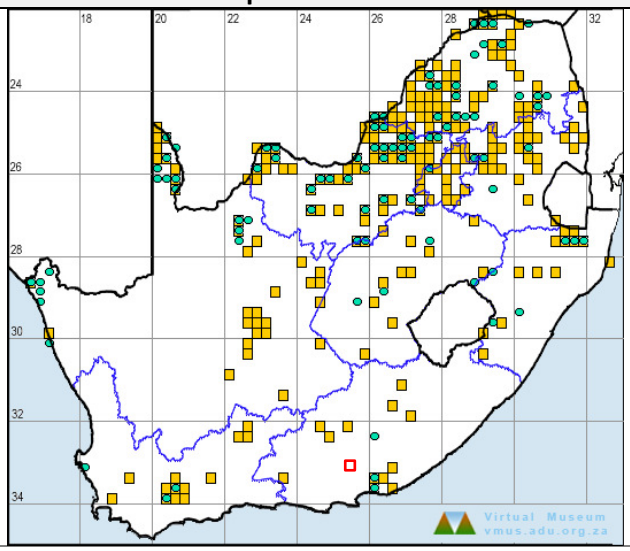
3.3 FAUNAL COMMUNITIES

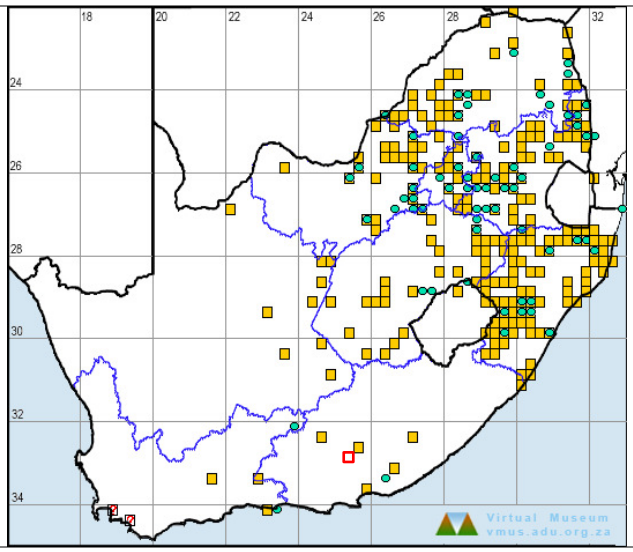
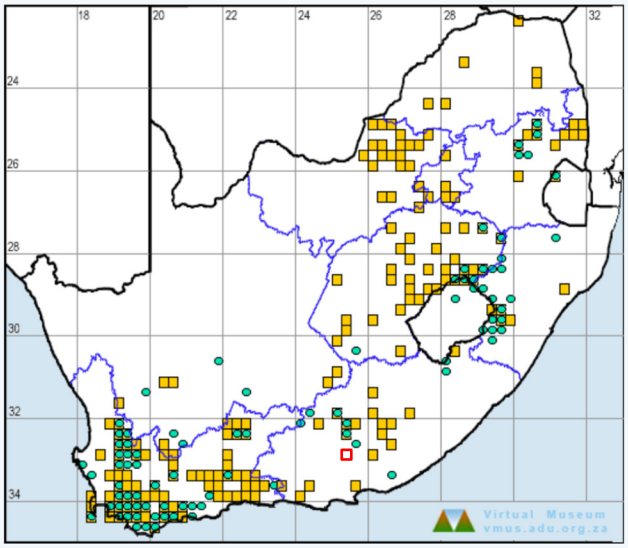
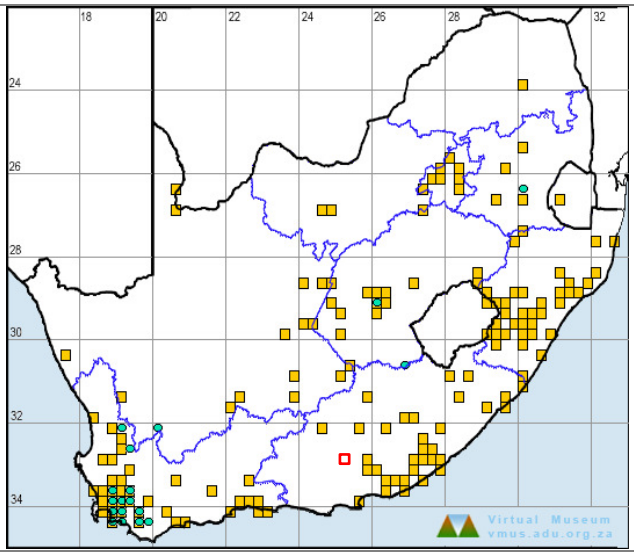
Mammals

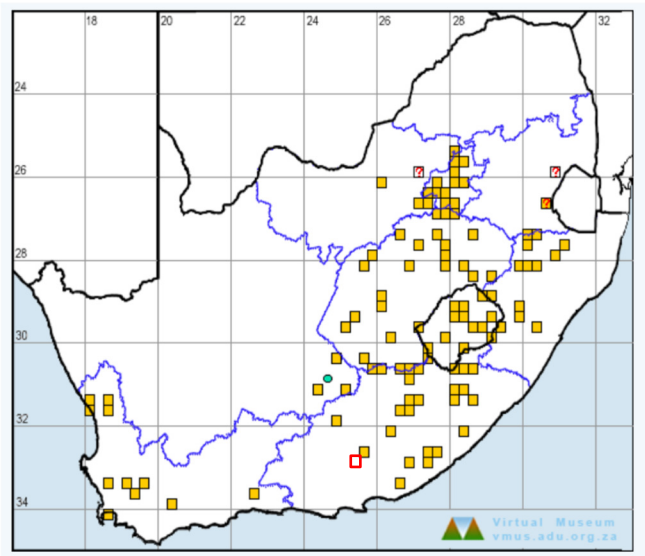
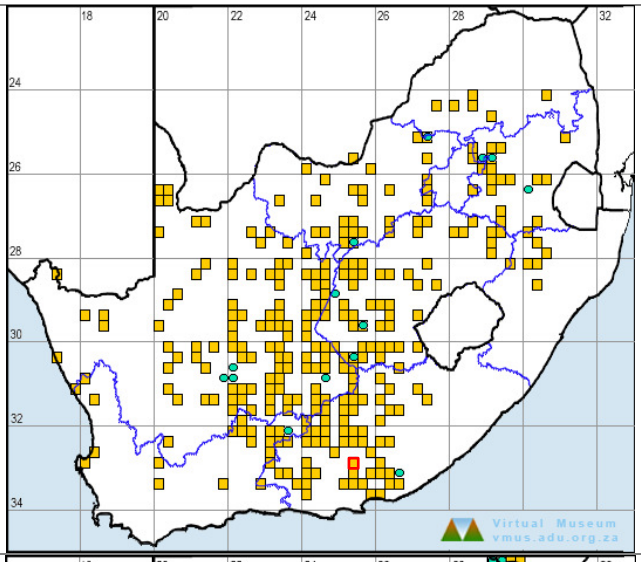
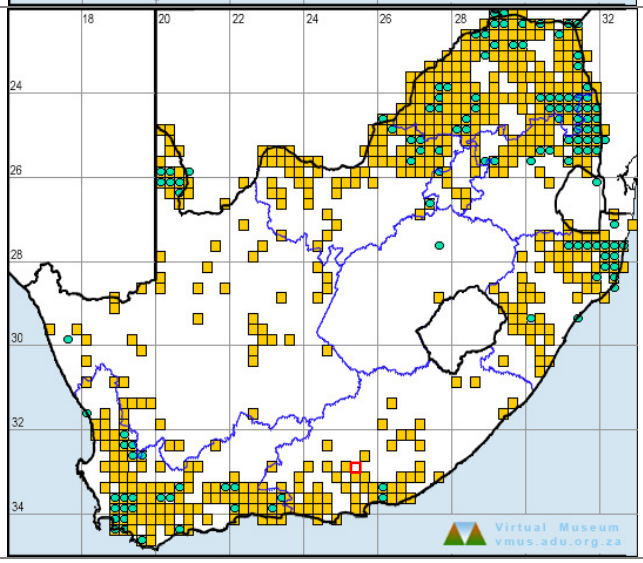
As many as 50 different naturally-occurring mammal species have been recorded from the vicinity of the Sun Garden site (Appendix 2). Common species observed during the site visit include Steenbok, Common Duiker, Kudu, Cape Porcupine, South African Ground Squirrel, Springhare, Aardvark, Grey Mongoose, Yellow Mongoose, Cape Hare, Bat-eared Fox, Vervet Monkey, Chacma Baboon, Suricate, Caracal and Black-backed Jackal. There is also some game farming in the area, with the result that there are also many introduced or farmed species present in the area, but as these populations are mostly maintained and managed by the landowners, they are not considered further here. Apart from the above common species, there are also several red-listed mammals which are confirmed present in the broader area or which may be present. These are detailed below in Table 2 and include Brown Hyena, Serval, White-tailed Rat, African Striped

