BASIC ASSESSMENT REPORT:

Specialist ecological study on the potential impacts of the proposed Middelburg Solar Park 1 and 2 Projects, Eastern Cape

Prepared by

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on behalf of
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REPORT VERSION: 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). A Basic Assessment study is undertaken in accordance with Regulation 22 in terms of the EIA Regulations published in Government Notice (GN) R543 of 18 June 2010, in terms of Chapter 5 of Section 24(5) of the National Environmental Management Act (No. 107 of 1998).

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 Middelburg Solar Energy Facility Project in the Eastern 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

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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 320 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 African Clean Energy Developments (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.

Scope and purpose of report

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

Indemnity and 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 on-going 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

INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by African Clean Energy Developments (Pty) Ltd to undertake an application for environmental authorisation through an Basic Assessment for the proposed "Middelburg Solar Park Project." The project involves the establishment of two solar energy parks and associated infrastructure, each park having a generating capacity of 75 MW. The purpose of the Basic Assessment is to identify environmental impacts associated with the project.

On 17 January 2012 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 study include:

- to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- to provide a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- an assessment of the significance of direct, indirect and cumulative impacts in terms of standard criteria;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- recommendations regarding practical mitigation measures for potentially significant impacts;
- a description of any assumptions, uncertainties and gaps in knowledge;

This report provides details of the results of the Basic Assessment study. The findings of the study are based on a desktop assessment of the study area, including mapping from aerial imagery, and a field assessment of the site.

Study area

At a regional level the study area falls within the Eastern Cape to the south of the town of Noupoort, near Middleburg. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The assessment is to be undertaken in a single phase, a Basic Assessment. The objective of the 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 habitat/sensitivity map of the study area based on available maps and database information.

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 are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. 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 0f 2004)

Plant and animal species of conservation concern

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

Red List plant species

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

The purpose of listing Red List plant species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements 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 at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species will then be assessed by comparing the habitat requirements with those habitats that occur on site.

Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with

the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed in the Scoping Report and were considered as being at risk of occurring there.

Other protected species

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

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

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

There is additional legislation that provides lists of protected species, but the legislation to which these are attached deal primarily with harvesting or trade in listed species and do not specifically address transformational threats to habitat or individuals. This includes the following legislation:

- *CITES: Convention on the Trade in Endangered Species of Wild Fauna and Flora*.

Red List animal species

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem et al. 2010). The likelihood of any of them occurring was evaluated 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.

Species probability of occurrence

Some species are highly mobile (e.g. many birds) or, in the case of plants, may be cryptic, difficult to find, rare, ephemeral or generally not easy to spot while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected 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. karoo shrubland), but detailed microhabitat requirements (e.g. mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. m mountain shrubland on shallow soils overlying sandstone);
- DEFINITE: species found in habitats on site.

Habitat sensitivity

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

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

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act) And may also be positive for the following: • High intrinsic biodiversity value (high	• CBA 1 areas. • Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	species richness and/or turnover, unique ecosystems) • High value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • Low ability to respond to disturbance (low resilience, dominant species very old).	
HIGH	Indigenous natural areas that are positive for any of the following: • High intrinsic biodiversity value (moderate/high species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). • Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	• CBA 2 "critical biodiversity areas". • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	• CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors	

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation. May also include secondary vegetation in an advanced state of development in which habitat is still ecologically functional.	
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. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 “irreplaceable biodiversity areas” would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 “corridor areas” would qualify for inclusion into this class.

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 and exclusions

- 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.
- It is not the intention of this study to produce comprehensive lists of species occurring on site (see “Assessment philosophy” section above). This would require detailed site

assessments that are not necessary for providing an assessment of impacts associated with the proposed project. No checklists of species occurring on site are, therefore, provided.

DESCRIPTION OF STUDY AREA

Location

The study site is situated south of Noupoort and north of Middelburg in the Eastern Cape and falls within the quarter degree grids 3124BD and 3125AC (Figure 1). The farm portions on which the proposed solar energy parks would occur are the following:

- Middleburg Solar Park 1 - Remainder of Farm 11 (Twee Fontein)
- Middleburg Solar Park 2 – Portion 4 of Farm 11 (Twee Fontein)

The study area is just to the east of the N9 national road that links Middelburg to Cradock. This road runs from north to south through the study area. The N10 (previously the R32 route) runs in westerly direction from the N9, originating in the study area and links the N9 south of Noupoort to Hanover. The site is therefore well-connected to a number of major routes in this region.

Topography

A general view of the topography of the study area is given in Figure 2. The study site is located just south of the Kikvorsberg-Agter Renosterberg mountain range. It includes the scarp slopes and hills of these mountains, but mostly the plains just to the south of the mountain ranges. The plains are almost entirely surrounded by hills and mountain slopes.

