Ecology Assessment

9.9MW Wildebeestkuil 1 and 2 Solar PV Plants, 132kV Power Lines and associated infrastructure, 9.9MW Leeuwbosch 1 and 2 Solar PV Plants and associated infrastructure, and the 132/11kV Leeudoringstad Solar Plant Substation near Leeudoringstad in the North West Province

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Ecological Basic Assessment study on the potential impacts of the proposed 9.9MW Wildebeestkuil 1 and 2 Solar PV Plants, 132kV Power Lines and associated infrastructure, 9.9MW Leeuwbosch 1 and 2 Solar PV Plants and associated infrastructure, and the 132/11kV Leeudoringstad Solar Substation near Leeudoringstad in the North West Province.

Location:
Maquassi Hills Local Municipality, within the Dr Kenneth Kaunda District Municipality in the North West Province

for

SiVEST Environmental Division
P O Box 2921,
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1 May 2021

Report version: 1st draft

Details of specialist consultant

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EXECUTIVE SUMMARY

David Hoare Consulting (Pty) Ltd was commissioned by SiVEST Environmental Division to provide specialist biodiversity consulting services for the BAs for the five proposed projects. The consulting services comprise an assessment of potential impacts on the general ecology in the study area by the five proposed projects. The study excludes Avifauna and Invertebrates. This report provides details of the results of the ecology study, based on a desktop assessment of the study area, mapping from aerial imagery and three site visits. The study area for the four projects is located on several farms that are situated near to the town of Leeudoringstad, located in the North West Province.

It should be noted that a combined report has been compiled for all five proposed projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and Leeudoringstad Solar Plant Substation). Where certain findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

The first section of the report provides an outline of the Terms of Reference for the study, Limitations, Assumptions and Uncertainties, a list of acronyms, abbreviations and a short glossary, and a table indicating compliance with Appendix 6 of the EIA Regulations, 2014 (as amended). This is followed by an introduction to the project and a description of layout alternatives for each of the five projects (where applicable).

The following section provides an outline of the methodology used to undertake the ecology assessment. This includes the approach taken to assess the sensitivity of the five sites and a summary of the background information used to undertake the assessments. Background information includes electronic databases with species information, Red Data Lists, published field guides and National and Provincial legislation, specifically regulations with published lists of species and/or ecosystems.

The next section of the report provides details on legislation that applies to development of the sites with respect to the ecological receiving environment. There are various Acts that limit development or require permits before development can proceed. The most important of these are permits required in terms of protected species that could potentially occur on site, including the National Environmental Management: Biodiversity Act, the North West Biodiversity Management Act and the National Forests Act.

The next section provides a description of the ecological receiving environment, including details on the location of the five sites, the regional vegetation patterns, local habitat patterns occurring on the sites, lists of plant and animal species of concern that are likely to occur there and a list of species that were observed on site during the site visit. Based on the similarity of the sites to one another and the fact that they border upon one another as well as share some infrastructure components, the description of biodiversity applies identically to all five sites, except where it is specifically indicated otherwise. Details of this section are summarised as follows:

1. The study area (including all four sites together) is situated in an area that is on relatively flat plains with relatively flat topography. Habitat on site is in a partly natural state and is in an area in which extensive crop cultivation previously took place. There is transformation and degradation on site associated with these historical activities.
2. There is one regional vegetation type occurring in the project study area, Vaal-Vet Sandy Grassland. There are no other national vegetation types in the near vicinity. The vegetation type is listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
3. Some of the habitat in the study area is mapped as “Ecological Support Area” (ESA). The remaining natural vegetation on site therefore has moderate value for conservation of ecological processes in the Province according to the broadscale CBA maps.
4. Habitats on site were divided into three units, namely “Grassland”, “Secondary Grassland”, and “Depressions”. A map of natural habitats of the study area was produced by mapping from aerial imagery, based on information collected in the field.
5. There are no plant species occurring on site or likely to occur on site that are protected according to the National Environmental Management: Biodiversity Act (Act No 10. Of 2004) (NEM:BA).

6. There are no plant species occurring on site that are protected according to the North West Biodiversity Management.
7. There are no protected tree species that are likely to occur in the study area.
8. A total of 79 mammal species have a geographical distribution that includes the general study area in which the sites are found. Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), the following are considered to have a medium probability of occurring on site, based on habitat suitability and evidence collected in the field: the Near Threatened South African Hedgehog and Brown Hyaena, and a number of protected species, including the Cape Fox, and Honey Badger.
9. The study area contains habitat that is suitable for a small number of frog species. One protected frog species, the Giant Bullfrog, could potentially occur on site.
10. A total of 55 reptile species have a geographical distribution that includes the general study area in which the sites are found. No reptile species of conservation concern could potentially occur in the study area.
11. A preliminary sensitivity map of the study area (including all five sites) was produced that identifies areas of medium sensitivity that should be taken into account during activities on site. This includes drainage areas and associated wetland-related habitat, grasslands, and ESA areas.

The section of the report following the above identifies a number of potential impacts for the five proposed projects, including direct and indirect impacts for the construction, operation and decommissioning phases of the projects, as well as cumulative impacts taken together with similar projects in the region. These are described and assessed. The preliminary assessment of impacts indicates that all impacts are of medium or low significance or can be reduced to medium or low significance with mitigation, with the exception of loss of natural vegetation, for which the impact remains of medium significance after mitigation. The assessed impacts were found to be the same for all five projects.

The next section of the report provides some possible mitigation measures for managing potential impacts related to these projects. Proposed mitigation measures include the following: minimise vegetation clearing and disturbance, formalise a rehabilitation programme, compile an alien plant management plan and undertaking regular monitoring. Note that the project has undergone a number of iterations in which infrastructure has been placed to avoid sensitivities, and biodiversity walk-through surveys have already been undertaken.

The report concludes that there are some sensitivities in the study area related to natural habitat, but that these can be minimised or avoided with the application of appropriate mitigation or management measures. There will be residual impacts, primarily on natural habitat, but the amount of habitat that will be lost to the projects is insignificant compared to the area in hectares of the regional vegetation type that occurs on site and therefore the residual impacts are considered acceptable, on condition local sensitivities of biodiversity importance are avoided. On this basis it is recommended that the respective projects be authorised.

The report includes a comprehensive list of Appendices containing lists of species and species of concern with a geographical distribution that includes the site as well as lists of species protected according to National legislation.

SPECIALISTS DECLARATION

I, David Hoare as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- act as the independent specialist in this application;
- 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;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- 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;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- 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 specialist: 

Name of specialist: Dr D B Hoare

Date: 1 May 2021

TERMS OF REFERENCE

The study was to adhere to the following:

- A field investigation to survey the study area and six (6) PV sites and associated grid corridors;
- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.
- Adherence to all best practice guidelines, relevant legislation and authority requirements.
- Identification of sensitive areas to be avoided (including providing shapefiles/kmls).
- Separate assessment and impact significance ratings for each phase of the six (6) proposed PV developments, noting the impacts during the Pre-construction, Construction, Operation, and Decommissioning Phases (according to SiVEST's impact rating methodology).
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered).
- Assessment of the significance of the cumulative impacts (according to SiVEST's impact rating methodology).
- Comparative assessment of alternatives to be provided for each of the six (6) phases and grid connection.
- Recommend mitigation measures in order to minimise the impact of the proposed development and note any specific mitigation measures for a particular phase; and
- Implications of specialist findings for the proposed development (e.g., permits, licenses etc).

LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the respective project sites:

- Rare and threatened plant and animal species are, by their nature, usually very difficult to locate and can be easily missed.
- The faunal component of the study relies primarily on existing information, as available in various spatial databases and published accounts. 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 for an area do not always adequately reflect the actual fauna and flora present at the site. In order to counter the likelihood that the area has not been well sampled in the past and in order ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study area and are likely to include a much wider array of species than actually occur at the site. The study excludes Bats, Avifauna, Aquatic Ecology and Invertebrates.
- Cumulative impacts are assessed by adding expected impacts from these proposed developments to existing and proposed developments of a similar nature that are within a 50 km radius of the respective proposed project sites.

ACRONYMS

AIS	Alien and Invasive species
CBA	Critical Biodiversity Area
CBD	Convention on Biological Diversity
CEPF	Critical Ecosystem Partnership Fund
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographical Information System
I&AP	Interested and Affected Party
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
NBA	National Biodiversity Assessment
NBSAP	National Biodiversity Strategy Action Plan
NW	North West Province
NWBMA	North West Biodiversity Management Act, No 4 of 2016
NDP	National Development Plan
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Areas
PA	Protected Area
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SCC	Species of Conservation Concern
SEA	Strategic Environmental Assessment
ToPS	Threatened and Protected Species
ToR	Terms of Reference

ABBREVIATIONS

%	Percentage
MW	Megawatt
kV	Kilovolt
cm	Centimetres
m	Metres
km	Kilometres

GLOSSARY

Definitions	
Alternative	Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.
Biodiversity	The diversity of genes, species and ecosystems, and the ecological and evolutionary processes that maintain that diversity.
Biodiversity offset	Conservation measures designed to remedy the residual negative impacts of development on biodiversity and ecological infrastructure, once the first three levels of the mitigation hierarchy have been explicitly considered (i.e., to avoid, minimize and rehabilitate / restore impacts). Offsets are the last resort form of mitigation, only to be implemented if nothing else can mitigate the impact.
Biodiversity priority areas	Features in the landscape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. These are identified using a systematic spatial biodiversity planning process and include the following categories: Protected Areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas, Ecological Support Areas, and Focus Areas for land-based Protected Area expansion.
Category 1a Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as a species that must be combatted or eradicated. These species are contained in Notice 3 of the AIS list, which is referred to as the National List of Invasive Species. Landowners are obliged to take immediate steps to control Category 1a species.
Category 1b Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as species that must be controlled or 'contained'. These species are contained in Notice 3 of the AIS list, which is referred to as the National List of Invasive Species. However, where an Invasive Species Management Programme has been developed for a Category 1b species, then landowners are obliged to "control" the species in accordance with the requirements of that programme.
Category 2 Listed Invasive Species	Species which require a permit to carry out a restricted activity e.g., cultivation within an area specified in the Notice or an area specified in the permit, as the case may be. Category 2 includes plant species that have economic, recreational, aesthetic or other valued properties, notwithstanding their invasiveness. It is important to note that a Category 2 species that falls outside the demarcated area specified in the permit, becomes a Category 1b invasive species. Permit-holders must take all the necessary steps to prevent the escape and spread of the species.
Category 3 Listed Invasive Species	A species listed by notice in terms of section 70(1)(a) of the act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the act, as specified in the notice. Category 3 species are less-transforming invasive species which are regulated by activity. The principal focus with these species is to ensure that they are not introduced, sold or transported. However, Category 3 plant species are automatically Category 1b species within riparian and wetland areas.
CBA Maps	A map of Critical Biodiversity Areas and Ecological Support Areas based on a systematic biodiversity plan.
Connectivity	The spatial continuity of a habitat or land cover type across a landscape.
Corridor	A relatively narrow strip of a particular type that differs from the areas adjacent on both sides.
Critical Biodiversity Areas	Areas required to meet biodiversity targets of representivity and persistence for ecosystems, species and ecological processes, determined by a systematic conservation plan. They may be terrestrial or aquatic and are mostly in a good ecological state. These areas need to be maintained in a natural or near-natural state, and a loss or degradation must be avoided. If these areas were to be modified, biodiversity targets could not be met.
Cumulative impact	Past, current and reasonably foreseeable future impacts of an activity, considered together with the impact of the proposed activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Ecological condition	An assessment of the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference condition of natural.
Ecological infrastructure	Naturally functioning ecosystems that generate or deliver valuable ecosystem services, e.g., mountain catchment areas, wetlands, and soils.
Ecological process	The functions and processes that operate to maintain and generate biodiversity.
Ecological Support Areas	An area that must be maintained in at least fair ecological condition in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or necessary to meet them in natural or near natural areas. It is one of five broad categories on a CBA map, and a subset of biodiversity priority areas.
Ecosystem resilience	The ability of an ecosystem to maintain its functions (biological, chemical, and physical) in the face of disturbance or to recover from external pressures.
Ecosystem threshold	The tipping point where ongoing disturbance or change results in an irreversible change in its composition, structure and functioning. Surpassing ecosystem thresholds diminishes the quality and quantity of ecosystem services provided, rapidly reduces the ability of the ecosystem to sustain life, and results in less resilient ecosystems.
Ecosystem services	The benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth.
Edge	The portion of an ecosystem or cover type near its perimeter, and within which environmental conditions may differ from interior locations in the ecosystem.
Endemic	Restricted or exclusive to a particular geographic area and occurring nowhere else. Endemism refers to the occurrence of endemic species.
Exempted Alien Species	An alien species that is not regulated in terms of this statutory framework - as defined in Notice 2 of the AIS List.
Forbs	Herbaceous plants with soft leaves and non-woody stems.
Fragmentation	The breaking up of a habitat or cover type into smaller, disconnected parcels, often associated with, but not equivalent to, habitat loss.
Geophyte	Perennial plants having underground perennating organs, such as bulbs, corms or tubers.
Global Hotspot	An area characterised by high levels of biodiversity and endemism, and that faces significant threats to that biodiversity.
Habitat	The area of an environment occupied by a species or group of species, due to the particular set of environmental conditions that prevail there.
Habitat loss	Conversion of natural habitat in an ecosystem to a land use or land cover class that results in irreversible change to the composition, structure and functional characteristics of the ecosystem concerned.
Keystone species	A species that has a disproportionately large effect on its environment relative to its abundance.
Prohibited Alien Species	An alien species listed by notice by the Minister, in respect of which a permit may not be issued as contemplated in section 67(1) of the act. These species are contained in Notice 4 of the AIS List, which is referred to as the List of Prohibited Alien Species.
Mitigate	The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.
"No-Go" option	The “no-go” development alternative option assumes the site remains in its current state, i.e., there is no construction of a WEF and associated infrastructure in the proposed project area.
Patch	A surface area that differs from its surroundings in nature or appearance.
Red List	A publication that provides information on the conservation and threat status of species, based on scientific conservation assessments.
Rehabilitation	Less than full restoration of an ecosystem to its predisturbance condition.
Restoration	To return a site to an approximation of its condition before alteration.
Riparian	The land adjacent to a river or stream that is, at least periodically, influenced by flooding.
Runoff	Non-channelized surface water flow.
Succulent	Plants that have some parts that are more than normally thickened and fleshy, usually to retain water in arid climates or soil conditions.

Species of special / conservation concern	Species that have particular ecological, economic or cultural significance, including but not limited to threatened species.
Systematic biodiversity conservation planning	Scientific methodology for determining areas of biodiversity importance involving: mapping biodiversity features (such as ecosystems, species, spatial components of ecological processes); mapping a range of information related to these biodiversity features and their condition (such as patterns of land and resource use, existing protected areas); setting quantitative targets for biodiversity features, analysing the information using GIS; and developing maps that show spatial biodiversity priorities. Systematic biodiversity planning is often called 'systematic conservation planning' in the scientific literature.
Threatened ecosystems	An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on analysis of ecosystem threat status. A threatened ecosystem has lost, or is losing, vital aspects of its structure, composition or function. The Biodiversity Act makes provision for the Minister or Environmental Affairs, or a provincial MEC of Environmental Affairs, to publish a list of threatened ecosystems.
Threatened species	A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

COMPLIANCE WITH APPENDIX 6 OF THE EIA REGULATIONS AND AMENDMENTS

National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		Clause	Section in Report
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Page ii
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Appendix 8
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Page viii
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Page ix
	(cA)	An indication of the quality and age of base data used for the specialist report;	Page 23-27
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Page 34
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Page 27
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	Page 23-27
	(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Page 54
	(g)	An indication of any areas to be avoided, including buffers;	Page 54
	(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Page 77
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Page x
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Page 56
	(k)	Any mitigation measures for inclusion in the EMPr;	Page 76
	(l)	Any conditions for inclusion in the environmental authorization;	Page 76
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Page 76
	(n)	A reasoned opinion –	

		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Page 80-81
		(iA) regarding the acceptability of the proposed activity or activities; and	Page 81
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Page 76
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
	(q)	Any other information requested by the authority.	N/A
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

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INTRODUCTION

Background

SiVEST SA (Pty) Ltd was appointed as the Environmental Assessment Practitioners (EAP) to undertake the required Basic Assessment (BA) processes for the proposed 9.9 megawatt (MW) Wildebeestkuil 1 and Wildebeestkuil 2 Solar Photovoltaic (PV) Plant, 132 kilovolt (kV) Power Line and associated infrastructure, 9.9MW Leeuwbosch 1 and Leeuwbosch 2 Solar PV Plant and associated infrastructure, and the 132/11kV Leeudoringstad Solar Plant Substation near the town of Leeudoringstad in the North West Province. On 1 September 2016 David Hoare Consulting (Pty) Ltd was commissioned by SiVEST Environmental Division to provide specialist Terrestrial Ecology consulting services for the BA for the proposed projects. The proposed facilities are situated near to the town of Leeudoringstad, located in the North West Province. The consulting services comprise an assessment of potential impacts on the general ecology in the study area by the proposed project. The study excludes Bats, Avifauna, Aquatic Ecology and Invertebrates.

It should be noted that a combined report has been compiled for all five proposed projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and Leeudoringstad Solar Plant Substation). Where certain findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

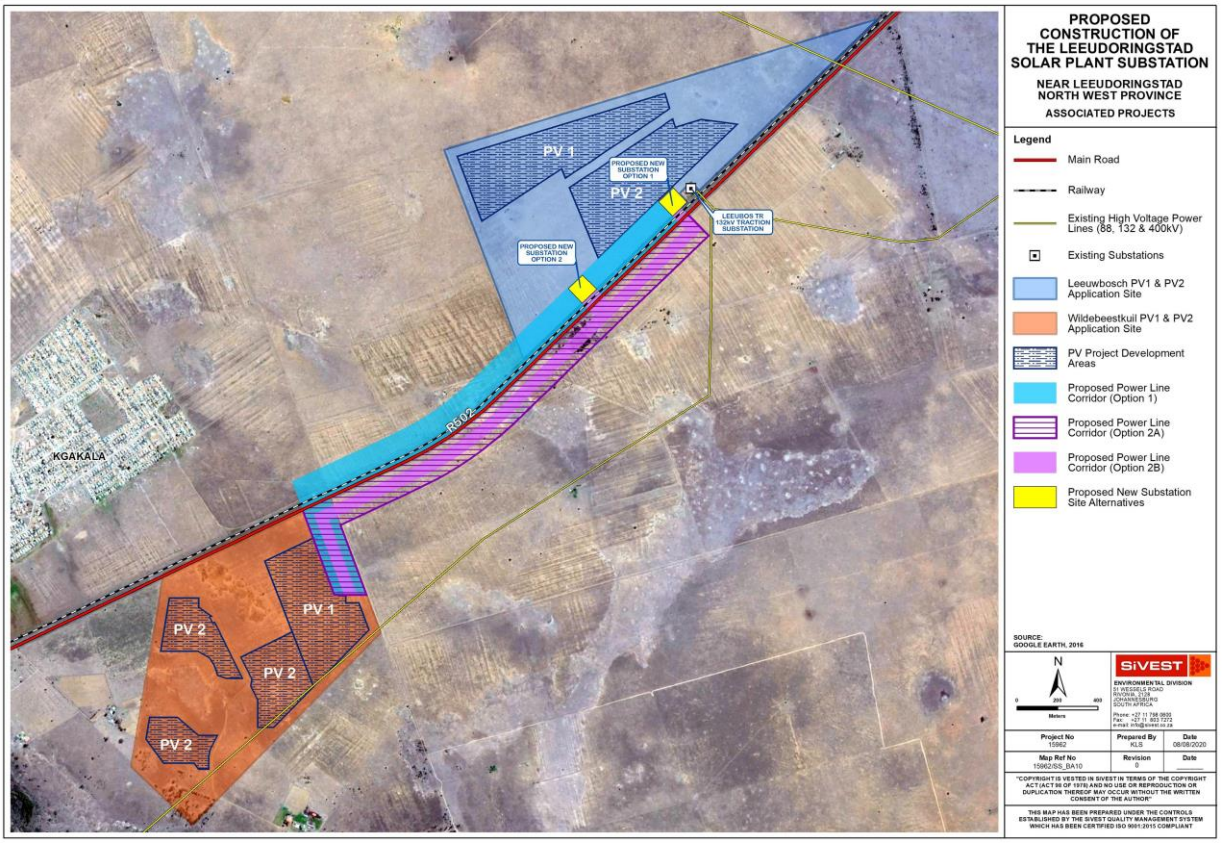

Figure 1: Proposed layout for all project components and options.

Project description

It is proposed that four (4) Solar PV Energy Facilities, two (2) of these with associated grid connection infrastructure, and substation, will be developed (Figure 1), these being:

- ***9.9MW Leeuwbosch 1 Solar PV Plant***, situated on the following farm portions:
    - Portion 37 of the Farm Leeuwbosch No. 44

- ***9.9MW Leeuwbosch 2 Solar PV Plant***, situated on the following farm portions:
    - Portion 37 of the Farm Leeuwbosch No. 44

- ***9.9MW Wildebeestkuil 1 Solar PV Plant & 132kV Power Line***, situated on the following farm portions:
    - Portion 37 of the Farm Leeuwbosch No. 44
    - Portion 13 of the Farm Wildebeestkuil No. 59;
    - Portion 14 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 22 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 5 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 7 of the Farm Leeuwbosch No. 44;
    - Remainder of Portion 29 of the Farm Leeuwbosch No. 44;
    - Portion 35 of the Farm Leeuwbosch No. 44;
    - Portion 36 of the Farm Leeuwbosch No. 44; and
    - Portion 38 of the Farm Leeuwbosch No. 44.

- ***9.9MW Wildebeestkuil 2 Solar PV Plant & 132kV Power Line***, situated on the following farm portions:
    - Portion 37 of the Farm Leeuwbosch No. 44
    - Portion 13 of the Farm Wildebeestkuil No. 59;
    - Portion 14 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 22 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 5 of the Farm Wildebeestkuil No. 59;
    - Remainder of Portion 7 of the Farm Leeuwbosch No. 44;
    - Remainder of Portion 29 of the Farm Leeuwbosch No. 44;
    - Portion 35 of the Farm Leeuwbosch No. 44;
    - Portion 36 of the Farm Leeuwbosch No. 44; and
    - Portion 38 of the Farm Leeuwbosch No. 44;

- ***132/11kV Leeudoringstad Solar Plant Substation***, covering an area of approximately 10 016m^2 (≈1ha), situated on the following farm portions:
    - Portion 37 of the Farm Leeuwbosch No. 44

The proposed Leeuwbosch and Wildebeestkuil Solar PV Plant developments will have total maximum generation capacities of up to approximately 9.9MW respectively. In addition, the electricity generated by the proposed Wildebeestkuil 1 and Wildebeestkuil 2 Solar PV Plant developments will be fed into the national electricity grid via 132kV power lines, which will connect to the Leeudoringstad Solar Plant Substation (part of a separate BA process). It should be noted that each proposed solar PV plant will consist of one (1) associated 132kV power line.