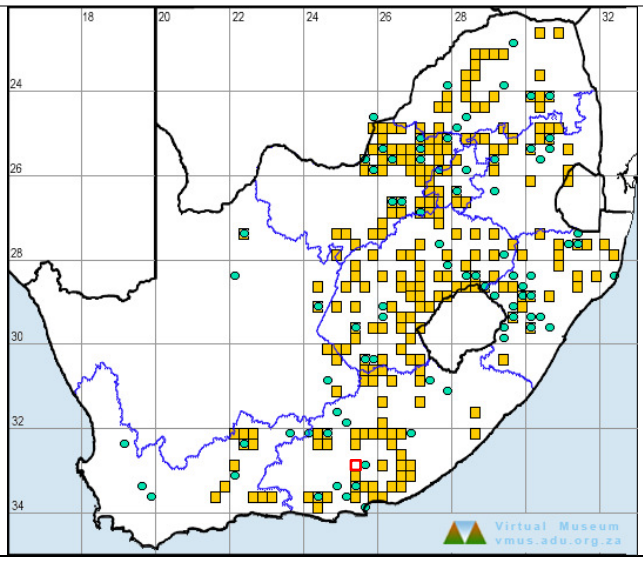
Weasel, Grey Rhebok, Black-footed Cat, Leopard and Mountain Reedbuck. Some of these species occur in the wider area at a low density and do not have well-established populations outside of conservation areas and larger game farms. Of greatest potential concern for the Sun Garden PV development are likely to be Mountain Reedbuck, Grey Rhebok, White-tailed Mouse and Black-footed Cat which are the listed species most likely to maintain free-ranging populations within the affected area within habitats that would potentially be affected by the development. For the larger, more ubiquitous listed species such as Mountain Reedbuck and Grey Rhebok, these species are likely to be displaced from the local area during construction if present, but would likely move back into the vicinity of the PV facility once the facility is operational. The more sensitive species such as Serval or Brown Hyena have large national and provincial distribution ranges and it is highly unlikely that the development would compromise the local or regional populations of these species. In general, the major long-term impacts of the development would be about 350 ha of direct habitat loss for the resident mammals and some disturbance associated with noise and human activity associated with operation of the PV facility. However, this would be localised in nature and largely restricted to the development footprint and immediate environment.

Table 2. Red-listed mammals which potentially occur at the Sun Garden site with their distribution map in the country according to the ADU database and their likelihood of being impacted by the development. The quarter degree square that the site falls into is shown by red square.

Species	ADU Distribution Map	Comment
Hyaena brunnea Brown Hyena Near Threatened		The wider area is considered relatively favourable for Brown Hyena due to the large number of game farms and conservation areas present. The density of Brown Hyena would however be low and it is not likely to be resident in the affected area. Although it is possible that the development would result in some habitat loss for this species, this is not considered highly likely given that this species is largely restricted to conservation areas.

Leptailurus serval Serval Near Threatened		Serval are rare in the Eastern Cape as the tall grassland habitat they prefer is not common. Several conservation areas are however attempting to re-establish them in the area. The habitat within the site is considered unsuitable for this species. As this species is associated with tall grassland or wetlands with a high density of rodents, it is highly unlikely that there would be any conflict between this species and the PV facility.
Pelea capreolus Vaal Rhebok Near Threatened		Grey Rhebok are associated with rocky hills, grassy mountain slopes, and plateau grasslands in the eastern extent of their distribution. They are predominantly browsers, often feeding on ground-hugging forbs, and largely water independent, obtaining most of their water requirements from their food. This species is present in the area and tends to the associated with the hills of the study area. Although this species may experience some habitat loss in the north of the PV development area, the extent of this would be low and would not affect the local population to a noticeable degree.
Poecilogale albinucha African Striped Weasel Near Threatened		The Striped Weasel is likely to occur in the broad area at a low density. It is likely to prefer the areas of the denser vegetation such as along drainage lines which would be little impacted by the current development. An impact on this species in not likely to occur and would be exceptionally unlikely to compromise the local population of Striped Weasel.

Mystromys albicaudatus African White-tailed Rat Vulnerable		Usually associated with calcrete soils within grasslands. They are never found on soft, sandy substrate, rocks, wetlands or river banks. Potentially present on the site, but the habitat does not appear to be particularly favourable for this species, making its presence within the affected are unlikely, although it is somewhat more likely to occur on the plains near to the MTS and as such may experience minor habitat loss as a result of the grid connection. The extent of habitat loss resulting from the development would not be significant for this widespread species.
Felis nigripes Black-footed Cat Vulnerable		Black-footed Cat are widespread in the semi-arid parts of the country and prefer areas with a mix of dense and open areas of vegetation. Although this species may occur at the site at a typical low density, it is unlikely that the development would result in significant habitat loss for this species given that it has a relatively wide distribution and habitat tolerance. It is not likely that the development would compromise the local or regional population of this species.
Panthera pardus Leopard Vulnerable		Leopard in the Eastern Cape are associated with conservation areas or rugged mountainous terrain. As such, the Sun Garden PV development is not likely to result in significant habitat loss for this species.

Redunca fulvorufula Mountain Reedbuck Endangered		Mountain Reedbuck are relatively common in the broader area around the site, but tend to be associated with the more mountainous slopes and higher elevation grasslands of the area. Although this species may experience some minor habitat loss from the PV facility a significant impact on this species is not likely.

Reptiles

Based on the ADU database, thirty-three reptile species have been recorded from the area around the Sun Garden site. This is a relatively low total, suggesting that the area has not been very well sampled in the past. However, even when the sample area is expanded to adjacent quarter degree squares, no species of concern are picked up. Common species observed during the site visit or on previous projects in the immediate area include Thin-tailed Legless Skink, Southern Rock Agama, Common Ground Agama, Cape Girdled Lizard, Spotted Gecko, Leopard Tortoise, Angulate Tortoise, Red-lipped Snake, Rock Monitor and Puff Adder. The drainage lines with dense riparian vegetation and the rocky hills and especially those with large rocky outcrops are considered to represent the most important reptile habitat at the site. The typical open plains habitat that comprises the majority of the PV area is considered low sensitivity for reptiles. The only reptile of potential concern known from the area is the Albany Sundvold Lizard *Nucras taeniolata* which is a narrow endemic that was previously listed as Near Threatened but as of 2017 has been assessed as being of Least Concern. This species has not been recorded from the vicinity of the Sun Garden site and based on the preferred habitat description, is not likely to occur within the site.

