

EIA REPORT:

Specialist ecological study on the potential impacts of the proposed
Ilanga Lethemba photovoltaic (PV) Solar Energy Facility, near De
Aar, Northern Cape

Prepared by

Dr David Hoare
(Ph.D., Pr.Sci.Nat.)

David Hoare Consulting cc
41 Soetdoring Ave
Lynnwood Manor,
Pretoria

for

Savannah Environmental (Pty) Ltd
PO Box 148,
Sunninghill,
2197

on behalf of
Solar Capital (Pty) Ltd

1 September 2011

EIA REPORT: 1st Draft



David Hoare Consulting cc
Biodiversity Assessments, Vegetation Description /
Mapping, Species Surveys

REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 543 Section 32 - Specialist reports and reports on specialized processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the "Control sheet for specialist report" given above.

Regulation 32. (1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialized process.

Regulation 32. (2): A person referred to in subregulation (1) must comply with the requirements of regulation (17) i.e is independent

Regulation 33. (3): A specialist report or a report on a specialized process prepared in terms of these Regulations must contain:

- (a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialized process;
- (b) declaration that the person is independent in a form as may be specified by the competent authority;
- (c) indication of the scope of, and the purpose for which, the report was prepared;
- (d) description of the methodology adopted in preparing the report or carrying out the specialized process;
- (e) description of any assumptions made and any uncertainties or gaps in knowledge;
- (f) description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
- (g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
- (h) description of any consultation process that was undertaken during the course of carrying out the study;
- (i) summary and copies of any comments that were received during any consultation process;
- (j) any other information requested by the competent authority.

Appointment of specialist

David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Ilanga Lethemba photovoltaic solar energy facility near De aar in the Northern Cape Province. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

Dr David Hoare
David Hoare Consulting cc
Postnet Suite no. 116
Private Bag X025
Lynnwood Ridge, 0040

Telephone: 012 804 2281

Cell: 083 284 5111
Fax: 086 550 2053
Email: dhoare@lantic.net

Summary of expertise

Dr David Hoare:

- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995.
- Conducted, or co-conducted, over 250 specialist ecological surveys as an ecological consultant.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with Solar Capital (Pty) Ltd. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is zero.

Scope and purpose of report

The scope and purpose of the report are reflected in the "Terms of reference" section of this report.

Conditions relating to this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. David Hoare Consulting cc and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

TABLE OF CONTENTS

REGULATIONS GOVERNING THIS REPORT	2
APPOINTMENT OF SPECIALIST.....	2
DETAILS OF SPECIALIST	2
SUMMARY OF EXPERTISE	3
INDEPENDENCE	3
SCOPE AND PURPOSE OF REPORT.....	3
CONDITIONS RELATING TO THIS REPORT	3
TABLE OF CONTENTS	4
INTRODUCTION	6
TERMS OF REFERENCE AND APPROACH.....	6
STUDY AREA	6
METHODOLOGY	7
ASSESSMENT PHILOSOPHY	7
PLANT AND ANIMAL SPECIES OF CONCERN	8
HABITATS OF CONCERN	9
ASSESSMENT OF IMPACTS.....	9
LIMITATIONS	10
DESCRIPTION OF STUDY AREA	11
LOCATION.....	11
TOPOGRAPHY	11
LAND TYPES AND SOILS	12
CLIMATE	13
LANDUSE AND LANDCOVER OF THE STUDY AREA	13
BROAD VEGETATION TYPES OF THE REGION.....	14
<i>Northern Upper Karoo</i>	14
<i>Besemkaree Koppies Shrubland</i>	14
CONSERVATION STATUS OF BROAD VEGETATION TYPES	15
RED LIST PLANT SPECIES OF THE STUDY AREA.....	15
RED LIST ANIMAL SPECIES OF THE STUDY AREA	16
PROTECTED TREES	17
SENSITIVITY ASSESSMENT	17
RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS	21
LEGISLATION	21
DESCRIPTION OF INFRASTRUCTURE	23
IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS	24
DESCRIPTION OF POTENTIAL IMPACTS	25
<i>Impact 1: Impacts on indigenous natural vegetation (terrestrial)</i>	25
<i>Impact 2: Impacts on threatened plants</i>	25
<i>Impact 3: Impacts on protected tree species</i>	26
<i>Impact 4: Impacts on threatened animals</i>	26
<i>Impact 5: Impacts on drainage areas</i>	26
<i>Impact 6: Establishment and spread of declared weeds and alien invader plants</i>	27
ASSESSMENT OF IMPACTS	28
PV PLANT	28
<i>Impact 1: Loss or fragmentation of indigenous natural vegetation</i>	28
<i>Impact 4: Loss of habitat for threatened animals</i>	29
<i>Impact 6: Establishment and spread of declared weeds and alien invader plants</i>	30
OVERHEAD POWERLINES	31

<i>Impact 1: Loss or fragmentation of indigenous natural vegetation</i>	31
<i>Impact 4: Impacts on threatened animals</i>	32
<i>Impact 5: Damage to wetlands/watercourses</i>	33
<i>Impact 6: Establishment and spread of declared weeds and alien invader plants</i>	34
ACCESS ROADS.....	35
<i>Impact 1: Loss or fragmentation of indigenous natural vegetation</i>	35
<i>Impact 4: Loss of habitat for threatened animals</i>	36
<i>Impact 6: Establishment and spread of declared weeds and alien invader plants</i>	37
DISCUSSION AND CONCLUSIONS	39
RECOMMENDATIONS	40
MANAGEMENT PLAN	42
IMPACTS ON THREATENED ANIMALS	42
IMPACTS DUE TO ALIEN INVASIVE PLANTS.....	43
IMPACTS ON INDIGENOUS NATURAL VEGETATION.....	44
IMPACTS ON WATERCOURSES	45
REFERENCES:	46
APPENDICES:	48
APPENDIX 1: PLANT SPECIES OF CONSERVATION IMPORTANCE (THREATENED, NEAR THREATENED AND DECLINING) THAT HAVE HISTORICALLY BEEN RECORDED IN THE STUDY AREA.....	48
APPENDIX 2: THREATENED VERTEBRATE SPECIES WITH A GEOGRAPHICAL DISTRIBUTION THAT INCLUDES THE CURRENT STUDY AREA.	49
APPENDIX 3: LIST OF PROTECTED TREE SPECIES (NATIONAL FORESTS ACT).....	51
APPENDIX 4: CHECKLIST OF PLANT SPECIES RECORDED DURING PREVIOUS BOTANICAL SURVEYS IN THE STUDY AREA AND SURROUNDS.	52

INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by Solar Capital (Pty) Ltd to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed "Ilanga Lethemba PV Solar Energy Facility". The project involves the establishment of a renewable energy facility for power generation and its associated infrastructure, including an array of pv panels, foundations for the pv panels where necessary, underground cabling between pv panels, inverters, overhead power line to link into an existing Eskom powerline, administration building, workshop area for maintenance and storage and internal access roads. The purpose of the EIA is to identify environmental impacts associated with the project.

On 28 February 2011 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological EIA study include:

- an indication of the methodology used in determining the significance of potential environmental impacts;
- a description of the environmental issues that were identified during the environmental impact assessment process;
- an assessment of the significance of direct, indirect and cumulative impacts in terms of standard criteria;
- a description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Plan;
- an indication of the extent to which the issue could be addressed by the adoption of achievable mitigation measures;
- a description of any assumptions, uncertainties and gaps in knowledge;
- an environmental impact statement which contains
- a summary of the key findings of the environmental impact assessment,
- an assessment of the positive and negative implications of the proposed activity,
- a comparative assessment of the positive and negative implications of the distribution line alternatives.

This report provides details of the results of the EIA phase. The findings of the study are based on a desktop assessment of the study area, detailed mapping from aerial imagery and a field survey of the site.

Study area

At a regional level the study area falls within the Northern Cape Province to the north-east of the town of De Aar. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The assessment is to be undertaken in two phases, a Scoping phase and an Environmental Impact Assessment phase. The objective of the Scoping phase study was to review fauna and flora patterns within the study area in order to identify any highly sensitive areas that should be avoided during development. It was therefore necessary to provide checklists of sensitive species that could potentially occur in the study area as well as habitats with high conservation value. For potential species, only those of high conservation concern are provided. It was also intended to provide a draft habitat map of the study area based on available maps and database information. The results of the EIA phase study are provided in 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
3. threatened animal species

Ecosystems

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

Processes

1. corridors
2. mega-conservancy networks
3. rivers and wetlands
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 is 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. Environment Conservation Act (Act 73 of 1989)
2. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)
3. National Environmental Management Biodiversity Act, 2004. (Act 10 Of 2004)

Plant and animal species of concern

The purpose of listing Red List plant and animal species is to provide information on the potential occurrence of species of special concern 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 in order 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 of conservation concern previously recorded in the area and any other species with potential conservation value. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute for the quarter degree squares within which the study area is situated.

Regulations published for the National Forests Act 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.

Provincial and 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)*.

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). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. 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.

For all threatened or protected organisms (flora and fauna) 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. fynbos), but detailed microhabitat requirements (e.g. mountain fynbos on shallow soils overlying Table Mountain 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 fynbos on shallow soils overlying Table Mountain sandstone);
- **DEFINITE**: species found in habitats on site.

Habitats of concern

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), Northern Cape Biodiversity Conservation Plan (NCBCP). 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.

Assessment of impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase were assessed in terms of the following criteria:

- » The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 was assigned as appropriate (with 1 being low and 5 being high):
- » The **duration**, wherein it was indicated whether:
 - * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - * medium-term (5–15 years) – assigned a score of 3;
 - * long term (> 15 years) - assigned a score of 4; or
 - * permanent - assigned a score of 5;

- » The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability was estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, was determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- » the **status**, which was described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the degree to which the impact can be mitigated.

The **significance** was calculated by combining the criteria in the following formula:

$$S=(E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Limitations

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.