The overall objectives of the proposed developments are to generate electricity (by capturing solar energy) to feed into the national electricity grid and "wheel" the power to customers based on a power purchase agreement. Additionally, an agreement is in place to sell the energy to PowerX, who hold a National Energy Regulator of South Africa (NERSA)-issued electricity trading license which allows them to purchase energy generated from clean and renewable resources and sell it to its customers.

Solar PV Components

<u>9.9MW Leeuwbosch 1, Leeuwbosch 2, Wildebeestkuil 1 and Wildebeestkuil 2 Solar PV Plants:</u>

The key components to be constructed for each proposed solar PV plant are listed below:

- Solar PV field (arrays) comprising multiple PV modules

- PV panel mountings. PV panels will be single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology
- Each PV module will be approximately 2.5m long and 1.2m wide and mounted on supporting structures above ground. The final design details will become available during the detailed design phase of the proposed developments, prior to the start of construction
- The foundations will most likely be either concrete or rammed piles. The final foundation design will be determined at the detailed design phase of the proposed developments

In addition, related infrastructure required for each proposed solar PV plant are:

- Underground cabling (≈0.8m × 0.6 wide);
- Permanent Guard House (≈876m²);
- Temporary building zone (≈2994m²);
- Switching Substation (≈2000m²);
- Internal gravel roads (≈3.5m width);
- Upgrade to existing roads; and
- Site fencing (≈2.1m high).

Grid connection – Wildebeestkuil 1, Wildebeestkuil 2 and Leeudoringstad Solar Plant Substation

As mentioned, the electricity generated by the proposed 9.9MW Wildebeestkuil 1 and Wildebeestkuil 2 Solar PV Plant projects will be fed into the national electricity grid via 132kV power lines, which will connect to the Leeudoringstad Solar Plant Substation (part of a separate BA process)[1]. Each proposed solar PV plant will consist of one (1) associated 132kV power line. Corridors between approximately 60m and 150m wide were assessed for the proposed power line corridor route alternatives associated with each proposed Wildebeestkuil solar PV plant (see below). This is to allow for flexibility to route the power lines within the assessed corridors. As such, the selected preferred power lines will be routed within the assessed corridors. The final servitudes will be routed within the power line corridors, and it expected that the servitude swill does not exceed 32m.

Three (3) power line corridor route alternatives for the proposed 132kV power line associated with each Wildebeestkuil solar PV plant were identified and assessed by the respective specialists as part of the BA processes. These alternatives essentially provide for different power line route alignments contained within an assessment corridor. The power line corridor route alternatives were informed by the identified environmental sensitive and/or "no-go" areas. The power line corridor route alternatives work as follows:

WILDEBEESTKUIL 1 SOLAR PV PLANT & 132KV POWER LINE:

1) Power Line Corridor Option 1:
This involves an overhead power line which will run north of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

2) Power Line Corridor Option 2A:
This involves an overhead power line which will run south of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km

[1] Proposed Leeudoringstad Solar Plant Substation part of separate BA process and will be authorised under a separate EA.

[2] 132kV power line corridor route associated with solar PV plant intrinsically linked to Leeudoringstad Solar Plant Substation site (part of separate on-going BA process). Leeudoringstad Solar Plant Substation site chosen as "preferred" by respective specialists as part of that separate BA process therefore informed connection point for power line corridor being proposed as part of this BA application.

to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

3) Power Line Corridor Option 2B:
This involves an underground power line which will run south of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

WILDEBEESTKUIL 2 SOLAR PV PLANT & 132KV POWER LINE:

1) Power Line Corridor Option 1:
This involves an overhead power line which will run north of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

2) Power Line Corridor Option 2A:
This involves an overhead power line which will run south of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

3) Power Line Corridor Option 2B:
This involves an underground power line which will run south of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

LEEUDORINGSTAD SOLAR PLANT SUBSTATION

The proposed Leeudoringstad Solar Plant Substation development will have a capacity of 132/11kV and will serve the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line and Wildebeestkuil 2 Solar PV Plant & 132kV Power Line (part of separate respective BA processes). Once fully developed, the intention is to feed the electricity generated by the proposed Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line and Wildebeestkuil 2 Solar PV Plant & 132kV Power Line into the national grid and "wheel" the power to customers based on a power purchase agreement.

Two (2) different location alternatives for the substation site have been identified and assessed.

No-Go alternative

The no development alternative option assumes the site remains in its current state, i.e., there is no construction of Solar PV Facilities, power lines, a substation or associated infrastructure in the proposed project area and the *status quo* would prevail.

This alternative would result in no environmental impacts from the proposed projects on the sites or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. Implementing the no-go option would entail no development.

The no-go option is a feasible option; however, this would prevent the proposed projects from contributing to the environmental, social and economic benefits associated with the development of the renewables sector.

APPROACH & METHODOLOGY

The study commenced as a desktop-study followed by a site-specific field study from the 4th – 8th February 2019. This report provides a Scoping level description of the site and assessment of the proposed projects from and ecology perspective. The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

As mentioned, a combined report has been compiled for all five proposed projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and Leeudoringstad Solar Plant Substation). Where certain methodologies, findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on the site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e., to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

1. threatened plant species;
2. protected trees; and
3. threatened animal species.

Ecosystems

1. threatened ecosystems;
2. protected ecosystems;
3. critical biodiversity areas;
4. areas of high biodiversity; and
5. centres of endemism.

Processes

1. corridors;
2. mega-conservancy networks;
3. rivers and wetlands; and
4. important topographical features.

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is

in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998); and
2. National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004).

Species of conservation concern

There are two types of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

Red List plant species

Determining the conservation status of a species is required to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the International Union for Conservation of Nature (IUCN) Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo *et al*., 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (http://redlist.sanbi.org/). According to the website of the Red List of Southern African Plants (http://redlist.sanbi.org/), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: http://www.iucnredlist.org*. The South African assessment is used in this study.

The purpose of listing Red List species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.

Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g., van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

Other protected species

National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

- National Environmental Management: Biodiversity Act (Act No 10 of 2004); and
- Northern Cape Nature Conservation Act (Act No. 9 of 2009).

This legislation contains lists of species that are protected. These lists were used to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, if it is possible that they could occur on site, this was stated.

Red List animal species

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem *et al*., 2010). The likelihood of any of them occurring was evaluated based on habitat preference and habitats available within the study area. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

Mammal threat status is according to Child et al. (2016), reptile threat status is according to Bates et al. 2014, and amphibian threat status is according to Minter et al. (2004).

Species probability of occurrence

Some species of plants may be cryptic, difficult to find, rare, ephemeral or generally not easy to identify while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected flora that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g., karoo shrubland), but detailed microhabitat requirements (e.g., mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g., mountain shrubland on shallow soils overlying sandstone);
- DEFINITE: species found in habitats on site.

Habitat sensitivity

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks *et al*., 2000) using available satellite imagery and aerial photography. From this, it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g., the National Spatial Biodiversity Assessment (NSBA). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological

functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • Protected habitats (areas protected according to national / provincial legislation, e.g., National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act) And may also be positive for the following: • High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) • High value ecological goods & services (e.g., water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • Low ability to respond to disturbance (low resilience, dominant species very old).	• CBA 1 areas. • Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.
HIGH	Indigenous natural areas that are positive for any of the following: • High intrinsic biodiversity value (moderate/high species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). • Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • Moderate to high value ecological goods & services (e.g., water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: • Protected habitats (areas protected according to national / provincial legislation, e.g., National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	• CBA 2 "critical biodiversity areas". • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem providing high value ecosystem goods and services.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
MEDIUM-HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	• CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	• Natural habitat with no specific sensitivities.
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	• Highly degraded areas or highly disturbed areas in which the original species composition has been lost.
LOW	No natural habitat remaining.	• Transformed areas.

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

Field surveys

The study area was visited and assessed to confirm patterns identified from the desktop assessment. Three site visits were undertaken on 13 September 2016, on 15 May 2017, and on 25 March 2021. The site visits were undertaken at different times of the summer growing season. Vegetation was in a moderate to good state. Many plant species could be identified, and habitats were generally in a good state to assess. This means that botanical diversity and species composition were possible to assess.

Specific features of potential concern were investigated in the field, including the following:

- General vegetation status, i.e., whether the vegetation was natural, disturbed/secondary or transformed;

- Presence of habitats of conservation concern in terms of high biodiversity, presence of SCC, specific sensitivities, e.g., wetlands, and any other factors that would indicate an elevated biodiversity or functional value that could not be determined from the desktop assessment;
- Presence of protected trees; and
- Potential presence of SCC, including observation of individual plants found on site or habitats that are suitable for any of the species identified from the desktop assessment.

Key parts of the development sites were visited during the reconnaissance site visit in such a way as to ensure all major variation was covered and that any unusual habitats or features were observed. A checklist of species occurring on site was collected during the surveys (Appendix 3, highlighted in green). Plant names follow Germishuizen *et al*. (2005). The season of the survey was favourable, and it there is high confidence that many of species present on site were identifiable at the time of the survey. The survey was of adequate duration and intensity to characterise the flora of the development site as per the regulations.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Convention on Biodiversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by DEA, but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.",
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

This report considers the Environmental Impact Assessment (EIA) Regulations of 2014 (NEMA, 2014) as amended in 2017 (NEMA, 2017), under the National Environmental Management Act, (Act No. 107 of 1998). According to these Regulations under Listing Notice 1 (GRN No. 327), Listing Notice 2 (GRN No 325) and Listing Notice 3 (GRN No 324), the activities listed are identified as activities that may require Environmental Authorisation prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of the Act.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

As the principal national act regulating biodiversity protection, NEM:BA, which is administered by DEA, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term biodiversity according to the Convention on Biodiversity (CBD) refers to the variability among living organisms from all sources including, inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are “of a nature that may negatively impact on the survival of a listed threatened or protected species”.

Alien and Invasive Species

Chapter 5 of NEM:BA relates to species and organisms posing a potential threat to biodiversity. The Act defines alien species and provides lists of invasive species in regulations. The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEM:BA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEM:BA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEM:BA, 2016).

According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. The purpose of Chapter 5 is:

a) to prevent the unauthorized introduction and spread of alien species and invasive species to ecosystems and habitats where they do not naturally occur;
b) to manage and control alien species and invasive species to prevent or minimize harm to the environment and to biodiversity in particular;
c) to eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

According to Section 65 of the Act, "Restricted activities involving alien species":

1) A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7. Restricted activities include the following:
    a. Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
    b. Having in possession or exercising physical control over any specimen of a listed invasive species.
    c. Growing, breeding or in any other way propagating any specimen of a listed invasive species, or causing it to multiply.
    d. Conveying, moving or otherwise translocating any specimen of a listed invasive species.
    e. Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any other way acquiring or disposing of any specimen of a listed invasive species.
    f. Spreading or allowing the spread of any specimen of a listed invasive species.
    g. Releasing any specimen of a listed invasive species.
    h. Additional activities that apply to aquatic species.
2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.
3)

An "**alien species**" is defined in the Act as:

a) a species that is not an indigenous species; or
b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by means of migration or dispersal without human intervention.

According to Section 71 of the Act, "Restricted activities involving listed invasive species":

1) A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.
2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**invasive species**" is defined in the Act as any species whose establishment and spread outside of its natural distribution range:

a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
b) may result in economic or environmental harm or harm to human health.

A "**listed invasive species**" is defined in the Act as any invasive species listed in terms of section 70(1).

According to Section 73 of the Act, "Duty of care relating to listed invasive species":

2) A person who is the owner of land on which a listed invasive species occurs must-
    a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
    b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
    c) take all the required steps to prevent or minimize harm to biodiversity.

According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection
Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The EIA Regulations (2014, as amended) include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (GNR. 327 of 2014, as amended),
- Listing Notice 2: activities that require a full environmental impact assessment report (EIR) (GNR. 325 of 2014, as amended),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (GNR. 324 of 2014, as amended).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List
Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List
Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy
Published under the National Environmental Management Act (Act No. 107 of 1998). The aim of the Policy is to ensure that significant residual impacts of developments are remedied as required by NEMA, thereby ensuring sustainable development as required by section 24 of the Constitution of the Republic of South Africa, 1996. This policy should be taken into consideration with every development application that still has significant residual impact after the Mitigation Sequence has been followed. The mitigation sequence entails the consecutive application of avoiding or preventing loss, then at minimizing or mitigating what cannot be avoided, rehabilitating where possible and, as a last resort, offsetting the residual impact. The Policy specifies that one impact that has come across consistently as unmitigable is the rapid and consistent transformation of certain ecosystems and vegetation types, leading to the loss of ecosystems and extinction of species. The Policy specifically targets ecosystems where the ability to reach protected area targets is lost or close to being lost. However, the Policy states that "*[w]here ecosystems remain largely untransformed, intact and functional, an offset would not be required for developments that lead to transformation, provided they have not been identified as a biodiversity priority*". Biodiversity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance. Residual impacts of 'very high' significance are a fatal flaw for development and residual biodiversity impacts of 'low' significance would usually not require offsets. The Policy indicates that impacts should preferably be avoided in protected areas, CBAs, verified wetland and river features and areas earmarked for protected area expansion.

National Forests Act (Act no 84 of 1998)

Protected trees
According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests
Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Water Act (Act 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for firefighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

North West Biodiversity Management Act, No. 4 of 2016

This Act provides for the management and conservation of the North West Province's biophysical environment and protected areas within the framework of the National Environmental Management Act No 107 of 1998, to provide for the protection of species and ecological systems that warrant provincial protection, and to provide for the sustainable use of indigenous biological resources. Amongst other regulations, the following may apply to the current project:

- Protects threatened or protected ecosystems, riparian habitats and aquatic systems (Chapter 3, Part 2, sections 10 - 12);
- Protects species by listing those that require protection and restricting activities involving listed species (Chapter 4, sections 13 - 23);
- Provides for the management of species and organisms posing potential threats to biodiversity (Chapter 5, sections 27 - 37) through listing invasive species, restricting activities involving listed invasive species, and providing guidelines and requirements for control and eradication, including control plans and invasive species status reports.

The Act provides lists of protected species for the Province (Schedule 2). A permit is required for the removal of any species on this list.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Lake Areas Development Act (Act No. 39 of 1975)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- Integrated Coastal Zone Management Act (Act No. 24 of 2008)

DESCRIPTION OF STUDY AREA

Location

The combined projects are located directly to the east of the town of Leeudoringstad, immediately adjacent to the R502 road to the town of Orkney. This is in the North-West Province approximately 20 km north of the Vaal River, which is the southern boundary of the Province (Figure 2, Figure 3 and Figure 4). The proposed projects are located within the Maquassi Hills Local Municipality, which falls within the Dr Kenneth Kaunda District Municipality in the North West Province of South Africa. The combined site (study area) is in the quarter degree grid 2726AB.

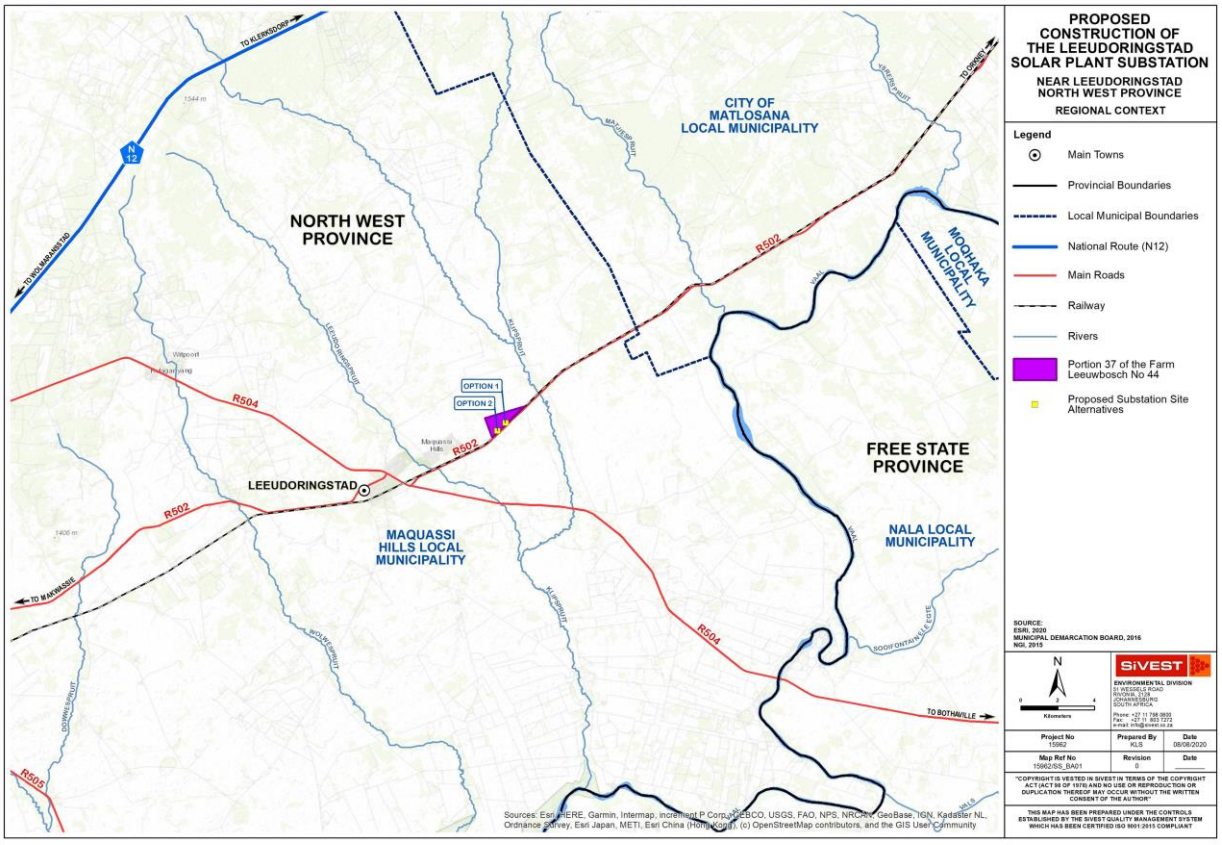

Figure 2: Study area in a regional context (relative to substation options). – Leeudoringstad Solar Plant Substation

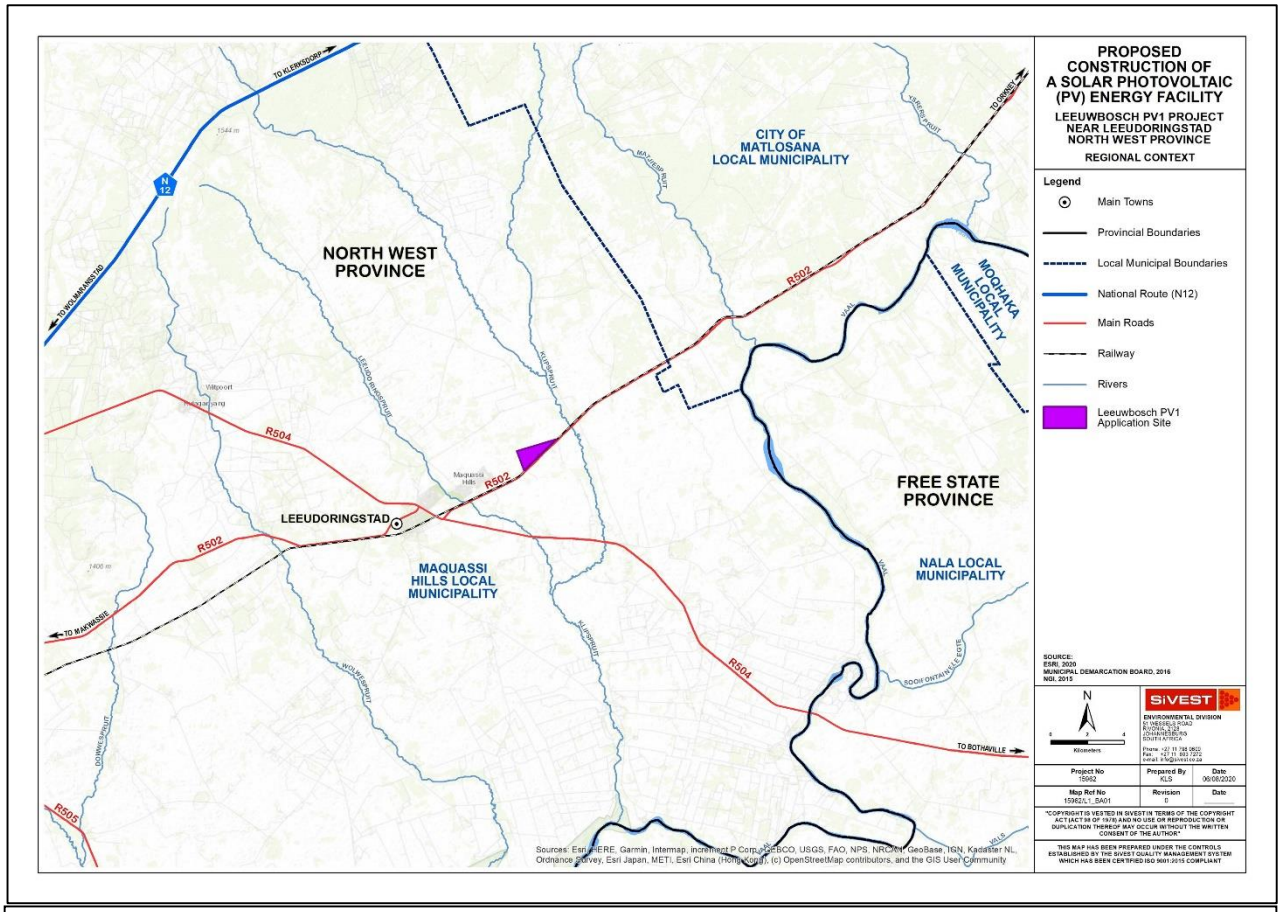

Figure 3: Study area in a regional context (relative to substation options). – Leeuwbosch 1 and Leeuwbosch 2 Solar PV Plant