In terms of the likely impacts of the development on reptiles, habitat loss is not likely to be highly significant as the direct footprint of the development would be less than 350 ha and this would not be highly significant in context of the affected habitats and the reptile community present. In addition, some reptiles such as some geckos and lizards increase within PV areas as they find the structures represent favourable habitat or provide shelter from aerial predators.

Figure 7. Some of the more common reptiles observed at the site include, from top left, the Rock Monitor, Spotted Grass Snake (Skaapsteker), Angulate Tortoise and Common Ground Agama.

Amphibians

Amphibian diversity within the Sun Garden site is likely to be low. A total of 15 species are known from the broader area and according to the ADU database, includes no species of conservation concern. Species observed in the area include Raucous Toad, Bubbling Kassinia, Common Platanna, Bronze Caco and Common River Frog. The amphibian community can be broadly divided into those species strongly associated with water bodies such as River Frogs and Platanna and those species which are able to range more freely such as toads and Caco's which may breed in streams and ponds, but are more terrestrial in nature. Overall, impacts on amphibians are likely to be local in nature and it is not likely that the local population of any resident species would be compromised by the development.

3.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

An extract of the 2019 Eastern Cape Biodiversity Plan for the study area is illustrated below (Figure 8). This biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. Although there are no CBAs within the Sun Garden site, the whole of the development area falls within an Ecological Support Area. Although the reasons layer that accompanies the Plan does not specify the exact reasons areas are selected as CBAs of ESAs, it does provide a list of attributes associated with each mapping unit. Within the ESA, the primary attribute common to these units is the presence of 2 vegetation types. As such, the ESA represents a transitional area with high topographical diversity and is designed as broad-scale corridor providing connectivity in an east-west direction and ultimately provides a linkage to the Addo Elephant National Park approximately 35km to the west of the site. The ESA is however large and includes a significant extent both to the north and south of the site and although the PV facility at 2.8 km wide in a north-south direction would represent an obstacle for movement for some fauna, the overall function of the ESA is not likely to be compromised. The rugged terrain between the site and the R400 to the south of the site is seen as being of greater significance for biodiversity maintenance and ecological processes than the affected area as would be the corridors along the Klein Vis and Brak Rivers. The larger fauna of the area would easily move around the facility with the result that they would be little impacted by the presence of the PV facility, while it would be the middle-sized and small vertebrate species that would potentially be most affected by the presence of the PV facility. As such, specific measures to allow for the movement of the such fauna through the area is recommended to reduce the potential impact of the development on faunal movement and habitat fragmentation. Recommended measures should include maintaining an intact grass or shrub layer within the facility as well as providing for gaps in the perimeter fencing that would allow for the smaller fauna of the area to pass in and out of the facility. This would not compromise the security of the facility as the gaps provided do not need to be large enough to allow humans to pass through. In addition, this would reduce some of the commonly associated negative ecological effects encountered with PV facilities which include outbreaks of rodents within the PV facility and which in turn tend to attract snakes into the facility area. Providing easier access into the facility area for the smaller predators of the area such as wild-cat and mongoose, would potentially allow for a more natural balance to be maintained. In terms of future conservation expansion, the 2016 NPAES does not include any focus areas near to the site and the closest expansion focus areas are around Addo Elephant National Park, well south of the site.

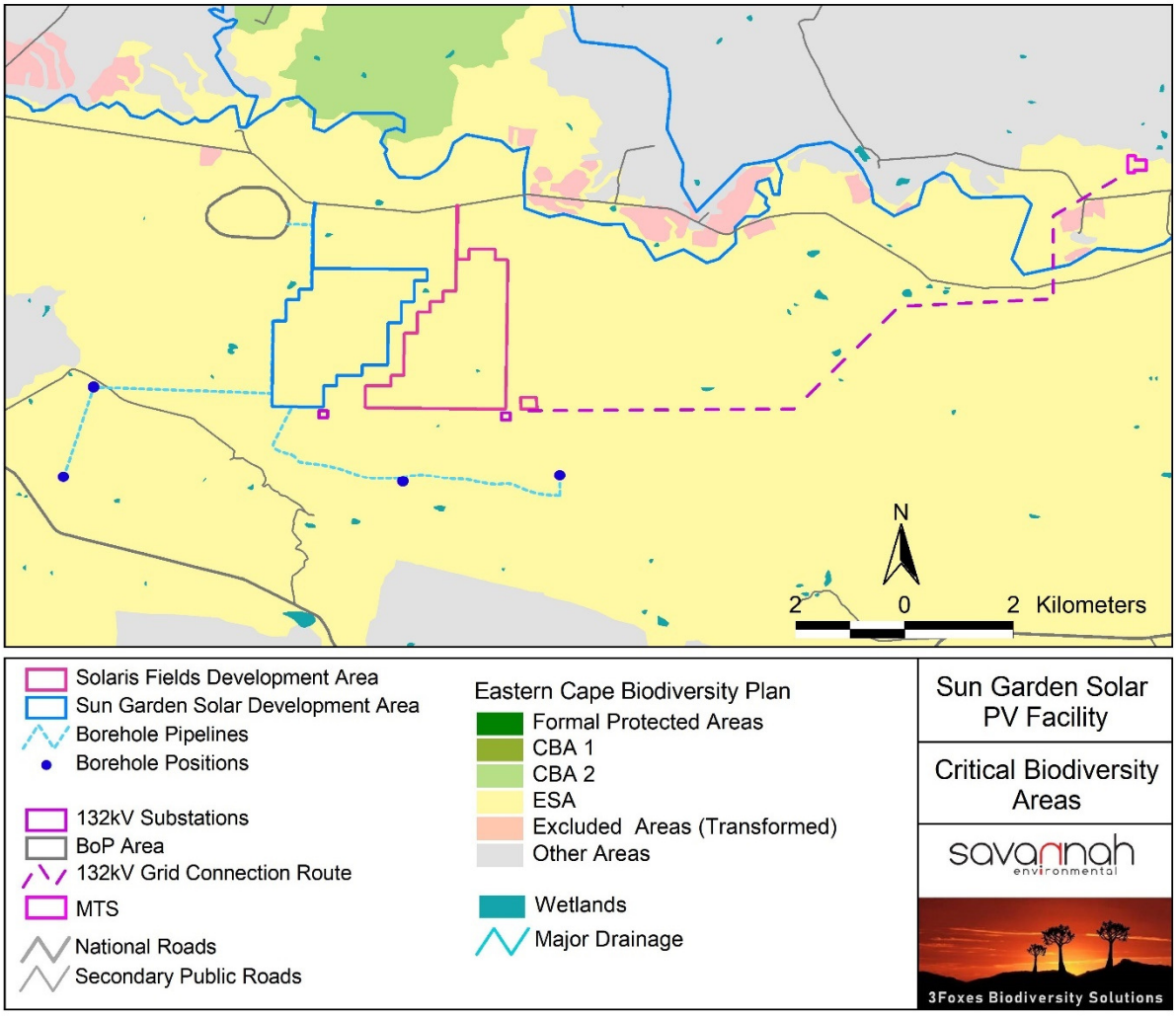


Figure 8. Extract of the Eastern Cape Biodiversity Plan for the study area, showing that the Sun Garden PV area and associated infrastructure falls within an extensive ESA.

3.5 CUMULATIVE IMPACTS

Where other renewable energy developments occur within 30km of a site, a cumulative impact assessment is required. This includes a general assessment of cumulative impact as well as an assessment of different potential cumulative impact sources and an indication of the size or extent of the identified cumulative impact.