There are no perennial rivers or streams in the study area, but there are non-perennial

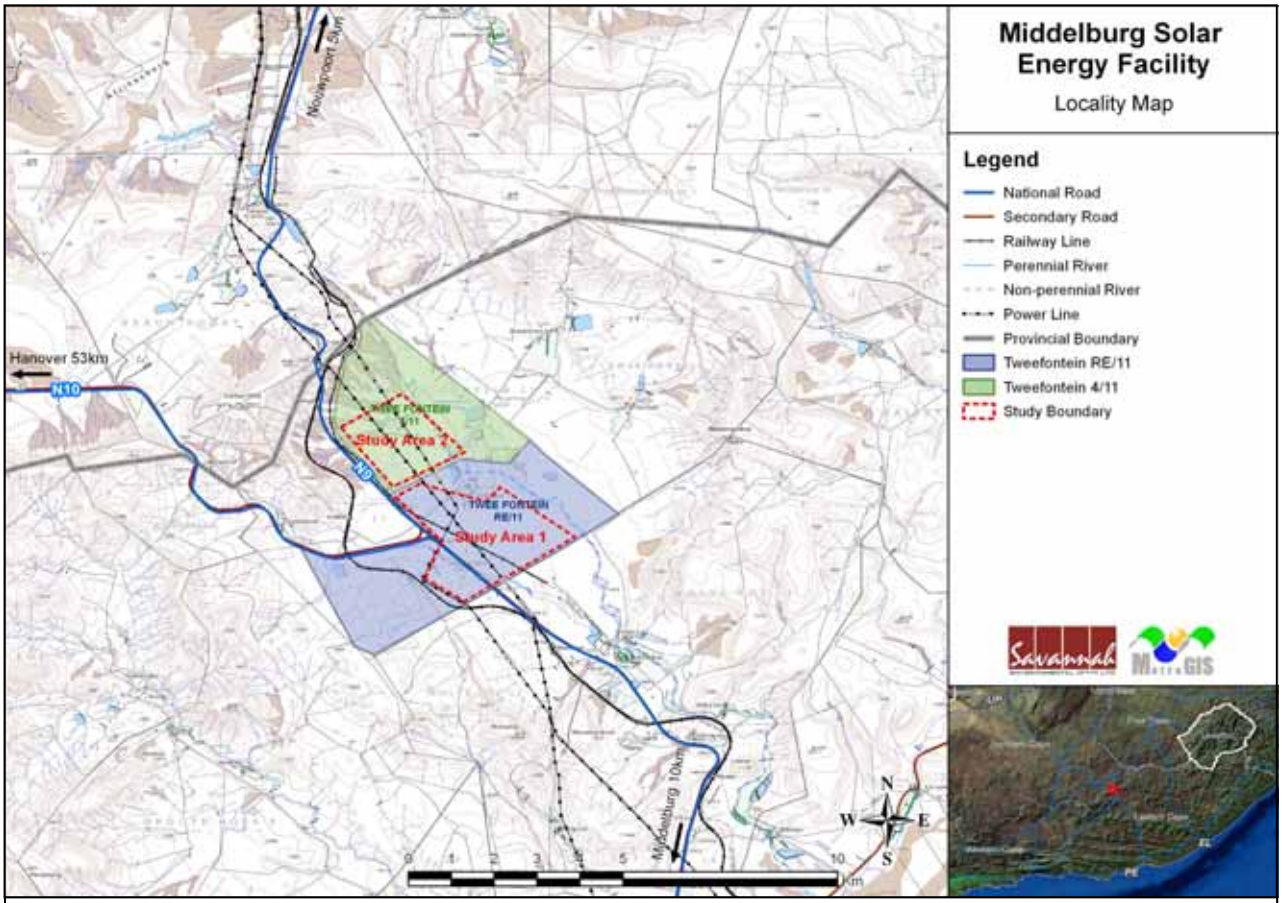

Figure 1: Location of the proposed Flagging Trees Wind Energy Facility.

drainage lines emanating from the mountains and hills which cut across the site.

The study area is gently to moderately sloping across the plains and steeply sloping against the mountains and hills. The site of the proposed solar parks are on the flat plains close to the N9 road (Figure 2).

Geology and soils

The major geological formation occurring in the study area is Beaufort Group of the Karoo Supergroup, consisting of mudstone and arenite. There is also Tarkastad Subgroup with the same constituents. Mudstone is a fine grained sedimentary rock whose original constituents were clays or muds, thus its grain size is relatively fine. It lacks distinct lamination, which distinguishes it from shale. Arenite is also a sedimentary rock, but has larger grain size.

Detailed soil information is not available for broad areas of the Eastern Cape. 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 a variety of landtypes in the study area (Figure 3). The most common landtypes in the study area are Da, Fb and Ib (Land Type Survey Staff, 1987). The Da landtype consists of duplex soils (sandier topsoil on clay subsoil) with red B horizons. These are the deeper, more structured soils of the plains areas. The Fb landtype consists mostly of shallow and/or rocky, slightly leached soils, often with lime. These also occur primarily on the plains, but also on the flat slopes on the summits of the mountains. The Ib landtype consists of 60-80% rock with shallow and/or rocky soils. These are the soils on the scarp slopes of the mountains and hills overlooking the plains.

Figure 2: General view of the topography of the study area looking towards the north (Google Earth image). Elevation is exaggerated.

The landtype associated with the exact position of Solar Parks 1 and 2 is the Da landtype, associated with the lowland plains of the study area.

Climate

The part of the Eastern Cape in which the study site is located is situated within a broad climatic area influenced largely by the mountainous terrain (Kopke 1988). The mean temperatures of the mountain region are generally lower than plains areas. Frost is a common phenomenon and the coldest periods (usually from June to August) are exacerbated by seasonal aridity. Winter frost is common and especially severe at higher altitudes. The average daily minima for the coldest months are below freezing. Winter frost and cold is therefore a potentially limiting factor for plant growth.