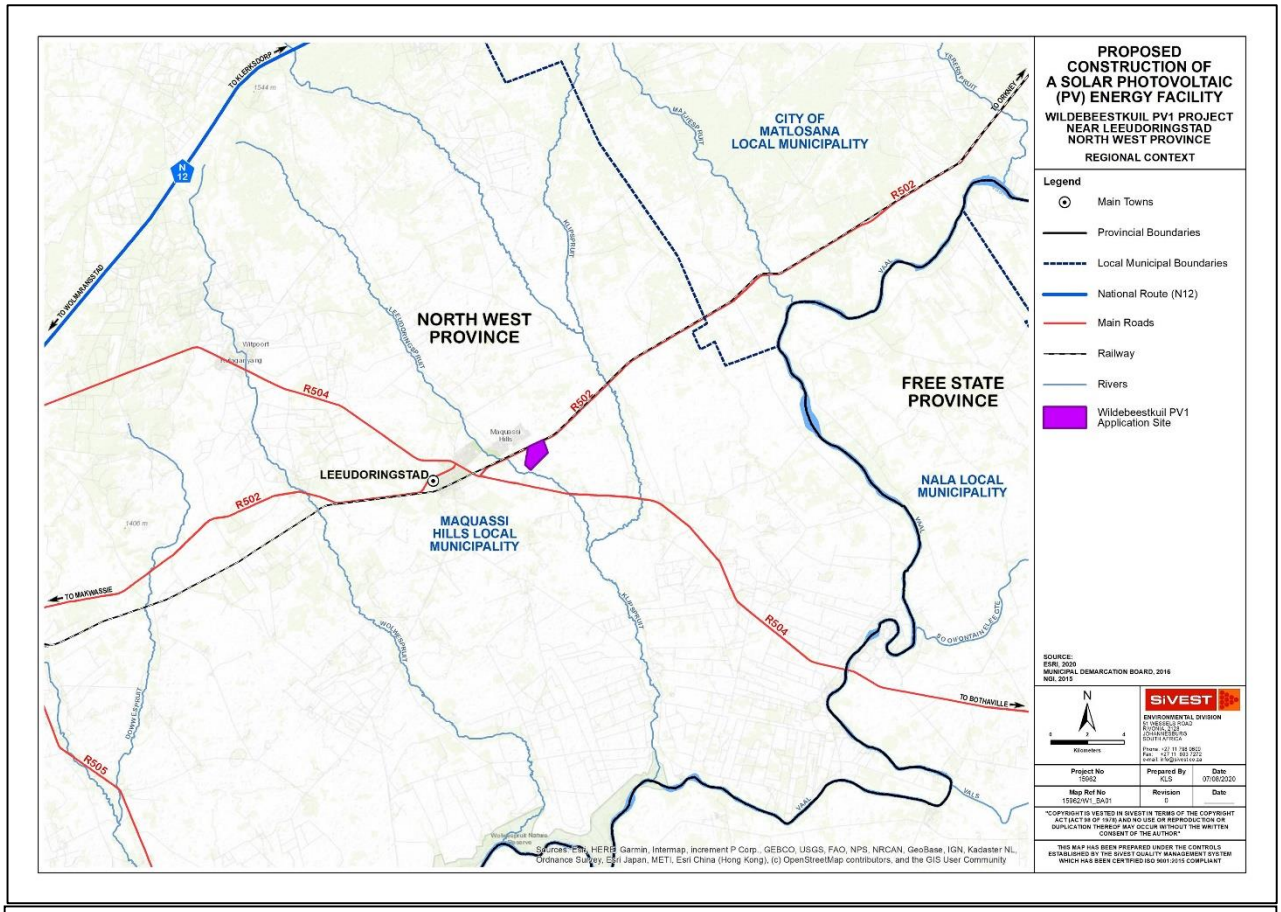

Figure 4: Study area in a regional context. – Wildebeestkuil 1 Solar PV Plant & 132kV Power Line and WIldebeestkuil 2 Solar PV Plant & 132kV Power Line

Site conditions

The entire study area is largely in a natural state but used for animal production. There is relatively little farm infrastructure on each land holding, although homesteads, farm buildings, camps, etc. are located nearby. The vegetation in the study area is used primarily for livestock grazing and is affected to some degree by this usage, but not to the extent that any severe degradation was noted on site. The vegetation and habitats in the study area appear to be largely in a natural state and reflecting what would be expected according to the natural relationship between the physical environment and the vegetation.

Topography and drainage

The study site is situated in an area with relatively gentle topography. There are no rock outcrops or ridges and no obvious drainage channels. The elevation on site varies from 1310 to 1321 m above sea level, an elevation difference of approximately 21 m across a relatively long distance of 1,7 km.

Soils

Detailed soil information is not available for broad areas of the country. As a surrogate, land type data was used to provide a general description of soils in the study area (land types are areas with largely uniform soils, topography and climate). The land types described below provide a generalized description of soils on site that may differ in detail from site-specific patterns, but not in overall trends. There are two land types in the study area. These are the Bd land type

on the south-western two-thirds and the Fb land type on the north-eastern third of the site (Land Type Survey Staff, 1987).

The B-group of land types refers to lands with a plinthic catena (containing plinthite: where iron oxides are found segregated and concentrated in the form of mottling and cementation) in which upland duplex and margalitic soils are rare (MacVicar et al. 1974). These soils are typically found in inland grassland areas of South Africa in which there is intermediate amounts of rainfall (Fey 2010). It is usually indicative of a fluctuating water table where there is seasonality in the soils water status (Fey 2010). Unit Bd refers to land in which red and/or yellow apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene forms) that are dystrophic and/or mesotrophic predominate over red and/or yellow apedal soils that are eutrophic, and in which red soils (mainly Hutton and Bainsvlei) are not widespread (MacVicar et al. 1974).

The F-group of land types accommodate pedologically young landscapes that are not predominantly rock and not predominantly alluvial or aeolian, and in which the dominant soil-forming processes include rock weathering, the formation of orthic topsoil horizons and commonly, clay illuviation, giving rise typically to lithocutanic horizons. The Fb land type refers to land where the soils are shallow and/or rocky, often on steep slopes. The soils are slightly leached and there is usually lime in some of the bottomlands.

Climate

The study area is within a relatively dry area. Rainfall occurs mainly in Summer, peaking in February. Mean annual rainfall is approximately 530 mm per year. All areas with less than 400 mm rainfall are considered to be arid and all areas with more than 600 mm are moist. The study area can therefore be considered to be intermediate. Winter frost is common and severe and occurs on average 37 days per year.

Broad vegetation patterns

There is one regional vegetation type occurring on site, namely Vaal-Vet Sandy Grassland. There are small patches of Highveld Salt Pans in nearby areas but not within the study area. The vegetation types that occur on site and nearby areas are briefly described below.

Vaal-Vet Sandy Grassland
This vegetation type occurs in the North-West and Free State Provinces in the area south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. It occurs on plains-dominated landscapes with some scattered, slightly irregular undulating plains and hills.

The vegetation is mainly a low-tussock grassland with an abundant karroid element (Mucina et al. 2006). The dominance of Themeda triandra is an important feature of this vegetation type. Locally low cover of *Themeda triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Important taxa include the grasses, *Anthephora pubescens* (d), *Aristida congesta* (d), *Chloris virgata* (d), *Cymbopogon caesius* (d), *Cynodon dactylon* (d), *Digitaria argyrograpta* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. lehmanniana* (d), *E. plana* (d), *E. trichophora* (d), *Heteropogon contortus* (d), *Panicum gilvum* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Tragus berteronianus* (d), *Brachiaria serrata*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis curvula, E. obtusa, E. superba, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis* and *Triraphis andropogonoides*, the herbs, *Stachys spathulata* (d), *Barleria macrostegia, Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Geigeria aspera* var. *aspera*, *Helichrysum caespititium, Hermannia depressa*, *Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala*, the geophytic herbs, *Bulbine narcissifolia* and *Ledebouria marginata*, the succulent Herb, *Tripteris aghillana* var. *integrifolia*, the low shrubs, *Felicia muricata* (d), *Pentzia globosa* (d), *Anthospermum rigidum* subsp. *pumilum*, *Helichrysum dregeanum*, *H. paronychioides* and *Ziziphus zeyheriana*.

Highveld Salt Pans

The Highveld Salt Pans vegetation type is found in the Northern Cape, Eastern Cape, North-West, Free State and Gauteng Provinces and occurs in pans scattered on the broad Grassland/Karoo and Grassland/Savanna interface roughly between Mafikeng/Koster in the north and Britstown/Middelburg in the south. The highest concentrations of pans are found around Dealesville, Bultfontein, Wesselsbron, Delareyville and Petrusburg. The average size of the playas in the western Free State is 0.2 km2, with a number of the largest ones (e.g. Florisbad Pan and Annaspan) measuring several kilometres across (Goudie & Thomas 1985). It is found in depressions in plateau landscapes containing temporary (and less frequently also permanent) water bodies. The central parts of the pans are often seasonally inundated and sometimes with floating macrophyte vegetation or the vegetation cover develops on drained bottoms of the pans and forms typical concentric zonation patterns. On the pan edges an open to sparse grassy dwarf shrubland may develop, especially when the pan is under heavy grazing pressure. (Mucina et al. 2006).

The bottoms of the pans are usually formed by shales of the Ecca Group giving rise to vertic clays. The environment of the pans undergoes dramatic changes from freshwater systems during the wet season to saline systems as the dry season progresses and evaporation intensifies. Wind erosion is of particular significance during the dry season, when the playa basin is dry and marginal vegetation is short and sparse (Allan et al. 1995). Dense dust can reach several thousand metres into the air under such windy conditions.

Important species in this vegetation type include the following: Low Shrubs: *Atriplex vestita*, *Felicia filifolia*, *F. muricata*, *Nenax microphylla*, *Nestlera conferta*, *Pentzia globosa*, *P. incana*. Succulent Shrubs: *Salsola glabrescens* (d), *Lycium cinereum*, *Malephora herrei*, *Suaeda fruticosa*, *Titanopsis hugo-¬schlechteri*. Megagraminoids: *Cyperus congestus*, *Phragmites australis*, *Typha latifolia*. Graminoids: *Chloris virgata* (d), *Cynodon dactylon* (d), *C. transvaalensis* (d), *Cyperus laevigatus* (d), *C. marginatus* (d), *Diplachne fusca* (d), *Eragrostis bicolor* (d), *E. chloromelas* (d), *E. plana* (d), *Hemarthria altissima* (d), *Juncus rigidus* (d), *Panicum coloratum* (d), *P. laevifolium* (d), *P. schinzii* (d), *Setaria incrassata* (d), *Andropogon eucomus*, *Aristida adscensionis*, *Brachiaria marlothii*, *Cyperus longus*, *C. rigidifolius*, *Echinochloa holubii*, *Eleocharis palustris*, *Enneapogon desvauxii*, *Eragrostis curvula*, *E. micrantha*, *E. obtusa*, *E. stapfii*, *Fuirena coerulescens*, *F. pubescens*, *Juncus exsertus*, *Scirpoides dioecus*, *Sporobolus albicans*, *S. fimbriatus*, *S. ioclados*, *S. tenel¬lus*, *Tragus berteronianus*, *T. racemosus*. Herbs: *Alternanthera sessilis*, *Amaranthus praetermissus*, *Aponogeton rehmannii, Atriplex suberecta, Chenopodium mucronatum, Gnaphalium declinatum, Mollugo cerviana, Phyla nodiflora, Platycarpha parvifolia, Pterodiscus speciosus, Senecio reptans*. Succulent Herb: *Zygophyllum simplex*.

Conservation status of broad vegetation types

On the basis of a scientific approach used at national level by SANBI (Driver *et al*., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 4 below, as determined by best available scientific approaches (Driver *et al*., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*., 2005).

Determining ecosystem status (Driver *et al*., 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 2: Conservation status of different vegetation types occurring in the study area.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al*. 2005; Mucina *et al*., 2006	National Ecosystem List (NEM:BA)
Vaal-Vet Sandy Grassland	24	0.3	63	Endangered	Endangered
Highveld Salt Pans	24	0.2	4	Least Threatened	Not listed

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in Table 3, Vaal-Vet Sandy Grassland is listed as Endangered and Highveld Salt Pans is listed as Least Threatened.

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. Vaal-Vet Sandy Grassland is listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

Biodiversity Conservation Plans

The North-West Province Biodiversity Conservation Assessment (obtained from bgis.sanbi.org) provides maps that show Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), corridors and hills. This shows a variety of features within the study area, including the following:

1. ESA 1 & 2 areas: The entire Leeuwbosch application area falls within this category (Figure 5), as well as parts of the powerline corridors (Figure 6). The Wilderbeestkuil site is outside of these areas (Figure 6).
2. CBA nodes: Nodes of Provincial-level biodiversity corridor network aimed at retaining connectivity between geographical areas. **The eastern third of the study area falls within this biodiversity corridor node area, as well as a small section of the easternmost part of the power line corridor**.
3. CBA SAVeg: Critical patches: Ecosystem Status - Endangered and Vulnerable Ecosystems: Remaining patches larger than 5 ha of provincially Endangered and Vulnerable ecosystems (vegetation types), i.e., the amount of vegetation remaining intact (of these ecosystems) is less than 60%. Any further modification of these vegetation types should be limited to existing irreversibly modified or heavily degraded areas. **The entire study area falls within this category, including all parts of the power line corridor where there is still natural vegetation**.

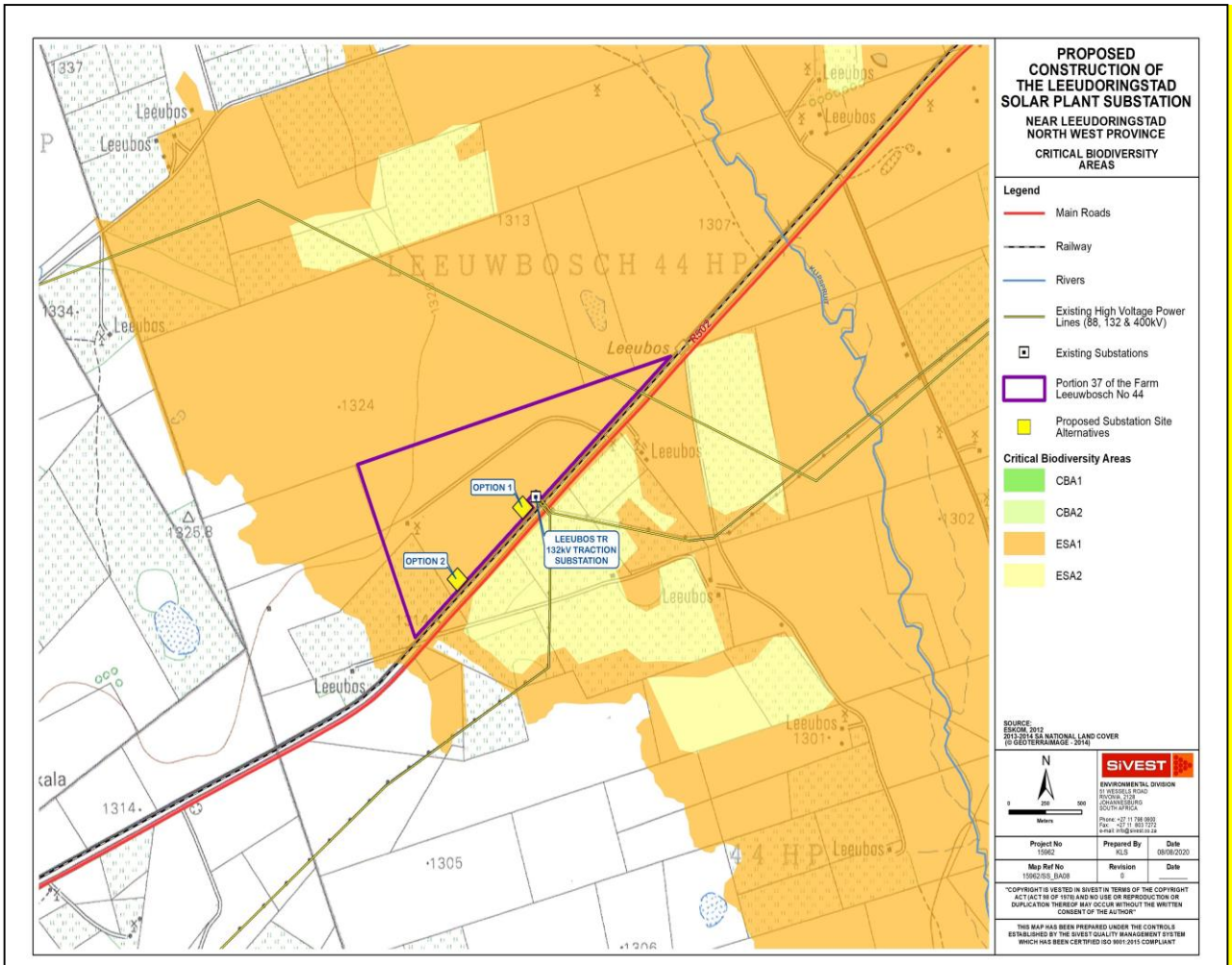

Figure 5: CBA map for the Leeuwbosch 1 and 2 Solar PV Plant projects and substation areas.

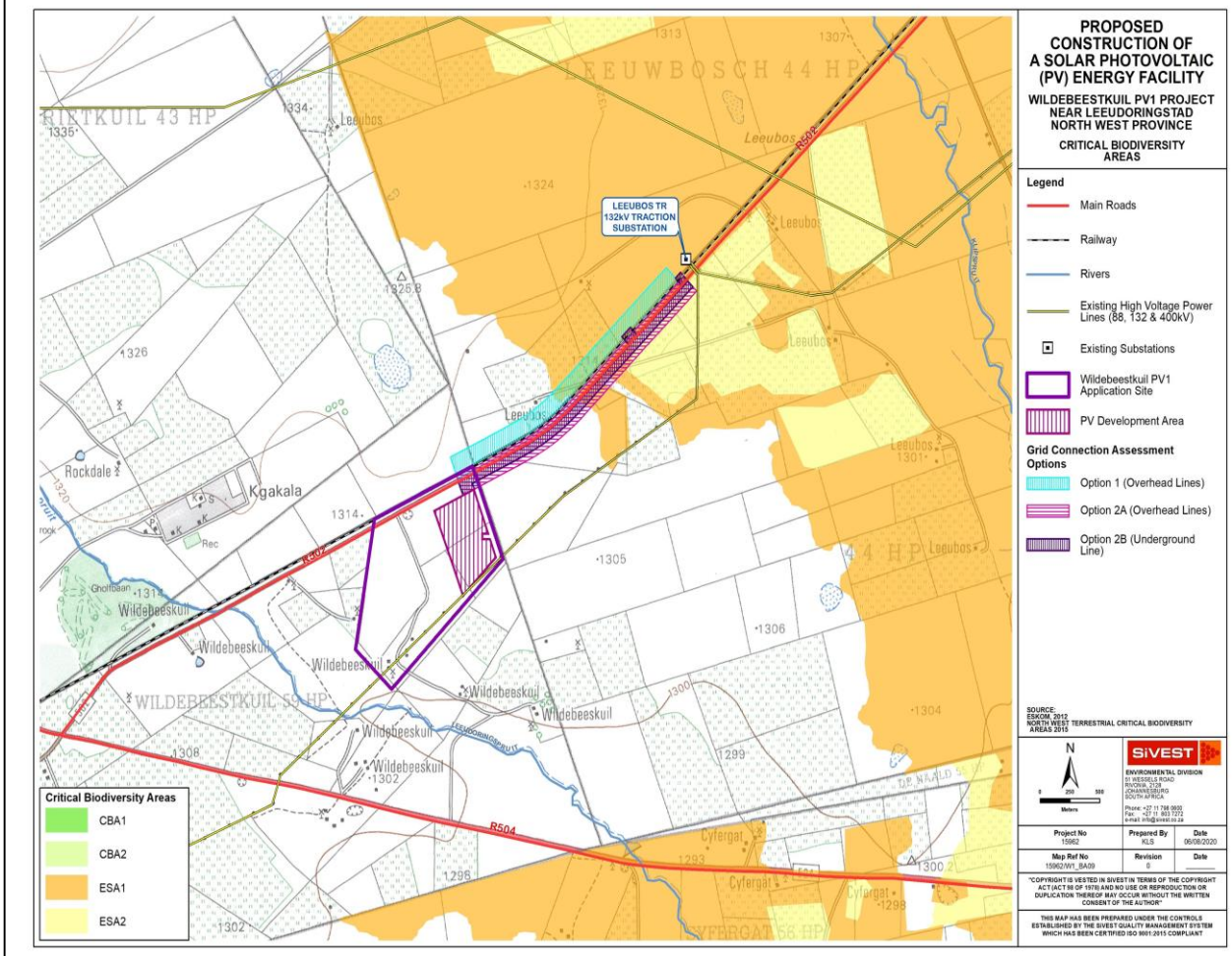

Figure 6: CBA map for the Wildebeestkuil 1 and 2 Solar PV Plant projects and OHL corridors

Proposed protected areas

According to the National Parks Area Expansion Strategy (NPAES), there is an area that includes most of the site and extending eastwards (on the southern side of the R502 rod) for 14 km and down to the Vaal River that has been identified as priority areas for inclusion in future protected areas (Figure 7). This particular component of the landscape is considered to be of high value for future conservation efforts by National Parks, and development of this area will partially affect future conservation planning. The site is, however, in the south-westernmost corner of this planned area so development of the site would not cause fragmentation of this area.

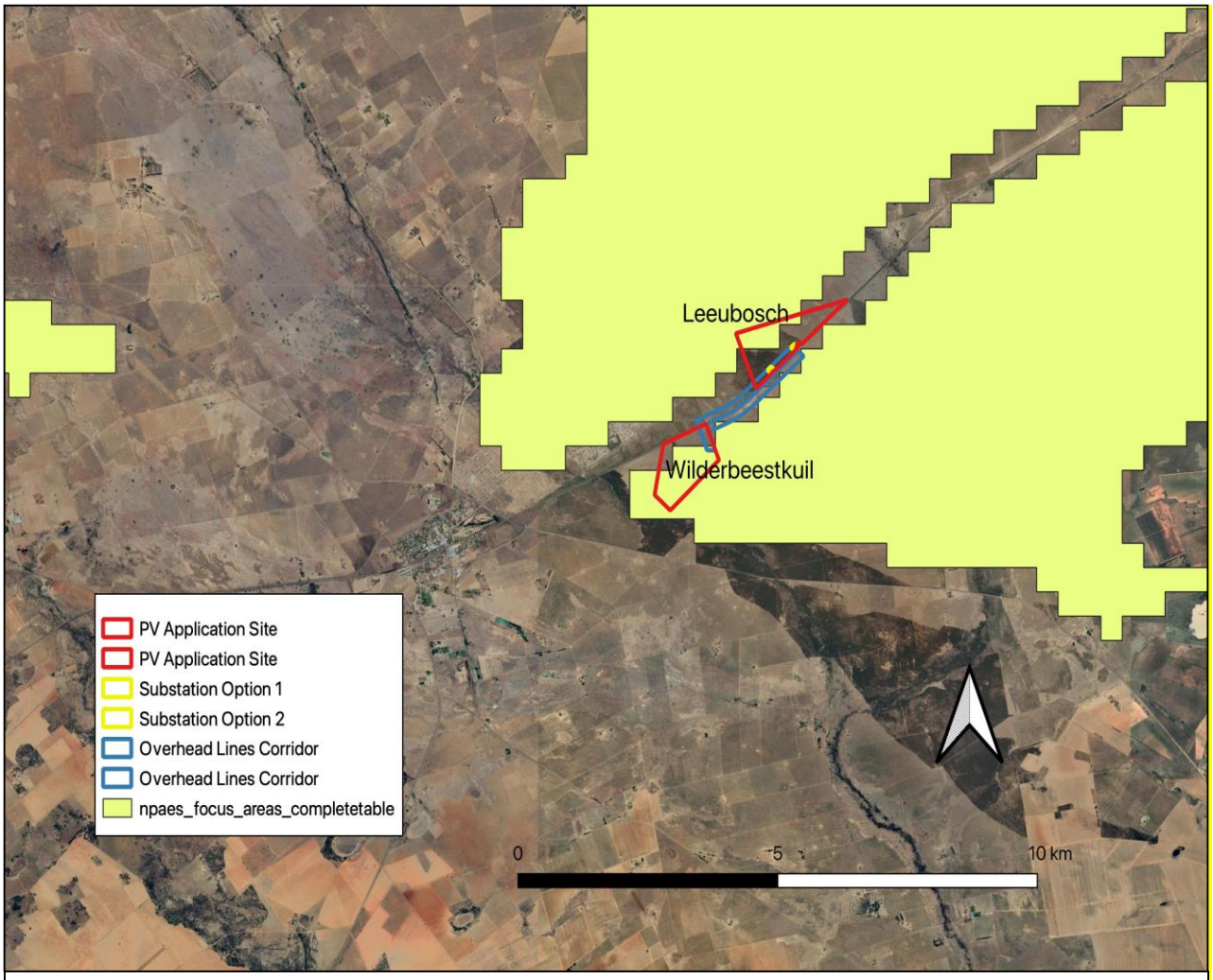

Figure 7: Proposed protected areas, according to the NPAES.

