

Terrestrial Biodiversity Assessment

prepared in accordance with the
*"Protocol for the Specialist Assessment and minimum report content requirements for
environmental impacts on Terrestrial Biodiversity"*

Leeuwbosch Pv 3 Solar Photovoltaic (PV)
Plant and Associated Infrastructure near
Leeudoringstad in North West Province



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Terrestrial Biodiversity Assessment report for the proposed Leeuwbosch Pv 3 Solar Photovoltaic (PV) Plant and associated infrastructure near Leeudoringstad in North West Province.

for

21 November 2022

Report version: 1st draft

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SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species, terrestrial plant species and terrestrial biodiversity", as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows:

Specialist	Qualification and accreditation
Dr David Hoare	<ul style="list-style-type: none">• PhD Botany• Pr.Sci.Nat. 400221/05 (Ecological Science, Botanical Science)

Declaration of independence:

David Hoare Consulting (Pty) Ltd is an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by David Hoare Consulting (Pty) Ltd is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

David Hoare Consulting (Pty) Ltd undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to David Hoare Consulting (Pty) Ltd by the client and in addition to information obtained during the course of this study, David Hoare Consulting (Pty) Ltd present the results and conclusion within the associated document to the best of the author's professional judgement and in accordance with best practice.



Dr David Hoare

21 November 2022

Date

TERMS OF REFERENCE

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL BIODIVERSITY

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1. An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified on the screening tool as being of “**very high sensitivity**” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment.

1.2. An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being “**low sensitivity**” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Compliance Statement.

1.3. However, where the information gathered from the site sensitivity verification differs from the designation of “very high” terrestrial biodiversity sensitivity on the screening tool and it is found to be of a “low” sensitivity, then a Terrestrial Biodiversity Compliance Statement must be submitted.

1.4. Similarly, where the information gathered from the site sensitivity verification differs from that identified as having a “low” terrestrial biodiversity sensitivity on the screening tool, a Terrestrial Biodiversity Specialist Assessment must be conducted.

1.5. If any part of the proposed development footprint falls within an area of “very high” sensitivity, the assessment and reporting requirements prescribed for the “very high” sensitivity apply to the entire footprint, **excluding linear activities** for which impacts on terrestrial biodiversity are temporary and the land in the opinion of the terrestrial biodiversity specialist, based on the mitigation and remedial measures, can be returned to the current state within two years of the completion of the construction phase, in which case a compliance statement applies. Development footprint in the context of this protocol means the area on which the proposed development will take place and includes any area that will be disturbed.

Terrestrial Biodiversity Specialist Assessment

2.1. The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.

2.2. The assessment must be undertaken on the preferred site and within the proposed development footprint.

2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:

2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;

2.3.2. ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;

2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;

2.3.4. the description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;

2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including:

- (a) main vegetation types;
- (b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;
- (c) ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and
- (d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;

2.3.6. the assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and

2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:

2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:

- (a) the reasons why an area has been identified as a CBA;
- (b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;
- (c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);
- (d) the impact on ecosystem threat status;
- (e) the impact on explicit subtypes in the vegetation;
- (f) the impact on overall species and ecosystem diversity of the site; and
- (g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;

2.3.7.2. terrestrial ecological support areas (ESAs), including:

- (a) the impact on the ecological processes that operate within or across the site;
- (b) the extent the proposed development will impact on the functionality of the ESA; and
- (c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;

2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-

- (a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;

2.3.7.4. priority areas for protected area expansion, including-

- (a) the way in which the proposed development will compromise or contribute to the expansion of the protected area network;

2.3.7.5. SWSAs including:

- (a) the impact(s) on the terrestrial habitat of a SWSA; and
- (b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);

2.3.7.6. FEPA subcatchments, including-

- (a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;

2.3.7.7 indigenous forests, including:

- (a) impact on the ecological integrity of the forest; and
- (b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.

2.4. The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.

Terrestrial Biodiversity Specialist Assessment Report

- 3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:
- 3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
 - 3.1.2. a signed statement of independence by the specialist;
 - 3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
 - 3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;
 - 3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;
 - 3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);
 - 3.1.7. additional environmental impacts expected from the proposed development;
 - 3.1.8. any direct, indirect and cumulative impacts of the proposed development;
 - 3.1.9. the degree to which impacts and risks can be mitigated;
 - 3.1.10. the degree to which the impacts and risks can be reversed;
 - 3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;
 - 3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);
 - 3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;
 - 3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and
 - 3.1.15. any conditions to which this statement is subjected.
- 3.2. The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.
- 3.3. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the Camden site:

- The assessment is based on a field survey conducted on 13 September 2016 and on 15 May 2017. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation.
- The vegetation was in good condition for sampling at the time of the field assessment, and the species lists obtained are considered reliable and relatively comprehensive.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints inherent in the EIA process, this was not possible for this study. However the comprehensive field survey is sufficient for the purposes of this report and towards sufficiently informing the decision making process by the Competent Authority.

INTRODUCTION

Leeuwbosch PV Generation (Pty) Ltd (hereafter referred to as “Leeuwbosch PV Generation”) is proposing to construct a solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44, approximately 6km north-east of the town of Leeudoringstad in the North West Province. The proposed development will have a maximum export capacity of up to 15 megawatt (MW) and will be known as the Leeuwbosch 3 Solar PV Plant. The proposed development is located within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality.

The proposed solar PV plant development does not fall within any of the Renewable Energy Development Zones (REDZs) which were formally gazetted on 16 February 2018 (Government Notice 114) for the purpose of development of solar and wind energy generation facilities.

No layout alternatives are being considered and assessed as part of the current BA process. The “No-go” alternative is the option of not implementing the proposed development.

Project description

It is anticipated that the proposed Solar PV energy facility will include PV fields (arrays) comprising of multiple PV panels. In summary, the proposed SEF development will include the following components:

- The proposed solar PV plant will include PV fields (arrays) comprising multiple PV modules;
- 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 2274mm (≈2.3m) long and 1134mm (≈1.1m) wide and mounted on supporting structures above ground;
- The foundations will most likely be either concrete or rammed piles;
- Generation capacity of up to 15MWac;
- The dimension of the PV panels will be approximately 2.3 m wide by 1.1 m long;
- One (1) new 33/132kV on-site substation (facility substation) occupying an area of up to approximately 0.2003ha (2 003m²);
- Site and internal access roads, up to 4m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary;
- One (1) guard house approximately 0.0876 ha (876m²) in size;
- One (1) temporary building zone 0.2944 ha (2 944m²);
- Galvanized steel fencing with electrification approximately 2.1m in height;
- Existing boreholes will be used where possible. Water will potentially be stored in water storage tanks;