DESCRIPTION OF STUDY AREA

Location

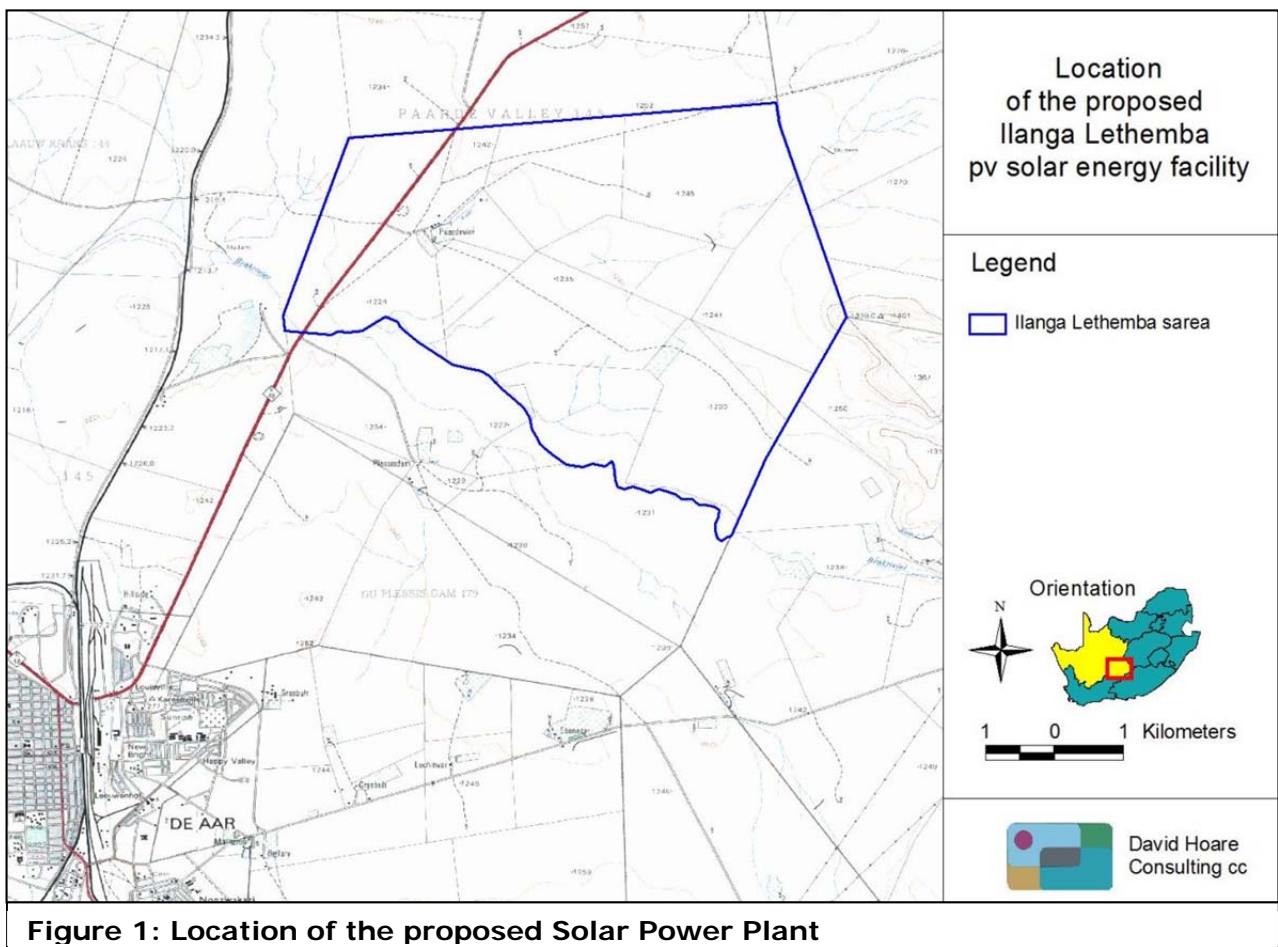
The study site is situated approximately 7 km north-east of De Aar within the Northern Cape (Figure 1). The site falls within the quarter degree grid 3024CA. The proposed facility would occur on Portion 3 of the Farm Paarde Valley 145.

No alternative site is currently being considered for the proposed facility, but the current site is sufficiently large to allow placement of the facility in alternative positions within the site. The site was chosen because of its proximity to De Aar and access to the electricity grid via the existing 132 kV powerline to Eskom`s Hydra substation. The Hydra substation is almost 10 km from the site, to the south.

The study area is accessible from De Aar via the R48 road from De Aar. The R48 connects to the N10 just north of De Aar to Hanover. There is a gravel road onto the Farm Paarde Valley and various farm roads on the site.

Topography

The topography of the study site is relatively gentle and slopes gently towards the south as well as westwards away from the hill in the eastern part of the site. The elevation on site varies from 1221 to 1355 m above sea level. There are various drainage lines draining the study area, all non-perennial. The main one is a dry river that runs along the southern



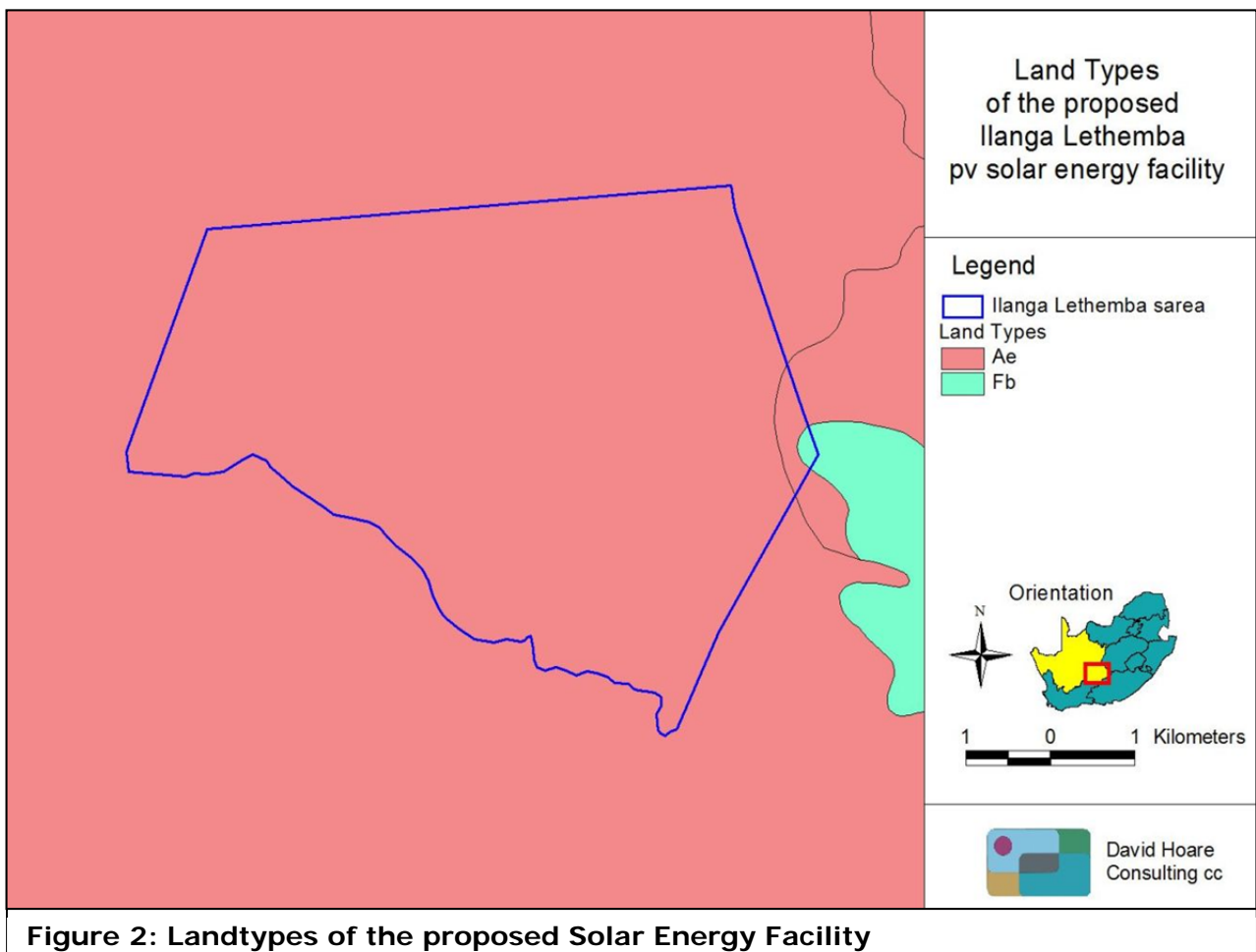
boundary of the study area. The other main drainage line enters the northern part of the site, running southwards before dissipating on site.

Land types and soils

Detailed soil information is not available for broad areas of the country. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There are two land types in the study area (Figure 2). The most common land type in the study area is Ae with a small area of Fb in the mid-eastern part of the site (Land Type Survey Staff, 1987).

The A-group of land types refer to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly. The Ag landtype consists of red, high base status soils, < 300 mm deep (MacVicar et al. 1974). The Ae landtype consists of red, high base status, > 300 mm deep soils and no dunes (MacVicar et al. 1974). Most of the site falls within this land type.

The F-group of land types indicates pedologically young landscapes that are not predominantly rock and nor predominantly alluvial or aeolian and in which the dominant soil-forming processes have been rock weathering, the formation of orthic topsoil horizons and, commonly, clay illuviation, giving rise typically to lithocutanic horizons (MacVicar et al. 1974). The soil forms that epitomise these processes are Glenrosa and Mispah. Fa refers to land in which lime in the soil occurs regularly in one or more valley bottom soils.