In terms of existing impacts in the area, there is a cluster of wind farms east of Cookhouse, with an approximate footprint of 600ha (Figure 9). In addition, there are also numerous approved but not built facilities which generally lie adjacent to the existing operational facilities. The exception is the Highlands WEF which lies to the west of Somerset East and is already authorised. The

planned facilities would have a footprint of approximately 500ha. Apart from the above facilities, the current suite of projects would include the adjacent Redding WEF as well as an additional 4 planned projects (3 wind farms and an MTS). The total footprint of these facilities would be approximately 100 ha each for the wind farms and 40ha for the MTS. Thus, in terms of total impact, all built and planned projects would amount to approximately 2200 ha in extent. The majority of these projects are located within the Bedford Dry Grassland and Great Fish Thicket vegetation types. The current PV development is however restricted largely to Albany Broken Veld, which is not currently heavily impacted by renewable energy development. It is only the adjacent planned Aeoulus WEF and Redding WEF that occur in a broadly similar environment to the current PV projects. These two projects would have a cumulative footprint of approximately 200ha, while the current Sun Garden and Sun Solar PV projects would have a combined footprint of approximately 700ha. Overall, while there would be some local impact on landscape connectivity habitat loss, the contribution of the Sun Garden PV Facility at 350ha is considered acceptable.

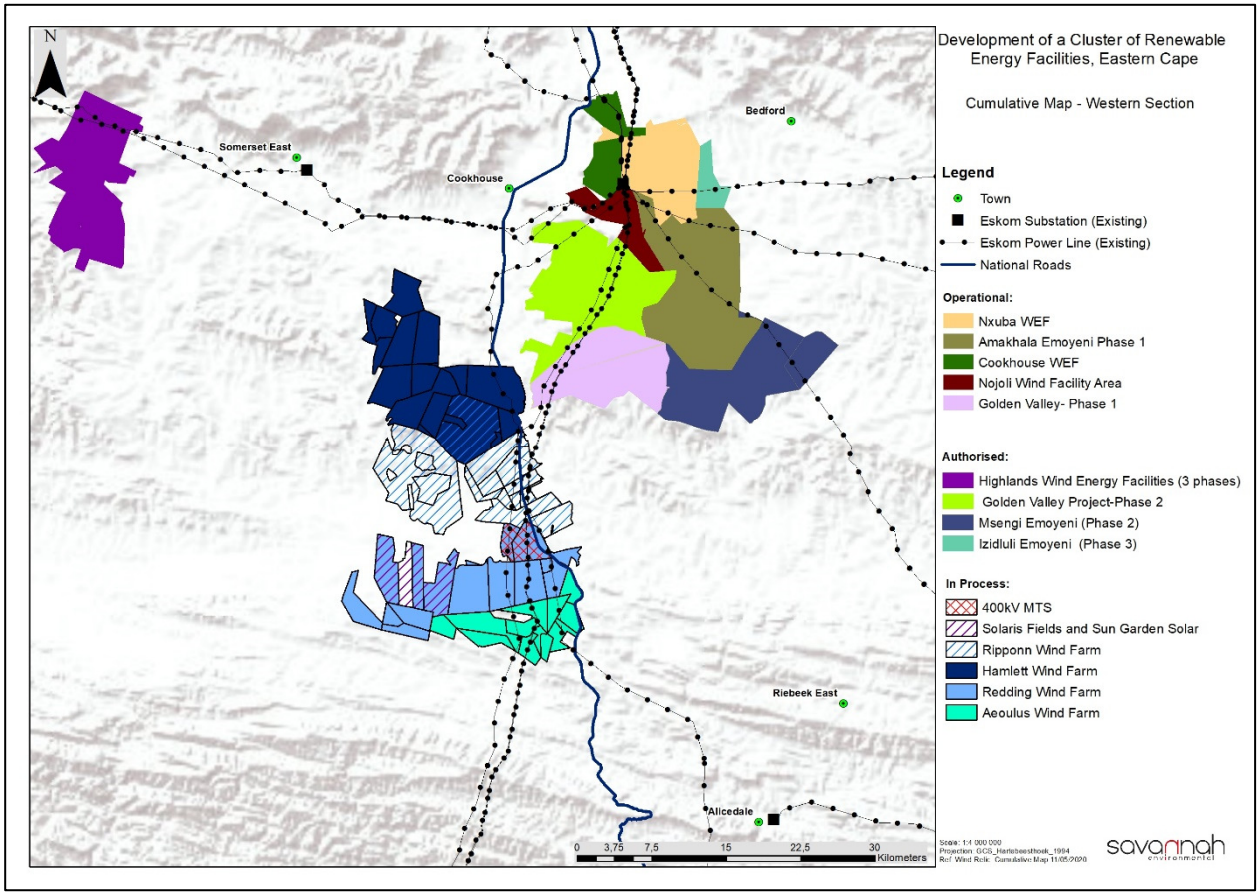


Figure 9. Map of other renewable energy projects known from the vicinity of the Sun Garden PV Facility. There is a cluster of operational and planned wind farms east of Cookhouse, while the

current project would impact an area with no PV facilities, but several planned wind energy facilities.

4 SUN GARDEN SENSITIVITY ASSESSMENT

The sensitivity map for the study area is depicted below in Figure 10. The lower slopes of the PV area consist of open plains considered to be low sensitivity while the upper slopes of the PV area are steeper of have a higher woody component and are considered to be medium sensitivity. Along the power line route to the MTS, there are some high sensitivity drainage features, but these can easily be spanned by the power line and are not likely to be significantly impacted by the power line. The drainage feature which occurs along the south-eastern boundary of the PV area would be vulnerable to impact and it is recommended that a freshwater specialist should demarcate the boundary of this feature in the field before construction to ensure that the PV area does not encroach into this area unnecessarily. In terms of fauna, the PV area does not have any habitats present that would be of particularly high value and no specific impact of high magnitude on fauna are expected. However, given the size of the facility and the location within an ESA it is recommended that specific measures are put in place with regards to the design of the fence around the facility to facilitate the movement of smaller fauna in and out of the PV area. Similarly, no plant species of high concern were observed within the PV and impacts on plant SCC are likely to be low. Perhaps the greatest area of potential concern regarding the PV facility would be the location of parts of the facility on a fairly steep slope (>5%) with soils that appear to have high erodibility. The panels would generate a lot of run off and combined with the high levels of disturbance that would occur after construction, the potential for erosion problems at the site are high. Consequently, specific mitigation measures to reduce and manage erosion and runoff at the site are recommended.