Component	Description / Dimensions
Location of site (centre point)	Latitude: 27°12'24.03" S Longitude: 26°18'2.64" E
Technology	<ul style="list-style-type: none">• The proposed solar PV plant will include PV fields (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 2274mm (≈2.3 m) long and 1134 mm (≈1.1 m) wide and mounted on supporting structures above

Component	Description / Dimensions
	<p>ground. At this stage it is anticipated that the structures will be mono-facial modules. The final design details will become available during the detailed design phase of the proposed development, prior to the start of construction.</p> <ul style="list-style-type: none"> 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 development.
SG codes	T0HP00000000004400037
Generation Capacity of Solar PV Plant	Maximum of up to ± 15 MW ac
Capacity of Switching Substation	More than 33 kV but less than 275 kV. Exact capacity of the proposed on-site switching substation will be determined and confirmed at a later stage.
Dimensions of PV Panels	<ul style="list-style-type: none"> Width: up to ± 2274 mm (≈ 2.3 m) Length: up to ± 1134 mm (≈ 1.1 m)
On-site Switching Substation	<ul style="list-style-type: none"> One (1) new on-site switching substation with a capacity of more than 33 but less than 275 kV. Total footprint: up to ± 0.2003 ha (2 003 m²). To contain transformers for voltage, step up from medium voltage to high voltage. DC power from the PV modules will be converted into AC power in the inverters and the voltage will be stepped up to medium voltage in the inverter transformers.
Guard House	One (1) permanent guard house of ± 0.0876 ha (876 m ²).
Temporary Building Zone	One (1) temporary building zone of ± 0.2944 ha (2 944 m ²).
Area Occupied by Buildings	Up to ± 1.3807 ha (13 807 m ²)
Width of Existing Internal Gravel Roads	<ul style="list-style-type: none"> Up to ± 4 m; Existing internal gravel site roads will be used wherever possible. However, where required, new internal gravel roads may be constructed.
Length of existing internal roads (to be potentially upgraded)	<ul style="list-style-type: none"> Up to ± 1.57 km
Site Access	Access to the proposed development will be via an existing gravel road which connects to the tarred R502 road.
Proximity to grid connection	<ul style="list-style-type: none"> Grid connection is to the 132/11kV Leeudoringstad Solar Plant Substation, which has been applied for as part of a separate BA process; and The 132/11kV Leeudoringstad Solar Plant Substation is located within the proposed Leeuwbosch 3 Solar PV Plant application site (namely Portion 37 of the Farm Leeuwbosch No. 44). Medium voltage cabling (anticipated to be ± 0.8 m x 0.6 m wide at this stage) will link the various PV arrays to the switching substation, as well as the Leeudoringstad Solar Plant Substation. These cables will be laid underground, wherever technically feasible.
Height of fencing	<ul style="list-style-type: none"> ± 2.1 m high Fencing will surround the entire proposed solar PV plant.
Type of fencing	Galvanised steel with electrification on top.
Area covered by fencing	Up to approximately 18 ha
Boreholes and storage tanks	<ul style="list-style-type: none"> At this stage it is anticipated that existing boreholes will be utilised; Water will potentially be stored in temporary water storage tanks.

SENSITIVITIES IDENTIFIED FROM DFFE ONLINE SCREENING TOOL

Terrestrial Biodiversity theme

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure:

Utilities Infrastructure => Electricity => Generation => Renewable => Solar =>PV

The terrestrial biodiversity theme indicates that the site is within one sensitivity class, namely **VERY HIGH** (Figure 1).

Terrestrial Biodiversity theme

Sensitivity features are indicated as follows:

Sensitivity	Feature(s)
Very High	Ecological Support Area 1
Very High	Endangered ecosystem



Figure 1: DFFE Screening Tool extract: terrestrial biodiversity theme

METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Project Area of Influence (PAOI)

The proposal is to develop a solar PV facility on site, along with associated infrastructure. Anticipated impacts will mostly occur during the construction phase, with few discernible effects anticipated during operation. These impacts are not expected to extend beyond the boundaries of the study area. The PAOI is therefore treated here as the development footprint within which direct impacts will occur (Figure 2).