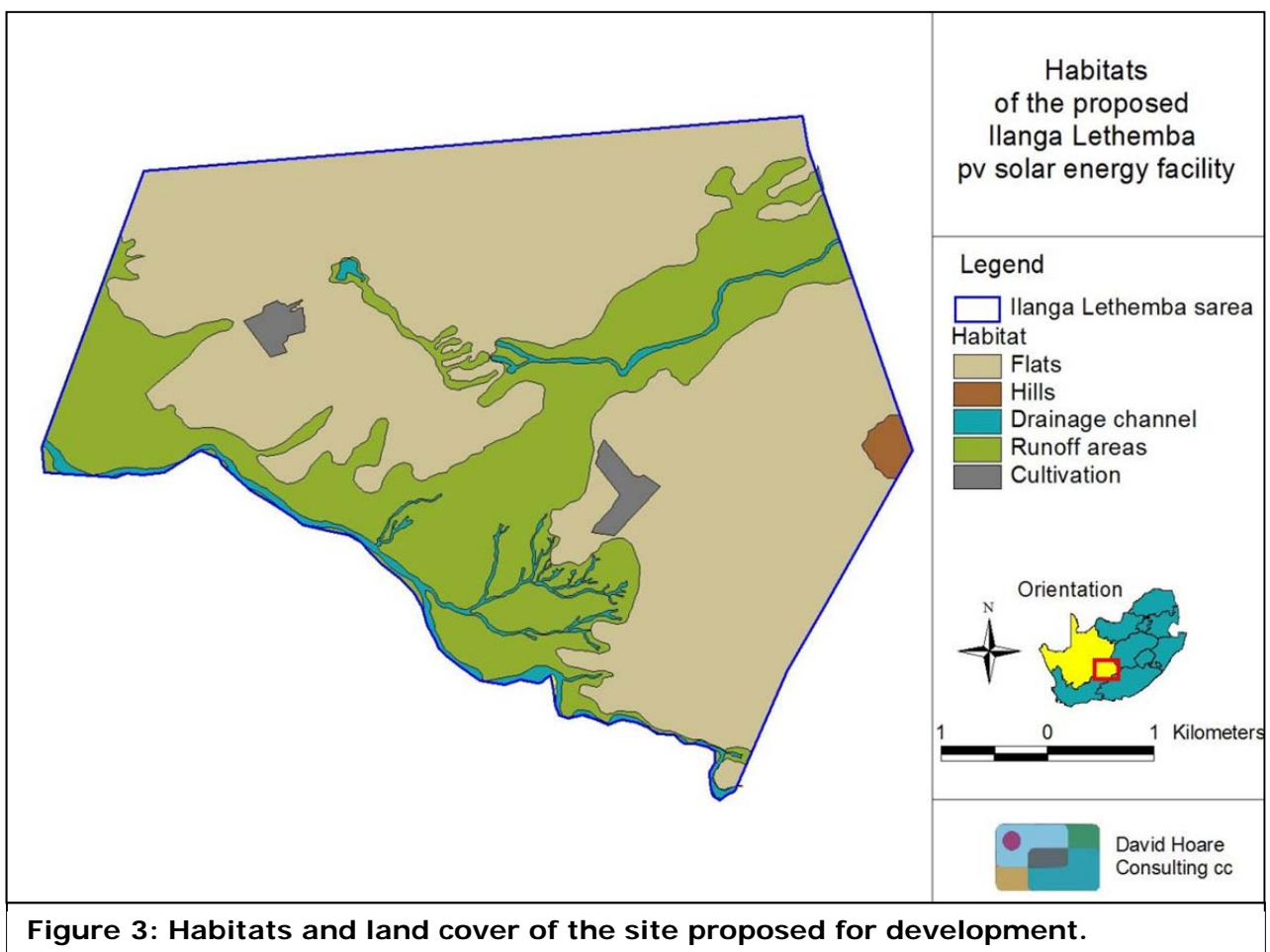
Climate

The climate is arid to semi-arid. Rainfall occurs from November to March, but peaks in mid- to late summer (February / March). Mean annual rainfall is 275 mm per year. All areas with less than 400 mm rainfall are considered to be arid. The study area can therefore be considered to be arid.

Landuse and landcover of the study area

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that the entire site consists of natural vegetation. This is largely confirmed from 1:50 000 topo-cadastral maps and Google imagery of the study area, both of which indicate small areas of cultivation within the site (see Figure 3). Aerial imagery indicates that the north-western part of the site, close to the main road, is visibly degraded in places.

It is probable that livestock farming has affected the vegetation of the study area to some degree. This area of the country consists primarily of farms used as rangeland for commercial livestock production. Commercial farming systems are characterised by land stocked at economically sustainable levels. These regions have been commercially farmed as stock ranches for close to 100 years. Degradation of vegetation has been blamed on high stocking rates of domestic livestock in commercial farming areas. The study area is no exception and degradation due to overgrazing is possible. This is especially problematic in arid regions where vegetation recovery from defoliation is slow and erosion of substrates happens easily under conditions of reduced vegetation cover.



Broad vegetation types of the region

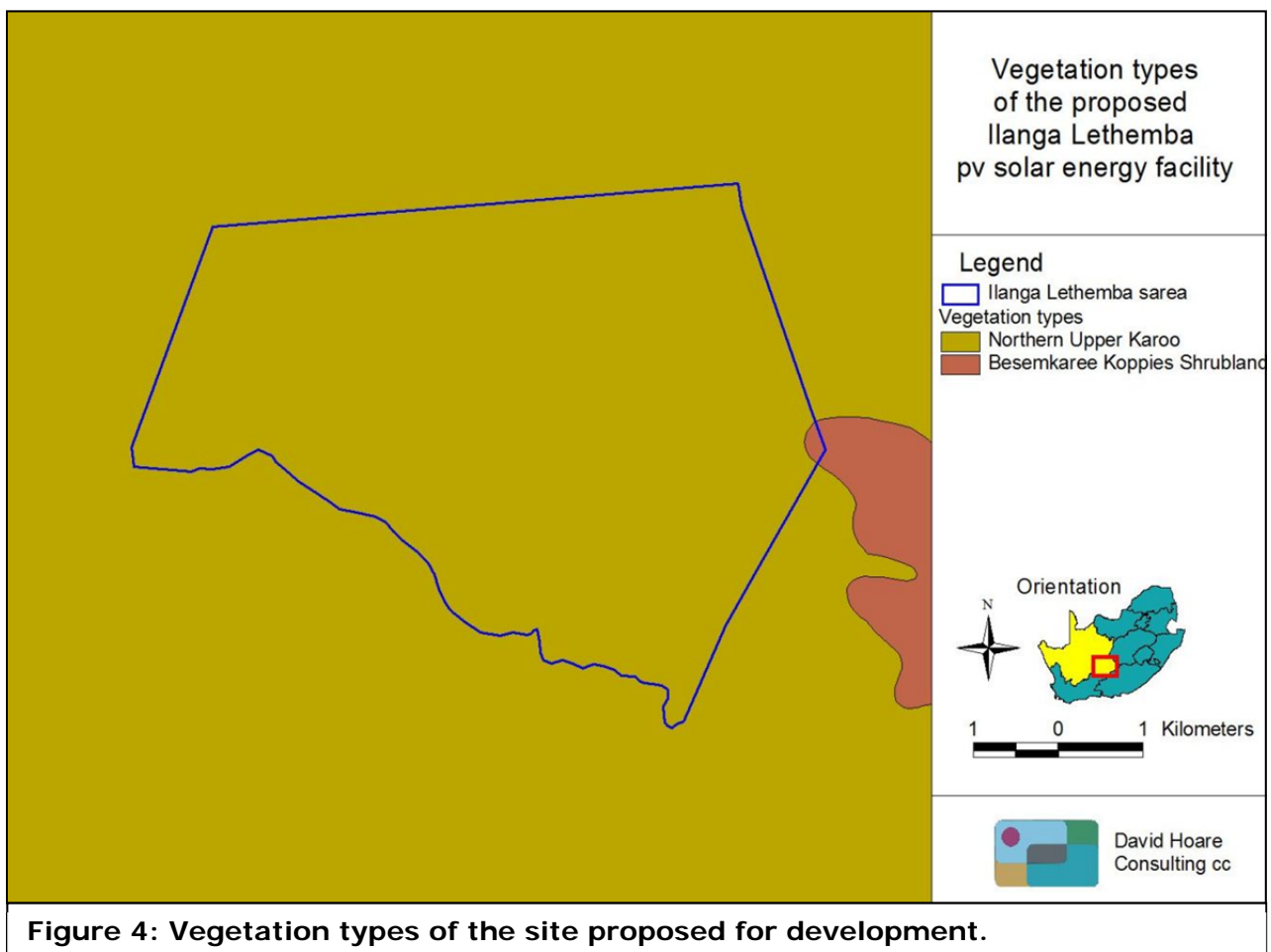
The study area falls within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006). This map shows two vegetation types occurring within the study site, namely Northern Upper Karoo and Besemkaree Koppies Shrubland (Figure 4). These two vegetation types are described in more detail below.

Northern Upper Karoo

This vegetation type occurs in the northern parts of the Upper Karoo Plateau, with its southern extent ending near De Aar. It is a shrubland dominated by dwarf karoo shrubs, grasses and some low trees, including *Acacia mellifera* subsp. *detinens* (Mucina *et al.* 2006). There are five known endemics in this vegetation (Mucina *et al.* 2006), namely the succulent shrubs, *Lithops hookeri* and *Stomatium pluridens*, the low shrubs, *Atriplex spongiosa* and *Galenia exigua* and the herb, *Manulea deserticola*. At a national scale this vegetation type has been transformed only a small amount (approximately 4%) and none is conserved; it is considered to be a Least Threatened vegetation type (Mucina *et al.* 2006).

Besemkaree Koppies Shrubland

This vegetation occurs on the slopes of koppies, buttes and tafelbergs of the extensive Eastern Upper Karoo from Richmond and Middelburg to the Orange River (Mucina *et al.* 2006). It is a two-layered karroid shrubland. The lower (closed canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses. The upper (loose canopy) layer is dominated by tall shrubs, namely *Rhus erosa*, *Rhus burchellii*, *Rhus*



ciliata, *Euclea crispa* subsp. *ovata*, *Diospyros austro-africana* and *Olea europea* subsp. *africana*. This vegetation type is considered to be Least Threatened with about 3% transformed and 5% conserved of a target of 28%.