Altitude has a strong influence on most climatic variables. Generally, an increase in altitude corresponds with a decrease in temperature and an increase in rainfall. Mountains also have an orographic influence on rainfall, escarpment zones usually experiencing increased rainfall and mists, depending on aspect, cause either an increase or decrease in mean daily insolation levels. The study site is located just south of mountain ranges and the climate is therefore strongly influenced by the presence of these mountains.

Strong bimodal pattern of rainfall exists in the study area with a high proportion of spring and autumn rainfall. The mean annual rainfall in the study area is estimated to vary from approximately 350 - 390 mm for different parts of the area (Dent *et al*. 1989). In grasslands,

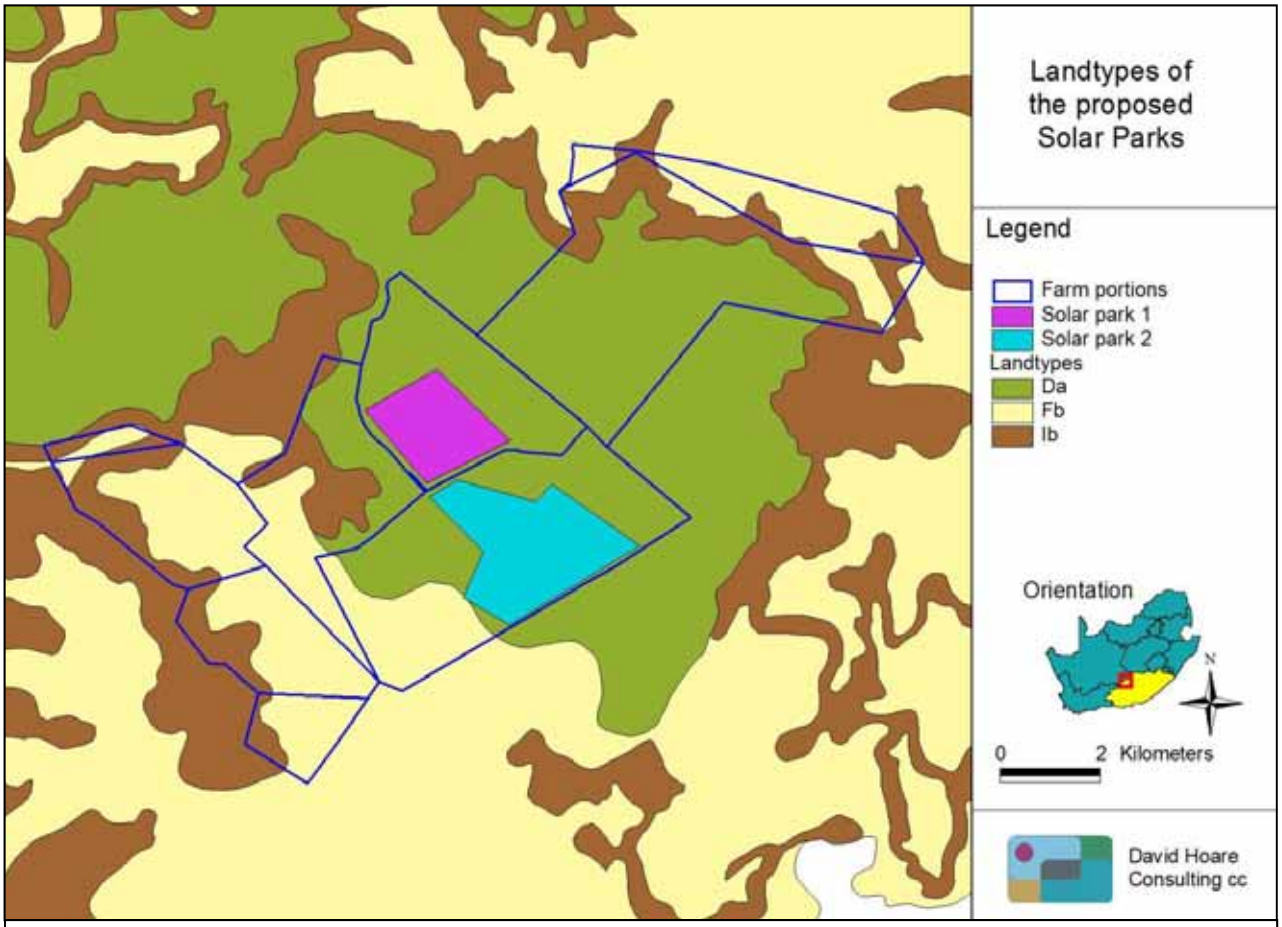

Figure 3: Landtypes of the proposed Middelburg Solar Parks.

all areas with less than 400 mm are considered to be arid grasslands. The study area can therefore be considered to be arid and, from a floristic point of view, to represent the boundary between grassland and karroid vegetation types.

The study area has high lightning flash densities, which makes the incidence of lightning-induced fire a high likelihood (Schulze 1984), although the generally low biomass of the karroid vegetation on the plains limits the likelihood of these areas burning that often. The Eastern Cape is considered to be one of the windiest parts of South Africa (Kopke 1988). Persistent north-westerly winds occur throughout the year bringing dry heat. This can have a severe desiccating effect on the vegetation in any aspects exposed to this wind. In contrast, cold, moist, south-easterly winds blow occasionally in summer. Northerlies, mostly in summer, bring thunderstorms by advecting moist tropical air. Cold fronts, mostly in winter, bring cold, sometimes dry winds.