Red List plant species of the study area

Lists of plant species previously recorded in the study area were obtained from the South African National Biodiversity Institute (SANBI) website (http://newposa.sanbi.org/). These are listed in Appendix 3. There are very few collection records for this part of the country so a much larger area was searched for potential species of concern. Despite this broader search, there are very few species that were identified of conservation concern that could potentially occur in the broad area that includes the project area.

Table 3: Explanation of IUCN Version 3.1 categories (IUCN 2001) and Orange List categories (Victor & Keith 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List

IUCN / Orange List category	Definition	Class
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well-known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

There is one species that may occur in the study area, the geophyte, *Eucomis autumnalis* subsp. *clavata*, listed as Declining (see Table 3 for explanation of categories). *Eucomis autumnalis* subsp. *clavata* is found in damp, open grassland and sheltered places from the coast to 2450 m. The species has been recorded in the current grid near to the current site and the possibility of it occurring in the study area is therefore considered to be high. It was not seen on site.

Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in Appendix 4. Two plant species that appear on this list that could potentially occur in the general region, although they have not previously been recorded in the grids of the study area, are Crinum bulbispermum and Harpagophytum procumbens.

Crinum bulbispermum
Crinum bulbispermum occurs from the Northern Cape eastwards to Mpumalanga and KwaZulu-Natal. It also occurs in Lesotho. It is found in grasslands and savanna near rivers, streams, seasonal pans and in damp depressions. There is a moderate to low probability that it occurs in the general study area, but it was not found on site, although it could potentially occur there.

Harpagophytum procumbens
Harpagophytum procumbens occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape. The species is found in well drained sandy habitats in open savanna and woodlands. It has been previously recorded in this general area in which the site is located. It is considered possible that this species could occur on site.

Protected plants (North West Biodiversity Management Act)

Plant species protected under the North West Biodiversity Management Act, 2016 (Act 4 of 2016) are listed in Appendix 5. None of these species were found on site.

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 2. There are two species that are known to have a geographical distribution that includes the grids in which the proposed project is located, namely *Boscia albitrunca* and *Vachellia erioloba*.

Vachellia erioloba (Camelthorn / Kameeldoring) is found in savanna, semi-desert and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops. None were found on site in areas potentially affected by the proposed project, although it has been recorded in close proximity as well as in other nearby areas.

Boscia albitrunca (Shepherd's Tree / Witgatboom / !Xhi) occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. This species could potentially occur on site in areas affected by the proposed project, but no individuals were found there. It has been previously recorded to the south of the current site

In summary, two species of protected trees could occur in the geographical area that includes the site, and one species was found to occur on site.

Vertebrate animal species of the study area

Vertebrate species (mammals, reptiles, amphibians) with a geographical distribution that includes the study area are listed in Appendix 4. All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals that could occur in the study area and have habitat preference that includes habitats available in the study area, are discussed further below.

In all cases, the site does not constitute important habitat for any of these species, but there is still a possibility that they may occur there. Development of the site is unlikely to cause a significant loss of habitat for any of these species, but care should still be taken to avoid or minimise impacts on them.

Mammals
There are 79 mammal species that have a geographical distribution that includes the study area, of which eleven are listed in a conservation category of some level (see Appendix 3). This is a relatively moderate diversity of mammals compared to other parts of South Africa. Based on the natural state of the study area and surrounding areas, it is considered likely that some of these species could occur on site. Listed species with a geographical range that includes the site are discussed in more detail below to evaluate the potential for them to occur on site.

White-tailed Rat
The White-tailed Rat (*Mystromys albicaudatus*), listed as Vulnerable (2016), is endemic to South Africa and Lesotho, where it is found primarily in Highveld grasslands, but extending into adjacent Fynbos and Karoo areas. It is terrestrial, but never found in soft, sandy substrates, rocks, wetlands or riverbanks, and do not occur in transformed habitat. The study area is on the edge of the known distribution of this species, but there are historical records in a nearby grid to the one in which the projects are located. There is therefore a medium to low probability of the study area being suitable for this species. **Based on distribution and habitat requirements, it is considered possible but unlikely that it could occur on site.**

Black Rhinoceros
The Black Rhinoceros (*Diceros bicornis bicornis*), listed as Endangered, has a geographical distribution that includes the study area. The species is confined to formal conservation areas as well as a few individuals held on private land. It is a browser occurring in bushveld habitat where it requires dense cover, sufficient browsing and permanent water. The species is only found in protected areas and on some private properties. It would not occur on site unless introduced deliberately. The habitat on site is not suitable. **The habitat on site is not suitable for this species, it does not occur there and would not be found there unless deliberately introduced.**

African Clawless Otter
The African Clawless Otter (*Aonyx capensis*), listed as Near Threatened (2016), is widely but patchily distributed throughout South Africa, and is also the most widely found otter in Africa. It is aquatic and seldom found far from permanent water, which needs to be fresh. They may be found in seasonal rivers in the Karoo, provided suitable-sized pools persist. The site is within the known distribution of this species and there are historical records for one adjacent grid to the south, although not from the current grid. There is no suitable habitat for this species on site. **It is therefore considered unlikely that it occurs on site.**

Black-footed Cat
The Black-footed Cat (*Felis nigripes*), listed as Vulnerable (2016), has been previously recorded in a neighbouring grid to the grid in which the project is located. It's known distribution is on the inland part of most of South Africa, but seemingly not within the winter-rainfall part of the country. It also occurs in Botswana and Namibia. The current project

area is within the known distribution range of the species and the species is therefore likely to occur in the area. The species is nocturnal and carnivorous, favouring any vegetation cover that is low and not too dense. They make use of dens in the daytime, which can be abandoned termite mounds, or dens dug by other animals, such as aardvark, springhares or cape ground squirrels. Local declines in their population have been attributed to increased densities of natural predators, such as Black-backed Jackal, Caracals and Leopards. They are highly vulnerable to domestic carnivores. The study area is suited to this species but based on the proximity of urban areas with associated domestic carnivores it is unlikely that it occurs there. **It is therefore considered unlikely that it occurs on site.**

Brown Hyaena

The Brown Hyaena (*Hyaena brunnea*), listed as Near Threatened (2015), is found in a band running down the centre of the country, expanding into the entire northern parts of the the country. The distribution includes the current study area, and there is a possibility that vagrant individuals could occur in this area. The species is found in desert areas, particularly along the west coast, semi-desert, open scrub and open woodland savannah (Mills & Hes 1997). It is a solitary scavenger that travels vast distances every day in search of food. It could potentially forage across the site but is unlikely to be restricted to such a small area. There is therefore a medium chance of the species occurring in the study area since the distribution range includes the study area. It is a mobile animal that is likely to move away from the path of any construction and development of parts of the site is therefore highly unlikely to have any negative effect on the species. **It is considered that there is a medium likelihood of it occurring on site.**

Spotted-necked Otter

The Spotted-necked Otter (*Hydrictus maculicollis*), listed as Least Concern (2008), is found in permanent, unsilted and unpolluted rivers, streams and freshwater lakes in the well-watered eastern parts of the country (Mills & Hes 1997). There is no suitable habitat on site or nearby.

Honey Badger

The Honey Badger (*Mellivora capensis*), listed as Least Concern (2016) but protected, is found in a wide variety of habitats. It is found over most of Africa, including most of South Africa. It could potentially occur on site but is a mobile animal that forages over wide areas.

Leopard

The Leopard (*Panthera pardus*), listed as Vulnerable (2016), has a wide habitat tolerance, but with a preference for densely wooded areas and rocky areas. In montane and rocky areas of the Eastern, Western and Northern Cape, they prey on dassies and klipspringers. They have large home ranges, but do not migrate easily, males having ranges of about 100 km^2 and females 20 km^2. It has been recorded in the grid in which the projects are located as well as most surrounding grids. There is therefore a high probability of this species occurring in the area, but if it did occur there it would probably be at very low densities. The proximity of the nearby town and other human activities means it is even less likely that it would be resident on site. **The proposed project could possibly displace individuals, in the unlikely event that they occur there, but is unlikely to have a significant effect on overall population densities.**

Cape Fox

The Cape Fox (*Vulpes chama*), listed as Least Concern (2016), is found in open country with habitats including grassland, grassland with scattered thickets, and lightly wooded areas (Mills & Hes 1997). It could potentially occur on site but is a mobile animal that forages over wide areas.

Percival's Short-eared Trident Bat

Percival's Short-eared Trident Bat (*Cloeotis percivali*), listed as Endangered (2016), appears to be associated with woodland where it roosts in caves and narrow crevices in numbers of 20-200 individuals. Although not previously recorded nearby, modelling indicates that it could potentially occur in this general geographical area (Monadjem et al. 2001), although observation records indicate it has not been previously recorded nearby. However, based on habitat and roosting requirements, it is unlikely to occur on site and, if so, only as foraging individuals.

Schreiber's Long-fingered Bat

Schreiber's Long-fingered Bat (*Miniopterus schreibersii*), listed as Near Threatened, occurs widely across South Africa and beyond. The core of its distribution is within the savannas and grasslands of southern Africa. It is cave-dependent with separate winter hibernacula and summer maternity roosts, up to 150 km apart (Monadjem et al. 2001). Based on these roosting requirements, it is unlikely to occur on site and, if so, only as foraging individuals.

Southern African Hedgehog

The Southern African Hedgehog (*Atelerix frontalis*), listed as Near Threatened (2016), is found in a wide variety of terrestrial habitats where there is adequate ground cover, avoiding mesic habitats (Mills & Hes 1997). The study area is well within the core extent of occurrence of this species and habitat on site is potentially suitable, at least in places. There is therefore a high probability of the study area being suitable for this species. **It is considered likely that it could occur on site.**

African Striped Weasel

The African Striped Weasel (*Poecilogale albinucha*), listed as Near Threatened (2016), is found throughout most of South Africa, except for the arid interior, and into central Africa (excluding Namibia). It has not been recorded in the grid in which the site is located or any surrounding grid, but the site is within the overall distribution range for the species. It is found primarily in moist grasslands and fynbos, where adequate numbers of prey may be found. **It is considered unlikely to occur in the study area**.

Southern African Vlei Rat

The Southern African Vlei Rat (Grassland-type) (*Otomys auratus*), listed as Near Threatened (2016), is near-endemic to South Africa, occurring in the north-eastern half of the country, associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions. It is likely to be associated with sedges and grasses in densely vegetated wetlands with wet soils. The study area is on the very edge of the known distribution of this species and there are no historical records for grid in which the study area is located. There is therefore a low probability of the study area being suitable for this species. **It is considered unlikely that it occurs on site.**

Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), those listed in Table 4 are considered to have a probability of occurring on site and being potentially negatively affected by proposed activities associated with the proposed projects. The only species of potential concern is the South African Hedgehog. All other species have a low probability of occurring on site, or they are mobile species that are unlikely to be resident on site.

Table 4: Mammal species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
Atelerix frontalis	South African Hedgehog	Near Threatened, protected	High
Hyaena brunnea	Brown hyaena	Near Threatened, protected	Medium
Vulpes chama	Cape Fox	Protected	Medium
Mellivora capensis	Honey Badger	Protected	Medium
Mystromys albicaudatus	White-tailed Rat	Vulnerable	Low
Panthera pardus	Leopard	Vulnerable, protected	Low
Felis nigripes	Black-footed Cat	Vulnerable, protected	Low
Poecilogale albinucha	African Striped Weasel	Near Threatened	Low
Cloeotis percivali	Percival's Short-eared Trident Bat	Endangered	Low
Miniopterus schreibersii	Schreiber's Long-fingered Bat	Near Threatened	Low
Otomys auratus	Southern African Vlei Rat	Near Threatened	Low
Aonyx capensis	African Clawless Otter	Near Threatened, protected	Zero
Hydrictus maculicollis	Spotted-necked Otter	Protected	Zero

Reptiles

A total of 52 reptile species has a geographical distribution that includes the study area in which the three project sites are found (Alexander & Marais 2007, Bates *et al*. 2014, Branch 1988, Marais 2004, Tolley & Burger 2007). This is a moderate diversity compared to average diversity in other parts of the country. Of the reptile species that could potentially occur in the study area, none have been listed in a threat category.

There are therefore no reptile species of conservation concern that could potentially occur in the study area and that may therefore be affected by the proposed projects.

Table 5: Reptile species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
None	None	N/A	N/A

Amphibians

A total of only 17 frog species has a geographical distribution that includes the general study area in which the project sites are found (Du Preez & Carruthers 2009). Some of these species are only marginally present in the study area due to the fact that their distribution range ends close to the study area. Of the frog species that could potentially occur in the study area, none are listed in a threat category, but one species is listed as protected, according to National and Provincial legislation, the Giant Bullfrog.

The Giant Bull Frog

The Giant Bull Frog (*Pyxicephalus adspersus*) previously listed as Near Threatened, is found in seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna and, at the limits of its distribution, in Nama Karoo and thicket. For most of the year the species remains buried up to 1 m underground. They emerge only during the peak of the rainy season to forage and breed. If conditions are extremely dry, they may remain cocooned underground for several years. Long distances often separate suitable breeding sites. In order to breed, they require shallow, rain-filled depressions that retain water long enough for the tadpoles to metamorphose. Before and after breeding, bullfrogs forage in open grassland, feeding mostly on insects, but also on other frogs, lizards, snakes, small birds and rodents. After breeding males generally bury themselves within 100 m of the breeding site, but females may disperse up to 1 km away. Based on habitat requirements, there is a medium probability that this species occurs in the study area.

It is concluded that the site contains habitat that is suitable for various frog species, although only one species of conservation concern is likely to occur in the study area. One frog species of concern is therefore potentially likely to be affected by development in the study area, including all five proposed projects, as shown in Table 6.

Table 6: Amphibian species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
Pyxicephalus adspersus	Giant Bullfrog	Protected	Medium

Birds

There are a total of 30 bird species that have a geographical distribution that includes the study area that are listed in a conservation category. Due to habitat requirements, only thirteen of these listed bird species could potentially occur on site. All of them have wide ranges and forage over wide areas. None of these species are likely to breed on site and none of them are likely to be dependent on the site relative to surrounding areas. The Blue Crane and Secretarybird are the species probably most likely to be found on the site itself.

White-backed Vulture

The White-backed Vulture (*Gyps africanus*), listed as Critically Endangered, inhabits woodland areas and roost in trees and on pylons. They typically nest in tall trees and not on cliffs. The overall geographical range of this species includes the general area around the site, but the species has not been recorded anywhere within 50 km of the site. The habitat on site is not entirely suitable and it is unlikely that the species would occur there or be dependent on the site for roosting or nesting.

Martial Eagle

The Martial Eagle (*Polemaetus bellicosus*), listed as Endangered, is found mostly in open savanna and woodland on plains and also semi-arid shrublands and edges of forests. It is rare in mountainous areas and in naturally treeless grasslands. Birds will occupy any habitats where there are adequate tall trees or pylons for nesting and perching,

including windpumps and alien trees. Martial Eagles generally require exceptionally large home ranges in excess of 130 km2. It occurs at medium to low densities in the study area. The species is virtually absent from cultivated areas. The species is moderately likely to occur in the study area. It is possible that the study area constitutes the home range of various individuals, but any localised loss of habitat is unlikely to affect any individuals significantly, unless nesting or perching sites are affected, none of which were seen on site.

Tawny Eagle

The Tawny Eagle (*Aquila rapax*), listed as Endangered, is found in lightly wooded savanna and thornveld, as well as semi-desert, but avoids dense forest and highlands. It enters the study area only marginally, so the study area is not considered to be important for the conservation of this species.

African Marsh Harrier

The African Marsh-Harrier (*Circus ranivorus*), listed as Endangered, is found in inland and coastal wetlands and adjacent moist grasslands. It is a common resident in the study area and has been recorded at a high reporting rate for the grid that neighbours the study area. The nest is built of sticks, reed stems and grass and usually placed in a reedbed over water. There is a moderate probability of the species being found in the study area. The primary threat faced by this species in southern Africa is "loss and degradation of its sensitive wetland habitats, brought about by drainage or damming for development and agriculture..., as well as pollution. Changes in the extent of moist wetland edges and surrounding grassland...could be more significant than changes in the extent of permanently inundated wetland and reedbeds." (Taylor et al. 2015). The species is not endemic to South Africa and also occurs in East and Central Africa. However, the high threat status attributed to this species means that any localised impacts should be avoided. Suitable habitat for the species does not occur on site and it is only likely to occur there as a vagrant.

Black Harrier

The Black Harrier (*Circus maurus*), listed as Endangered, is found in fynbos, renosterveld, Karoo shrublands, dry grasslands and croplands. It is endemic to southern Africa and is a common non-breeding migrant in the study area. Its favoured breeding habitat is fynbos, particularly Strandveld and Mountain Fynbos. Nevertheless, the entire study area is within the peripheral low-density distribution area of this species. There is a moderate to low probability of the species being found in the study area and it breeds further south in fynbos areas only. In the study area it uses habitat only for foraging during non-breeding periods. Any localised loss of habitat is therefore unlikely to affect any individuals significantly.

Yellow-billed Stork

The Yellow-billed Stork (*Mycteria ibis*), listed as Endangered, is found on the shoreline of most inland freshwater bodies and also occasionally in estuaries. They forage in a diversity of permanent and seasonal wetland habitat where there is open shallow water that is generally free of vegetation. It is an uncommon non-breeding migrant in the study area. There is a low probability of the species being found in the study area. The main threat to the species is loss of wetland habitats, including the system of pans, marshes and floodplains on which the bird depends for foraging. Suitable habitat for the species does not occur on site and it is only likely to occur there as a vagrant.

Cape Vulture

The Cape Vulture (*Gyps coprotheres*), listed as Endangered, breeds in cliff breeding sites in mountainous area but ranges widely in surrounding areas. It is mapped in Chittenden (2009) as a common resident in the study area. The study area is indicated as including areas of low and no density distributions of this species. There is a low probability of the species being found in the study area; localised areas are unlikely to be important for the species and any localised loss of habitat is unlikely to affect any individuals significantly.

Burchell's Courser

Burchell's Courser (*Cursorius rufus*), listed as Vulnerable, is found in sparsely vegetated arid regions, with typical habitat including heavily grazed or burnt grassland, stony or gravelly plains, stubbly sandveld, dry riverbeds and edges of saline pans. It is endemic to southern Africa and is an uncommon resident in the study area. The study area is on the boundary of the known geographical range of this species. There is a low probability of the species being found in the study area. A small localised loss of habitat is unlikely to have any significant effect on this species, unless it affects breeding individuals.

Lanner Falcon

The Lanner Falcon (*Falco biarmicus*) listed as Vulnerable, favours open grassland or woodland near cliff or electricity pylon breeding sites. It prefers open grassland, cleared woodlands and agricultural areas. It is a common resident in the study area, but within an area indicated as having erratic occurrence or low density only part of its distribution. It nests on cliffs, using the stick nests of other species when breeding in trees or on electricity pylons. There is a low probability of the species being found in the study area. Localised loss of natural areas may affect local foraging habitat. The overall effect on the species is unlikely to be significant.

White-backed Night Heron

The White-backed Night Heron (*Gorsachius leuconotus*), listed as Vulnerable, occurs extensively throughout the Afrotropics. Within South Africa the species occurs very sparsely in low-lying, high rainfall areas of northern and eastern South Africa and Swaziland, extending westwards along the south coast to Knysna. In the study area, it occurs in a band centred on the Vaal River. It is found mostly along clear, swift- or slow-flowing perennial rivers and streams with forested banks and overhanging vegetation. No such habitat occurs on site.

African Grass Owl

The African Grass Owl (*Tyto capensis*), listed as Vulnerable, is found in tall rank, or dense, short, grassland. It is an uncommon resident in the study area. The species has not been recorded in the grid or in any of the surrounding grids. Nests on the ground in tall grassland where it makes a network of tunnels in the grass. No suitable habitat occurs on site. There is therefore a low probability of the species occurring in the study area.

Great White Pelican

The Great White Pelican (*Pelecanus onocrotalus*), listed as Vulnerable, is found in estuaries, lagoons, coastal bays, shallow lakes, floodplain pans and dams, where they feed on fish. No such habitat occurs on site. Dry land roosts, in the form of islands, wide shorelines or peninsulas associated with the waterbodies where they feed are needed. No such habitats occur on site. The species is therefore highly unlikely to occur on site.

Pink-backed Pelican

The Pink-backed Pelican (*Pelecanus rufescens*), listed as Vulnerable, forage in a wide range of wetlands, both fresh and saline, including bays, lagoons, estuaries, lakes, dams and rivers. No such habitat occurs on site. Birds loaf on the shoreline and roost in trees. There is a low probability of the birds occurring on site.

Secretarybird

The Secretarybird (*Sagittarius serpentarius*), listed as Vulnerable, prefers open grassland and scrub, with the ground cover shorter than 50 cm and with sufficient scattered trees as roost/nest sites. It is found throughout South Africa, although absent from mountain fynbos, forest, dense woodland and very rocky, hilly or mountainous woodland. It is a very common resident in the study area. There is a high probability of the species occurring in the study area. The species occurs throughout South Africa and individual birds move large distances within the region. Localised loss of habitat and general disturbance may affect individuals of this species, but it is unlikely to do more than displace localised individuals.