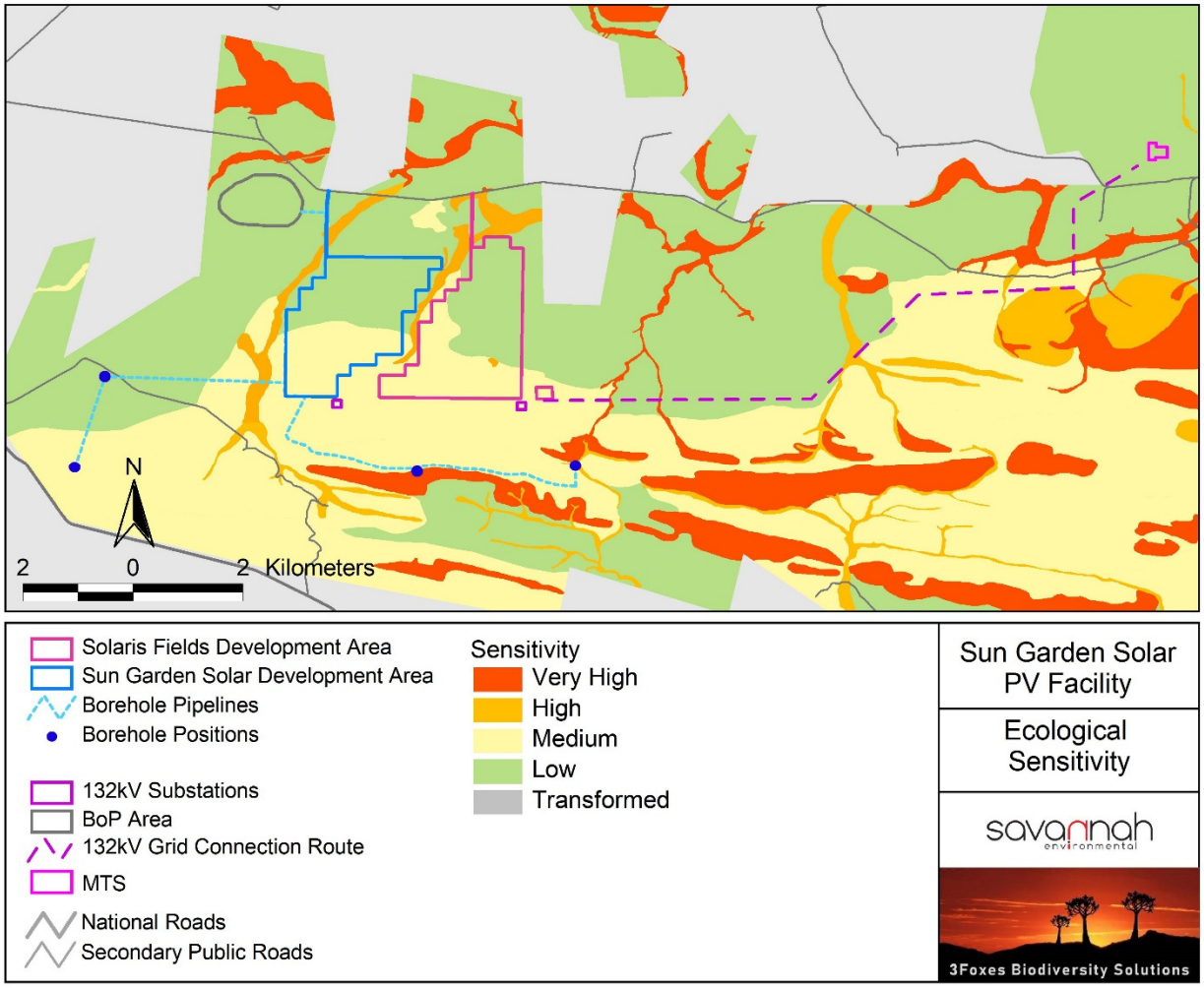


Figure 10. Ecological sensitivity map for the Sun Garden and surrounding area including the grid connection route to the MTS.

Figure 11. The soils of the Sun Garden site are considered fairly vulnerable to erosion and specific measures to manage runoff so as to reduce and combat erosion would need to be an important element of the development.

5 *IMPACTS AND ISSUES IDENTIFICATION*

The development of the Sun Garden PV Facility and associated infrastructure, is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to PV arrays, roads and associated infrastructure. The following impacts are identified as the major impacts that are likely to be associated with the development and which are assessed for the Sun Garden PV Facility, for the preconstruction, construction and operation phases of the development.

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Sun Garden PV Facility are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed

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

The development would require vegetation clearing for PV panels, access roads, buildings and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species may also be impacted. These impacts would occur during the construction phase of the development, with additional vegetation impacts during operation likely to be relatively low. This impact is therefore assessed for the construction phase only.

Impact 2. Direct Faunal Impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and certain mammals would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. During the operation phase, impacts on fauna would be significantly reduced, but some persistent impacts on habitat loss and fragmentation would occur. Faunal impacts will therefore be assessed during the construction and operation phase of the facility.

Impact 3. Increased Erosion Risk

The large amount of disturbance created during construction would leave the site highly vulnerable to erosion. The site is quite steep and along with friable soils, the disturbance created at construction will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operation phase and should therefore be assessed for both phases.

Impact 4. Alien Plant Invasion

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some woody aliens are already present in the area and additional alien plant invasion following construction is highly likely and regular alien plant clearing activities would be required. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion for years. This impact would manifest during the operation phase, although some of the required measures to reduce this impact are required during construction.

Impact 5. Impacts on CBAs and ESAs

The development is not located within any CBA areas but will result in some habitat loss and fragmentation within an ESA. In addition, the presence of the PV Facility and daily operational activities at the site is likely to result in some habitat fragmentation for fauna and a negative impact on the overall functioning of the ESA. This impact would persist for the life of the facility and is thus assessed for the operation phase of the PV facility.

Impact 6. Cumulative Impact 1. Cumulative Impacts on broad-scale ecological processes

The development will contribute to cumulative impacts on habitat loss and fragmentation in the area and potentially the ability to meet future conservation targets. In addition, the presence of the PV Facility and daily operational activities at the site may deter certain species from the area, resulting in a loss in broad-scale landscape connectivity.

6 ASSESSMENT OF IMPACTS

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

6.1 CONSTRUCTION PHASE

Impact 1. Impacts on vegetation and protected plant species

Nature: Vegetation clearing for PV arrays, access roads, and other infrastructure will impact on vegetation and protected plant species.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (3)	Long-term (3)
Magnitude	Moderate (5)	Moderate (4)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (45)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	This impact is not highly reversible as it would take a long time for any cleared areas to return to their former state and rehabilitation of arid environments is difficult.	
Irreplaceable loss of resources?	There would be some potential loss of long-term productivity and diversity as it would take a long time (decades) for any cleared areas to return to their former state and rehabilitation of arid environments is difficult.	
Can impacts be mitigated?	Yes	
Mitigation:		

Mitigation measures to reduce residual risk or enhance opportunities:

1) Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the provincial permit conditions.
2) Search and rescue for identified species of concern before construction.
3) Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained.
4) Pre-construction 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, remaining within demarcated construction areas etc.
5) Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas.
6) Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna.
7) Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
8) All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
9) Temporary laydown 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.

Cumulative impacts:

The clearing would contribute to cumulative vegetation impacts in the area. The development footprint during construction would be approximately 350 ha and given the intact nature of the surrounding area and the current low level of existing transformation impacts, the contribution of the Sun Garden PV Facility to cumulative impact in the area would be local in nature of a relatively low magnitude at the wider landscape level.

Residual Risks:

Since vegetation clearing is an inevitable consequence of the development, this component of the development impact cannot be entirely mitigated and some residual habitat loss equivalent to the footprint of the development will remain.

Impact 2. Impacts on fauna due to construction phase activities

Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. Due to noise and operation of heavy machinery, faunal disturbance will extend well beyond the footprint and extend into adjacent areas. This will however be transient and restricted to the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (5)
Probability	Highly Likely (4)	Probable (3)
Significance	**Medium (40)**	**27 (Low)**

Status (positive or negative)	Negative	Negative
Reversibility	Noise and disturbance are largely reversible but habitat loss due to transformation of intact habitat is not considered easily reversible.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition.
2) Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer.
3) All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
4) 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.
5) 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.
6) The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off of the construction site.
7) No fuelwood collection should be allowed on-site.
8) If any parts of the site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs or HPS bulbs) as far as practically possible, which do not attract insects and which should be directed downwards.

Cumulative impacts:

The site clearing would contribute to cumulative habitat loss for fauna in the area, but this would be largely local in nature.

Residual Risks:

Noise and disturbance would be transient and largely reversible but habitat loss due to transformation of intact habitat would be permanent.