Landuse and landcover of the study area

A large proportion of the study area is natural, although degraded to varying degrees through historical land-use practices. The landscape 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.

The dominant landcover is classified as “Shrubland and low fynbos”, a reference to the karroid vegetation on site. The upland areas have greater grass cover, but are still characterised by the dominance of karroid dwarf shrubs. Modifications to the natural vegetation in the study area include some small areas of cultivation, farms dams and conservation works, the national roads passing through the area, homesteads and a railway line.

Broad vegetation types of the region

The study area falls on the interface between the Nama-Karoo and Grassland Biomes (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 four vegetation types occurring within the broad study area, namely ***Eastern Upper Karoo***, ***Besemkaree Koppies Shrubland***, ***Tarkastad Montane Shrubland*** and ***Karoo Escarpment Grassland***. However, only Eastern Upper Karoo vegetation will be directly affected by the proposed project. These vegetation types are described in more detail below.

Eastern Upper Karoo
This is a vegetation type dominated by dwarf microphyllous shrubs with ‘white’ grasses, mostly of the genera *Aristida* and *Eragrostis*. It occurs on the flats and gently sloping plains that are interspersed with hills and rocky areas. It is found on the lowland plains of the study area (Figure 4) and is the most commonly occurring vegetation type on site. This is the only vegetation type that will be directly affected by the proposed project. Eastern Upper Karoo is considered to be Least Threatened, with <1% conserved of a target of 21% and 2% transformed (Mucina *et al*. 2006b).

Besemkaree Koppies Shrubland
This vegetation type is found on the slopes of koppies, butts and tafelbergs within the plains of the Eastern Upper Karoo (Mucina et al. 2006a). 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-africanus and Olea europea subsp. africana (Mucina et al. 2006a). This vegetation type is found in small amounts in the hills on the western side of the study area (Figure 4). Besemkaree Koppies Shrubland is considered to be Least Threatened, with 5% conserved of a target of 28% and 3% transformed (Mucina et al. 2006a).

Tarkastad Montane Shrubland

This vegetation type is found within the area between the Great Escarpment in the north and the minor escarpment in the south (Mucina et al. 2006a).. It occurs on the ridges, hills and isolated mountain slopes in which high rock cover is found, often consisting of large round boulders. The vegetation is a low, semi-open, mixed shrubland with 'white' grasses and dwarf shrubs forming a prominent component of the vegetation (Mucina et al. 2006a). This vegetation type occurs as a narrow band along the summit of the mountain slopes in the north-eastern part of the study area (Figure 4). Tarkastad Montane Shrubland is considered to be Least Threatened, with 1% conserved of a target of 28% and 2% transformed (Mucina et al. 2006a).

Karoo Escarpment Grassland

This vegetation type is found on the Karoo Escarpment and on the north-facing slopes of the Winterberg Mountains. It occurs on the mountain summits, low mountains and hills. The vegetation is a wiry tussock grassland, usually dominated by Merxmuellera disticha. Other common species include the grasses typical of dry grasslands (Eragrostis, Tetrachne, Karroochloa, Helictotrichon, Melica, Tragus, Elionurus and Aristida). There is an important low