Black Stork

The Black Stork (*Ciconia nigra*), listed as Vulnerable, is associated with mountainous regions, but not restricted to them. It is a solitary cliff-nester. It is piscivorous and is reliant on shallow waterbodies, such as estuaries and rivers, in which it forages. It is absent from seasonal pans that lack fish. The species is found in most parts of South Africa and is a common resident in the study area. Due to lack of nesting and foraging habitat, there is a low probability of the species occurring on site.

Caspian Tern

The Caspian Tern (*Sterna caspia*), listed as Vulnerable, is concentrated at estuaries and sheltered bays along the coastline and is found, in inland areas, at large, permanent waterbodies. The species also hunts over water. No such habitat occurs on site. It is therefore highly unlikely to occur on site, except as a travelling vagrant.

Kori Bustard

The Kori Bustard (*Ardeotis kori*), listed as Near Threatened, inhabits fairly dry, open savanna within the 100-600 mm rainfall zone, as well as Nama Karoo and occasionally western grasslands where clumps of trees on tree-lined

watercourses provide shade and shelter. Suitable habitat occurs nearby, but not on the site itself. It is therefore possible, but unlikely, that individuals may be seen on site.

Blue Crane
The Blue Crane (*Anthropoides paradiseus*), listed as Near Threatened, is found mostly in natural grassland but also in wetlands, cultivated pastures and croplands. It is a common resident in the study area and has been recorded at a low reporting rate in the grid in which the study area is located as well as most surrounding grids. Eggs are laid on the ground. There is a moderate probability of the species occurring in the study area. Localised loss of habitat and general disturbance may affect individuals of this species, but this will probably lead to localised displacement and not an overall effect on the population within the study area. The species is relatively widely distributed in South Africa and not dependent on any small, localised pieces of habitat.

Eurasian Curlew
The Eurasian Curlew (*Numenius arquata*), listed as Near Threatened, is found mainly at large, relatively undisturbed estuaries or lagoons and associated mudflats. It may occur as a transient passage migrant at virtually any waterbody in inland South Africa, but especially on the central Highveld, where the site is located. No waterbodies occur on site and it is unlikely that the species would be found on site.

Maccoa Duck
The Maccoa Duck (*Oxyura maccoa*), listed as Near Threatened, is found during the breeding season in small, shallow and nutrient-rich inland freshwater lakes and also makes use of man-made infrastructure, such as farm dams and sewage farms. Nests are in emergent vegetation over deep water. It is a very common resident in parts of the study area. There is a high probability of the species occurring in the general study area, but due to the lack of suitable habitat, it is unlikely to occur on site.

Red-footed Falcon
The Red-footed Falcon (*Falco vespertinus*), listed as Near Threatened, is found in open semi-arid and arid savanna. It roosts communally at dusk in large numbers around traditional roosts, typically tall alien trees in rural towns. The species is a common non-breeding migrant in the study area. The site is potentially suitable for the species, including some tall trees that could be used for roosting, although no individuals were seen during the field survey. Localised loss of roosting habitat could potentially affect individuals of this species by displacing them, but this is unlikely to have a major effect on the species in the area.

Greater Flamingo
The Greater Flamingo (*Phoenicopterus roseus*), listed as Near Threatened, is found in saline and brackish shallow water bodies such as saltpans, large dams and coastal mudflats. It is a common resident in the study area. The nest is a cone of mud. There is no suitable habitat on site and the species will not occur there.

Lesser Flamingo
The Lesser Flamingo (*Phoeniconaias minor*), listed as Near Threatened, is found in eutrophic shallow wetlands, especially saltpans. It is a common resident in the study area. It breeds colonially and its nest is a cone of mud. There is no suitable habitat on site and the species will not occur there.

Pallid Harrier
The Pallid Harrier (*Circus macrouras*), listed as Near Threatened, is found in grassland associated with open pans or floodplains and also in croplands. It is an occasional visitor to the study area. Threats in South Africa are related to general habitat destruction and degradation. Localised loss of habitat and general disturbance may affect individuals of this species, but it is unlikely to have a significant effect on the regional population.

Short-clawed Lark
The Short-clawed Lark (*Certhilauda chuana*), listed as Near Threatened, is found in semi-arid thorn-savanna, sparsely vegetated with short grass and scattered low bushes. The main geographical occurrence of this species is in Botswana, extending into South Africa with the current site located on the southern boundary of the distribution of the species. The habitat on site is marginal and is not included in the most recent assessment of the distribution of this species. It is considered unlikely that the species would occur on site.

Greater Painted-Snipe

The Greater Painted-snipe (*Rostratula benghalensis*), listed as Near Threatened, is found in freshwater wetlands in vegetated waterside habitats with exposed mud. They occur sparsely along the shorelines of dams, lakes and pans, on the banks of slow-moving rivers, on marshy floodplains, in temporarily-flooded grassland and at rainwater pools on clay soils with plentiful adjacent cover. It has an erratic occurrence in the study area. There is no suitable habitat on site and the species is therefore highly unlikely to occur there.

Black-winged Pratincole

The Black-winged Pratincole (*Glareola nordmannii*), listed as Near Threatened, is found in open grasslands, on edges of pans and in cultivated fields. It is attracted to damp ground and newly flooded grassland. It is a very common non-breeding migrant in the study area. It is a gregarious species that is found in small groups or large flocks of up to many thousands of birds. There is no suitable habitat on site and the species is therefore unlikely to occur on site.

European Roller

The European Roller (*Croacius garrulus*), listed as Near Threatened, is found in open woodland, perching on open dead branches, telephone poles and power lines. It is a common non-breeding migrant in the study area but occurs at low densities in the study area and surrounding areas. There is a moderate probability of the species occurring in the study area. Threats to this species are within its breeding range and not in southern Africa. The study area has limited amounts of suitable habitat. It is unlikely that localised loss of habitat will affect the species in any significant way at all.

Abdim's Stork

Abdims' Stork (*Ciconia abdimii*), listed as Near Threatened, is found in grassland, savanna woodland, near pans and cultivated lands in groups of up to 100 birds. It is a common non-breeding migrant in the study area. The threats to the species are not well-understood and it has been listed until more detailed information is available to make an informed assessment. It is unlikely that localised loss of habitat will affect the species in any significant way at all.

Marabou Stork

The Marabou Stork (*Leptoptilos crumeniferus*), listed as Near Threatened, are scavengers that feed on a wide range of food resources, including carrion, aquatic vertebrates and human waste. It only breeds at a limited number of localities throughout its range, which are located at Pongola Game Reserve and in Swaziland. No suitable carrion or waste dumps occur on site and the species is unlikely to occur there.

Table 7: Bird species of conservation concern with a likelihood of occurring on site.

Scientific name	Common name	Status	Likelihood of occurrence
Gyps africanus	White-backed Vulture	Critically Endangered	Low
Polemaetus bellicosus	Martial Eagle	Endangered	Medium
Aquila rapax	Tawny Eagle	Endangered	Medium
Circus ranivorus	African Marsh Harrier	Endangered	Low
Circus maurus	Black Harrier	Endangered	Low
Cursorius rufus	Burchell's Courser	Vulnerable	Low
Falco biarmicus	Lanner Falcon	Vulnerable	Low
Sagittarius serpentarius	Secretarybird	Vulnerable	High
Anthropoides paradiseus	Blue Crane	Near Threatened	Medium
Falco vespertinus	Red-footed Falcon	Near Threatened	Medium
Circus macrouras	Pallid Harrier	Near Threatened	Low
Croacius garrulus	European Roller	Near Threatened	Low
Ciconia abdimii	Abdim's Stork	Near Threatened	Low

Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "*a person may not carry out a restricted activity involving a specimen of*

a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "*of a nature that may negatively impact on the survival of a listed threatened or protected species*". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in Appendix 6, marked with the letter "N". Due to habitat and forage requirements, and the fact that some species are restricted to game farms and/or conservation areas, only the Brown Hyaena, Honey Badger, Cape Fox, South African Hedgehog, and Giant Bullfrog have a likelihood of occurring on site. The first three of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. This means that only the South African Hedgehog and the Giant Bullfrog are likely to be affected by any construction activities, if they occur on site.

Habitats on site

A map of habitats within the study area and adjacent areas is provided in Figure 8. Transformed areas where no vegetation occurs included roads, farm buildings and similar existing disturbances. The broad natural habitat units on site are as follows:

1. Grassland;
2. Secondary grassland (previously cultivated areas);
3. Depressions (containing seasonal and temporary wetlands);
4. Alien trees;
5. Disturbed areas;
6. Transformed areas.

Grassland
The site is characterised by short, sparse grassland that appears to be in moderate to poor condition in most places. It appears that some parts of the study area may have been cultivated at some point in history, but this is not clearly evident from the vegetation structure and composition on site. It seems that at least parts of the site were previously cultivated, but that sufficient time has passed for the old lands to recover to something resembling the original species composition. Alternatively, all parts of the site were previously disturbed and due to soil and/or hydrological properties of the landscape, only some areas are still evident on aerial imagery. For mapping purposes, only those areas that could be clearly seen to have been previously ploughed are classified as secondary grassland and other grassland areas as unaltered, but this distinction is not evident from species composition of the grasslands. The species composition is relatively diverse, although dominated by *Aristida congesta* in places, which indicates overgrazing or previous disturbance of the soil profile. This supports the contention that significant parts of the site have been previously ploughed. The topography within these areas is relatively flat. Common and dominant species include *Aristida congesta* subsp. *congesta*, *Themeda triandra*, *Trichoneura grandiglumis*, *Eragrostis chloromelas*, *Heteropogon contortus*, *Felicia muricata*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Cynodon dactylon*, *Digitaria erianthe*, *Solanum supinum*, *Bulbine narcissifolia* and *Cucumis zeyheri*.

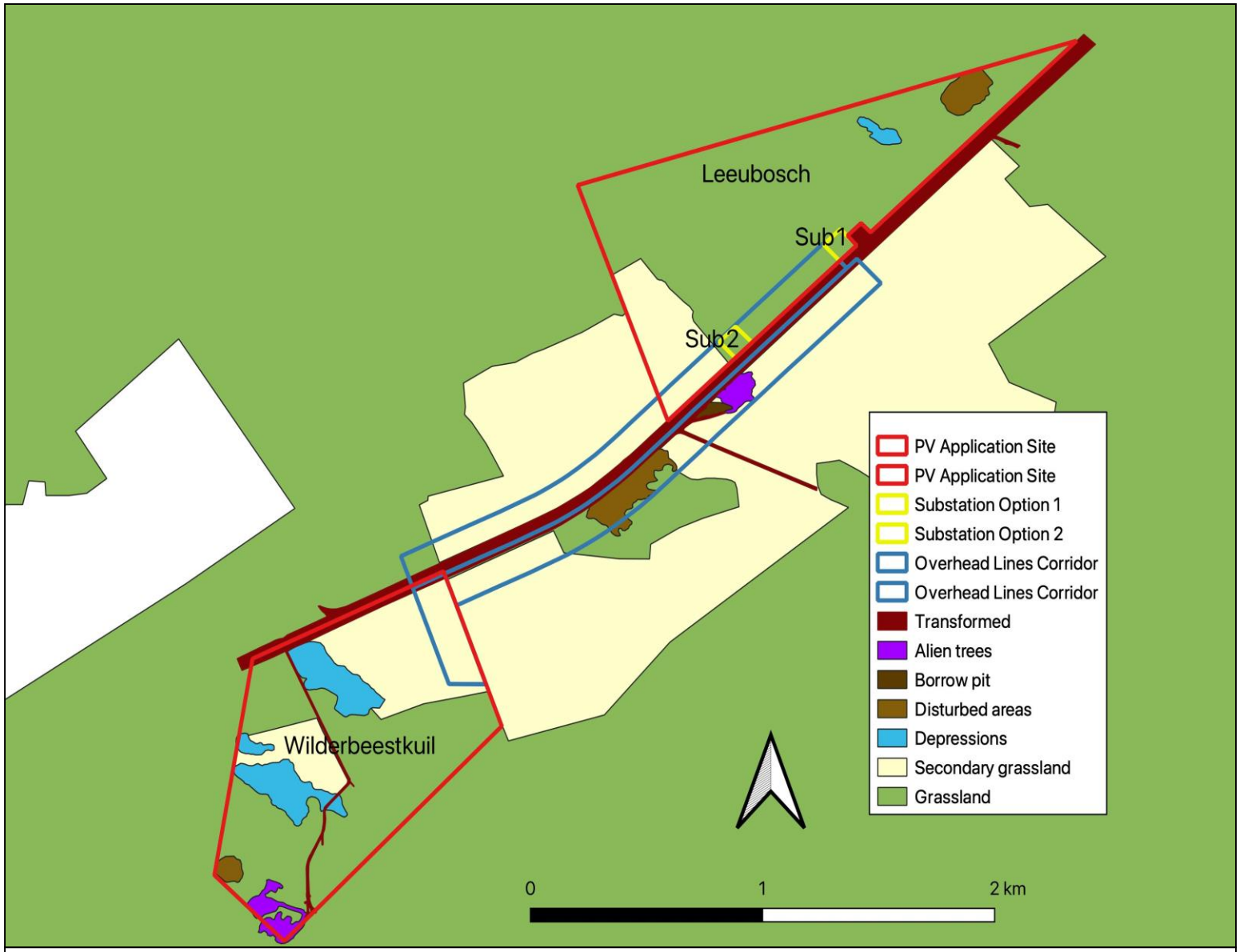

Figure 8: Main habitats of the study area – All projects.

Secondary grassland

Large parts of the site, as well as surrounding areas, have been cultivated at some point in history (see plough lines in Figure 9 below), but this is not always clearly evident from the vegetation structure and composition on site. It seems that at least parts of the site were previously cultivated, but that sufficient time has passed for the old lands to recover to something resembling the original species composition. For mapping purposes, only those areas that could be clearly seen to have been previously ploughed are classified as secondary grassland and other grassland areas as unaltered, but this distinction is not always evident from species composition of the grasslands. The species composition is relatively diverse, although dominated by *Aristida congesta* in places, which indicates overgrazing or previous disturbance of the soil profile. This supports the contention that significant parts of the site have been previously ploughed.

Figure 9: Plough lines evident on Google Earth imagery.

Depressions

There is a small pan depression in the centre of the Leeuwbosch site. The species composition is different to surrounding areas with floristic indicators of seasonal wetness and typical zonation bands, dominated by *Schoenoplectus corymbosus*, *Persicaria lapathifolia* and *Cyperus difformis*. Less wet areas were dominated by the tall grasses, *Echinochloa holubii*, *Setaria pallida-fusca* and *Eragrostis biflora*, along with the small sedge, *Kyllinga erecta*, and the smaller grasses, *Eragrostis plana* and *Eragrostis planiculmis*. There is a band around the edge of the wetland vegetation dominated by the herb, *Gnaphalium filagopsis*. This species composition was typical of the shallow depressions on site and in nearby areas on other sites. The slightly stony / rocky edges of the pan have a diverse species composition.

At the Wildebeestkuil site are patches on site where the species composition indicates seasonally or temporarily wet soil conditions. For the main wetland system running diagonally through the site, it appears to have been excavated for borrow material or has eroded out. The lower parts of these areas have developed wetlands that vary in their seasonality, with some having permanent water at the time of the May survey, although completely dry at the time of

the previous September survey. The species composition is indicative of seasonal to permanent wetlands, dominated by *Schoenoplectus corymbosus* and *Cyperus difformis*. Where standing water was found, there was also the floating hydrophyte, *Marsilea macrocarpa*. Less wet areas were dominated by the tall grasses, *Echinochloa holubii*, *Setaria pallida-fusca* and *Eragrostis biflora*, along with the small sedge, *Kyllinga erecta*, and the smaller grasses, *Eragrostis plana* and *Eragrostis planiculmis*. Typically, there is a band around the edge of the wetland vegetation dominated by the herb, *Gnaphalium filagopsis*. This species composition was typical of the shallow depressions on site and in nearby areas on other sites.

The value of these wetland habitats is debatable in the sense that, in the case of the main wetland system on site, they were obviously disturbed in the past, but the species composition that has developed in these disturbed areas has converged on the species composition in undisturbed sites. They therefore represent the natural species composition that would be expected in these areas.

Habitat sensitivity

To determine ecological sensitivity in the study area, local and regional factors were taken into account. There are some habitats in the study area that have been described as sensitive in their own right, irrespective of regional assessments. This includes primarily the grasslands and depressions in which wetland vegetation occurs.

At a regional level, the Critical Biodiversity Area (CBA) map for North West Province indicates various parts of the study area as being important for maintenance of ecological patterns. These fall within ESAs.

In terms of other species of concern, there are no specific locations where conservation of habitat would benefit a specific species based on the existing data available. All mammal and bird species of concern described previously could occur on any part of the site, although it is probable that depressions and drainage areas are of more importance than plains areas.

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

1. Depressions;
2. Grasslands;
3. ESA areas.

Based on this information, a map of habitat sensitivity on site is provided in Figure 10. This shows main habitat sensitivity classes on site, as follows:

1. LOW for all transformed and degraded areas.
2. MEDIUM-LOW for all secondary vegetation.
3. MEDIUM-HIGH for all areas that appear to be natural. This is because of the fact that the site is within an Endangered vegetation type (Vaal-Vet Sandy Grassland). Permanent wetland areas are classified within this category.

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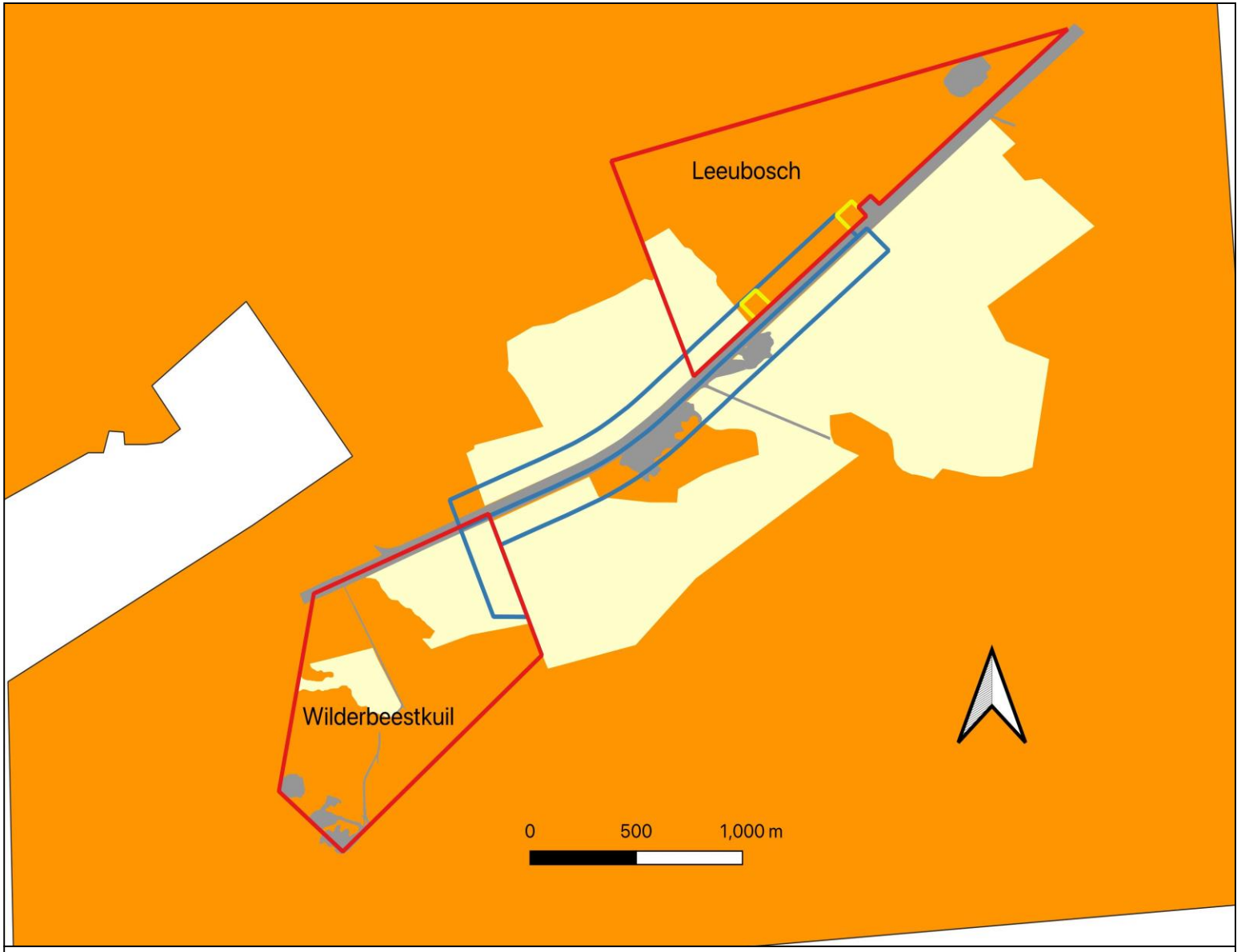

Figure 10: Habitat sensitivity of the study area, including all projects and infrastructure options.

DESCRIPTION OF POTENTIAL IMPACTS

As mentioned, a combined report has been compiled for all five proposed projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and Leeudoringstad Solar Plant Substation). Where certain impacts and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

Potential issues relevant to impacts on the ecology of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including indigenous grassland and wetland vegetation that leads to direct or indirect loss of such habitat.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
    - disruption to nutrient-flow dynamics;
    - impedance of movement of material or water;
    - habitat fragmentation;
    - changes to abiotic environmental conditions;
    - changes to disturbance regimes, e.g., increased or decreased incidence of fire;
    - changes to successional processes;
    - effects on pollinators;
    - increased invasion by alien plants.

Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed projects taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g., reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

Potential sensitive receptors in the general study area

Atelerix frontalis	South African Hedgehog	Near Threatened, protected	High
Hyaena brunnea	Brown hyaena	Near Threatened, protected	Medium
Vulpes chama	Cape Fox	Protected	Medium
Mellivora capensis	Honey Badger	Protected	Medium

A summary of the potential ecological issues for the study area is as follows (issues assessed by other specialists, e.g., on birds and on wetland and hydrological function, are not included here):

- Presence of natural vegetation on site, much of which has high conservation value due to being within a listed Endangered ecosystem and with some parts within ESAs.
- Presence of shallow depressions and drainage valleys and associated vegetation on site, assessed as being sensitive to impacts associated with development as well as being important habitat for various plant and animal species.
- Presence in nearby areas of Camelthorn trees, protected under the National Forests Act (Act 84 of 1998).

- Potential presence of one protected frog species, namely the Giant Bullfrog, not listed, but protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).
- Presence of four mammal species of concern, the South African Hedgehog (Near Threatened), the Brown Hyaena (Near Threatened), the Cape Fox, and the Honey Badger, all protected according to the National Environmental Management: Biodiversity Act (Act 10 of 2004).
- Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. There are a large number of alien invasive species present in neighbouring areas, all of which have the potential to invade more widely, given the right circumstances.