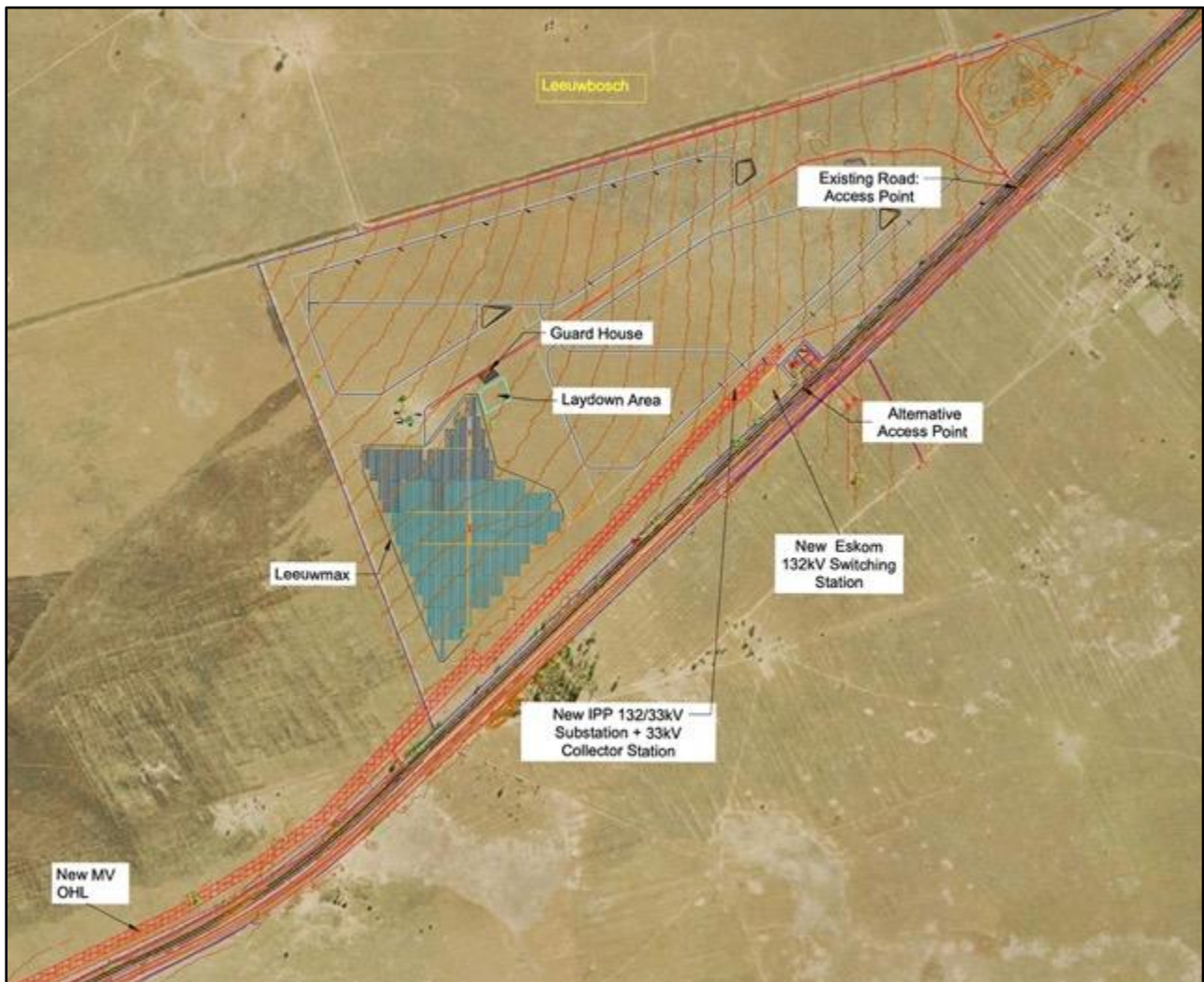


Figure 2: Proposed Project Area of Influence (PAOI).

Survey timing

The study commenced as a desktop-study followed by site-specific field study on 29 April 2021 and 27 October 2021. The site is within the grassland biome with a peak rainfall season in summer, which occurs from October to March. There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to May (Figure 3), with most perennial species characteristic of the vegetation being easily identifiable from January to March. The timing of the field survey was therefore ideal in terms of assessing the vegetation condition and flora composition of the site.

A more accurate indication of rainfall seasonality, which drives most ecological processes, is shown in Figure 4, which shows that the nearby Klerksdorp has peak rainfall from October to April. The timing of the survey in late summer and then in early summer is therefore optimal in terms of assessing the flora and vegetation of the site. The overall condition of the vegetation was therefore possible to be determined with a high degree of confidence.

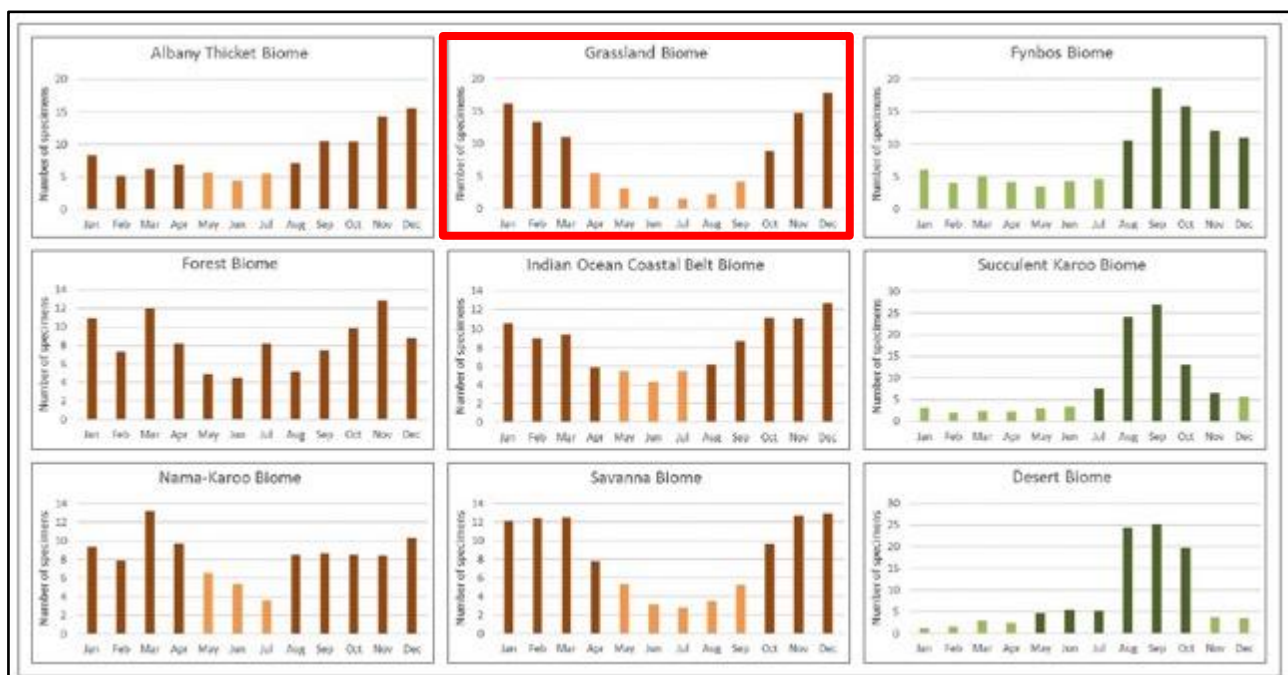
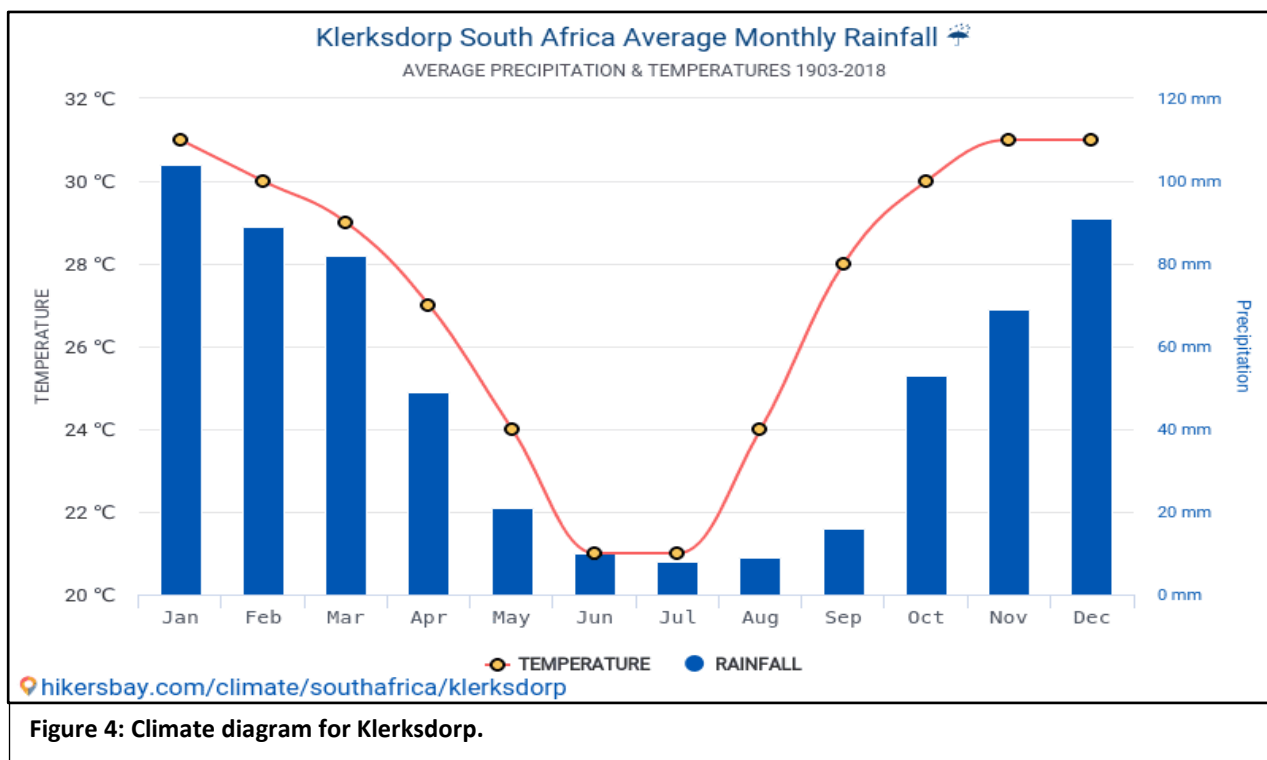