Conservation status of broad vegetation types

On the basis of a recently established 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 1, 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).

Both of the vegetation types occurring in the study area (Table 2) are classified as Least Threatened (Driver *et al.* 2005; Mucina *et al.*, 2006).

Table 2: Conservation status of different vegetation types occurring in the study area, according to Driver *et al.* 2005 and Mucina *et al.* 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	Draft Ecosystem List (NEMBA)
Northern Upper Karoo	21	0	4	Least Threatened	Not listed
Besemkaree Koppies Shrubland	28	5	3	Least Threatened	Not listed

Critical Biodiversity Areas have been identified for all municipal areas of the Northern Cape Province and are published on the SANBI website (bgis.sanbi.org). These maps identify no areas of concern in the current study area. This is consistent with patterns identified from other sources within the current scoping document.

Red List plant species of the study area

Lists of plant species of conservation concern previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed. There is one species on this list, *Protea subvestita*, which is listed as Vulnerable (see Table 3 for explanation of categories). This species occurs along the southern and eastern Great Escarpment of the country in montane habitats, particularly highland grassland and fynbos. The record from the adjacent grid is considered to be incorrect and it is considered highly unlikely that this species occurs anywhere near to the site. There are, therefore, no threatened or near threatened plant species that are considered likely to occur on site.

Table 3: Explanation of IUCN Ver. 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
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

Red List animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 2. Those vertebrate species with a geographical distribution that includes the study area, and habitat preference that includes habitats available in the study area are discussed further.

There is one mammal species of low conservation concern that could occur in available habitats in the study area. This is a species classified nationally as near threatened (NT), but globally as Least Concern, Geoffroy's Horseshoe Bat. This is a cave-dwelling species and, based on aerial imagery and a site-visit, it was determined that there are no caves, rock crevices or other suitable roosting habitats on site.

There are three threatened bird species (all VU) and three Near Threatened bird species that have a medium to high probability of utilising available habitats in the study area, either for foraging or breeding. The species most likely to use parts of the site for breeding is Ludwig's Bustard. The Martial Eagle, Lesser Kestrel, Blue Korhaan, Secretarybird and Lanner Falcon may also use the site or parts of the site for foraging.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on site. This species is classified as Least Concern globally and Near threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. No highly suitable habitat for this species occurs on site. In addition, the landowner has no memory of ever seeing bullfrogs on site or nearby.

There is one reptile species of conservation concern that has a distribution that includes the study area, the Karoo Padloper. This species occurs widely in the southern parts of the Nama Karoo, including Britstown to the west of De Aar. It occurs in rocky or stony areas, often occurring on ridges or plateaus, which do not occur on site. Important habitat is horizontal rock crevices, which may be found to the east of the site, but not on the site itself. It is therefore considered unlikely that this species would be found on site.

The threatened species of concern for the site are therefore as follows:

- Ludwig's Bustard.

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. The only one that has a geographical distribution that includes the study area is *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi). *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 does not occur anywhere on site.

Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that could (a) possibly have high conservation value or that (b) may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 5 in red. An explanation of the different sensitivity classes is given in Table 4.

Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. The information provided in the preceding sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. Relatively fine-scale mapping was used to provide

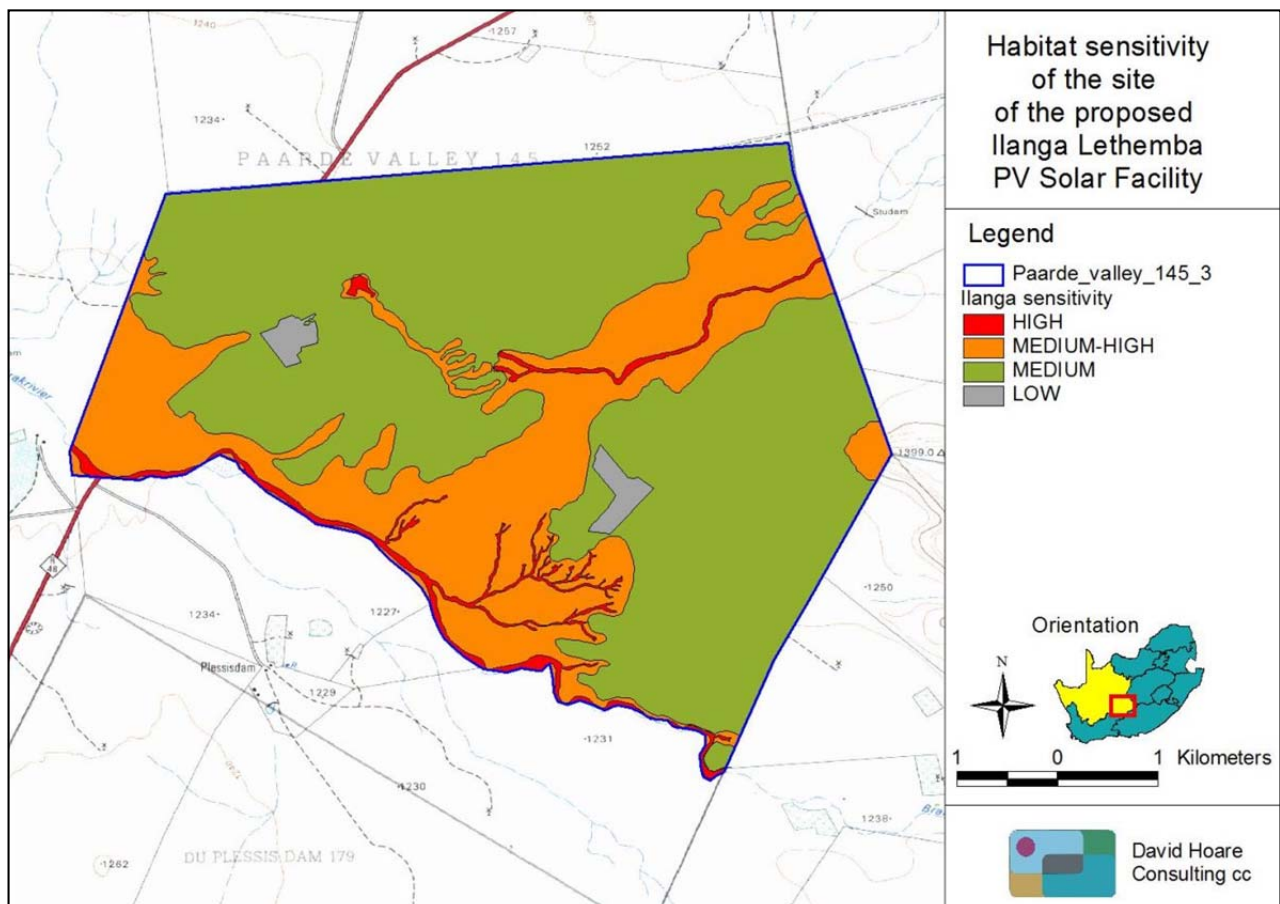


Figure 5: Potentially sensitive areas of the study area.

information on the location of sensitive features.

Table 4: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	<p>Indigenous natural areas that are highly positive for <u>any</u> of the following:</p> <ul style="list-style-type: none"> • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • <u>Protected</u> 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) <p>And may also be positive for the following:</p> <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique ecosystems) • <u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). 	<ul style="list-style-type: none"> • 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	<p>Indigenous natural areas that are positive for any of the following:</p> <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>moderate/high</u> species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • <u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age). • <u>Moderate</u> conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • <u>Moderate to high</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). <p>And may also be positive for the following:</p> <ul style="list-style-type: none"> • <u>Protected</u> habitats (areas protected according to national / provincial 	<ul style="list-style-type: none"> • 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.

	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)	<ul style="list-style-type: none"> • Ecosystem providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above, but not a combination of factors.	<ul style="list-style-type: none"> • 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 <u>ecologically functional</u> .	
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	
LOW	No natural habitat remaining.	

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.
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.
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.

There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. Non-perennial rivers and drainage lines: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;

2. Potential occurrence of populations of conservation concern, including Red List fauna, and protected trees, that have been evaluated as having a high chance of occurring within natural habitats within the study area;

These factors have been taken into account in evaluating sensitivity within the study area. A map of areas of different sensitivity is shown in Figure 5. The sensitivity classification for the site is as follows:

1. HIGH: (i) All of the drainage lines on site are classified as having high sensitivity (see Table 4 and Figure 5). They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide high value ecosystem goods and services.
2. MEDIUM-HIGH: (i) Runoff areas, i.e. areas that are hydrologically important are classified as having MEDIUM-HIGH sensitivity (see Table 4 and Figure 5). (ii) The hill in the south-eastern corner of the site is also classified as having MEDIUM-HIGH sensitivity.
3. MEDIUM: Remaining natural areas are classified as having MEDIUM sensitivity (see Table 4 and Figure 5). As per Table 4, these are areas of indigenous natural vegetation in which no features of particular concern are located.
4. LOW: Areas where no natural vegetation occurs is classified as having low sensitivity (see Table 4 and Figure 5). This includes cultivated lands, previously cultivated areas with secondary vegetation, areas dominated by alien trees, and areas of buildings, roads and bare ground.

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.

Legislation

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

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."

Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997

The ECA states that:

Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of inter alia the following factors:

- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

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

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 are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

In terms of Section 57 of the National Environmental Management: Biodiversity Act (Act No 10 of 2004), "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. The Minister may, by notice in the Gazette, prohibit the carrying out of any activity (a) which is of a nature that may negatively impact on the survival of a listed threatened or protected species; and (b) which is specified in the notice."

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 Water Act

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.

Northern Cape Nature Conservation Act, No. 9 of 2009

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:

- Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;
- Aquatic habitats may not be destroyed or damaged;
- 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.