Construction Phase Impacts – All projects

Direct impacts

Direct impacts include the following:

1. Loss and/or fragmentation of indigenous natural vegetation due to clearing.
2. Loss of individuals of protected trees;
3. Loss of faunal habitat and refugia;
4. Direct mortality of sedentary fauna due to machinery, construction and increased traffic;
5. Displacement and/or disturbance of fauna due to increased activity and noise levels;

Operational Phase Impacts – All projects

Direct impacts

Ongoing direct impacts will include the following:

1. Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure;

Indirect impacts

These will include the following:

1. Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors;
2. Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape;

Decommissioning Phase Impacts – All projects

Direct impacts

These will include the following:

1. Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites;
2. Direct mortality of fauna due to machinery, construction and increased traffic;
3. Displacement and/or disturbance of fauna due to increased activity and noise levels;

Indirect impacts

These will occur due to renewed disturbance due to decommissioning activities, as follows:

1. Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors;
2. Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape;

ASSESSMENT OF IMPACTS

This section of the report provides an assessment of identified impacts for each of the five proposed projects. As mentioned, a combined report has been compiled for all five proposed projects. It should be noted that the assessment is identical for all five projects and therefore the tables below apply to all five projects.

Solar PV Infrastructure (Leeuwbosch 1, Leeuwbosch 2, Wildebeestkuil 1 and Wildebeestkuil 2)

There are various impacts that have been assessed as having medium significance prior to mitigation, but for which the significance is low after mitigation. This means that, with one exception, all impacts are assessed as having low significance after mitigation. The exception is the impact on indigenous natural vegetation, with a significance of high before and medium after mitigation, where construction will lead to a loss of vegetation. The impact will definitely occur, will be permanent and is irreversible, and no mitigation can change these factors.

Table 8: Assessment of impacts for the solar PV infrastructure for all four facilities – Leeuwbosch 1, Leeuwbosch 2, Wildebeestkuil 1 and Wildebeestkuil 2.

SOLAR PV FACILITIES – LEEUWBOSCH 1, LEEUWBOSCH 2, WILDEBEESTKUIL 1 AND WILDEBEESTKUIL 2																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Indigenous natural vegetation	Loss and/or fragmentation of vegetation due to clearing for construction of infrastructure.	1	4	3	3	4	3	45	-	High	• Use existing road infrastructure for access roads. • Avoid construction of infrastructure within sensitive habitats. • Minimise vegetation clearing and disturbance to footprint areas only. • Compile a rehabilitation programme and rehabilitate disturbed areas. • Compile an Alien Invasive Management Plan.	1	4	3	2	4	3	42	-	Medium
Protected trees	Loss of individuals due to clearing for construction of infrastructure.	1	2	2	2	2	1	9	-	Low	• Avoid damage or loss of trees in neighbouring areas (none were found within footprint areas during walk-through survey).	1	2	2	2	1	1	8	-	Low

Fauna	Loss of habitat due to clearing for construction of infrastructure	1	3	2	2	3	2	22	-	Low	• Use existing road infrastructure for access roads. • Avoid construction of infrastructure within sensitive habitats. • Minimise vegetation clearing and disturbance to footprint areas only. • Compile a rehabilitation programme and rehabilitate disturbed areas. • Compile an Alien Invasive Management Plan.	1	2	2	2	3	1	10	-	Low
Fauna	Direct mortality due to machinery, construction and increased traffic	1	2	2	2	3	2	20	-	Low	• Avoid construction of infrastructure within sensitive habitats. • Implement traffic control measures, including speed limits and no-go zones.	1	1	2	2	3	1	9	-	Low
Fauna	Displacement and disturbance due to increased activity and noise levels	1	2	2	1	1	1	7	-	Low	• Avoid construction of infrastructure within sensitive habitats. • Implement traffic control measures, including speed limits and no-go zones.	1	2	2	1	1	1	7	-	Low
Operational Phase																				
Fauna	Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure	2	2	2	2	3	1	11	-	Low	• Implement traffic control measures, including speed limits. • Environmental awareness education for staff and visitors.	2	2	2	1	3	1	10	-	Low

Vegetation	Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	2	3	2	3	3	2	26	-	Medium	• Compile and implement Alien Invasive Management Plan. • Rehabilitate disturbed areas.	1	2	1	2	3	1	9	-	Low
Vegetation	Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	• Compile and implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. • Undertake regular monitoring to detect erosion features early so that they can be controlled. • Implement control measures. • Avoid building on or near steep or unstable slopes. • Construct proper culverts, bridges and/or crossings at drainage-line crossings, and other attenuation devices to limit overland flow	1	2	2	2	3	1	10	-	Low
Decommissioning Phase																				
Vegetation	Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	1	2	2	2	2	2	18	-	Low	• No additional clearing of vegetation should take place without a proper assessment of the environmental impacts and authorization from relevant authorities. • If any additional infrastructure needs to be	1	2	2	2	2	1	9	-	Low

											constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing infrastructure, and clustered to avoid dispersed impacts. • No driving of vehicles off-road. • Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. • Access to sensitive areas outside of development footprint should not be permitted during operation. • Surface runoff and erosion must be properly controlled and any issues addressed as quickly as possible									
Fauna	Direct mortality of fauna due to machinery, construction and increased traffic	1	2	2	2	3	2	20	-	Low	• Personnel and vehicles to avoid sensitive habitats. • No speeding on access roads – install speed control measures, such as speed humps, if necessary • No illegal collecting of any individuals, particularly the Armadillo Girdled Lizard. • No hunting of protected species or hunting of any	1	2	2	1	3	1	9	-	Low

											other species without a valid permit. • Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species. • Report any sitings to conservation authorities. Prevent unauthorised access to the site – project roads provide access to remote areas that were not previously easily accessible for illegal collecting or hunting									
Fauna	Displacement and/or disturbance of fauna due to increased activity and noise levels	1	2	2	1	1	1	7	-	Low	• Restrict impact to development footprint only and limit disturbance spreading into surrounding areas. • Access to sensitive areas outside of infrastructure footprint should not be permitted during construction. • No speeding on access roads – install speed control measures, such as speed humps, if necessary • No hunting of protected species. • Personnel to be educated about protection status of species, including distinguishing features to	1	2	2	1	1	1	7	-	Low

											be able to identify protected species. • Report any sitings to conservation authorities									
Vegetation	Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	2	3	2	3	3	2	26	-	Medium	• Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. • Undertake regular monitoring to detect alien invasions early so that they can be controlled. • Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. • Do NOT use any alien plants during any rehabilitation that may be required.	1	2	2	2	3	1	10	-	Low
Vegetation	Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	• Implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. • Following decommissioning, undertake regular monitoring for an appropriate length of time to detect erosion features early so that they can be controlled.	1	2	2	2	3	1	10	-	Low

											• Implement any control measures that may become necessary. • Avoid undertaking any activities on or near steep or unstable slopes.									

Grid Infrastructure (Wildebeestkuil 1, Wildebeestkuil 2 and Leeudoringstad Solar Plant Substation)

All assessed impacts have a low significance after the application of mitigation measures.

Table 9: Assessment of impacts of the grid connection infrastructure for all three projects (including all alternatives for power line corridors and substation sites).

GRID CONNECTION INFRASTRUCTURE - WILDEBEESTKUIL 1, WILDEBEESTKUIL 2 AND LEEUDORINGSTAD SOLAR PLANT SUBSTATION																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Indigenous natural vegetation	Loss and/or fragmentation of vegetation due to clearing for construction of infrastructure.	1	3	2	2	3	2	22	-	Low	• Use existing road infrastructure for access roads. • Avoid construction of infrastructure within sensitive habitats. • Minimise vegetation clearing and disturbance to footprint areas only. • Compile a rehabilitation programme and rehabilitate disturbed areas.	1	3	2	2	2	2	20	-	Low
Protected trees	Loss of individuals due to clearing for construction of infrastructure.	1	3	2	2	3	2	22	-	Low	Avoid trees in surrounding areas.	1	3	1	2	1	1	8	-	Low

Fauna	Loss of habitat due to clearing for construction of infrastructure	1	3	2	2	3	2	22	-	Low	• Use existing road infrastructure for access roads. • Avoid construction of infrastructure within sensitive habitats. • Minimise vegetation clearing and disturbance to footprint areas only. • Compile a rehabilitation programme and rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Fauna	Direct mortality due to machinery, construction and increased traffic	1	2	2	2	1	2	16	-	Low	• Avoid construction of infrastructure within sensitive habitats. • Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low
Fauna	Displacement and disturbance due to increased activity and noise levels	1	2	2	2	1	2	16	-	Low	• Avoid construction of infrastructure within sensitive habitats. • Implement traffic control measures, including speed limits and no-go zones.	1	2	2	2	1	1	8	-	Low
Operational Phase																				
Fauna	Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure	1	2	2	2	1	2	16	-	Low	• Implement traffic control measures, including speed limits. • Environmental awareness education for staff and visitors.	1	2	2	2	1	1	8	-	Low
Vegetation	Establishment and spread of alien invasive plant species due to the	2	3	2	3	3	2	26	-	Medium	• Compile and implement Alien Invasive Management Plan. • Rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low

	presence of migration corridors and disturbance vectors																			
Vegetation	Runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	2	2	3	3	2	22	-	Medium	• Compile and implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. • Undertake regular monitoring to detect erosion features early so that they can be controlled. • Implement control measures. • Avoid building on or near steep or unstable slopes. • Construct proper culverts, bridges and/or crossings at drainage-line crossings, and other attenuation devices to limit overland flow	1	2	2	2	3	1	10	-	Low
Decommissioning Phase																				
Vegetation	Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	1	3	2	2	2	2	20	-	Low	• No additional clearing of vegetation should take place without a proper assessment of the environmental impacts and authorization from relevant authorities. • If any additional infrastructure needs to be constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing	1	3	2	2	2	1	10	-	Low

											infrastructure, and clustered to avoid dispersed impacts. • No driving of vehicles off-road. • Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. • Access to sensitive areas outside of development footprint should not be permitted during operation. • Surface runoff and erosion must be properly controlled and any issues addressed as quickly as possible									
Fauna	Direct mortality of fauna due to machinery, construction and increased traffic	1	2	2	2	3	2	20	-	Low	• Personnel and vehicles to avoid sensitive habitats. • No speeding on access roads – install speed control measures, such as speed humps, if necessary. • No illegal collecting of any individuals, particularly the Armadillo Girdled Lizard. • No hunting of protected species or hunting of any other species without a valid permit. • Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species.	1	2	2	1	3	1	9	-	Low

											• Report any sitings to conservation authorities. • Prevent unauthorised access to the site – project roads provide access to remote areas that were not previously easily accessible for illegal collecting or hunting.									
Fauna	Displacement and/or disturbance of fauna due to increased activity and noise levels	1	2	2	1	1	1	7	-	Low	• Restrict impact to development footprint only and limit disturbance spreading into surrounding areas. • Access to sensitive areas outside of infrastructure footprint should not be permitted during construction. • No speeding on access roads – install speed control measures, such as speed humps, if necessary • No hunting of protected species. • Personnel to be educated about protection status of species, including distinguishing features to be able to identify protected species. • Report any sitings to conservation authorities	1	2	2	1	1	1	7	-	Low
Vegetation	Continued establishment and spread of alien invasive plant	2	3	2	3	3	2	26	-	Medium	• Implement an alien management plan, which highlights control priorities and areas and provides a	1	2	2	2	3	1	10	-	Low

	species due to the presence of migration corridors and disturbance vectors										programme for long-term control. • Undertake regular monitoring to detect alien invasions early so that they can be controlled. • Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. • Do NOT use any alien plants during any rehabilitation that may be required.									
Vegetation	Continued runoff and erosion due to the presence of hard surfaces that change the infiltration and runoff properties of the landscape	1	3	2	3	3	2	24	-	Medium	• Implement a stormwater management plan, which highlights control priorities and areas and provides a programme for long-term control. • Following decommissioning, undertake regular monitoring for an appropriate length of time to detect erosion features early so that they can be controlled. • Implement any control measures that may become necessary. • Avoid undertaking any activities on or near steep or unstable slopes.	1	2	2	2	3	1	10	-	Low

CUMULATIVE IMPACTS

Although it is important to assess the impacts of the proposed projects specifically, it is equally important to assess the cumulative visual impact that could materialise if other renewable energy facilities (both wind and solar facilities) and associated infrastructure projects are developed in the broader area. Cumulative impacts occur where existing or planned developments, in conjunction with the proposed developments, result in significant incremental changes in the broader study area. In this instance, such developments would include renewable energy facilities and associated infrastructure development.

The projects shown in Figure 11, Figure 12 and Figure 13 have been identified within a 50 km radius of the project area and are included in the Cumulative Impact Assessment. There are 4 projects listed that cover a fairly broad area.

The table below lists the projects that will need to be considered when examining the cumulative impacts.

Table 10: Proposed Renewable Energy Projects in the Area

Applicant	**Project**	**Technology**	**Capacity**	**Status of Application / Development**
Bokomoso Energy (Pty) Ltd	Bokomoso PV Solar Energy Facility	Solar PV	75MW	Under Construction
Kabi Solar (Pty) Ltd	Kabi Vaalkop Solar PV Facility	Solar PV	75MW	Approved
Kabi Solar (Pty) Ltd	Kabi Witkop Solar PV Facility	Solar PV	75MW	In process
Genesis Orkney Solar (Pty) Ltd	Orkney PV SEF	Solar PV	100MW	Approved
Blue Wave Capital SA (Pty) Ltd	Wolmaransstad Solar Energy Facility	Solar PV	75MW	In process
Upgrade Energy (Pty) Ltd	Wildebeestkuil 1 and Wildebeestkuil 2 Solar PV Plants	Solar PV	9.9MW	In process
Upgrade Energy (Pty) Ltd	Leeuwbosch 1 Solar PV Plant	Solar PV	9.9MW	In process
Upgrade Energy (Pty) Ltd	Leeuwbosch 2 Solar PV Plant	Solar PV	9.9MW	In process

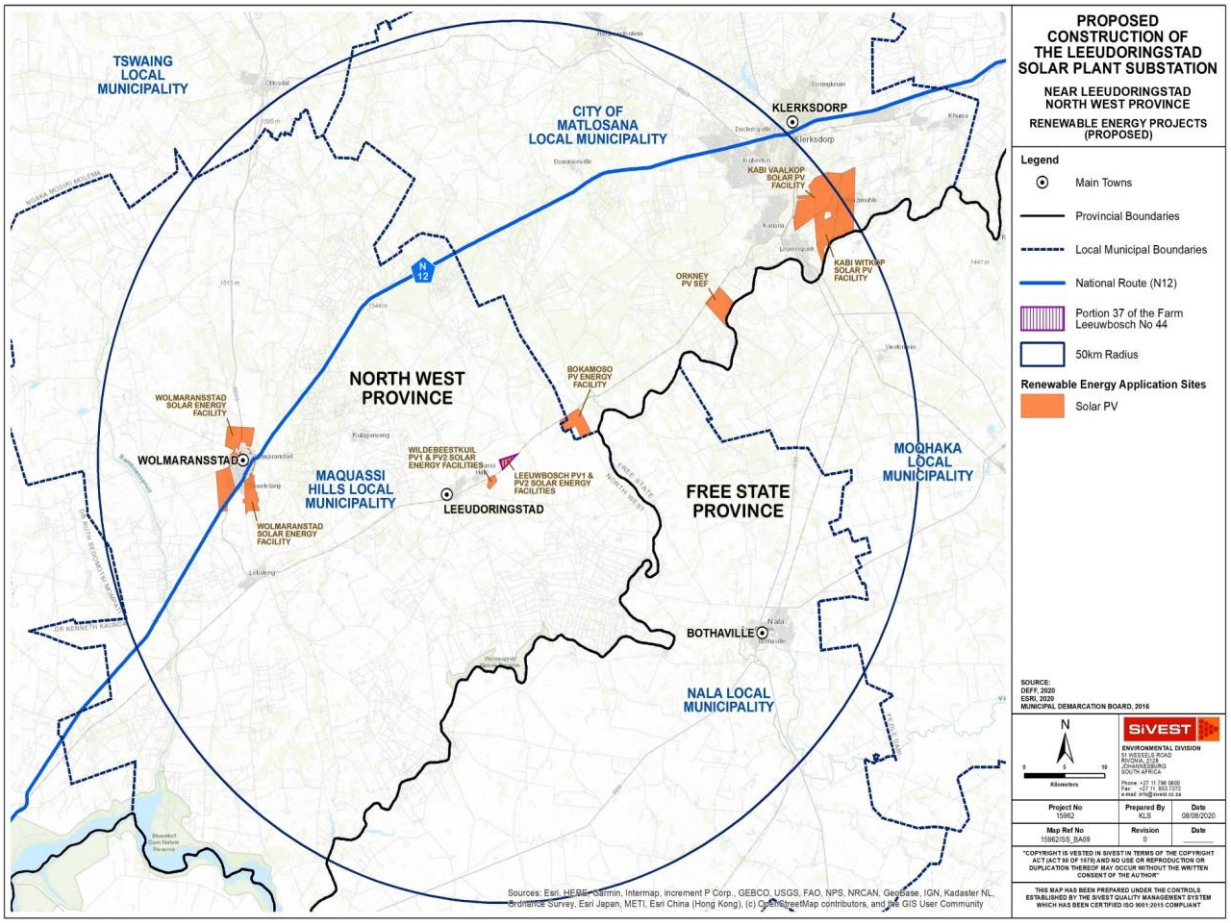

Figure 11: Other renewable energy developments within 50 km radius - Leeudoringstad Solar Plant Substation.

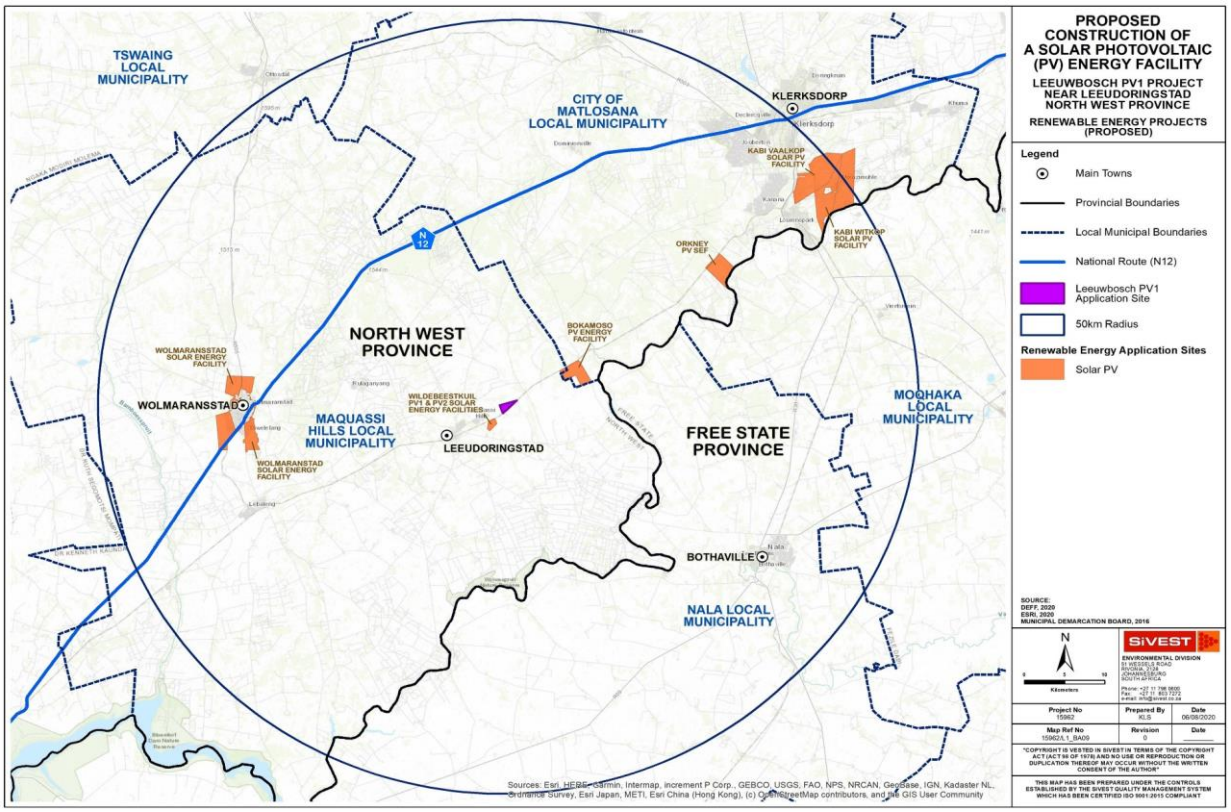

Figure 12: Other renewable energy developments within 50 km radius - Leeuwbosch 1 and Leeuwbosch 2 Solar PV Plants.

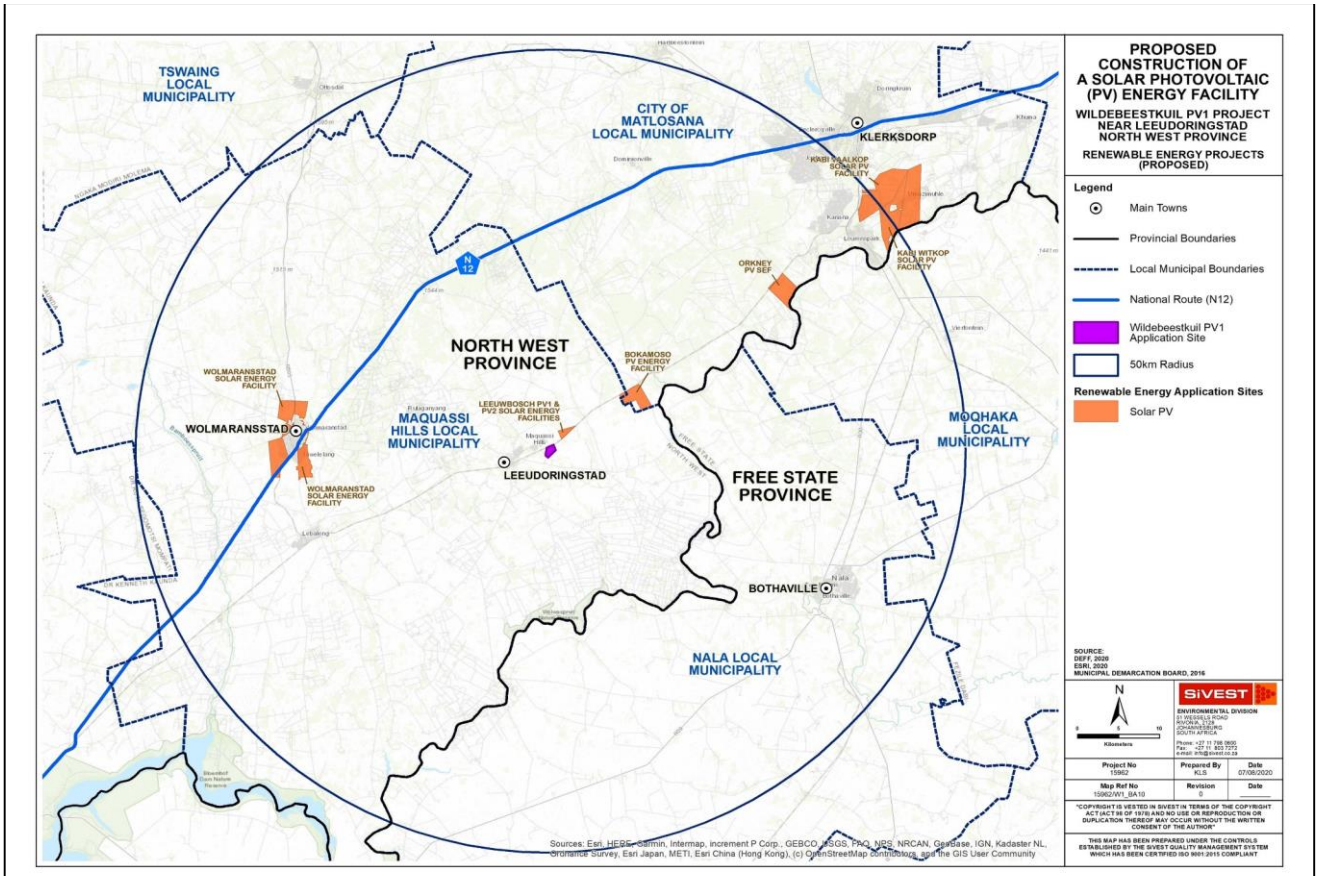

Figure 13: Other renewable energy developments within 50 km radius - Wildebeestkuil 1 and Wildebeestkuil 2 Solar PV Plants.