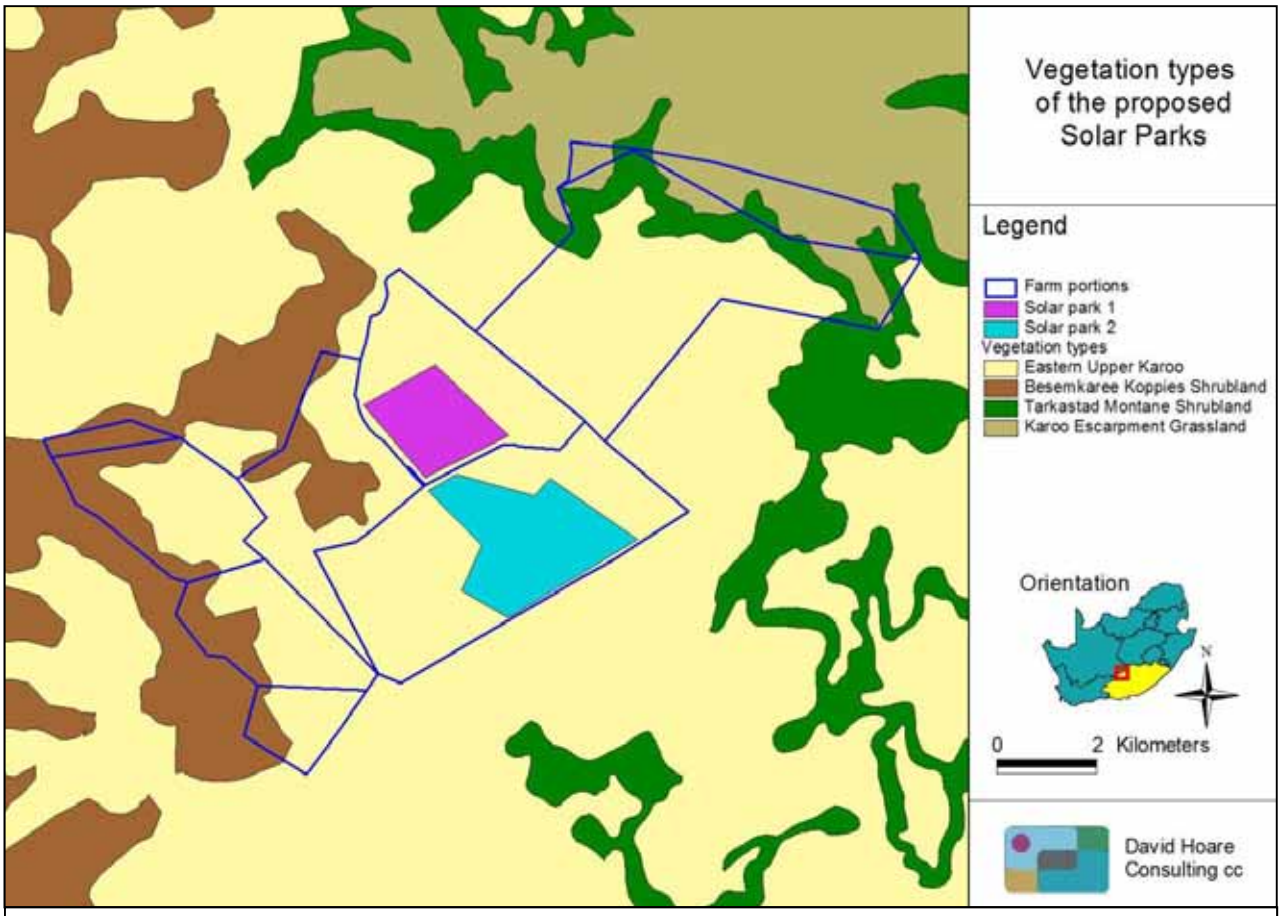

Figure 4: Vegetation types of the study area.

shrub component throughout this grassland unit (Mucina et al. 2006a). This vegetation type is found at the summit of the mountains in the north-eastern side of the study area (Figure 4). Karoo Escarpment Grassland is considered to be Least Threatened, with 3% conserved of a target of 24% and 1% transformed (Mucina et al. 2006a).

Conservation status of broad vegetation types

The vegetation types have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in Table 2, 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).

Table 2: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

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

Of the four vegetation types occurring in the study area (Table 3), all are classified as Least Threatened (Driver et al. 2005; Mucina et al., 2006). In all of these vegetation types, the amount of transformation is relatively low (1-3%, Table 3). The rates of conservation are not very high (1-5%, Table 3), but most of these vegetation types are utilized in their natural state to support commercial livestock farming and there is no immediate threat of them becoming transformed to another landcover type in which natural vegetation is not supported. Despite low levels of transformation, rates of degradation may be relatively high in some of these vegetation types.

Table 3: 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
Eastern Upper Karoo	21	<1	2	Least Threatened
Besemkaree Koppies Shrubland	28	5	3	Least Threatened
Tarkastad Montane Shrubland	28	1	2	Least Threatened
Karoo Escarpment Grassland	24	3	1	Least Threatened

Plant species of conservation concern in the study area

Plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute (www.sanbi.org). These are listed in Appendix 1. Additional species that could occur in similar habitats, as determined from database searches and literature sources (e.g. Victor & Dold 2003), but have not been recorded in these grids are also listed.

Species of conservation concern that have historically been recorded from the area were evaluated to determine the likelihood of any of them occurring on site. Of the species that are

considered to occur within the geographical area under consideration, there was one species of conservation concern recorded that could occur in habitats that are available in the study area and that has been previously recorded nearby (see Appendix 4). This species (*Boophane disticha*) is listed as Declining in South Africa (see Table 3 for explanation of categories) and is not considered to be of major conservation concern for the project. Furthermore, it is unlikely to occur in the lowland habitats that will be affected by the project.

Table 3: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and other classes of conservation concern (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
LC (Declining)	Least Concern, declining taxa	Orange List
LC (Rare)	Least Concern, rare	Orange List
LC (Critically Rare)	Least Concern, rare: only one subpopulation	Orange List
DDD	Data Deficient: not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
LC	Least Concern	Least Concern

Red List animal species of the study area

All threatened 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 are no mammal species of conservation concern that have a medium or high likelihood of occurring in available habitats in the study area. The mammal species classified as threatened or near threatened that have a geographical distribution that includes the site were assessed as having a low chance of occurring in available habitats in the study area or the study site is at the margin of their distribution range.

There are seven threatened bird species (all classified as vulnerable) that may utilize available habitats on site for foraging. These species are the Lesser Kestrel, Blue Crane, Cape Vulture, Martial Eagle, Tawny Eagle, Kori Bustard and Ludwig's Bustard.

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. The Giant Bullfrog inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas. It also utilises non-permanent vleis and shallow water on margins of waterholes and dams. It prefers sandy substrates although they sometimes inhabit clay soils. It has been previously recorded in the grid and some farm dams on site could support populations. It is therefore possible that it could occur on site.

There is one threatened reptile species (Plain Mountain Adder) that has a distribution close to the study area, but suitable habitat only occurs in the mountainous areas and not on site.

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

- Lesser Kestrel (VU),

- Blue Crane (VU),
- Cape Vulture (VU),
- Martial Eagle (VU),
- Tawny Eagle (VU),
- Kori Bustard (VU),
- Ludwig's Bustard (VU),
- Giant Bullfrog (protected).

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. Those that have a geographical distribution that includes the study area are *Catha edulis, Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius*, *Prunus africana and Sideroxylon inerme* subsp. *inerme*.