DESCRIPTION OF INFRASTRUCTURE

The position of the proposed infrastructure within the study area is indicated in Figure 6. This shows 4 PV panel arrays grouped into two areas (blue areas in Figure 6). Each solar array will produce 75 MW of power. These will be linked by internal access roads, one to the northern two arrays and one to the south-eastern two arrays. Overhead powerlines will carry power from the PV panel arrays to a central substation (22kV powerlines) and from there an existing 132 kV powerline will evacuate the electricity to the Hydra substation. . The proposed 22kV overhead powerlines will be located next to and parallel to the existing Eskom powerline.

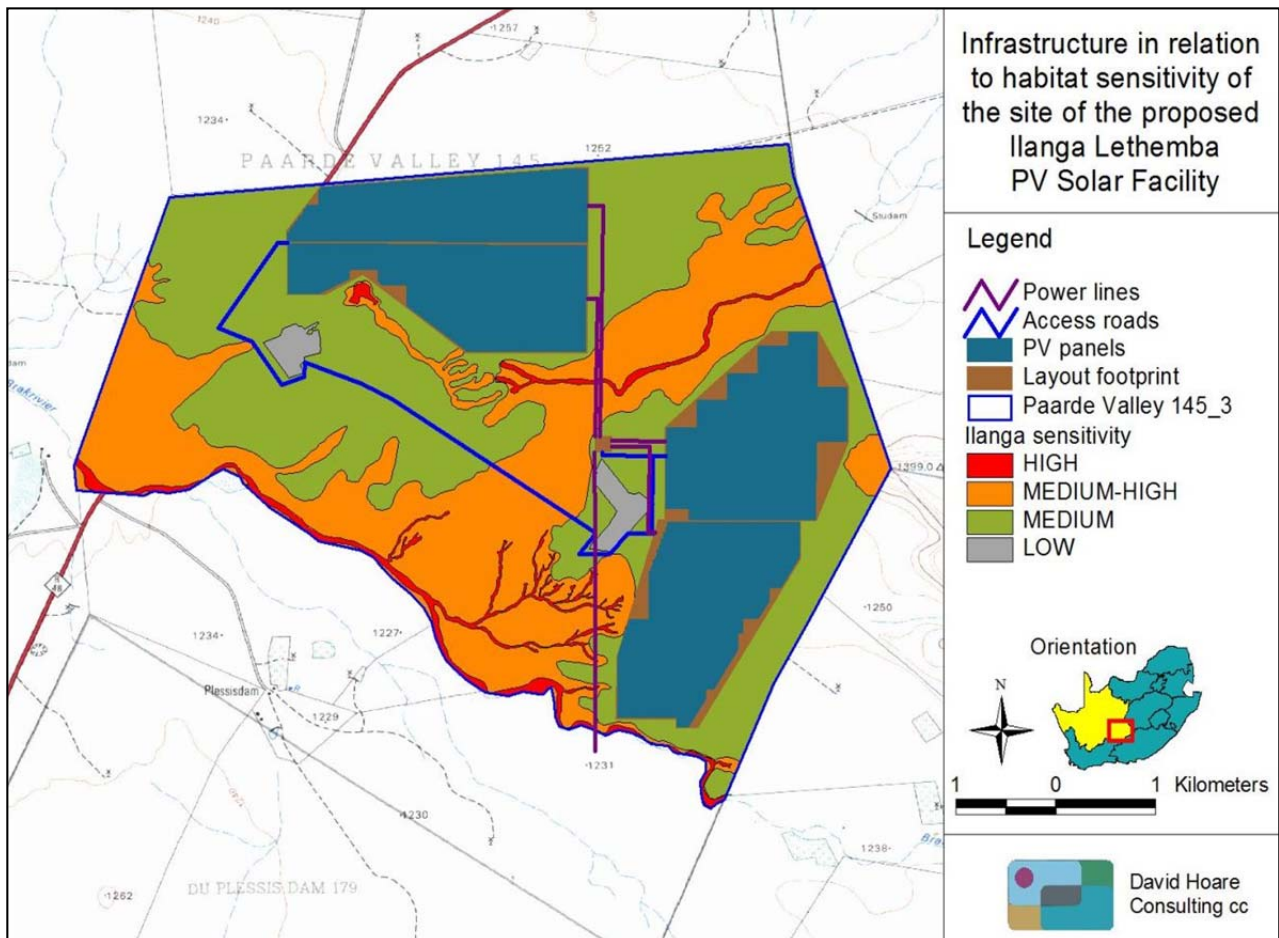


Figure 6: Proposed infrastructure position in the study area.

IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

Potential issues relevant to potential 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 forest, fynbos 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 project 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.

A number of direct risks to ecosystems that would result from **construction** of the proposed solar energy facility are as follows:

- Clearing of land for construction.
- Construction of access roads.
- Placement of power lines, cables and water pipelines (if applicable).
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

There are also risks associated with **operation** of the proposed facility, as follows:

- Maintenance of surrounding vegetation as part of management of the facility.

Description of potential impacts

Major potential impacts are described briefly below. These are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of solar energy facilities on the ecological environment. The major expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual organisms.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Nature: Construction of infrastructure will lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). The general condition of the vegetation on site can only be assessed during the field survey to be undertaken during the EIA phase. Consequences of the potential impact of loss of indigenous natural vegetation occurring may include:

1. negative change in conservation status of habitat (Driver et al. 2005);
2. increased vulnerability of remaining portions to future disturbance;
3. general loss of habitat for sensitive species;
4. loss in variation within sensitive habitats due to loss of portions of it;
5. general reduction in biodiversity;
6. increased fragmentation (depending on location of impact);
7. disturbance to processes maintaining biodiversity and ecosystem goods and services; and
8. loss of ecosystem goods and services.

It has been established that the vegetation types on site are Northern Upper Karoo and Besemkaree Koppies Shrubland, which are classified as Least Threatened. The vegetation on site is in moderate condition. The species composition and structure has been affected by overgrazing.

Impact 2: Impacts on threatened plants

Nature: Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species.

There are no threatened plant species likely to occur on site. This potential impact is therefore not applicable to the current proposal.

Impact 3: Impacts on protected tree species

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(l)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section 15(1) of the National Forests Act, 1998 “no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated”.

One species has a geographic distribution that includes the study area, *Boscia albitrunca*. This species does not occur in any part of the study area. This potential impact is therefore not applicable to the current proposal.

Impact 4: Impacts on threatened animals

Nature: Threatened animal species are indirectly affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction. Animals are generally mobile and, in most cases, can move away from a potential threat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

It has been evaluated that there is one threatened bird species that could occur in available habitats in the proposed study area. This is Ludwig’s Bustard, listed as Vulnerable (VU).

Impact 5: Impacts on drainage areas

Nature: The site is in a very arid area. There are no wetlands on site, but there are clearly a number of dry river beds and drainage areas. According to the National Water Act, the drainage lines / watercourses are classified as water resources. Construction may lead to some direct or indirect loss of or damage to some of these areas or changes to the catchment of these areas. This may affect the hydrology of the landscape or lead to loss of habitat for species that depend on this habitat type. Dry river beds and drainage lines may be an important habitat for animal species in the study area.

There is one main watercourse along the southern boundary of the site and some minor drainage lines feeding into this. The overhead powerlines are the only infrastructure that coincides with these watercourses.

Impact 6: Establishment and spread of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes *inter alia* high disturbance (such as clearing for construction activities) and negative grazing practices (Zachariades *et al.* 2005). Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al.* 2003). Consequences of this may include:

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. fragmentation of sensitive habitats;
8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

It is not known to what extent the site contains alien plants. Potential weeds with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Prosopis velutina*, *Atriplex numularia*, and *Nicotiana glauca*. The shrub, *Prosopis glandulosa*, is potentially the most problematic and is widely distributed in the Northern Upper Karoo vegetation type. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions and has been recorded near to the site. The only species found on site (away from the farm residence) are *Salix babylonica* (one dead tree) and *Datura ferox* (around a livestock waterhole where extra water and nutrients are found). There is therefore the potential for alien plants to spread or invade following disturbance on site, but it is considered unlikely considering that the site has been farmed for many years without alien problems arising.

ASSESSMENT OF IMPACTS

Impacts are assessed for each component of infrastructure for the proposed solar energy facility. There is therefore a separate assessment for the photovoltaic plant facility, overhead power lines and access roads.

PV plant

There are four PV arrays of 75 MW arranged in two main areas (Figure 6).

Impact 1: Loss or fragmentation of indigenous natural vegetation

The vegetation types on site are Northern Upper Karoo and Besemkaree Koppies Shrubland, which are classified as Least Threatened. Terrestrial vegetation on site is therefore not considered to be of high conservation value.

Extent: The impact will occur at the site of the proposed pv power plant. The construction of the pv plant potentially affects a moderate proportion of natural vegetation on site and is scored as local. The vegetation in this area is in moderately poor condition due to long-term overgrazing.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the pv power plant.

<i>Nature: Loss of habitat within indigenous natural vegetation types</i>		
	Without mitigation	With mitigation
<i>Extent</i>	local (1)	local (1)
<i>Duration</i>	permanent (5)	permanent (5)
<i>Magnitude</i>	Low (4)	low (3)
<i>Probability</i>	definite (5)	definite (5)
<i>Significance</i>	medium (50)	medium (45)
<i>Status (positive or negative)</i>	negative	negative
<i>Reversibility</i>	Not reversible	Not reversible
<i>Irreplaceable loss of resources?</i>	Yes	Yes
<i>Can impacts be mitigated?</i>	Only to a small extent	
<i>Mitigation:</i> Avoid unnecessary impacts on natural vegetation surrounding the pv power plant. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
<i>Cumulative impacts:</i> Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact. Although other PV power plants and wind energy facilities are proposed in the De Aar vicinity, the overall cumulative impact on vegetation is considered to be small in comparison to the extent of		

affected vegetation types.

Residual Impacts:
Some loss of this vegetation type will definitely occur.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of habitat for threatened animals

It has been evaluated that there is one threatened bird species that could occur in available habitats in the proposed study area. This is Ludwig’s Bustard, listed as Vulnerable (VU). This species is seldom found very close to human habitation. The site is a few kilometres from De Aar and there is a risk of it occurring on site.