Description of cumulative impacts

There are various cumulative impacts that may occur as a result of the combined impact of a number of similar projects in the area, as follows:

1. Loss and/or fragmentation of indigenous natural vegetation due to clearing;
2. Loss of individuals of plant species of conservation concern and/or protected plants or trees;
3. Changes to ecological processes at a landscape level;
4. Mortality, displacement and/or disturbance of fauna;
5. General increase in the spread and invasion of new habitats by alien invasive plant species;
6. Reduction in the opportunity to undertake or plan conservation, including effects on CBAs and ESAs, as well as on the opportunity to conserve any part of the landscape.

Cumulative impacts on indigenous natural vegetation

The regional terrestrial vegetation type in the broad study area is listed as Vulnerable. Loss of habitat will definitely occur for each project, each of which will be a small area in comparison to the total area of the vegetation type. The total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, the area lost in total will be small compared to the total area of the vegetation types concerned. Direct loss of habitat will not result in a change in the conservation status of the vegetation types, but overall degradation due to fragmentation effects may be cause for concern. The cumulative effect will therefore be low for vegetation loss.

Cumulative impacts on plant species of concern and protected plant species
There are no plant species of conservation concern for the site, but there are various protected plant species that may occur in the study area, all of which are relatively widespread. Constructing the current project increases the likelihood of individuals being affected, but unless large numbers of individuals are directly affected, there will only be small cumulative effects.

Cumulative impacts on ecological processes
There are various ecological processes that may be affected at a landscape level by the presence of multiple projects. This includes obvious processes, such as migration, pollination and dispersal, but also more difficult to interpret factors, such as spatial heterogeneity, community composition and environmental gradients, that can become disrupted when landscapes are disturbed at a high level. Disturbance can alter the pattern of variation in the structure or function of ecosystems. Fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. An important consequence of repeated, random clearing is that contiguous cover can break down into isolated patches. This happens when the area cleared exceed a critical level and landscapes start to become disconnected. Spatially heterogenous patterns can be interpreted as individualistic responses to environmental gradients and lead to natural patterns in the landscape. Disrupting gradients and creating disturbance edges across wide areas is very disruptive of natural processes and will lead to fundamental changes in ecosystem function. It is possible that this could be a cumulative consequence of the combined projects but is difficult to determine without a detailed assessment of fragmentation of the combination of all the projects.

Cumulative impacts on fauna
Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the area. This effect will be increased if there are a number of projects being constructed at the same time or in quick succession, so the effect is likely to be cumulative. However, the geographical ranges of the species of concern are wide and it is considered that the significance of the effect will be low in the long-term. It is possible that some species will be more significantly negatively affected than others, especially shy species, territorial species that get displaced, or those with large territories that get shrunk. It is also possible that some species will benefit from the increased presence of humans and will migrate into the area. This will possibly cause additional shifts in other species that are affected by the increase in numbers or new species.

Cumulative impacts due to spread of declared weeds and alien invader plants
There is a moderate to high possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. For the current site, the impact is predicted to be a moderate to high risk due to the current presence of various invasive species on site and in surrounding areas. The significance will probably be low if control measures are implemented. However, the increased overall disturbance of the landscape will create invasion opportunities and, if new invasions are not controlled, can create nodes that spread to new locations due to the heightened disturbance levels.

Cumulative impacts due to loss of protected animals
There are various animal species protected according to National legislation that occur in the geographical area covered by the combined projects. Some of these animals may be vulnerable to secondary impacts, such as hunting, roadkill and illegal collecting. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. However, in all cases, the geographical distribution of each species is much wider than the combined project areas. The significance will therefore be low, especially if control measures are implemented.

Cumulative impacts on CBAs and conservation planning
Some parts of the site and surrounding areas are included in Critical Biodiversity Areas for the North West Province. Disruption of these areas means that conservation planners have to find alternative sites to include in future CBAs according to an algorithm that seeks a least-cost outcome for preserving biodiversity, i.e., the least amount of land space for preserving the greatest amount of area of biodiversity importance, as well as meeting specific conservation targets. At some point, the loss of suitable sites leads to a situation where it is no longer possible to plan effective conservation networks or the cost of doing so increases due to a lack of choice. The higher the density of similar projects in a uniform area, the less chance there is of finding sites suitable for conservation that contain all the attributes that are desired to be conserved, including both ecological processes and ecological patterns. Due to the small number of projects within 50 km of the current site, this effect is not considered to be significant.

Assessment of cumulative impacts

Cumulative impacts are identical for all five projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and 132/11kV Leeudoringstad Solar Plant Substation). The table below (Table 11) therefore applies to all five projects.

Based on the assessment provided, all cumulative impacts can be reduced to a LOW significance with mitigation measures. Based on this assessment, it is considered that the cumulative impacts are acceptable.

Table 11: Assessment of cumulative impacts for all four proposed PV solar energy facilities, including 132kV power lines associated with Wildebeestkuil 1 and Wildebeestkuil 2 solar PV plants, as well as the grid infrastructure, including substation.

LEEUWBOSCH 1 SOLAR PV PLANT, LEEUWBOSCH 2 SOLAR PV PLANT, WILDEBEESTKUIL 1 SOLAR PV PLANT & 132KV POWER LINE AND WILDEBEESTKUIL 2 SOLAR PV PLANT & 132KV POWER LINE																					
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Cumulative																					
Vegetation	Loss and/or fragmentation of indigenous natural vegetation due to clearing	2	4	4	2	4	1	16	-	Low	Apply project-specific mitigation measures.	2	4	4	2	4	1	16	-	Low
Plant species of concern and protected plants and trees	Loss of individuals	2	4	2	2	2	1	12	-	Low	It is a legal requirement to obtain permits for specimens that will be lost.	2	4	2	2	2	1	12	-	Low
Ecosystems	Changes to ecological processes at a landscape level	2	2	2	3	2	2	22	-	Low	Limit development within conservation zones, especially CBA1 areas.	2	2	2	2	2	2	20	-	Low
Fauna	Mortality, displacement and/or disturbance	2	2	2	2	1	2	18	-	Low	Apply site-specific mitigation measures.	2	2	2	1	1	1	8	-	Low
Vegetation, ecosystems and habitats	General increase in the spread and invasion of new habitats by alien invasive plant species	2	3	2	3	3	2	26	-	Medium	• Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. • Undertake regular monitoring to detect alien	2	2	2	2	3	1	11	-	Low

											invasions early so that they can be controlled. • Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. • Do NOT use any alien plants during any rehabilitation that may be required.									
Ecosystems and vegetation	Reduction in the opportunity to undertake or plan conservation, including effects on CBAs and ESAs, as well as on the opportunity to conserve any part of the landscape	3	1	2	3	4	1	13	-	Low	Avoid development within conservation zones, especially CBA1 areas.	3	1	2	2	4	1	12	-	Low

POSSIBLE MITIGATION MEASURES

This section of the report provides a description of mitigation measures that could be applied to minimize identified impacts for this project.

Mitigation measures

Use existing road infrastructure
There are existing gravel roads in the study area, as well as access roads along existing power lines. Where possible, these roads should be used for access to the proposed project areas.

Adjust infrastructure positions to avoid sensitive habitats
Where one infrastructure option is preferable over another, but there are still sensitive habitats affected, the infrastructure should be moved to avoid the sensitivity, wherever possible. During the extended planning phase for this project, this has already been undertaken.

Minimise vegetation clearing and disturbance
For all construction activities, the amount of vegetation cleared should be as small as possible to minimize the amount of habitat that is lost as well as to minimize the amount of rehabilitation of disturbed areas that will be required. Areas outside the direct construction camp footprint must be fenced off or marked in some other appropriate manner and no activities must be permitted there. Vehicles and personnel must be prohibited from being in natural areas outside the footprint of the proposed construction. Access for unauthorised personnel must also be limited.

Rehabilitation Programme
A Biodiversity Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

Botanical walk-through survey
This is a requirement only to ensure legal compliance and should take place once the final layout has been determined. A Biodiversity pre-construction walk-through survey has already been undertaken and no listed and/or protected species were found within the footprint of the proposed infrastructure.

Alien plant management plan
It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)), landowners are legally responsible for the control of alien species on their properties. This programme should include monitoring procedures.

Undertake regular monitoring
Monitoring should be undertaken to evaluate the success of mitigation measures.

COMPARISON OF ALTERNATIVES

No design or layout alternatives for the PV development areas, Switching Substations, Guard houses and Temporary Building Zones (and all other associated infrastructure) are being considered or assessed as part of the current BA processes. Design and layout alternatives were considered and assessed as part of a previous BA process that was never completed, and as such the PV development areas, Switching Substations, Guard houses and Temporary Building Zones (and all other associated infrastructure) have been placed to avoid site sensitivities identified as part of a previous BA process as well as the current BA processes. Specialist studies were originally undertaken in 2016 and all current layouts and/or positions being proposed were selected based on the environmental sensitivities identified as part of these studies in 2016. All specialist studies which were undertaken in 2016 were however updated in 2020 (including ground-truthing, where required) to focus on the impacts of the layouts being proposed as part of the current projects. The results of the updated specialist assessments have informed the layouts being proposed as part of the current BA processes. The proposed layouts have therefore been informed by the identified environmental sensitive and/or "no-go" areas.

In light of the above, no further comparative assessment is required for the respective solar PV plant layouts (Leeuwbosch and Wildebeestkuil).

Three grid connection infrastructure alternatives (namely power line corridor route alternatives) have however been provided for the respective Wildebeestkuil 1 and WIldebeestkuil 2 Solar PV Plant projects. Each proposed Wildebeestkuil solar PV plant will consist of one associated 132kV power line. These alternatives essentially provide for two different route alignments with associated substations contained within an assessment corridor between approximately 60m and 150m wide. This is to allow for flexibility to route the power lines within the assessed corridors. As such, the selected preferred power lines will be routed within the assessed corridors. The final servitudes will be routed within the power line corridors, and it expected that the servitude swill does not exceed 32m. The power line corridor route alternatives were informed by the identified environmental sensitive and/or "no-go" areas.

In addition, two different location alternatives for the substation site were identified and assessed as part of the current BA process for the Leeudoringstad Solar Plant Substation. The proposed substation site has been informed by the identified environmental sensitive and/or "no-go" areas. These alternatives are described below.

Grid Connection – Wildebeestkuil 1, Wildebeestkuil 2 and Leeudoringstad Solar Plant Substation

As mentioned, there are three power line corridor route alternatives for each respective Wildebeestkuil Solar PV Plant project as well as two substation site alternatives for the Leeudoringstad Solar Plant Substation project, as follows (see Figure 14):

WILDEBEESTKUIL 1 SOLAR PV PLANT & 132KV POWER LINE:

Power Line Corridor Option 1
This involves an overhead power line which will run north of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland. There were no particular sensitivities encountered.

Power Line Corridor Option 2A
This involves an overhead power line which will run south of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant

Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland, as well as degraded areas. There were no particular sensitivities encountered.

Power Line Corridor Option 2B
This involves an underground power line which will run south of the R502, from the switching substation located within the Wildebeestkuil PV1 Solar PV Plant application site to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation (part of separate BA process), depending on the alternative chosen as 'preferred' for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil PV1 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland, as well as degraded areas. There were no particular sensitivities encountered.

WILDEBEESTKUIL 2 SOLAR PV PLANT & 132KV POWER LINE:

Power Line Corridor Option 1:
This involves an overhead power line which will run north of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland. There were no particular sensitivities encountered.

Power Line Corridor Option 2A:
This involves an overhead power line which will run south of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland, as well as degraded areas. There were no particular sensitivities encountered.

Power Line Corridor Option 2B:
This involves an underground power line which will run south of the R502, from the switching substation located within the Wildebeestkuil 2 Solar PV Plant application site (namely Portion 14 of the Farm Wildebeestkuil No. 59) to either Option 1 or Option 2 of the Leeudoringstad Solar Plant Substation, depending on the alternative chosen as "preferred" for the Leeudoringstad Solar Plant Substation site[2]. The Leeudoringstad Solar Plant Substation site alternatives are situated approximately 2km to the north-east of the Wildebeestkuil 2 Solar PV Plant application site, within Portion 37 of the Farm Leeuwbosch No. 44.

Most of this alignment is within areas of secondary grassland, as well as degraded areas. There were no particular sensitivities encountered.

LEEUDORINGSTAD SOLAR PLANT SUBSTATION

Design and layout alternatives were considered and assessed as part of a previous BA process that was never completed, as such the substation site has been placed to avoid site sensitivities identified as part of a previous BA process as well as the current BA processes. Specialist studies were originally undertaken in 2016 and all current layouts and/or positions being proposed were selected based on the environmental sensitivities identified as part of these studies in 2016. All specialist studies which were undertaken in 2016 were however updated in 2020 (including ground-truthing, where required) to focus on the impacts of the layouts being proposed as part of the current project. The results of the updated specialist assessments have informed the layout being proposed as part of the current BA process. The proposed substation site has therefore been informed by the identified environmental sensitive and/or "no-go" areas.

As mentioned, however, two (2) different location alternatives for the substation site have been identified and assessed.

Both substation sites are within areas of natural grassland immediately adjacent to the railway line. There is no fundamental difference between the two sites and neither site contained areas of particular sensitivity, except for being within grassland.

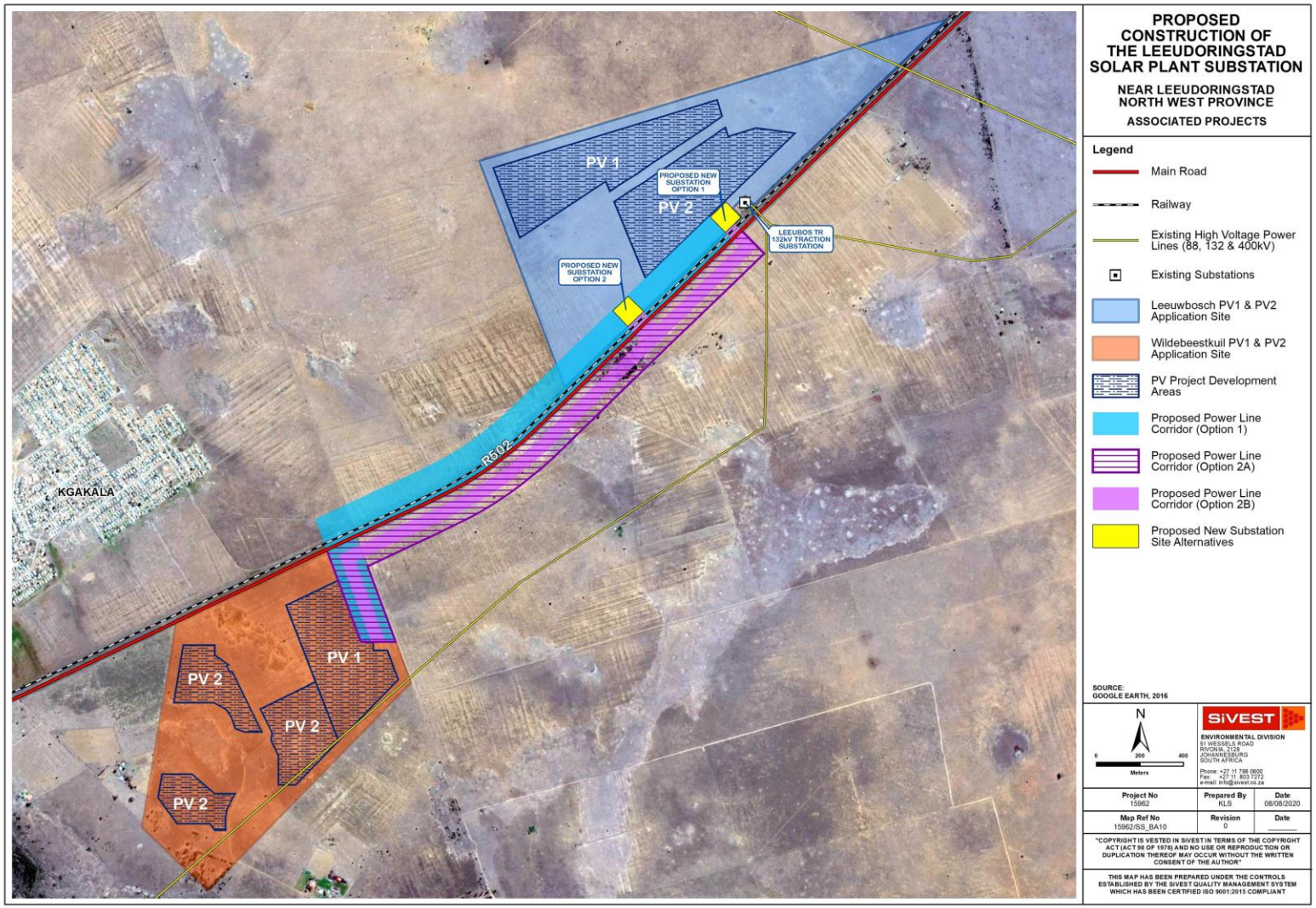

Figure 14 Powerline and substation alternatives – Wildebeestkuil 1, Wildebeestkuil 2 and Leeudoringstad Solar Plant Substation.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 12: Comparative assessment of layout alternatives – Wildebeestkuil 1, Wildebeestkuil 2 and Leeudoringstad Solar Plant Substation.

ALTERNATIVES	Preference	Reasons (incl. potential issues)
POWER LINE CORRIDORS – WILDEBEESTKUIL 1 AND WILDEBEESTKUIL 2:		
Option 1	FAVOURABLE	No issues
Option 2A	FAVOURABLE	No issues
Option 2b	FAVOURABLE	No issues
LEEUDORINGSTAD SOLAR PLANT SUBSTATION:		
Option 1	FAVOURABLE	No issues
Option 2	FAVOURABLE	No issues

DISCUSSION AND CONCLUSIONS

It should be noted that a combined report has been compiled for all five proposed projects (namely the Leeuwbosch 1 Solar PV Plant, Leeuwbosch 2 Solar PV Plant, Wildebeestkuil 1 Solar PV Plant & 132kV Power Line, Wildebeestkuil 2 Solar PV Plant & 132kV Power Line and Leeudoringstad Solar Plant Substation). Where certain findings and/or mitigation measures are project specific, this has been indicated.

The project study area for the combined projects consists of a mixture of natural and secondary grassland, along with other localised modifications to the landscape, within a largely agricultural area close to a small town. The natural vegetation is grassland but within an area in which large proportions of the landscape were previously cultivated. The original natural vegetation has therefore been modified to a large degree by these historical agricultural activities. As a result, the regional vegetation type, Vaal-Vet Sandy Grassland has undergone a high degree of overall transformation and is listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). Any remaining natural habitat on site therefore has to be considered to possibly have biodiversity value, although only some parts of the Leeuwbosch site are mapped as Ecological Support Areas in the Provincial Conservation Plan.

There are no plant species occurring on site or likely to occur there that are protected according to the National Environmental Management: Biodiversity Act. There are also no species found on site that are protected according to the North West Biodiversity Management Act. In addition, there a small number of the protected tree, *Vachellia erioloba*, in the general area, but none within the footprint of proposed infrastructure (all options). There is therefore no flora of concern for any of the five projects or for any of the grid / power line or substation options.

There are a small number of fauna of possible conservation concern that were assessed as having a possibility of occurring on site (all five project sites). This includes the Near Threatened South African Hedgehog and Brown Hyaena, and a number of protected species, including the Cape Fox, Honey Badger, and Giant Bullfrog. Some of them (Cape Fox, Brown Hyena, Honey Badger) are **highly mobile species that are unlikely to be affected by any activities on site, but others are more restricted or territorial and could be more significantly affected**. Of those that are more likely to be affected, are the South African Hedgehog and the Giant Bullfrog, neither of which are confirmed to occur on site.

The vegetation on site is similar for all five project sites and consists largely of a mixture of grassland and secondary grassland. Due to the length of time since last cultivation, in combination with possible degradation of natural areas due to other factors, there is little difference in species composition across all areas assessed, except for the possible dominance of *Aristida congesta* in some areas that may be due to historical degradation. The overall species diversity is not high and there are no specific habitats within the proposed footprints that are unique. Some localised depressions have been identified, some of which are secondary, in which wetland vegetation occurs. These areas have all been omitted from the proposed project footprint areas.

The projects involve construction of arrays of solar panels with access roads, sub-stations, and power lines to take the power to the grid. The plains are relatively flat and accessible from existing roads. It is therefore expected that impacts can be contained within footprint areas. All project components are adjacent to an existing regional road and railway line, as well as within proximity to a small town. There will therefore be limited overall habitat fragmentation and no necessity to build extensive access roads.

An impact assessment identified various impacts, all typical of projects of this nature, most of which can be minimised with mitigation measures. As with any greenfields development, it is difficult to mitigate loss of habitat, but in the case of the current projects, few sensitivities have been identified for the remaining areas of natural habitat.

Conclusions

At the site-specific scale, some sensitivities have been identified, primarily related to natural habitat. However, it is possible that these can be minimised or avoided with the application of appropriate mitigation or management measures. There will be residual impacts, primarily on natural habitat. **The amount of habitat that will be lost to the**

projects is insignificant compared to the area in hectares of the regional vegetation type that occurs on site. From this perspective it is unlikely that the proposed projects will have an unacceptable impact on the natural environment. The view is that they should be authorised.

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APPENDICES:

Appendix 1: Plant species of conservation importance (Threatened, Near Threatened and Declining) that have historically been recorded in the study area.