Figure 3: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines). The site is within the Grassland Biome.



Field surveys

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A meander approach was adopted with no time restrictions - the objective was to comprehensively examine all natural areas. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made. Digital photographs were taken of features and habitats on site, as well as of all plant species that were seen. All plant species recorded were uploaded to the iNaturalist website.

Aerial imagery from Google Earth was used to identify and assess habitats on site. This included historical imagery that may show information not visible in any single dated image. Patterns identified from satellite imagery were verified on the ground. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled. Digital photographs were taken at locations where features of interest were observed.

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 species of conservation concern, 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 species of conservation concern, 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 site 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. Plant and animal species observed were recorded. The season of the survey was favourable, and 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.

Sources of information

Regional Vegetation

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (<http://bgis.sanbi.org>) as follows:
 - Mucina, L. and Rutherford, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.
 - South African National Biodiversity Institute 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 23 September 2021.

Threatened Ecosystems

- The conservation status of the vegetation types were obtained from Mucina and Rutherford (2006) and the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).
- The plant species checklist of species that could potentially occur on site was compiled from a plant species checklist extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grid 2629BA.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, <http://redlist.sanbi.org>).

Regional plans

- The Mpumalanga Biodiversity Sector Plan (MBSP) retrieved from the SANBI BGIS website (<https://bgis.sanbi.org/MBSP>). Information on this map is found in Lötter & Ferrar (2006) and Ferrar & Lötter (2007).
- South Africa Protected Areas Database (SAPAD_OR_2021_Q2) retrieved from the Department of Forestry, Fisheries and the Environment website (https://egis.environment.gov.za/data_egis/data_download/current).
- Information from the National Protected Areas Expansion Strategy (NPAES) was consulted for possible inclusion of the site into a protected area in future (available on <http://bgis.sanbi.org>).

Aerial imagery

- Recent satellite imagery (courtesy of Google Earth Pro). Google Earth Pro also provides historical imagery for a period up to 15 years ago, which aided in the determination of certain vegetation types and land use historically and currently present 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 estimated as still being 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.

Sensitivity classes follow the approach for determining Site Ecological Importance (SEI) in the Species Environmental Assessment Guidelines. As per the Species Environmental Assessment Guidelines, Site Ecological Importance (SEI) is

calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts ($SEI = BI + RR$). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. $BI = CI + FI$. The full methodology is available in the Species Environmental Assessment Guidelines (pages 26 - 30).

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 the Department of Forestry, Fisheries and the Environment (DFFE) 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. According to these Regulations under Listing Notice 1 (GRN No. 983, as amended), Listing Notice 2 (GRN No 984, as amended) and Listing Notice 3 (GRN No 985, as amended), the activities listed are identified as activities that 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) (NEMBA)

As the principal national act regulating biodiversity protection, NEMBA, which is administered by DFFE, 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 NEMBA, 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 are 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 NEMBA 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 NEMBA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEMBA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEMBA, 2016).

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.

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

This notice, published under Section 52(1)(a) of NEMBA, 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).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of NEMBA.

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of NEMBA.

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy

Published under NEMA. 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 unmitigatable 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, Critical Biodiversity Areas (CBA), 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 water resource require 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 floodline 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 fire-fighting. 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.

Mpumalanga Nature Conservation Act, No. 10 of 1998

This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project:

- Various species are protected;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

The Act provides lists of protected species for the Province. According to the Mpumalanga Nature Conservation Act, a permit is required for the removal of any species on this list.

National Environmental Management Protected Areas Act, No. 57 of 2003

The National Environmental Management: Protected Areas Act 57 of 2003 has the following objectives:

- to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes;
- to provide for the establishment of a national register of all national, provincial and local protected areas;
- to provide for the management of those areas in accordance with national norms and standards;
- to provide for intergovernmental co-operation and public consultation in matters concerning protected areas; and
- to provide for matters in connection therewith.

It has been amended several times:

- National Environmental Management: Protected Areas Amendment Act 21 of 2014
- National Environmental Management: Protected Areas Amendment Act 15 of 2009
- National Environmental Management: Protected Areas Amendment Act 15 of 2009
- National Environmental Laws Amendment Act 14 of 2009
- National Environmental Management: Protected Areas Amendment Act 31 of 2004