Extent: The impact will occur at the site of the proposed pv power plant. It is scored as local.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be permanent.

Magnitude: Impacts could result in a slight impact on population processes, which is scored as low.

Probability: It is probable that there will be an impact on the species.

Mitigation measures: Unnecessary impacts on terrestrial habitats outside the footprint of the infrastructure and drainage lines should be avoided. No specific mitigation measures are further required for this species for this infrastructure component.

Nature: Impacts on individuals of threatened animal species (Riverine Rabbit)		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (3)	small (2)
Probability	probable (3)	probable (3)
Significance	low (27)	low (24)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Avoid impacts on natural habitats outside the footprint of the proposed infrastructure.		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to watercourses) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Establishment and spread of declared weeds and alien invader plants

Potential weeds with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Prosopis velutina*, *Atriplex numularia*, and *Nicotiana glauca*. The shrub, *Prosopis glandulosa*, is potentially the most problematic. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions and has been recorded near to the site. There is therefore the potential for alien plants to spread or invade following disturbance on site.

Extent: The impact will occur at the site of the proposed pv plant, but could potentially spread into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility, which will be 20 years or more. This is long-term.

Magnitude: The impact is likely to be small and will not result in a significant impact on processes.

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	With mitigation
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	long-term (4)	long-term (4)
Magnitude	small (3)	small (2)
Probability	probable (4)	improbable (2)
Significance	medium (36)	low (16)
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation:		
<ul style="list-style-type: none"> (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established 		
Cumulative impacts:		

Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Overhead powerlines

Proposed overhead powerlines (22 kV) will be adjacent to existing Eskom overhead powerlines and will run in a north-south direction through the site (Figure 6).

Impact 1: Loss or fragmentation of indigenous natural vegetation

The vegetation types on site are Northern Upper Karoo and Besemkaree Koppies Shrubland, which are classified as Least Threatened. Terrestrial vegetation on site is therefore not considered to be of high conservation value.

Extent: The impact will occur at the site of the proposed overhead powerlines. The construction of the powerline potentially affects a very small proportion of natural vegetation on site and is scored as local. The vegetation in this area is in moderately poor condition due to long-term overgrazing.

Duration: The impact will occur during construction. Indications from existing powerlines on site is that the base of tower structures becomes revegetated. The impact will therefore be medium-term.

Magnitude: At a local scale, the impact is likely to result in no impact on processes, which is scored as small.

Probability: According to the provided layout, it is probable that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the tower structures and/or the servitude of the powerline.
2. Service roads in the servitude must be properly maintained to avoid erosion impacts.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	Medium-term (2)	Medium-term (2)
Magnitude	small (3)	small (2)
Probability	probable (3)	probable (3)
Significance	low (18)	low (15)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation:		
(1) Avoid unnecessary impacts on natural vegetation surrounding the powerline servitude. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		

(2) Service roads must be properly maintained to avoid erosion impacts.
Cumulative impacts: Soil erosion may lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: None.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Impacts on threatened animals

It has been evaluated that there is one threatened bird species that could occur in available habitats in the proposed study area. This is Ludwig’s Bustard, listed as Vulnerable (VU). This species is seldom found very close to human habitation. The site is a few kilometres from De Aar and there is a risk of it occurring on site. Bustards are particularly vulnerable to being affected by overhead powerlines. However, there is an existing overhead powerline along the same alignment as that proposed for this study. The impact will therefore not be new, but may be a slight increase in an existing impact.

Extent: The impact will occur at the site of the proposed powerline, but could affect the surrounding population processes. It is scored as local and surroundings.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be long-term.

Magnitude: The impact could result in a slight impact on population processes, which is scored as small.

Probability: No individuals of this species were found on site, but it is expected that they could be found on site. It is therefore scored as probable that the impact will occur on the species.

Mitigation measures: Place devices on powerlines to make them more visible to flying birds.

Nature: Impacts on individuals of threatened animal species (Riverine Rabbit)		
	Without mitigation	With mitigation
Extent	Local & surroundings (2)	Local & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	small (3)	small (2)
Probability	probable (3)	probable (3)
Significance	low (27)	low (24)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (2) Place devices on powerlines to make them more visible to flying birds.		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions, damage to wetlands) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 5: Damage to wetlands/watercourses

There are a number of dry stream beds and drainage areas on site, of which some are within the servitude of the proposed powerline. According to the National Water Act, these are classified as wetlands or water resources. Construction may lead to some direct or indirect loss of or damage to these affected areas or changes to the catchment of these areas.

Extent: The impact will occur at the site of the proposed powerline, but could have downstream impacts. The extent of the potential impact is therefore on the site and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a long-term effect.

Magnitude: In the long-term, impacts could result in processes continuing but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is likely that the impact will occur.

Mitigation measures:

1. Place tower structures a minimum of 50 m from watercourses.
2. Service roads in the servitude must be properly maintained to avoid erosion impacts.
3. If not, there is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	With mitigation
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Small (2)
Probability	Probable (3)	Improbable (3)
Significance	medium (36)	low (24)
Status (positive or negative)	negative	negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Place tower structures a minimum of 50 m from watercourses. (2) Service roads in the servitude must be properly maintained to avoid erosion impacts. (3) If not, there is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.		
Cumulative impacts: Soil erosion, alien invasions, may all lead to additional impacts on watercourse habitats that will exacerbate this impact.		
Residual Impacts: None.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Establishment and spread of declared weeds and alien invader plants

Potential weeds with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Prosopis velutina*, *Atriplex numularia*, and *Nicotiana glauca*. The shrub, *Prosopis glandulosa*, is potentially the most problematic. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions and has been recorded near to the site. There is therefore the potential for alien plants to spread or invade following disturbance on site.

Extent: The impact will occur at the site of the proposed powerline, but could potentially spread into the surrounding landscape, depending on the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility, which will be 20 years or more. This is long-term.

Magnitude: The impact is likely to be small and will not result in a significant impact on processes.

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	With mitigation
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	long-term (4)	long-term (4)
Magnitude	small (3)	small (2)
Probability	probable (4)	improbable (2)
Significance	medium (36)	low (16)
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation:		
<ul style="list-style-type: none"> (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established 		
Cumulative impacts:		

Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:

Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Access roads

There is a single access road to the eastern side of the site where two of the pv arrays are located and another access road to the northern part of the site where the other two pv arrays are located (Figure 6). The northern access road is very short and the eastern access road is along an existing track to a cultivated land in that part of the site.

Impact 1: Loss or fragmentation of indigenous natural vegetation

The vegetation types on site are Northern Upper Karoo and Besemkaree Koppies Shrubland, which are classified as Least Threatened. Terrestrial vegetation on site is therefore not considered to be of high conservation value.

Extent: The impact will occur at the site of the proposed access roads. The construction of the access roads potentially affects a very small proportion of natural vegetation on site and is scored as local. The vegetation in this area is in moderately poor condition due to long-term overgrazing.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in no impact on processes, which is scored as small.

Probability: According to the provided layout, which indicates that the main access road will occur in the position of an existing track, it is probable that the impact will occur.

Mitigation measures:

- Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint/servitude of the access road.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (2)	small (1)
Probability	probable (3)	probable (3)
Significance	low (24)	low (21)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Only to a small extent	
Mitigation:		
(3) Avoid unnecessary impacts on natural vegetation surrounding the access roads. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
Cumulative impacts:		

None.

Residual Impacts:
Some loss of this vegetation type is likely to occur, but it is a very small proportion of the site.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of habitat for threatened animals

It has been evaluated that there is one threatened bird species that could occur in available habitats in the proposed study area. This is Ludwig’s Bustard, listed as Vulnerable (VU). This species is seldom found very close to human habitation. The site is a few kilometres from De Aar and there is a risk of it occurring on site.

Extent: The impact will occur at the site of the proposed access road. It is scored as local.

Duration: The impact will occur during construction. There is an existing track along the eastern access road and the northern access road is short to the point of being insignificant. The duration of the impact is therefore during construction only, which is scored as short-term.

Magnitude: Impacts are likely to result in no impact on population processes, which is scored as small.

Probability: It is highly improbable that there will be an impact on the species due to construction of the access roads.

Mitigation measures: Unnecessary impacts on terrestrial habitats outside the footprint of the infrastructure and drainage lines should be avoided. No specific mitigation measures are further required for this species for this infrastructure component.

Nature: Impacts on individuals of threatened animal species (Riverine Rabbit)		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	small (3)	small (2)
Probability	improbable (2)	improbable (2)
Significance	low (10)	low (8)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Avoid impacts on natural habitats outside the footprint of the proposed infrastructure.		
Cumulative impacts: None		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Establishment and spread of declared weeds and alien invader plants

Potential weeds with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Prosopis velutina*, *Atriplex numularia*, and *Nicotiana glauca*. The shrub, *Prosopis glandulosa*, is potentially the most problematic. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions and has been recorded near to the site. There is therefore the potential for alien plants to spread or invade following disturbance on site.

Extent: The impact will occur at the site of the proposed access road, but could potentially spread into the surrounding landscape, depending on the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility, which will be 20 years or more. This is long-term.

Magnitude: The impact is likely to be small and will not result in a significant impact on processes.

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	With mitigation
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	long-term (4)	long-term (4)
Magnitude	small (3)	small (2)
Probability	probable (4)	improbable (2)
Significance	medium (36)	low (16)
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation:		
<ul style="list-style-type: none"> (6) keep disturbance of indigenous vegetation to a minimum (7) rehabilitate disturbed areas as quickly as possible (8) do not translocate soil stockpiles from areas with alien plants (9) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (10) establish an ongoing monitoring programme to detect and quantify any aliens that may become established 		
Cumulative impacts:		
Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		

Residual Impacts:

Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

DISCUSSION AND CONCLUSIONS

There are two major vegetation types that occur in the study area, namely Northern Upper Karoo and Besemkaree Koppies Shrubland. Both of these vegetation types are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation across most of the site is therefore not considered to have high conservation status.

Potential factors that may lead to parts of the study area having elevated ecological sensitivity are the presence of dry watercourses on site and the potential presence of one animal species of conservation concern.