Sources: see text.

Family	Taxon	Status	Habitat	Likelihood of occurrence in study area
AMARYLLIDACEAE	Crinum bulbispermum	Declining	Near rivers, streams, seasonal pans and in damp depressions	MEDIUM
HYACINTHACEAE	Eucomis autumnalis subsp. clavata	Declining	Damp open grassland and sheltered places from the coast to 2450 m.	LOW

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

Appendix 2: List of protected tree species (National Forests Act).

Acacia (Vachellia) erioloba	Acacia haematoxylon
Adansonia digitata	Afzelia quanzensis
Balanites subsp. maughamii	Barringtonia racemosa
Boscia albitrunca	Brachystegia spiciformis
Breonadia salicina	Bruguiera gymnhorrhiza
Cassipourea swaziensis	Catha edulis
Ceriops tagal	Cleistanthus schlectheri var. schlechteri
Colubrina nicholsonii	Combretum imberbe
Curtisia dentata	Elaedendron (Cassine) transvaalensis
Erythrophysa transvaalensis	Euclea pseudebenus
Ficus trichopoda	Leucadendron argenteum
Lumnitzera racemosa var. racemosa	Lydenburgia abottii
Lydenburgia cassinoides	Mimusops caffra
Newtonia hildebrandtii var. hildebrandtii	Ocotea bullata
Ozoroa namaensis	Philenoptera violacea (Lonchocarpus capassa)
Pittosporum viridiflorum	Podocarpus elongatus
Podocarpus falcatus	Podocarpus henkelii
Podocarpus latifolius	Protea comptonii
Protea curvata	Prunus africana
Pterocarpus angolensis	Rhizophora mucronata
Sclerocarya birrea subsp. caffra	Securidaca longependunculata
Sideroxylon inerme subsp. inerme	Tephrosia pondoensis
Warburgia salutaris	Widdringtonia cedarbergensis
Widdringtonia schwarzii	

Boscia albitrunca and *Vachellia erioloba* have a geographical distribution that is close to the study area.

Appendix 3: Plant species previously recorded in the general area.

This list was compiled by extracting a list of species that have been recorded within a rectangular area that includes the study area as well as similar habitats in surrounding areas, as obtained from http://newposa.sanbi.org/ accessed on 20 April 2019. It is probable that it includes some species that occur in habitats that do not occur on site. The list was supplemented from field observations, as well as observations from www.inaturalist.org, which are photographic observ actions verified by an online community.

The list is arranged by family in alphabetical order. Species listed in green are those that were found on site.

Acanthosicyos naudinianus
Achyranthes aspera var. sicula*
Acrotome inflata
Achyropsis leptostachya
Achyropsis sp.
Ornithogalum prasinum
Albuca setosa
Albuca shawii
Albuca virens subsp. arida
Albuca virens subsp. virens
Alectra pumila
Aloe greatheadii
Alternanthera pungens*
Andropogon appendiculatus
Anthospermum rigidum
Anthospermum sp.
Anthephora pubescens
Antizoma angustifolia
Aponogeton rehmannii
Aptosimum indivisum
Aptosimum elongatum
Arctotis arctotoides
Arctotis venusta
Aristida adscensionis
Aristida canescens
Aristida congesta subsp. barbicollis
Aristida congesta subsp. congesta
Aristida diffusa subsp. burkei
Aristida junciformis subsp. junciformis
Aristida stipata subsp. graciliflora
Aristida stipitata subsp. stipitata
Asclepias aurea
Asclepias brevipes
Asclepias densiflora
Asclepias fruticosus
Asclepias gibba var. gibba
Asclepias sp.
Asparagus laricinus
Asparagus sp.
Asparagus suaveolens
Atriplex nummularia subsp. nummularia*
Atriplex semibaccata var. typica*
Barleria macrostegia
Berkheya cf heterophylla
Blepharis integrifolia
Blepharis squarrosa
Boerhavia diffusa
Bolusia acuminata
Boscia albitrunca (Protected tree species)
Brachiaria eruciformis
Brachiaria nigropedata
Brachiaria serrata
Brachystelma stenophyllum
Bulbine abyssinica
Bulbine capitata
Bulbine frutescens
Bulbine narcissifolia
Bulbostylis hispidula subsp. pyriformis
Bulbostylis humilis
Cadaba aphylla
Celtis africana
Chamaecrista blensis
Chamaecrista comosa
Chascanum adenostachyum
Chascanum pinnatifidum var. pinnatifidum
Chasmatophyllum musculinum
Cheilanthes parviloba
Chlorophytum angulicaule
Chlorophytum fasciculatum
Clematis brachiata
Coccinia sessilifolia
Colchicum melanthoides subsp. melanthoides
Commelina africana var. krebsiana
Commelina diffusa
Commelina livingstonii
Commicarpus pilosus
Convolvulus aschersonii
Convolvulus dregeanus
Convolvulus sagittatus
Convolvulus sp.
Corchorus asplenifolius
Crabbea acaulis
Crassula capitella subsp. nodulosa

Crassula lanceolata subsp. lanceolata
Crotalaria sphaerocarpa subsp. sphaerocarpa
Crotalaria sp.
Croton gratissimus var. subgratissimus
Cucumis zeyheri
Cullen tomentosum
Cuscuta campestris
Cymbopogon caesius
Cymbopogon dieterienii
Cymbopogon pospischilli
Cynodon dactylon
Cyperus assimilis
Cyperus capensis
Cyperus congestus
Cyperus decurvatus
Cyperus difformis
Cyperus eragrostis*
Cyperus longus var. tenuiflorus
Cyperus margaritaceus var. margaritaceus
Cyperus rupestris var. rupestris
Cyperus sphaerospermus
Cyperus usitatus
Cyphia assimilis
Cyphia sp.
Cyphia stenopetala
Delosperma sp.
Denekia capensis
Deverra burchellii
Diandrochloa sp. (prob. namaquensis)
Dianthus micropetalus
Dianthus mooiensis subsp. kirkii
Dicoma anomala subsp. gerrardii
Digitaria erianthe
Diheteropogon amplectens
Diopsyros lycioides subsp. lycioides
Diospyros austro-africana var. microphylla
Dipcade viride
Drimia elata (DDT)
Duthieastrum linifolium
Dyschoriste transvaalensis
Echinochloa colona
Echinochloa holubii
Ehretia alba
Elephantorrhiza elephantina
Elionurus muticus
Eragrostis biflora
Eragrostis chloromelas
Eragrostis curvula
Eragrostis gummiflua
Eragrostis lappula
Eragrostis lehmanniana var. lehmanniana
Eragrostis obtusa
Eragrostis pallens
Eragrostis plana
Eragrostis planiculmis
Eragrostis pseudobtusa
Eragrostis stapfii
Eragrostis superba
Eragrostis trichophora
Eragrostis viscosa
Erigeron bonariense*
Eriospermum cooperi
Eucalyptus camaldulensis* (Declared invader category 2)
Euclea natalensis
Euclea undulata
Eucomis autumnalis subsp. clavata (Declining)
Euphorbia inaequilatera var. inaequilatera
Euphorbia pseudotuberosa
Evolvulus alsinoides
Exochaenium grande
Felicia muricata
Flaveria bidentis*
Fockia angustifolia
Gazania krebsiana
Geigeria burkei subsp. burkei var. burkei
Gisekia pharnacoides var. pharnacoides
Gladiolus permeabilis subsp. edulis
Gnaphalium filagopsis
Gnidia sericocephala
Gomphocarpus fruticosus subsp. fruticosus
Gomphostigma virgatum
Gomphrena celosioides*
Grewia flava
Guilleminea densa*
Gymnosporia buxifolia
Gymnosporia tenuispina
Haemanthus humilis subsp. hirsutus
Harpagophytum procumbens subsp. procumbens (Protected)
Helichrysum argyrosphaerum
Helichrysum caespititium
Helichrysum callicomum
Helichrysum nudifolium
Helichrysum sp.
Helichrysum zeyheri
Heliotropium ciliatum
Heliotropium nelsonii
Hemarthria altissima
Hermannia coccocarpa
Hermannia depressa
Hermannia stellulata
Hermannia tomentosa
Hermstaedtia odorata var. aurantiaca
Hermstaedtia odorata var. odorata
Heteropogon contortus

Hibiscus microcarpus
Hibiscus pusillus
Hillardiella oligocephala
Hyparrhenia hirta
Hypertelis salsoloides var. salsoloides
Indigofera commixta
Indigofera cryptantha
Indigofera daleoides var. daleoides
Indigofera heterotricha
Indigofera rhytidocarpa subsp. rhytidocarpa
Indigofera vicioides var. vicioides
Ipomoea albivenia
Ipomoea bathycolpos
Ipomoea bolusiana
Ipomoea oenotheroides
Ipomoea ommaneyi
Jamesbrittenia aurantiaca
Jamesbrittenia sp.
Juncus rigidus
Justicia orchioides subsp. glabrata
Kalanchoe rotundifolia
Kohautia amatymbica
Kohautia caespitosa subsp. brachyloba
Kyllinga alba
Kyllinga erecta
Kyphocarpa angustifolia
Lactuca inermis
Lantana rugosa
Lasiosiphon burchellii
Lasiosiphon capitatus
Ledebouria sp.
Leptochloa fusca
Lippia scaberrima
Leobordea carinata
Leobordea adpressa subsp. adpressa
Lippia javonica
Listia heterophylla
Lobelia thermalis
Lotononis sp.
Lycium arenicola
Lycium cinereum
Lycium hirsutum
Lycium horridum
Macledium zeyheri
Malva parviflora
Marsilea macrocarpa
Medicago laciniata
Melhania prostrata
Melinis repens
Mestoklema arboriforme
Momordica balsamina
Monsonia angustifolia
Nerine frithii
Nerine laticoma
Nicotiana glauca*
Nidorella anomala
Nidorella hottentotta
Nidorella resedifolia subsp. resedifolia
Ocimum angustifolium
Ophioglossum polyphyllum var. polyphyllum
Opuntia microdasys*
Orbea sp.
Ornithogalum juncifolium var. juncifolium
Ornithogalum flexuosum
Ornithoglossum vulgare
Oropetium capense
Orthanthera jasminiflora
Osteospermum muricatum
Oxalis corniculata*
Oxygonum dregeanum subsp. canescens var. canescens
Panicum kalaharense
Panicum schinzii
Papaver aculeatum
Pappea capensis
Paspalum dilatatum*
Paspalum distichum
Pavetta zeyheri subsp. zeyheri
Pavonia burchellii
Pellaea calomelanos var. calomelanos
Pentzia globosa
Pentzia incana
Persicaria lapathifolia*
Pharmaceum brevicaule
Phyllanthus parvulus var. parvulus
Plumbago zeylanica*
Pogonarthria squarrosa
Polygala hottentotta
Polygala uncinata
Portulaca hereroensis
Portulaca kermesina
Portulaca quadrifida
Potamogeton pectinatus
Protea roupelliae subsp. roupelliae
Pseudognaphlium luteo-album
Pseudognaphalium oligandrum
Raphionacme hirsuta
Requienia sphaerosperma
Rhynchosia sp.
Rhynchosia venulosa
Richardia scabra*
Ruelliopsis setosa
Rumex lanceolatus*
Ruschia hamata
Ruschia sp.
Salsola glabrescens

Salvia disermas
Salvia runcinata
Salvia stenophylla
Scabiosa columbaria
Schizocarphus nervosus
Schinus molle* (Proposed declared invader)
Schmidtia pappophoroides
Schkuhria pinnata*
Schoenoplectus corymbosus
Schoenoplectus muricinux
Searsia ciliata
Searsia lancea
Searsia leptodictya forma leptodictya
Searsia magalismontana subsp. magalismontana
Searsia pyroides var. pyroides
Searsia rigida var. margaretae
Seddera capensis
Selaginella dregei
Selago densiflora
Selago welwitschii var. australis
Senecio inaequidens
Senegalia burkei
Senegalia caffra
Senegalia hereroensis
Senna italica subsp. arachoides
Sericorema remotiflora
Seriphium plumosum
Sesbania bispinosa var. bispinosa*
Setaria incrassata
Setaria pallida-fusca
Setaria sphacelata var. torta
Sida chrysantha
Sida dregei
Silene undulata
Solanum elaeagnifolium
Solanum lichtensteinii
Solanum rubetorum
Solanum supinum var. supinum*
Solanum tomentosum*
Sporobolus africanus
Sporobolus discosporus
Sporobolus fimbriatus
Stachys rugosa
Stachys spathulata
Stipagrostis uniplumis var. neesii
Stipagrostis uniplumis var. uniplumis
Sutera aurantiaca
Tarchonanthus camphoratus
Tephrosia capensis
Tephrosia lupinifolia
Teucrium trifidum
Themeda triandra
Thesium gracilarioides
Thunbergia neglecta
Thunbergia sp.
Trachyandra asperata var. asperata
Trachyandra laxa var. rigida
Trachyandra saltii var. saltii
Tragia rupestris
Tragia sp.
Tragus racemosus
Tribulus terrestris
Trichodesma angustifolium subsp. angustifolium
Trichoneura grandiglumis
Tristachya rehmannii
Tulbaghia acutiloba
Urochloa panicoides
Vachellia karroo
Vahlia capensis subsp. vulgaris var. linearis
Vachellia erioloba
Vachellia hebeclada subsp. hebeclada
Vachellia robusta subsp. robusta
Vahlia capensis
Verbesina encelloides var. encelloides*
Verbena bonariensis*
Verbena officinalis*
Vernonia oligocephala
Viscum rotundifolium
Wahlenbergia androsacea
Wahlenbergia banksiana
Wahlenbergia denticulata var. denticulata
Wahlenbergia denticulata var. transvaalensis
Wahlenbergia undulata
Ximenia americana
Ziziphus mucronata subsp. mucronata
Zornia milneana

Appendix 4: Animal species with a geographical distribution that includes the study area.

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) (see Appendix 6) marked with "N"

Mammals:
Red hartebeest
Springbok
Black wildebeest
Blue wildebeest
Blesbok
[N]Black rhinoceros VU
Klipspringer
Gemsbok
Warthog
Steenbok
Common duiker
Eland
Kudu
Rock hyrax
[N]Cape clawless otter
Water mongoose
Black-backed jackal
Caracal
Yellow mongoose
[N]Black-footed cat
African wild cat
Slender mongoose
Small-spotted genet
Large-spotted genet
[N]Brown hyaena NT
White-tailed mongoose
Striped polecat
[N]Spotted-necked otter NT
[N]Honey badger
Bat-eared fox
[N]Leopard VU
African striped weasel NT
Aardwolf
Suricate
[N]Cape fox
African straw-coloured fruit bat
Percival's short-eared trident bat VU
Geoffroy's horseshoe bat NT/LC
Egyptian slit-faced bat
Egyptian free-tailed bat
Natal long-fingered bat NT
Long-tailed serotine bat
Temminck's myotis
Welwitsch's myotis
Cape serotine bat
[N]South African hedgehog NT
Reddish-grey musk shrew
Tiny musk shrew
Lesser red musk shrew
Swamp musk shrew
Least dwarf shrew
Lesser dwarf shrew
Cape/desert hare
Scrub/savannah hare
Vervet monkey
Chacma baboon
Red veld rat
Tete veld rat
Namaqua rock mouse
Common mole rat
Grey climbing mouse
Short-tailed gerbil
Woodland dormouse
Porcupine
Single-striped mouse
Large-eared mouse
Multimammate mouse
Desert pygmy mouse
White-tailed rat VU
Angoni vlei rat
Vlei rat
Springhare
Striped mouse
Pouched mouse
Kreb's fat mouse
Highveld gerbil
Bushveld gerbil
Tree rat
Greater cane rat
Cape ground squirrel
Rock elephant shrew
Aardvark

Reptiles:
Pelomedusidae:
Marsh terrapin
Testudinidae:
Serrated tent tortoise
Leopard tortoise
Gekkonidae:
Common dwarf gecko
Cape gecko

Amphisbaenidae
Cape worm lizard
Lacertidae:
Savanna lizard
Holub's sandveld lizard
Spotted sandveld lizard
Spotted sand lizard
Cordylidae:
Common girdled lizard
Southern karusa lizard
Gerrhosauridae:
Yellow-throated plated lizard
Scincidae:
Thin-tailed legless skink
Wahlberg's snake-eyed skink
Cape skink
Speckled rock skink
Speckled sand skink
Variable skink
Varanidae:
Southern rock monitor
Nile monitor
Chamaeleonidae:
Common flap-necked chameleon
Agamidae:
Eastern ground agama
Southern rock agama
Typhlopidae:
Bibron's blind snake
Delelande's beaked blind snake
Leptotyphlopidae
Peter's thread snake
Viperidae:
Puff adder
Rhombic night adder
Lamprophiidae:
Black-headed centipede eater
Bibron's stiletto snake
Common house snake
Aurora snake
Brown water snake
Cape wolf snake
Short-snouted grass snake
Cross-marked grass snake
Fork-marked sand snake
Spotted grass snake
Striped grass snake
South African slug eater
Two-striped shovel-snout
Sundevall's shovel-snout
Mole snake
Elapidae:
Sundevall's garter snake
Rinkhals
Cape cobra
Colubridae:
Red-lipped snake
Rhombic egg eater
Boomslang
Spotted bush snake

Amphibians
Bushveld rain frog
Eastern olive toad
Guttural toad
Raucous toad
Southern pygmy toad
Red toad
Bubbling kassina
Snoring puddle frog
Common platanna
Boettger's caco
Common river frog
Cape river frog
[N]Giant bullfrog NT
Striped stream frog
Tremolo sand frog
Natal sand frog
Tandy's sand frog

Appendix 5: Flora and Fauna protected under the North West Biodiversity Management Act No. 4 of 2016.

SCHEDULE 2: SPECIALLY PROTECTED SPECIES
As per Section 13 of the Act

CLASS MAMMALIA	
Common name	**Scientific name**
Aardvark	Orycteropus afer
Aardwolf	Proteles cristata
African Civet	Vivettictis civetta
African Clawless Otter	Aonyx capensis
African Marsh Rat	Dasymys incomtus
All bat species except for the Cape Serotine Bat Neoromicia capensis	Order Chiroptera
Bat-eared Fox	Otocyon megalotis
Black-tailed Tree Rat	Thallomys nigricauda
Blesbok	Damaliscus pygargus phillipsi
Blue Wildebeest	Connochaetes taurinus
Buffalo	Syncerus caffer
Bushbuck	Tragelaphus scriptus
All Dormouse species	Family Myoxidae
All Cat or Felid species	Family Felidae
Dwarf Mongoose	Helogale parvula
Eland	Taurotragus oryx
All Elephant Shrews or Sengis	Family Macroscelididae
Giraffe	Giraffa camelopardalis
Gemsbok	Oryx gazella
All Golden Moles	Family Chrysochloridae
Grey Rhebok	Pelea capreolus
Hippopotamus	Hippopotomus amphibius
Klipspringer	Oreotragus oreotragus
Kreb's Fat Mouse	Steatomys krebsii
Maquassie Musk Shrew	Crocidura maquassiensis
Mountain Reedbuck	Redunca fulvorufula
Plains Zebra	Equus zebra
All Red Rock Rabbits	Pronolagus sp.
Red Hartebeest	Alcephus buselaphus
Sable Antelope	Hippotragus niger
South African Galago	Galago moholi
Striped Weasel	Poecigale albinucha
Waterbuck	Kobus ellipsiprymnus
White-tailed Rat	Mystromys albicaudatus
Woosnam's Desert Rat	Zelotomys woosnami
CLASS AMPHIBIA	
All Pygmy Toads	Poyntonophrynus sp.
All bullfrogs	Pyxicephalus sp.
CLASS REPTILIA	
Eastern Tiger Snake	Telescopus semiannulatus
All Chameleons	Chamaeleo sp.
All Flat Lizards	Platysaurus sp.
Giant Plated Lizard	Gerrhosaurus validus

All Grass Lizards	Chamaesaura sp.
All Girdled Lizards	Cordylus sp.
Striped Harlequin Snake	Homoroselaps dorsalis
Horned Adder	Bitis caudalis
Kalahari Tent Tortoise	Psammobates oculiferus
Lobatse Hinged Tortoise	Kinixys lobatsinana
All Monitor Lizards or LKeguaans	Varanus sp.
Spotted House Snake	Lamprophis guttatus
All Thick-toed Geckos	Pachydactylis sp.
KINGDOM PLANTAE	
	Aloe braamvanykii
	Anacampseros dicapitata
	Barleria media
	Blepharis angustata
All species of the genus	Brachystelma sp.
	Ceropegia insignis
	Ceropegia stentiae
	Cineraria austrotransvaalensis
	Cineraria exilis
	Cleome conrathii
	Commelina bella
	Cynodon polevansii
	Delosperma leendertziae
	Dicliptera magaliesbergensis
	Drimia sanguinea
All species	Euphorbia sp., except Euphorbia ingens
All Ferns, except the Bracken Fern Pteridium aquilinum	Division Pteridophyta
Fairy Elephant's Foot	Frithia pulchra
	Gladiolus filiformis
	Gnaphalium nelsonii
	Indigofera commixta
	Kniphofia typhoides
	Ledebouria atrobrunnea
	Ledebouria confusa
	Lessertia phillipsiana
	Lithops leslei subsp. leslei
	Lobelia cuneifolia var ananda
	Miraglossum laeve
	Nerine gracilis
	Nuxia glomerulata
	Rennera stellata
	Searsia maricoana
	Senecio holubii
	Spirostachys africana
	Sporobolus oxyphyllus
	Stenostelma umbelluliferum

Appendix 6: Flora and vertebrate animal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

Adenium swazicum
Aloidendron pillansii
Diaphananthe millarii
Dioscorea ebutsniorum (no such species!!)
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

ENDANGERED SPECIES

Flora

Angraecum stella-africae
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hildebrandtii

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture
Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

VULNERABLE SPECIES

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwilla plumbea
Zantedeschia jucunda

Aves

White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon

Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia
Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax
Roan antelope
Pangolin
Juliana's golden mole
Suni
Large-eared free-tailed bat
Lion
Leopard
Blue duiker

PROTECTED SPECIES
Flora
Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus
Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Amphibia
Giant bullfrog
African bullfrog

Reptilia
Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armadillo girdled lizard
Nile crocodile
African rock python

Aves
Southern ground hornbill
African marsh harrier
Denham's bustard
Jackass penguin

Mammalia
Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox

Appendix 8: Curriculum vitae: Dr David Hoare

Education
Matric - Graeme College, Grahamstown, 1984
B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993
B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction
M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction
PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership
Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005 – present. Reg. no. 400221/05 (Ecology, Botany)
Member, International Association of Vegetation Scientists (IAVS)
Member, Ecological Society of America (ESA)
Member, International Association for Impact Assessment (IAIA)
Member, Herpetological Association of Africa (HAA)

Employment history
1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.
1January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
1January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.
1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant
Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:

Refereed scientific articles (in chronological order):

Journal articles:

HOARE, D.B. & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.

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