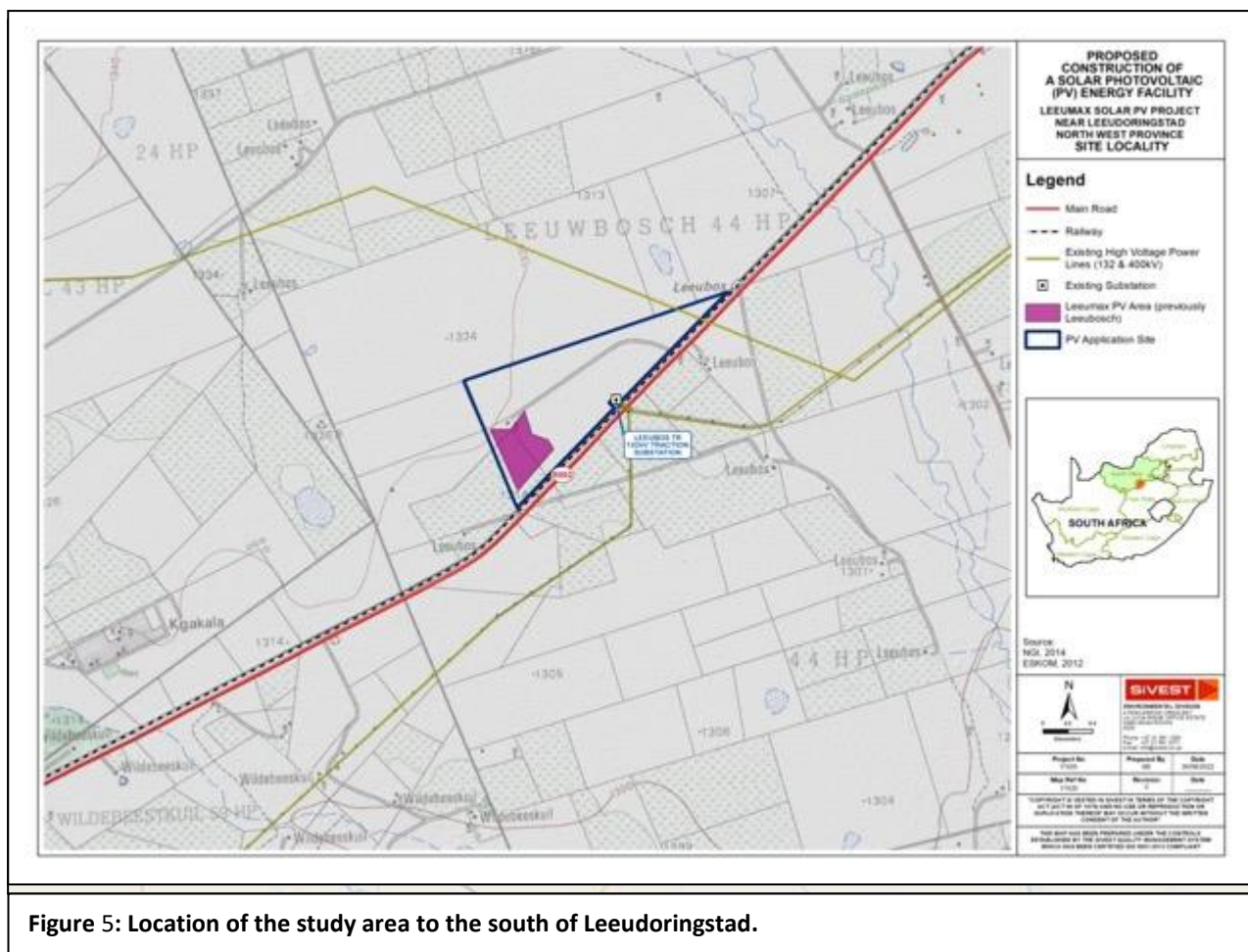
DESCRIPTION OF STUDY AREA

Location

The project is located on Portion 37 of the Farm Leeuwbosch No. 44, approximately 6km north-east of the town of Leeudoringstad in the North West Province (Figure 5). The site is just off the R502 (Orkney to Leeudoringstad) road.

Site conditions

The site is currently natural grassland that is used for grazing. There is no infrastructure on site, except for a small reservoir on the northern edge of the proposed project site.



Regional vegetation patterns

There is one regional vegetation type occurring on site, namely Vaal-Vet Sandy Grassland (Figure 6). There are small patches of Highveld Salt Pans in nearby areas. These two vegetation types that occur on site and nearby are briefly described below according to published information. The description is from Mucina & Rutherford (2006), extracted from the SANBI BGIS website (<http://bgis.sanbi.org/vegmap>).

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, *Antheophora pubescens* (d), *Aristida congesta* (d), *Chloris virgata* (d), *Cymbopogon caesus* (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),

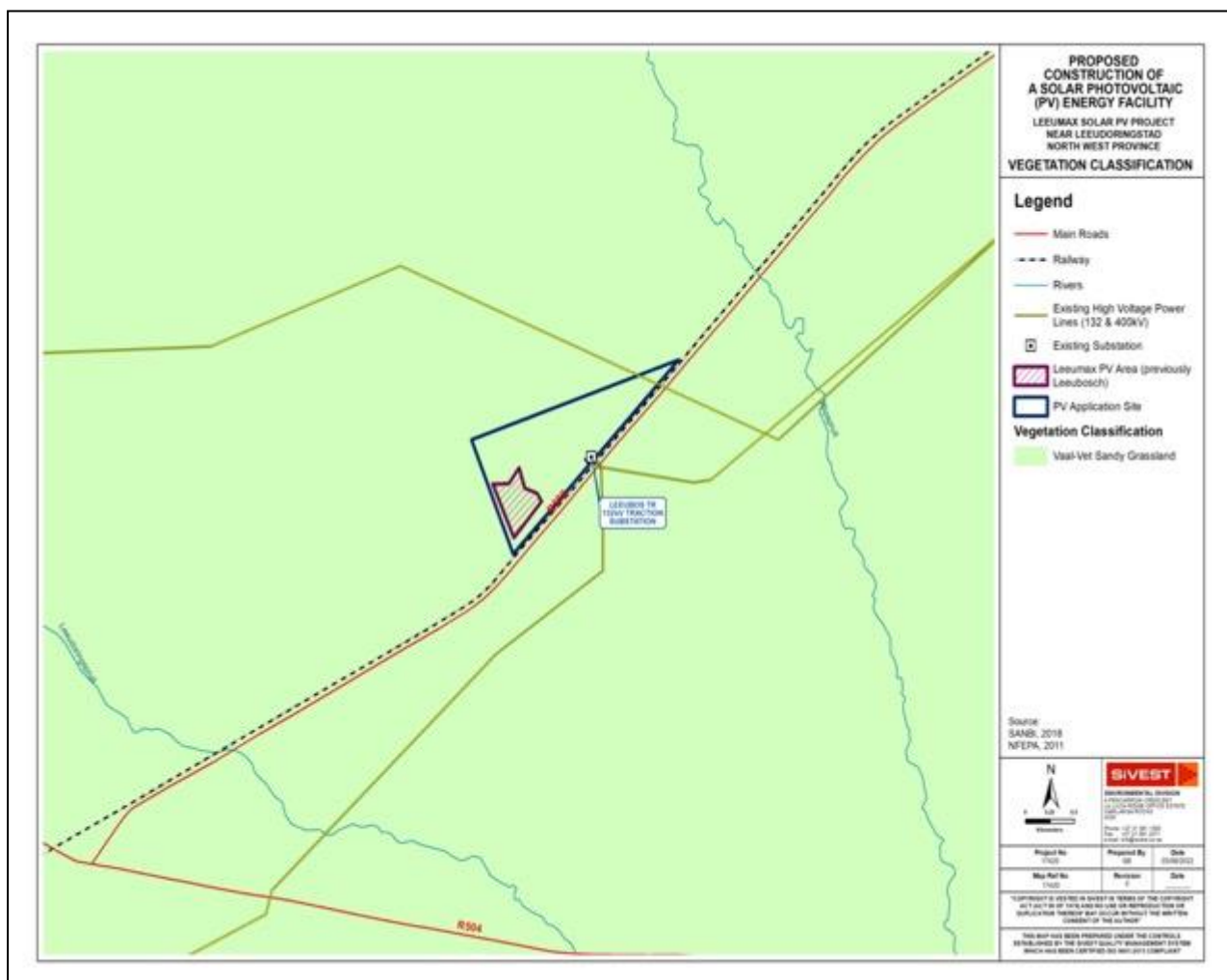


Figure 6: Regional vegetation types of the study area.