Watercourses and drainage lines represent natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Wetlands (including drainage lines) are protected under national legislation (National Water Act). Any impacts on these areas would require a permit from the National Department of Water Affairs.

There is one protected tree species that has a potential of occurring in the area, *Boscia albitrunca* (shepherd's tree). It does not occur on site.

There are no threatened or near threatened plant species that have a high likelihood of occurring in available habitats in the study area.

There are a number of animal species of conservation concern that may occur in habitats within the study area. This includes three threatened bird species, Ludwig's Bustard, Martial Eagle and Lesser Kestrel (all classified as VU) of which one species may use the site for breeding purposes (Ludwig's Bustard) and three near threatened bird species that may be found on site (Secretarybird, Lanner Falcon and Blue Korhaan). Habitat requirements for these species are provided in the appendices to this report.

One protected amphibian species, the Giant Bullfrog, has a geographical distribution that includes the site. This species is protected according to the National Environmental Management: Biodiversity Act (Act No 10 of 2004). Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. It was evaluated that there was a very low probability of this species occurring on site.

Most of the study area is in a natural condition. There are two small areas of cultivation and some areas that appear on aerial imagery to be degraded. The vegetation is not in pristine condition and has been affected by overgrazing by domestic livestock over long periods of time.

A risk assessment was undertaken which identified five main potential negative impacts on the ecological receiving environment. The identified potential impacts are the following:

1. Impacts on indigenous natural vegetation
2. Impacts on habitat of threatened animals
3. Impacts on watercourses
4. Establishment and spread of declared weeds and alien invader plants

Impacts were assessed after collection of relevant data in the field. A summary of the significance of impacts before and after mitigation is given in Table 4 below. This shows that the potential impact on natural vegetation by the PV solar arrays is the only impact with a significance of "medium" after mitigation. This significance score is due to the fact that the

impact will be permanent and will definitely occur. All other potential impacts are either "low" or can be reduced to "low" with mitigation.

Recommendations

The following recommendations are made to reduce impacts:

- Powerline tower structures must be positioned outside watercourses.

Table 4: Summary of the significance of impacts for different infrastructure components before and after mitigation.

Impact	PV power plant		Overhead powerlines		Access roads	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
1. vegetation	medium (50)	medium (45)	low (18)	low (15)	low (24)	low (21)
2. threatened animals	low (27)	low (24)	low (27)	low (24)	low (10)	low (8)
3. watercourses	zero (0)	zero (0)	medium (36)	low (24)	zero (0)	zero (0)
4. alien plants	medium (36)	low (16)	medium (36)	low (16)	medium (36)	low (16)

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

MANAGEMENT PLAN

Control measures are only proposed for those impacts where mitigation measures are proposed to reduce the significance of impacts, i.e. some impacts are of low significance and thus no mitigation measures are proposed or no mitigation measures are possible or required.

Impacts on threatened animals

OBJECTIVE: Limit impacts on threatened animals		
Project component/s	Any infrastructure or activity that will result in disturbance to habitat suitable for threatened animal species or to populations of threatened animal species	
Potential Impact	Loss of habitat suitable for populations of threatened animal species or direct loss of individuals of threatened animals	
Activity/risk source	Construction, operation, environmental management	
Mitigation: Target/Objective	Target: no significant impacts on identified suitable habitat or populations of threatened animal species within project control area Time period: construction, operation	
Mitigation: Action/control	Responsibility	Timeframe
(1) Ensure that construction impacts are contained within the footprint of the proposed infrastructure and do not spread into surrounding natural areas. (2) Place devices on overhead powerlines to make them more visible to birds.	Construction team, management (environmental officer),	construction, operation
Performance Indicator	No significant loss of individuals of threatened animal species	
Monitoring	<ul style="list-style-type: none"> Collision mortality of Ludwig's Bustard with overhead powerlines. 	

Impacts due to alien invasive plants

OBJECTIVE: Control alien invasive plants

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no alien plants within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid creating conditions in which alien plants may become established: <ol style="list-style-type: none"> a. keep disturbance of indigenous vegetation to a minimum b. rehabilitate disturbed areas as quickly as possible c. do not import soil from areas with alien plants (2) establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act) (3) immediately control any alien plants that become established using registered control methods	Construction team, management (environmental officer),	construction, operation

Performance Indicator	For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	<ul style="list-style-type: none"> • Ongoing monitoring of area by environmental control officer during construction • Ongoing monitoring of area by environmental manager during operation • Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework.

Impacts on indigenous natural vegetation

OBJECTIVE: Control loss of indigenous natural vegetation

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Loss of indigenous natural vegetation due to construction activities
Activity/risk source	Construction
Mitigation: Target/Objective	Target: minimal loss of natural vegetation Time period: construction

Mitigation: Action/control	Responsibility	Timeframe
(1) The construction impacts must be contained to the footprint of the infrastructure. (2) Rehabilitate any disturbed areas immediately to stabilize landscapes.	Construction team, management (environmental officer),	construction

Performance Indicator	No loss of natural vegetation outside planned footprint of infrastructure.
Monitoring	<ul style="list-style-type: none"> None

Impacts on watercourses

OBJECTIVE: Limit damage to watercourses

Project component/s	Any infrastructure or activity that will result in disturbance to wetlands
Potential Impact	Damage to watercourses areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the watercourse as a natural system
Activity/risk source	Construction, operation
Mitigation: Target/Objective	Target: no damage to watercourses within project area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) Ensure that powerline tower structures are placed outside watercourses (a minimum of 50 m away)	Construction team, management, environmental control officer	Planning, construction

Performance Indicator	No permanent infrastructure within watercourses
Monitoring	<ul style="list-style-type: none"> None

REFERENCES:

- ACOCKS, J.P.H. 1988. Veld types of South Africa (3rd edn.). *Mem. Bot. Surv. S. Afr.* No 28. Government printer, Pretoria.
- BARNES, K.N. (ed.) (2000) The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.
- BRANCH, W.R. (1988) South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.
- DENT, M.C., LYNCH, S.D. & SCHULZE, R.E. 1989. Mapping mean annual and other rainfall statistics in southern Africa. Department of Agricultural Engineering, University of Natal. ACRU Report No. 27. Massachusetts: Clark University.
- DRIVER, A., MAZE, K., ROUGET, M., LOMBARD, A.T., NEL, J., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K and STRAUSS, T. 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. *Strelitzia* 17. South African National Biodiversity Institute, Pretoria.
- DU PREEZ, L. & CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Random House Struik, Cape Town.
- FAIRBANKS, D.H.K., THOMPSON, M.W., VINK, D.E., NEWBY, T.S., VAN DEN BERG, H.M & EVERARD, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. *S.Afr.J. Science* 96: 69-82.
- FRIEDMANN, Y. & DALY, B. (eds.) 2004. The Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.
- GERMISHUIZEN, G. & MEYER, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. *Strelitzia* 14. National Botanical Institute, Pretoria.
- GERMISHUIZEN, G., MEYER, N.L., STEENKAMP, Y and KEITH, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.
- GROOMBRIDGE, B. (ed.) 1994. *1994 IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland.
- HARTMANN, M.O. 1988. The soils of the Eastern Cape. In: M.N. Bruton & F.W. Gess. (ed.) *Towards an environmental plan for the Eastern Cape*. Rhodes University, Grahamstown.
- HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book - Butterflies. *South African National Scientific Programmes* No. 158, Foundation for Research Development, CSIR, Pretoria.
- IUCN (2001). *IUCN Red Data List categories and criteria: Version 3.1*. IUCN Species Survival Commission: Gland, Switzerland.
- KOPKE, D. 1988. The climate of the Eastern Cape. In: M.N. Bruton & F.W. Gess. (ed.) *Towards an environmental plan for the Eastern Cape*. Rhodes University, Grahamstown.
- LOW, A.B. & REBELO, A.G. (1998) *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.
- MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. *S. Afr. J. Agric. Extension*, 3(3): 1-4.
- MILLS, G. & HES, L. 1997. *The complete book of southern African mammals*. Struik Publishers, Cape Town.
- MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. and KLOEPFER, D. (eds.) 2004. *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series #9. Smithsonian Institution, Washington, DC.
- MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1–2.

- MUCINA, L. AND RUTHERFORD, M.C. (editors) (2006). Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. *Strelitzia* 19, National Botanical Institute, Pretoria.
- 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.
- MUCINA, L., RUTHERFORD, M.C. AND POWRIE, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.
- MUCINA, L., RUTHERFORD, M.C., **HOARE, D.B.** & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.
- MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUELLER-DOMBOIS, D. AND ELLENBERG, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.
- PALMER, A.R. 1991. A syntaxonomic and synecological account of the vegetation of the eastern Cape midlands. *S.Afr.J.Bot.* 57: 76-94.
- PASSMORE, N.I. & CARRUTHERS, V.C. (1995) South African Frogs; a complete guide. Southern Book Publishers and Witwatersrand University Press. Johannesburg.
- RUTHERFORD, M.C. & WESTFALL, R.H. (1994). Biomes of southern Africa: an objective categorization. *Memoirs of the Botanical Survey of South Africa* No. 63.
- SCHULZE, B.R. 1984. Climate of South Africa, Part 8, General Survey, WB 28. *South African Weather Bureau* 60. Government Printer, Pretoria.
- VAN WYK, A.E. & SMITH, G.F. 2001. Regions of floristic endemism in southern Africa. Umdaus press, Hatfield.
- WEATHER BUREAU 1996. *Climate data for stations from the Eastern Cape*.
- WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNISO vegetation map of Africa. Natural Resources Research 20. Unesco, Paris.

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

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	Status	Habitat	Likelihood of occurrence on site
PROTEACEAE	Protea subvestita	VU	Found primarily in the eastern and southern Great Escarpment region of South Africa. Montane areas, mostly highland grassland and fynbos. Collection in grid 3024CC was from 1886 - no locality information is provided for this specimen and it is possibly incorrectly linked to this grid (no other records are in similar geographical location or habitat and typical habitat does not match anything found in grid).	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: Threatened vertebrate species with a geographical distribution that includes the current study area.