Catha edulis is found in evergreen forest, often in rocky places. *Curtisia dentata* occurs in coastal and montane forest. *Ocotea bullata* occurs in montane forest. *Pittosporum viridiflorum* occurs along forest margins, in bush-clumps and in bushveld, often in rocky outcrops. *Podocarpus falcatus* is found in Afromontane forest. *Podocarpus latifolius* is found in coastal and Afromontane forest. *Prunus africana* occurs in montane forest, usually in mistbelt areas. *Sideroxylon inerme* subsp. *inerme* usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld.

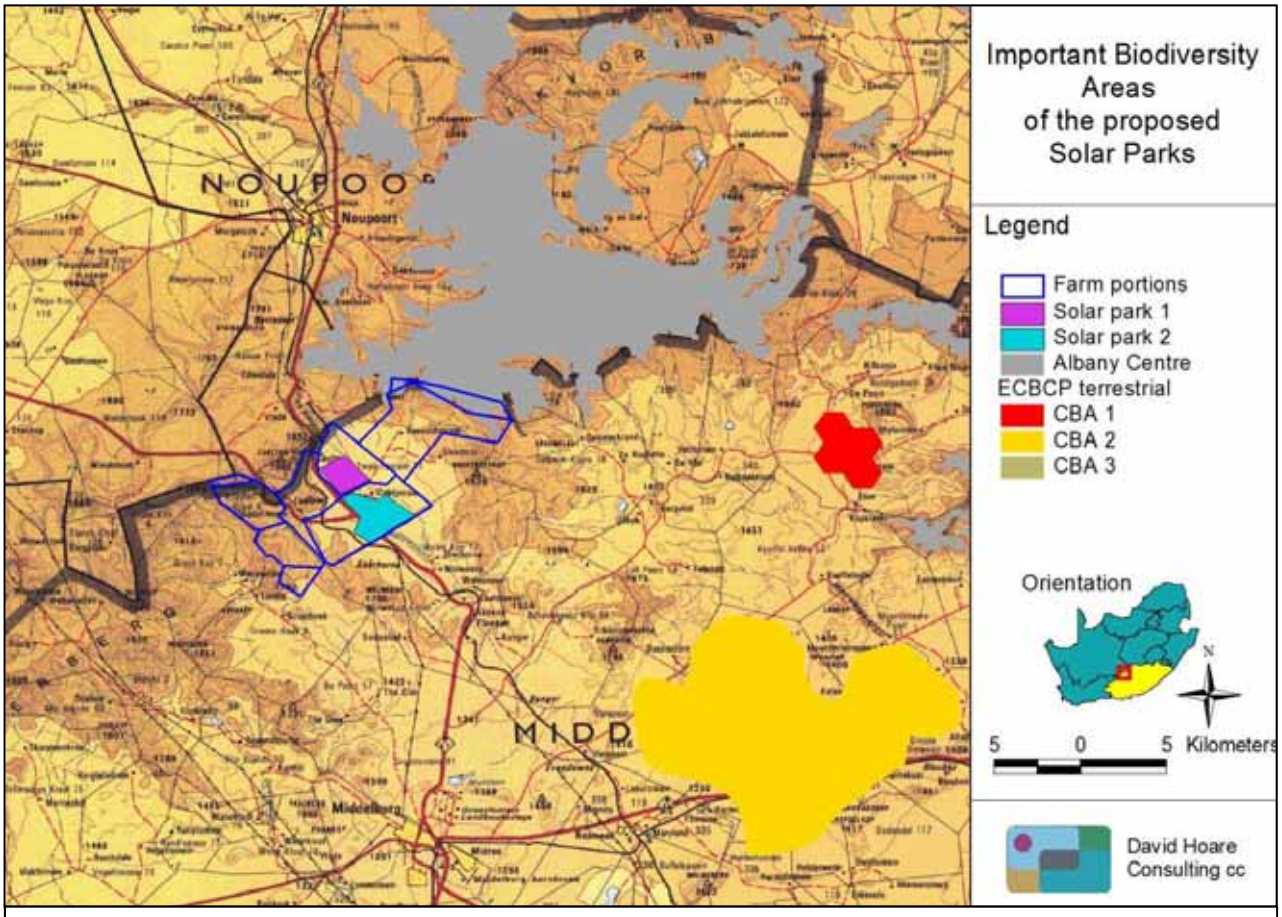

Figure 5: Important biodiversity areas of the study area (from ECBCP).

None of these species occurs on the site of either proposed Solar Park, nor have they been previously recorded in the quarter degree grids that include the study area.

Other features of conservation concern

There have been a number of regional conservation assessments produced within the Eastern Cape Province, including the following:

- Subtropical Thicket Ecosystem Programme (STEP)
- Succulent Karoo Ecosystems Programme (SKEP)
- National Spatial Biodiversity Assessment (NSBA)
- Eastern Cape Biodiversity Conservation Plan (ECBCP).

These studies identify patterns and processes that are important for maintaining biodiversity in the region. Unfortunately, many of these studies have been done using coarse scale satellite imagery that does not provide spatial or spectral accuracy at the scale of the present study. They are, however, useful for understanding broad issues and patterns within the area. The ECBCP has integrated all previous studies and is a useful reference for identifying conservation issues in the study area and surrounds.