Impact 3. Increased Erosion Risk During Construction

Nature: During construction, the site will be highly vulnerable to soil erosion due to the disturbance created and likely low natural revegetation of disturbed areas.		
	Without mitigation	**With mitigation**

Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (5)	Low (3)
Probability	Highly Likely (4)	Improbable (2)
Significance	**Medium (36)**	**12 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources?	Large amounts of erosion would result in some irreplaceable loss of topsoil and ecosystem productivity, but with mitigation there would be no significant loss of resources.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

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

Cumulative impacts:

Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.

Residual Risks:

Some low-level erosion due to wind and water impacts is likely to occur despite erosion control measures. With the effective implementation of the recommended mitigation, the magnitude of this residual impact can however be reduced to a low level.

6.2 Operation Phase Impacts

Impact 3. Impacts on fauna due to operational phase activities

Nature: The operation and presence of the facility may lead to disturbance or persecution of fauna within or adjacent to the facility.		
	Without mitigation	**With mitigation**

Extent	Local (1)	Local (1)
Duration	Long-term (3)	Long-term (3)
Magnitude	Medium Low (3)	Low (2)
Probability	Probable (4)	Probable (3)
Significance	**Low (28)**	**18 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Disturbance and habitat fragmentation are generally reversible impacts that would occur on a more or less persistent basis during the life of the PV facility, but cease thereafter.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
2) If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.
3) 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.
4) All vehicles accessing the site should adhere to a low speed limit (30km/h max for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises.
5) In terms of the boundary fence, no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.
6) The boundary fence should have access points for smaller fauna to enter and exit the PV area.

Cumulative impacts:

The habitat loss resulting from hard infrastructure would contribute to cumulative habitat loss and fragmentation for fauna in the area, but this would be largely local in nature.

Residual Risks:

Some habitat loss, fragmentation and disturbance are unavoidable during the operation of the PV facility, but would be of a local nature.

Impact 4. Increased Erosion Risk

Nature: Following construction, the site will be highly vulnerable to soil erosion due to the disturbance created and likely low natural revegetation of disturbed areas.

	Without mitigation	With mitigation
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (4)
Magnitude	Moderate (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources?	Large amounts of erosion would result in some irreplaceable loss of topsoil and ecosystem productivity, but with mitigation there would be no significant loss of resources.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.
2) All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
3) It may be necessary to construct ponds to capture and process runoff from the site. If this is necessary, this should take place in consultation with a freshwater specialist. Any ponds constructed should not be lined with smooth plastic as fauna tend to fall into such ponds and are unable to escape due to the slippery sides of the pond.
4) Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.
5) All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
6) All cleared areas must be revegetated with indigenous perennial shrubs and succulents from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.

Cumulative impacts:

Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.

Residual Risks:

Some low-level erosion due to wind and water impacts is likely to occur despite erosion control measures. With the effective implementation of the recommended mitigation, the magnitude of this residual impact can however be reduced to a low level.

Impact 5. Alien plant invasion risk

Nature: Following construction, the site will be highly vulnerable to alien plant invasion due to disturbance and the increased runoff created by the hard infrastructure. There is a risk that alien species would spread to adjacent drainage lines and other vulnerable areas.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Moderate (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**12 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversibility would be high for mild infestation, but would become increasingly low with extensive invasion.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Can impacts be mitigated?	Yes	
Mitigation: Mitigation measures to reduce residual risk or enhance opportunities: 1) Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2) Due to the disturbance at the site as well as the increased runoff generated by the PV panels and hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled. 3) Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility must be undertaken as these are also likely to be prone to invasion problems. 4) Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.		
Cumulative impacts: Alien invasion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.		
Residual Risks: Although some alien plant invasion is likely to occur at the site, with mitigation, there would be minimal residual impact.		

Impact 6. Impact on CBAs, ESAs and broad-scale ecological processes

Nature: Transformation during construction and long-term presence of the facility will contribute to cumulative habitat loss within the affected ESA and may compromise the overall ecological functioning of the ESA and its long-term biodiversity value.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Low (4)
Probability	Highly Likely (4)	Likely (3)
Significance	**Medium (44)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: 1) There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. 2) All disturbed areas that are not used such as excess road widths, should be rehabilitated with locally occurring shrubs and grasses after construction to reduce the overall footprint of the development. 3) Noise and disturbance on the site should be kept to a minimum during operation and maintenance activities. 4) There should be regular (at least every 50m) access points in the boundary fence of the facility to allow smaller fauna to enter the facility area. These should be constructed as boxed gaps in the fence of dimensions 20cm x 40cm and should be orientated in both directions.		
Residual Impacts: Habitat loss within the ESAs cannot be fully mitigated with that some habitat loss and fragmentation would occur during operation, even with mitigation.		

6.3 DECOMMISSIONING PHASE IMPACTS

Impact 7. Impacts on fauna due to decommissioning phase activities

Nature: Due to disturbance, noise and the operation of heavy machinery, faunal disturbance due to decommissioning will extend beyond the footprint and impact adjacent areas to some degree. This will however be transient and restricted to the period while machinery is operational. In the long term, decommissioning should restore the ecological functioning and at least some habitat value to the affected areas.		
	Without mitigation	**With mitigation**

Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (4)	Low (2)
Probability	Highly probable (4)	Probable (3)
Significance	**Low (28)**	**15 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Noise and disturbance would be of relatively short duration and are considered reversible.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) 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.
2) 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.
3) 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.
4) No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
5) 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 landowners concerned.

Cumulative impacts:

There would be transient contribution to cumulative disturbance impacts, but this would cease after decommissioning.

Residual Risks:

Noise and disturbance during decommissioning would be unavoidable, but would be transient and ultimately the site would be restored to a near-natural state.

Impact 8. Increased Erosion Risk due to Decommissioning

Nature: Following decommissioning, the site will be highly vulnerable to soil erosion due to the disturbance created by the removal of infrastructure from the site.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)

Duration	Long-term (4)	Medium-term (3)
Magnitude	Moderate (5)	Minor (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) The site should be fully rehabilitated with locally-occurring shrubs and grasses.
2) Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
3) There should be regular monitoring for erosion for at least 5 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
4) All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
5) All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.

Cumulative impacts:

Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.

Residual Risks:

Some low-level erosion due to wind and water impacts are likely to occur following decommissioning despite erosion control measures. With the effective implementation of the recommended mitigation, the magnitude of this residual impact can however be reduced to a low level.

Impact 9. Alien plant invasion risk following decommissioning

Nature: Following decommissioning, the site will be highly vulnerable to alien plant invasion due to the large amount of disturbance generated by decommissioning. Disturbed areas, drainage lines and other wetter areas are likely to be particularly vulnerable.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)

Magnitude	Moderate (4)	Low (3)
Probability	Probable (4)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversibility would be high for mild infestation, but would become increasingly low with extensive invasion.	
Irreplaceable loss of resources?	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures to reduce residual risk or enhance opportunities:

1) Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
2) Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled.
3) Alien management at the site should take place according to the Alien Invasive Management Plan. This should make provision for alien monitoring and management for at least 5 years after decommissioning.
4) Regular alien clearing (annual) should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Cumulative impacts:

Alien invasion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.

Residual Risks:

Although some alien plant invasion is likely to occur at the site, with mitigation, there would be minimal residual impact.

6.4 CUMULATIVE IMPACTS

Impact 10. Cumulative ecological impacts due to renewable energy development in the area.

Nature:

Renewable (wind & solar) energy development in the wider area around the site will generate cumulative impacts on habitat loss and fragmentation for fauna and flora.