MAMMALS

Common name	Taxon	Habitat ¹	National status	Global status ²	Likelihood of occurrence
Black rhinoceros	<i>Diceros bicornis bicornis</i>	Wide variety of habitats, but currently only occurs in game reserves.	CR	CR	NONE , only occurs in game reserves
Geoffroy's horseshoe bat	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	MEDIUM , overall geographical distribution includes this area, general habitat is suitable - presence of caves unknown, but improbable.

¹Distribution and national status according to Friedmann & Daly 2004.

²Global status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 14 April 2011.

AMPHIBIANS

Common name	Species	Habitat	Status	Likelihood of occurrence
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	NT ¹ LC ² Protected (NEMBA)	MEDIUM , within known distribution range and suitable habitat may occur on site.

¹Status according to Minter et al. 2004.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 11 September 2010.

REPTILES

Common name	Species	Habitat	Status ³	Likelihood of occurrence
Karoo padloper	<i>Homopus solus</i>	Occurs widely in the southern parts of the Nama Karoo. Rocky or stony areas, often occurring on ridges or plateaus. Important habitat is horizontal rock crevices.	VU	LOW , on edge of known distribution. No suitable habitat on site.

³Distribution according to Alexander & Marais 2007.

⁴Status according to Alexander & Marais 2007.

BIRDS

Common name	Species	Habitat	Status	Importance of site for species
Ludwig's Bustard	<i>Neotis ludwigii</i>	This is a near-endemic to southern Africa, with its range centred on the Nama Karoo and Succulent Karoo biomes. It occurs in western grasslands of the Eastern Cape, but supposedly as a nonbreeding visitor. The most important threat to this species is collisions with overhead powerlines and telephone wires. It inhabits the open plains of the semi-arid Karoo and especially in areas where extensive sheep farming is prevalent. Common resident in study area.	VU ¹ EN ² Protected (NEMBA)	MEDIUM, breeding, HIGH, foraging
Martial Eagle	<i>Polemaetus bellicosus</i>	The Martial Eagle is widespread but uncommon throughout South Africa and neighbouring countries. It tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo and woodland. It relies on large trees (and electricity pylons) to provide nest sites. It is found typically in flat country and is rarer in mountains and forests. One of the main reason it is declining is because of persecution on private land. This species has been recorded from the study area and many surrounding areas. Common resident in study area.	VU ¹ NT ² Protected (NEMBA)	LOW, breeding, MEDIUM, foraging
Lesser Kestrel	<i>Falco naumannii</i>	Open grassveld, mainly on highveld, usually near towns or farms. Common non-breeding migrant in study area.	VU	LOW, breeding,

Common name	Species	Habitat	Status	Importance of site for species
				MEDIUM, foraging
Blue Korhaan	<i>Eupodotis caerulescens</i>	Open grassveld, karoo scrub, cultivated lands. Endemic to South Africa. Common resident in study area.	NT	MEDIUM, breeding, MEDIUM, foraging
Yellow-billed Stork	<i>Mycteria ibis</i>	Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries. Uncommon non-breeding migrant in study area.	NT	LOW, breeding, LOW, foraging
Secretarybird	<i>Sagittarius serpentarius</i>	Widespread across South Africa, occurring in savanna and open grassland from coastal regions to high altitudes, but avoids thick bush and forest. Sensitive to disturbance and high human population numbers - higher numbers usually found in conservation areas. Uncommon resident in study area.	NT	MEDIUM, breeding, MEDIUM, foraging
Lanner Falcon	<i>Falco biarmicus</i>	Widespread species, occurring in Afrotropics, Middle East and western Palearctic. Occurs in mountains or open country from semidesert to woodland and agricultural land; also cities (Durban, Harare). Common resident in study area.	NT	LOW, breeding, MEDIUM, foraging
Peregrine Falcon	<i>Falco peregrinus</i>	Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt pigeons. Uncommon resident or non-breeding migrant in study area.	NT	LOW, breeding, LOW, foraging

¹Status according to Barnes 2000.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org).
Downloaded on 11 September 2010.

Appendix 3: List of protected tree species (National Forests Act).

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

Boscia albitrunca has a geographical distribution that coincides with the study area.

Appendix 4: Checklist of plant species recorded during previous botanical surveys in the study area and surrounds.

(Species from quarter degree grid in which the site is located as well as surrounding grids in which similar vegetation is found)

Allophyllus decipiens
Aptosimum procumbens
Aptosimum spinescens
Arachnioides webbiana subsp. foliosa
Arctotis leiocarpa
Aristida adscensionis
Aristida congesta subsp. barbicollis
Aristida congesta subsp. congesta
Aristida vestita
Asparagus striatus
Asparagus suaveolens
Athanasia minuta subsp. minuta
Atriplex vestita var. appendiculata
Barleria rigida
Bassia salsoloides
Berkheya eriobasis
Brunsvigia radulosa
Bulbostylis humilis
Calobota spinescens
Campylopus robillardae
Cenchrus ciliaris
Chaenostoma halimifolium
Cheilanthes eckloniana
Chloris virgata
Chrysocoma ciliata
Clusia imbricata
Colchicum asteroides
Commelina africana var. africana
Crassula corallina subsp. corallina
Cucumis africanus
Cucumis heptadactylus
Cucumis myriocarpus subsp. leptodermis
Cullen tomentosum
Cyanella lutea
Cynodon incompletus
Daubinya comata
Dianthus micropetalus
Dicoma capensis
Digitaria erianthe
Dimorphotheca cuneata
Dimorphotheca zeyheri
Dipcade viride
Disa pulchra
Empodium elongatum
Enneapogon desvauxii
Enneapogon scaber
Enneapogon scoparius
Eragrostis bergiana
Eragrostis bicolor
Eragrostis chloromelas
Eragrostis curvula
Eragrostis homomalla

Eragrostis lehmanniana var. lehmanniana
Eragrostis nindensis
Eragrostis obtusa
Eragrostis procumbens
*Eragrostis tef
Eragrostis truncata
Erucastrum strigosum
Eulophia foliosa
Euphorbia aequoris
Euphorbia arida
Euphorbia pugniformis
Felicia burkei
Felicia filifolia subsp. filifolia
Felicia muricata subsp. muricata
Fingerhuthia africana
Galenia pubescens
Gazania jurineifolia subsp. jurineifolia
Gazania krebsiana subsp. arctotoides
Geigeria fillifolia
Geigeria ornativa subsp. ornativa
Gisekia pharnacioides var. pharnacioides
Gladiolus dalenii subsp. dalenii
Gladiolus ecklonii
Gladiolus permeabilis subsp. edulis
Gnidia polycephala
Grewia flava
Haworthia venosa subsp. tessellata
Helichrysum asperum var. asperum
Helichrysum dregeanum
Helichrysum micropoides
Helichrysum zeyheri
Heliophila minima
Heliotropium lineare
Hermannia burkei
Hermannia cuneifolia var. cuneifolia
Hermannia erodioides
Hermannia pulchella
Hertia pallens
Heteropogon contortus
Huernia humilis
Hymenophyllum tunbridgense
Hypericum lalandii
Hypertelis salsoloides var. salsoloides
Indigastrum argyraeum
Jamesbrittenia filicaulis
Kniphofia ensifolia subsp. ensifolia
Ledebouria apertiflora
Lessertia annularis
Lepidostephium denticulatum
Leysera tenella
Limeum sulcatum var. sulcatum
Limosella africana var. africana
Lobelia flaccida subsp. flaccida
Lotononis platycarpa
Lycium horridum
Lycium pumilum
Manulea fragrans

Melianthus dregeanus
Melica decumbens
Melolobium candicans
Microloma armatum var. armatum
Monopsis scabra
Moraea falcifolia
Nemesia fruticans
Oligomeris dipetala var. dipetala
Ornithogalum nannodes
Ornithoglossum vulgare
Oropetium capense
Oscularia deltoides
Osteospermum leptolobum
Osteospermum spinescens
Osyris lanceolata
Oxalis depressa
Othonna pavonia
Pachypodium succulentum
Panicum coloratum var. coloratum
Panicum impeditum
Peliostomum leucorrhizum
Peliostomum origanoides
Pelargonium aestivale
Pelargonium pseudofumarioides
Pelargonium tragacanthoides
*Pennisetum villosum
Pentaschistis airoides subsp. airoides
Pentaschistis setifolia
Pentzia calcarea
Pentzia elegans
Pentzia globosa
Pentzia incana
Pentzia lanata
Pentzia quinquefida
Pentzia spinescens
Phymaspermum aciculare
Phymaspermum parvifolium
Polygala ephedroides
Protea subvestita (3024CC)
Pseudocrossidium crinitum
Psilocaulon coriarium
Pteronia glauca
Pteronia glaucescens
Pteronia sordida
*Puccinellia distans
Radyera urens
Riccia albornata
Riccia nigrella
Rosenia humilis
Rosenia oppositifolia
Rumex lanceolatus
Salsola calluna
Salsola dealata
Salsola glabrescens
Salsola humifusa
Salvia verbenaca
Satyrium longicaude var. longicaude

Sebaea pentandra var. pentandra
Selago albida
Selago paniculata
Selago saxatilis
Senecio isatideus
Sesamum capense
Solanum retroflexum
*Sorghum halepense
Sporobolus discosporus
Sporobolus fimbriatus
Sporobolus iocladius
Stachys cuneata
Stachys linearis
Stapelia grandiflora var. grandiflora
Stipagrostis ciliata var. capensis
Stipagrostis namaquensis
Stipagrostis obtusa
Syringodia concolor
Tetragonia fruticosa
Themeda triandra
Thesium congestum
Tortula atrovirens
Tragus berteronianus
Tragus koelerioides
Tragus racemosus
Trichostomum brachydontium
Tripteris aghillana var. aghillana
Urochloa panicoides
Wahlenbergia nodosa
Zaluzianskya karrooica
Zygophyllum microcarpum