The ECBCP identifies Critical Biodiversity Areas (CBAs), which are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (Berliner & Desmet 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows:

1. PA: Protected areas.
2. CBA 1: Critically Endangered vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. CBA 2: Endangered vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
4. CBA 3: Vulnerable vegetation types.

Within and around the study area, the ECBCP identifies no CBAs that occur within the region in which the study area is located (Figure 5). The closest CBAs to the study area are 14 km to the south-east and 15 km to the east. These areas are outside the study area (see Figure 5) and will not be affected by the proposed project.

The study site occurs just on the edge of the Albany Centre of Floristic Endemism (van Wyk & Smith 2001). The summit of the mountains in the north-eastern part of the study area are considered to be within this Albany Centre. The Albany Centre is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier et al. 2000, Steenkamp et al. 2004, 2005). Thicket is the most conspicuous component of this Centre and there is a high degree of endemism amongst succulent plants in this Centre of Endemism. It may be presumed that assessments of vegetation types and species in the sections above will also address components that would be important for the Albany Centre of Endemism, but ensuring that no endemic elements of the Albany Centre are negatively affected is also important. No thicket elements occur in the study area.

Watercourses and drainage areas

Wetlands, riparian zones and watercourses are defined in the National Water Act as a water resource (National Water Act of 1998). A "watercourse" in terms of the National Water Act (act 36 of 1998) means:

- A 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.

According to this definition, there are a number of watercourses on site. These have been mapped and are shown in Figure 6. Many of these are ephemeral drainage areas without any natural channel, but there are also significant areas that are channelled and which may be classified as watercourses.

There are no areas on site, except for small farm dams, in which there is perennial water. Even some smaller farm dams appear to be empty for a large proportion of the year.

Site sensitivity assessment

The sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas of sensitivity are shown in Figure 5. An

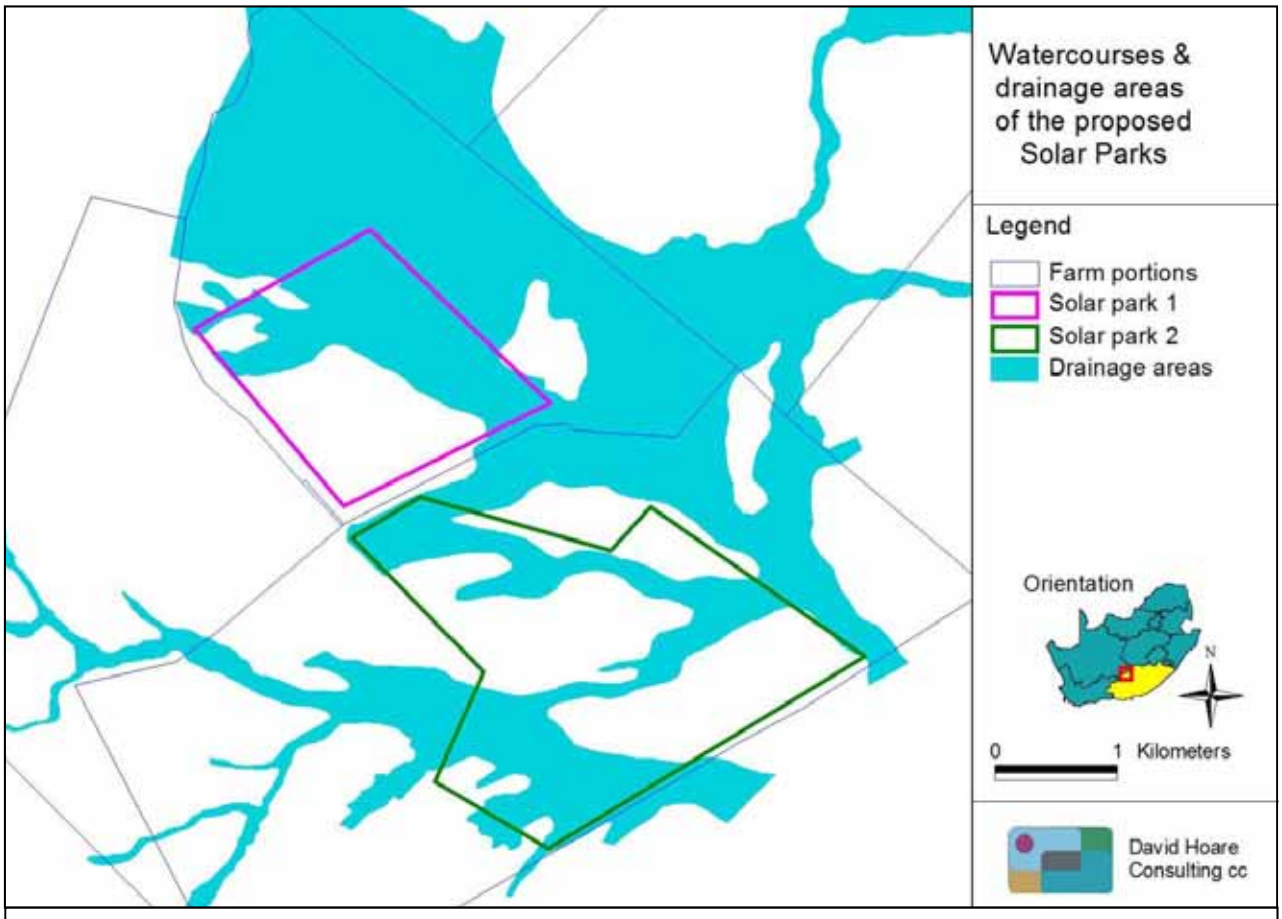

Figure 6: Drainage areas & watercourses on site.

explanation of the different sensitivity classes is given in Table 1.