	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Local (1)	Local (2)
Duration	Long-term (4)	Long-term (4)

Magnitude	Low (3)	Moderate (5)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	No	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: 1) The facility should have access points for fauna as detailed in order to promote the movement of fauna through the facility and reduce the impact of the development on habitat fragmentation. 2) Promote sustainable land use practices in the area and especially in areas adjacent to the facility to improve the quality of the habitat for fauna and flora. 3) Ensure that alien species of flora are managed to ensure that they do not have a broadly negative impact.		
Residual Impacts: The solar and wind farm developments in the area will generate some residual impact through noise, disturbance and habitat loss. There is however currently only one operational wind farm in the broader area and the additional contribution of the current project to residual impact would be relatively low.		

7 CONCLUSION & RECOMMENDATIONS

The Sun Garden PV Facility site falls largely within the Albany Broken Veld vegetation type and it is only the grid connection that traverses some Kowie Thicket and Southern Karoo Riviere vegetation types. The northern, lower slopes and plains of the site consist of low shrublands considered to be low sensitivity with few fauna or flora of concern likely to be present. The upper, southern slopes of the PV site are steeper or contain a higher proportion of woody species and are considered medium sensitivity. The drainage feature which occurs along the south-eastern boundary of the PV area would be vulnerable to impact and it is recommended that a freshwater specialist should demarcate the boundary of this feature in the field before construction to ensure that the PV area does not encroach into this area unnecessarily. Along the grid connection route to the MTS, there are some high sensitivity drainage features, but these can easily be spanned by the power line and are not likely to be significantly impacted by the power line. In terms of fauna, the PV area does not have any habitats present that would be of particularly high value and no specific impacts of high magnitude on fauna are expected. However, given the size of the facility (350ha) and the location within an ESA it is recommended that specific measures are put in place with regards to the design of the fence around the facility to facilitate the movement of smaller fauna in and out of the PV area.

In terms of cumulative impacts, there are numerous existing, planned and authorised wind energy projects in the wider area, raising the potential for cumulative impacts. The majority of the existing projects are however located within the Bedford Dry Grassland and Great Fish Thicket vegetation types. The Sun Garden PV development is however restricted almost entirely to Albany Broken Veld, which is not currently heavily impacted by renewable energy development. It is only the adjacent planned Aeoulus WEF and Redding WEF that occur in a broadly similar environment to the Sun Garden PV project. These two wind energy projects would have a cumulative footprint of approximately 200ha, while the current Sun Garden and adjacent Solaris Fields PV project would have a combined footprint of approximately 700ha. Overall, while there would be some local impact on landscape connectivity habitat loss, the contribution of the Sun Garden PV Facility at 350ha is considered acceptable.

The impact of greatest potential concern regarding the Sun Garden PV facility would be the location of parts of the facility on a fairly steep slope with soils that appear to have high erodibility. The panels would generate a lot of run off and combined with the high levels of disturbance that would occur after construction, the potential for erosion problems at the site are high. Consequently, specific mitigation measures to reduce and manage erosion and runoff at the site are recommended. Specific input from a specialist with experience in this field should be used to reduce potential erosion impacts at the site and the recommended measures would need to be integrated into the design and construction of the facility.

Impact Statement

There are no impacts associated with the Sun Garden PV Facility and associate infrastructure that cannot be mitigated to an acceptable level and as such, the assessed layout is considered acceptable. With the application of relatively simple mitigation and avoidance measures, the impact of the Sun Garden PV Facility on the local environment can be reduced to an acceptable magnitude. The contribution of the Sun Garden PV Facility 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 Sun Garden PV Facility that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. The following conditions should be included in the EA for the development:

- The permitter fence of the facility must have access points for smaller fauna at least every 50m of fence. These should be a minimum of 40cm x 20cm in size and should be orientated both vertically and horizontally.

- The facility must have a detailed runoff and erosion management plan that takes account of the vulnerability of the area to erosion damage. This should be developed with input from a specialist with specific experience in this regard.

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9 ANNEX 1. LIST OF PLANT SCC

Plant species of conservation concern known from the vicinity of the Sun Garden study site, based on the SANBI POSA database. Conservation status is from the South African Red Data List of Plants 2021.

Family	Genus	Species	IUCN Status
Aizoaceae	*Drosanthemum*	*crassum*	NT
Amaryllidaceae	*Crinum*	*campanulatum*	NT
Crassulaceae	*Crassula*	*decidua*	NT

10 ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur in the broad vicinity of the Sun Garden study area. Conservation status is from SANBI/EWT 2016 mammal species assessment.

Scientific Name	Common Name	Status	Records
Cryptomys hottentotus	Southern African Mole-rat	Least Concern (2016)	10
Antidorcas marsupialis	Springbok	Least Concern (2016)	11
Pelea capreolus	Vaal Rhebok	Near Threatened (2016)	1
Raphicerus campestris	Steenbok	Least Concern (2016)	31
Redunca fulvorufula	Mountain Reedbuck	Near Threatened	38
Sylvicapra grimmia	Bush Duiker	Least Concern (2016)	299
Tragelaphus scriptus	Bushbuck	Least Concern	439
Tragelaphus strepsiceros	Greater Kudu	Least Concern (2016)	1729
Canis mesomelas	Black-backed Jackal	Least Concern (2016)	306
Otocyon megalotis	Bat-eared Fox	Least Concern (2016)	162
Vulpes chama	Cape Fox	Least Concern (2016)	2
Chlorocebus pygerythrus	Vervet Monkey	Least Concern (2016)	14
Papio ursinus	Chacma Baboon	Least Concern (2016)	76
Amblysomus hottentotus	Hottentot Golden Mole	Least Concern (2016)	6
Caracal caracal	Caracal	Least Concern (2016)	50
Felis nigripes	Black-footed Cat	Vulnerable (2016)	6
Felis silvestris	Wildcat	Least Concern (2016)	24
Leptailurus serval	Serval	Near Threatened (2016)	2
Panthera pardus	Leopard	Vulnerable (2016)	19
Graphiurus (Graphiurus) murinus	Forest African Dormouse	Least Concern	3
Graphiurus (Graphiurus) ocularis	Spectacled African Dormouse	Least Concern	1
Cynictis penicillata	Yellow Mongoose	Least Concern (2016)	21
Herpestes pulverulentus	Cape Gray Mongoose	Least Concern (2016)	8
Ichneumia albicauda	White-tailed Mongoose	Least Concern (2016)	2
Suricata suricatta	Meerkat	Least Concern (2016)	17
Proteles cristata	Aardwolf	Least Concern (2016)	4
Hystrix africaeaustralis	Cape Porcupine	Least Concern	20
Lepus saxatilis	Scrub Hare	Least Concern	1
Aethomys ineptus	Tete Veld Aethomys	Least Concern (2016)	1
Aethomys namaquensis	Namaqua Rock Mouse	Least Concern	1
Desmodillus auricularis	Cape Short-tailed Gerbil	Least Concern (2016)	2
Grammomys dolichurus	Common Grammomys	Least Concern (2016)	2
Mastomys coucha	Southern African Mastomys	Least Concern (2016)	3
Mastomys natalensis	Natal Mastomys	Least Concern (2016)	7
Mus (Nannomys) minutoides	Southern African Pygmy Mouse	Least Concern	1
Otomys irroratus	Southern African Vlei Rat (Fynbos type)	Least Concern (2016)	8
Otomys saundersiae	Saunders' Vlei Rat	Least Concern	1

Otomys unisulcatus	Karoo Bush Rat	Least Concern (2016)	6
Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern (2016)	5
Ictonyx striatus	Striped Polecat	Least Concern (2016)	2
Mellivora capensis	Honey Badger	Least Concern (2016)	11
Poecilogale albinucha	African Striped Weasel	Near Threatened (2016)	2
Dendromus melanotis	Gray African Climbing Mouse	Least Concern (2016)	1
Mystromys albicaudatus	African White-tailed Rat	Vulnerable (2016)	1
Saccostomus campestris	Southern African Pouched Mouse	Least Concern (2016)	1
Orycteropus afer	Aardvark	Least Concern (2016)	3
Procavia capensis	Cape Rock Hyrax	Least Concern (2016)	10
Crocidura flavescens	Greater Red Musk Shrew	Least Concern (2016)	1
Crocidura hirta	Lesser Red Musk Shrew	Least Concern (2016)	1
Potamochoerus porcus	Bushpig	Least Concern (2016)	11
Genetta genetta	Common Genet	Least Concern (2016)	1
Genetta tigrina	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)	6

11 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur in the broad vicinity of the Sun Garden site, based on records from the SARCA database, conservation status is from Bates et al. 2014.