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*.

Conservation status of regional 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

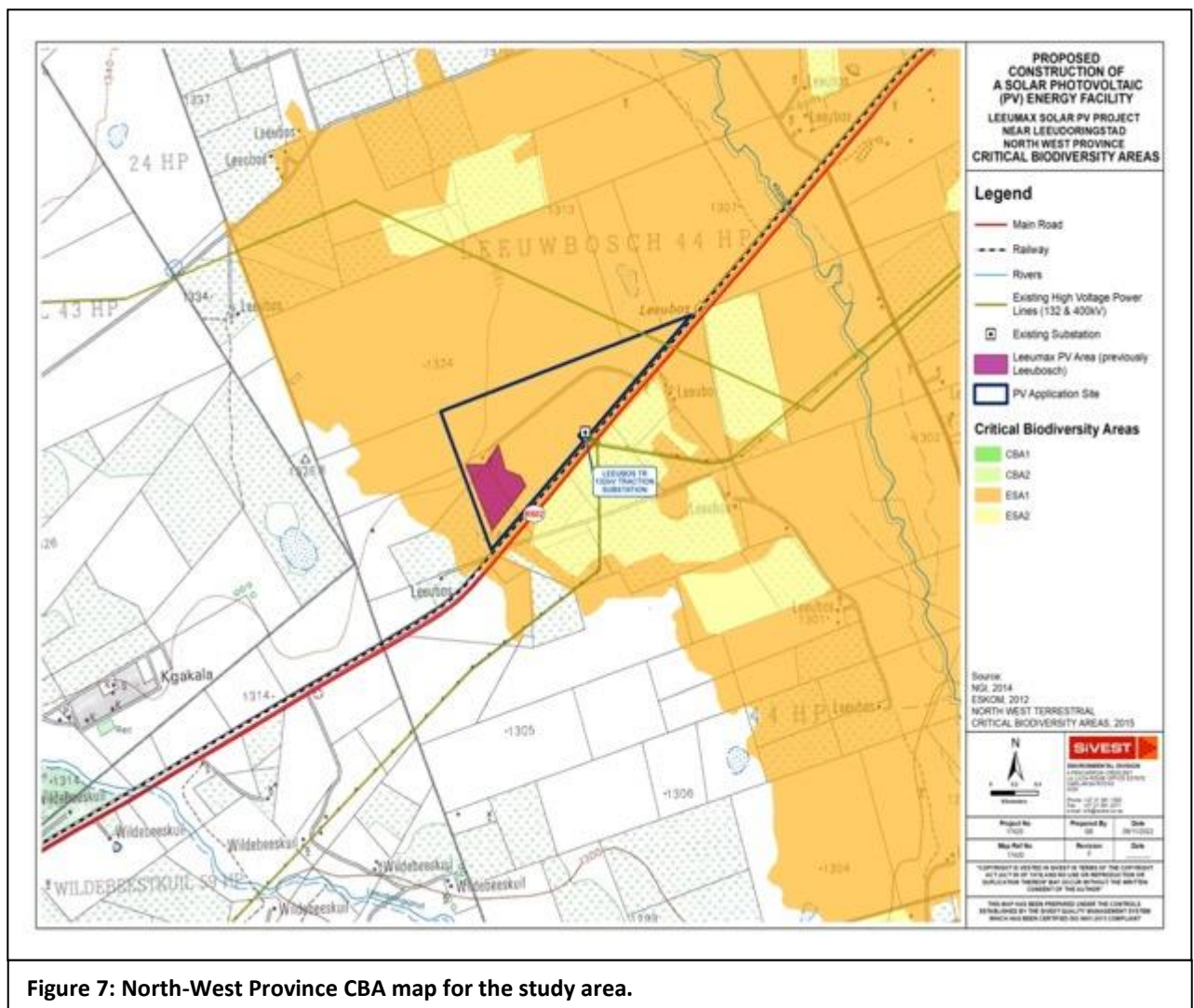
Conservation status of vegetation types occurring in the study area:

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 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), Vaal-Vet Sandy Grassland is listed as Endangered.

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, and other ecosystems defined in the Act, 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). Vaal-Vet Sandy Grassland covers the entire site (Figure 5).

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 that the entire site and surrounding areas falls within an Ecological Support Area 1.



Habitats on site

Natural habitats on site match the landcover map for the area (Figure 8). The majority of the solar PV area is within a previously cultivated area that currently contains secondary grassland. Remaining areas are natural grassland. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. **Natural grassland** (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);

Transformed and degraded areas:

2. **Old lands** (secondary grasslands on previously cultivated areas);

NATURAL VERSUS SECONDARY GRASSLAND	
Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes , or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that then develops is as a result of recolonization of the area through propagation.

The natural grassland on site is characterised by medium-height grassland that appears to be overgrazed at times. The presence of scattered termite mounds throughout the site indicates that the grassland is in a natural state (not ploughed). There were also no plough lines in these grasslands on the aerial imagery for the site. Significant parts of the site have been cultivated at some point in history, which is also clearly evident from the vegetation structure and species composition on site. The topography within these grassland areas is relatively flat. Common and dominant species in the natural areas include *Themeda triandra*, *Digitaria erianthe*, *Eragrostis chloromelas*, *Aristida congesta* subsp. *congesta*, *Cymbopogon pospischilii*, *Eragrostis superba*, *Setaria sphacelata* var. *torta*, *Eragrostis obtusa*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Felicia muricata*, *Hermannia depressa*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Walafrida densiflora* and *Barleria* species. A total of 25 species per 100m² was recorded in these natural grasslands, which is moderately diverse relative to other Highveld grasslands. In comparison, the previously cultivated areas had only 17 species per 100m². Common and dominant species in the previously cultivated areas were *Aristida congesta* subsp. *congesta*, *Eragrostis lehmanniana*, *Themeda triandra*, *Eragrostis superba*, *Melinis repens*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Hermannia depressa* and *Pentzia* species.

Habitat sensitivity

A summary of sensitivities that occur on site are as follows:

1. Listed ecosystems: Vaal-Vet Sandy Grassland is listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
2. ESAs: The entire site is within an Ecological Support Area¹.

This information was used in conjunction with methodology to calculate Site Ecological Importance, described below. A map of habitat sensitivity on site is provided in Figure 9.