Scientific Name	Common name	Status	Records
Agama aculeata aculeata	Common Ground Agama	Least Concern (SARCA 2014)	1
Agama atra	Southern Rock Agama	Least Concern (SARCA 2014)	24
Bradypodion ventrale	Eastern Cape Dwarf Chameleon	Least Concern (SARCA 2014)	18
Crotaphopeltis hotamboeia	Red-lipped Snake	Least Concern (SARCA 2014)	11
Dasypeltis inornata	Southern Brown Egg-eater	Least Concern (SARCA 2014)	4
Dasypeltis scabra	Rhombic Egg-eater	Least Concern (SARCA 2014)	8
Dispholidus typus typus	Boomslang	Least Concern (SARCA 2014)	17
Philothamnus occidentalis	Western Natal Green Snake	Least Concern (SARCA 2014)	11
Philothamnus semivariegatus	Spotted Bush Snake	Least Concern (SARCA 2014)	6
Chamaesaura anguina anguina	Cape Grass Lizard	Least Concern (SARCA 2014)	5
Cordylus cordylus	Cape Girdled Lizard	Least Concern (SARCA 2014)	34
Pseudocordylus microlepidotus fasciatus	Karoo Crag Lizard	Least Concern (SARCA 2014)	5
Hemachatus haemachatus	Rinkhals	Least Concern (SARCA 2014)	6
Naja nivea	Cape Cobra	Least Concern (SARCA 2014)	8
Chondrodactylus bibronii	Bibron's Gecko	Least Concern (SARCA 2014)	3
Goggia essexi	Essex's Pygmy Gecko	Least Concern (SARCA 2014)	15
Lygodactylus capensis	Common Dwarf Gecko	Least Concern (SARCA 2014)	1
Pachydactylus maculatus	Spotted Gecko	Least Concern (SARCA 2014)	22
Pachydactylus mariquensis	Marico Gecko	Least Concern (SARCA 2014)	4
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)	6
Nucras lalandii	Delalande's Sandveld Lizard	Least Concern (SARCA 2014)	2
Nucras taeniolata	Albany Sandveld Lizard	Near Threatened (SARCA 2014)	7
Pedioplanis burchelli	Burchell's Sand Lizard	Least Concern (SARCA 2014)	5
Pedioplanis lineoocellata pulchella	Common Sand Lizard	Least Concern (SARCA 2014)	9
Tropidosaura montana rangeri	Ranger's Mountain Lizard		7
Aparallactus capensis	Black-headed Centipede-eater	Least Concern (SARCA 2014)	7
Boaedon capensis	Brown House Snake	Least Concern (SARCA 2014)	15
Duberria lutrix lutrix	South African Slug-eater	Least Concern (SARCA 2014)	12
Homoroselaps lacteus	Spotted Harlequin Snake	Least Concern (SARCA 2014)	15
Lamprophis aurora	Aurora House Snake	Least Concern (SARCA 2014)	2
Lamprophis fuscus	Yellow-bellied House Snake	Least Concern (SARCA 2014)	7

Lycodonomorphus inornatus	Olive House Snake	Least Concern (SARCA 2014)	6
Lycodonomorphus laevissimus	Dusky-bellied Water Snake	Least Concern (SARCA 2014)	10
Lycodonomorphus rufulus	Brown Water Snake	Least Concern (SARCA 2014)	14
Lycophidion capense capense	Cape Wolf Snake	Least Concern (SARCA 2014)	7
Prosymna sundevallii	Sundevall's Shovel-snout	Least Concern (SARCA 2014)	4
Psammophis crucifer	Cross-marked Grass Snake	Least Concern (SARCA 2014)	11
Psammophis notostictus	Karoo Sand Snake	Least Concern (SARCA 2014)	7
Psammophylax rhombeatus	Spotted Grass Snake	Least Concern (SARCA 2014)	23
Pseudaspis cana	Mole Snake	Least Concern (SARCA 2014)	1
Leptotyphlops nigricans	Black Thread Snake	Least Concern (SARCA 2014)	8
Pelomedusa galeata	South African Marsh Terrapin	Not evaluated	7
Acontias gracilicauda	Thin-tailed Legless Skink	Least Concern (SARCA 2014)	8
Acontias meleagris	Cape Legless Skink	Least Concern (SARCA 2014)	4
Acontias orientalis	Eastern Legless Skink	Least Concern (SARCA 2014)	18
Scelotes caffer	Cape Dwarf Burrowing Skink	Least Concern (SARCA 2014)	11
Trachylepis capensis	Cape Skink	Least Concern (SARCA 2014)	8
Trachylepis homalocephala	Red-sided Skink	Least Concern (SARCA 2014)	5
Trachylepis varia sensu stricto	Common Variable Skink		9
Trachylepis variegata	Variegated Skink	Least Concern (SARCA 2014)	2
Chersina angulata	Angulate Tortoise	Least Concern (SARCA 2014)	11
Homopus areolatus	Parrot-beaked Tortoise	Least Concern (SARCA 2014)	12
Psammobates tentorius tentorius	Karoo Tent Tortoise		12
Stigmochelys pardalis	Leopard Tortoise	Least Concern (SARCA 2014)	9
Afrotyphlops bibronii	Bibron's Blind Snake	Least Concern (SARCA 2014)	5
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	8
Varanus albigularis albigularis	Rock Monitor	Least Concern (SARCA 2014)	9
Varanus niloticus	Water Monitor	Least Concern (SARCA 2014)	6
Bitis arietans arietans	Puff Adder	Least Concern (SARCA 2014)	31
Causus rhombeatus	Rhombic Night Adder	Least Concern (SARCA 2014)	14

12 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in in the broad vicinity of the Sun Garden site. Conservation status is from the Minter et al. 2004 or more recent 2017 SANBI assessments.

Scientific Name	Common Name	Status	Records
Breviceps adspersus	Bushveld Rain Frog	Least Concern	4
Sclerophrys capensis	Raucous Toad	Least Concern	21
Sclerophrys pardalis	Eastern Leopard Toad	Least Concern	5
Vandijkophrynus gariepensis gariepensis	Karoo Toad (subsp. gariepensis)	Least Concern	6
Hyperolius marmoratus	Painted Reed Frog	Least Concern	15
Kassina senegalensis	Bubbling Kassina	Least Concern	18
Semnodactylus wealii	Rattling Frog	Least Concern	12
Phrynobatrachus natalensis	Snoring Puddle Frog	Least Concern	1
Xenopus laevis	Common Platanna	Least Concern	5
Amietia delalandii	Delalande's River Frog	Least Concern (2017)	13
Amietia poyntoni	Poynton's River Frog	Least Concern (2017)	1
Cacosternum boettgeri	Common Caco	Least Concern (2013)	21
Cacosternum nanum	Bronze Caco	Least Concern (2013)	13
Strongylopus fasciatus	Striped Stream Frog	Least Concern	8
Tomopterna tandyi	Tandy's Sand Frog	Least Concern	2