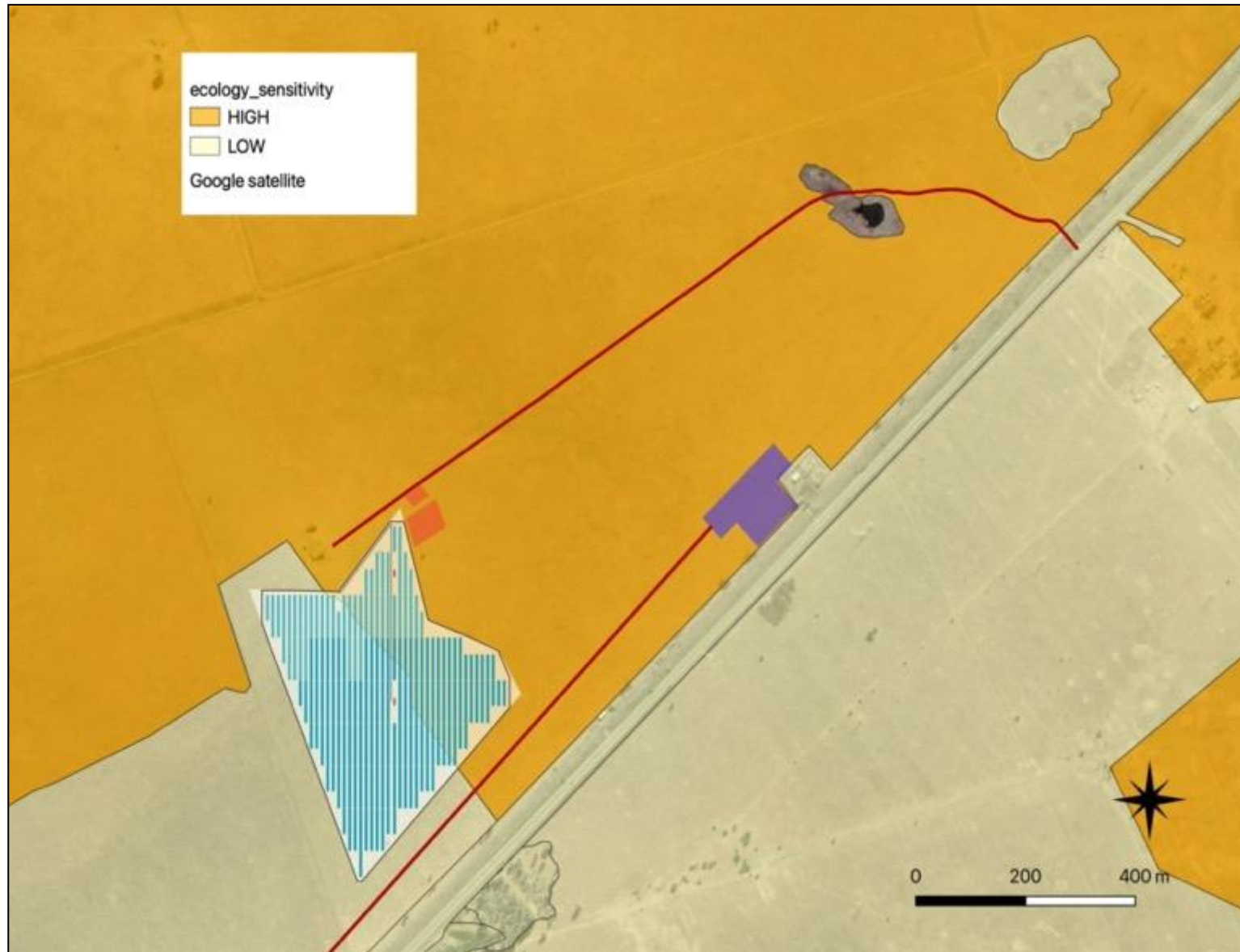


Figure 9: Habitat sensitivity of the study area, based on Site Ecological Index.

SITE ECOLOGICAL IMPORTANCE

The Species Environmental Assessment Guidelines (SANBI 2020) require that a Site Ecological Importance is calculated for each habitat on site, and provides methodology for making this calculation.

1. **Natural grassland** (open grassland on undulating plains, including moderately to heavily grazed areas);
2. **Old lands** (secondary grasslands on old lands);

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts ($SEI = BI + RR$). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. $BI = CI + FI$.

Site ecological importance for habitats found on site:

Habitat	Conservation importance	Functional integrity	Receptor resilience	Site Ecological Importance (BI)
Natural grassland	High Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.	Medium Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Very low Habitat that is unable to recover from major impacts	High (BI = Medium)
Old lands	Low No natural habitat remaining.	Very low Several major current negative ecological impacts.	High Habitat that can recover relatively quickly (5-10 years) to restore >75% to restore the original species composition and functionality	Very low (BI = Very low)

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report, but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in the Table below.

Guidelines for interpreting SEI in the context of the proposed development activities:

Site ecological importance	Interpretation in relation to proposed development activities
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e. last remaining populations of species, last

	remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

ASSESSMENT OF SIGNIFICANCE OF ECOLOGICAL IMPACTS

Anticipated impacts

The main impacts on Terrestrial Biodiversity associated with construction of the proposed infrastructure are anticipated to be as follows:

1. Direct loss of habitat within the footprint of the proposed infrastructure, and associated impacts on CBAs and threatened ecosystems.
2. Invasion by alien invasive plant species, leading to degradation of habitat. This could occur anywhere on site where disturbance is introduced and alien plants are not specifically controlled. The reason is that they already occur in the area and would opportunistically colonise any area of soil where they are not vigorously controlled.

The main mitigation measures, other than required Management Plans for plant rescue, rehabilitation, and alien plant management, are related to infrastructure location, which is a planning phase measure.

Planning Phase impacts

There are no negative impacts that are likely to be created as a result of project planning.

Construction Phase impacts

Impact 1: Impacts on indigenous natural vegetation

The regional terrestrial vegetation type in the broad study area is Vaal-Vet Sandy Grassland, listed as Endangered. It is also located within a CBA Node and Corridor area and a ESA Wetland area in the Provincial Conservation Plan and falls partly within an area identified for future conservation in the National Parks Area Expansion Strategy. The combination of these attributes indicates that any areas of natural habitat on site have high conservation value. However, some parts of the site are degraded or secondary, showing the existence of plough lines on the aerial image of the site, poor vegetation cover and relatively poor species diversity and composition.

Some loss of habitat will occur, but this will be insignificant in comparison to the total area of the vegetation types concerned. The assessment here is for all infrastructure components.

Operational Phase Impacts

Impact 2: Establishment and spread of declared weeds and alien invader plants

There is a moderate 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 potential consequences may be of low seriousness for surrounding natural habitats due to the fact that little natural vegetation still remains on site. Control measures could prevent the impact from occurring.

Decommissioning Phase Impacts

It is expected that the project will operate for a minimum of twenty years or more (a typical planned life-span for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment

Cumulative impacts on indigenous natural vegetation

The regional terrestrial vegetation types in the broad study area are listed as Endangered. This is the same vegetation type that will be affected by any other projects that would take place in the area. Loss of habitat will definitely occur, but this will be a small area in comparison to the total area of the vegetation type. The vegetation type occupies an area of 22 743 km², of which more than 63% has been altered, so approximately 8 400 km² remains. 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 type and will not result in a change in the conservation status of the vegetation type. The cumulative effect will therefore be low. In addition, the current project is located very close to an existing urban area. There will therefore be limited fragmentation of natural habitat, a factor that may be of concern if the project was located in a rural area with the no existing infrastructure nearby.

Cumulative impacts due to spread of declared weeds and alien invader plants

There is a moderate 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 low due to existing impacts on site and the high ability to control any additional impact. The significance will therefore be low, especially if control measures are implemented.

Summary of mitigation measures

The following mitigation measures are recommended to address known potential impacts:

- Restrict impact to development footprint only and limit disturbance in surrounding areas.
- Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications.
- Undertake regular monitoring to detect alien invasions early so that they can be controlled.
- Prior to commencement of construction, compile and implement a stormwater management plan including monitoring specifications.
- Monitor surfaces for erosion, repair and/or upgrade, where necessary.
- Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.

Summary of monitoring recommendations

Specific monitoring recommendations should be provided in the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

Alien Invasive Species:

- Monitor for early detection, to find species when they first appear on site. This should be as per the frequency specified in the management plan, and should be conducted by an experienced botanist. Early detection should provide a list of species and locations where they have been detected. Summer (vegetation maximum growth period) is usually the most appropriate time, but monitoring can be adaptable, depending on local conditions – this must be specified in the management plan.
- Monitor for the effect of management actions on target species, which provides information on the effectiveness of management actions. Such monitoring depends on the management actions taking place. It should take place after each management action.

- Monitor for the effect of management actions on non-target species and habitats.

Rehabilitated areas:

- Rehabilitation Plan must be compiled by an approved ecologist prior to achieving COD and prior to the start of decommissioning.
- All management actions associated with rehabilitation must be recorded after each management action has taken place.
- All rehabilitated areas should be monitored to assess vegetation recovery. This should be for a minimum of three years after post-construction rehabilitation, but depends on the assessed trajectory of rehabilitation (whether it is following a favourable progression of vegetation establishment or not – this depends on the total vegetation cover present, and the proportion that consists of perennial growth of desired species). For each monitoring site, an equivalent comparative site in adjacent undisturbed vegetation should be similarly monitored. Monitoring data collection should include the following:
 - total vegetation cover and height, as well as for each major growth form;
 - species composition, including relative dominance;
 - soil stability and/or development of erosion features;
 - representative photographs should be taken at each monitoring period.
- Monitoring of rehabilitated areas should take place at the frequency and for the duration determined in the rehabilitation plan, or until vegetation stability has been achieved.

Table 1: Rating of impacts

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, degradation or fragmentation of vegetation through direct clearing	1	4	4	2	4	2	30	-	Medium	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 and implement Alien Invasive Management Plan. Limit access to sensitive areas during construction. Undertake monitoring to evaluate whether further measures are required.	1	4	3	2	4	2	28	-	Medium
Operational Phase																				

Vegetation	Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	Medium	Compile and implement Alien Invasive Management Plan. Rehabilitate disturbed areas.	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 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	1	3	2	2	2	1	10	-	Low

											runoff and erosion must be properly controlled and any issues addressed as quickly as possible									
Vegetation	Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	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
Cumulative																				

Indigenous natural vegetation	Loss, degradation or fragmentation of vegetation through direct clearing	2	4	4	2	4	2	32	-	Medium	Limit development within conservation zones, especially CBA1 areas.	2	4	4	2	4	1	16	-	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 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.	2	2	2	2	3	1	11	-	Low

COMPARATIVE ASSESSMENT OF ALTERNATIVES

No alternatives are being considered for this project.

No-Go Alternative

The “no-go” option assumes that the site remains in its current state, i.e. there is no construction of a Solar PV and associated infrastructure in the proposed project area and the status quo would proceed. The current land use is livestock grazing, which has the potential to lead to long-term degradation under overgrazing or could potentially benefit the land under ideal grazing. The local effect of the “no-go” alternative would therefore be beneficial in the long-term because it would entail no loss of grassland habitat.

DISCUSSION

In general, the site is considered to have potentially high sensitivity or biodiversity value, based on the location of the site within a listed ecosystem as well as being within an Ecological Support Area.

The project study area consists of natural grassland habitat, and degraded areas associated with previous cultivation. The site is within an area where the remaining natural habitat has been assessed as having high conservation value. Existing impacts on natural habitat are related to possible previous cultivation on site. The extent of previous cultivation can be determined from the combination of local species composition and patterns from aerial imagery. The proposed project will therefore have some effects on areas of natural habitat that may possibly have important biodiversity value.

The vegetation on site is part of a threatened ecosystem and has been assessed as being of high conservation value due to rates of transformation. The regional vegetation type that occurs on site, Vaal-Vet Sandy Grassland, is listed as Endangered in the National Ecosystem List, is part of an area earmarked for future National Park expansion and is part of a Provincial Ecological Support Area. Any remaining natural habitat on site therefore has high terrestrial biodiversity value.

The most significant impact associated with the project is due to clearing of indigenous natural vegetation. This impact was evaluated as having a significance of MEDIUM after mitigation. All other assessed impacts had a significance of LOW after mitigation. One potential impact with the most significant risk in the absence of any management is due to the potential spread and growth of alien invasive plant species, which is facilitated by disturbance.

On the basis of the relatively limited extent that will be disturbed, and the general absence of any species of concern, the proposed development can be authorised.

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APPENDICES:

Appendix 1: 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.
1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
1 January 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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Book chapters and conference proceedings:

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- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited*. CEMEX, pp.218–229. ISBN 968-6397-77-9
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Conference Presentations:

- HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
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- BRITTON, D., SILBERBAUER, L., ROBERTSON, H., LUBKE, R., HOARE, D., VICTOR, J., EDGE, D. & BALL, J. 1997. The Life-history, ecology and conservation of the Brenton Blue Butterfly (*Orachrysops niobe*) (Trimen)(*Lycaenidea*) at Brenton-on-Sea. Unpublished report for the Endangered Wildlife Trust of Southern Africa, Johannesburg. 38pp.
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Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.
- Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.
- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.
- South African Association of Botanists Annual Congress, Cape Town, January 1998
- Randse Afriikaanse Universiteit postgraduate symposium, 1997.
- South African Association of Botanists Annual Congress, Bloemfontein, January 1995.