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. Watercourses and drainage areas: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
2. potential occurrence of populations of Red List animals that have been evaluated as having a chance of occurring within remaining natural habitats within the study area.

These factors have all been taken into account in mapping potentially sensitive areas within the study area. These are mapped in Figure 6. This map shows the drainage areas / watercourses to have HIGH sensitivity and the remaining areas to have MEDIUM sensitivity (Figure 6).

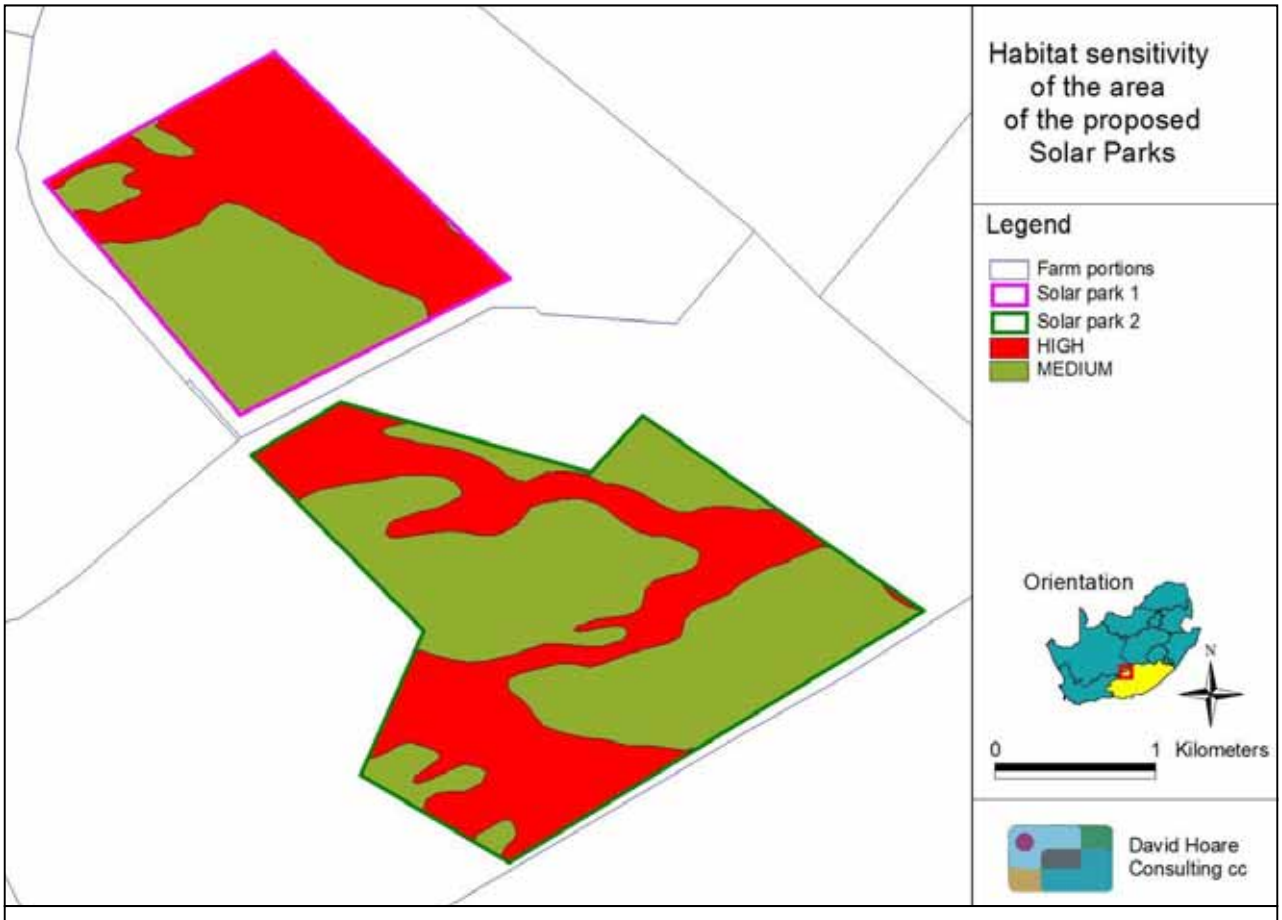

Figure 6: Habitat sensitivity on site.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of biodiversity importance to the proposed project. Legislation is also mentioned in other parts of the document to place particular issues in context, but this section represents a more comprehensive listing of applicable legislation. 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 EIAs for all projects listed as a Listing Notice 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.

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

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

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

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

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

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

• Listing Notice 1: activities that require a basic assessment (R544 of 2010),

• Listing Notice 2: activities that require seeping and environmental impact report (EIR) (R545 of 201 0),

• Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m2 of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means any development that Involves loss of natural habitat In a listed critically endangered or endangered ecosystem Is likely to require at least a basic assessment in terms of the EIA regulations.

It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report In terms of the EIA regulations Is triggered only In remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

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

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

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.

National Veld and Forest Fire Act (Act No. 101 of 1998)
Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

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.

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: Loss or fragmentation of indigenous natural vegetation (terrestrial)
Nature: Construction of infrastructure may lead to direct loss of vegetation. This may 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). 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.

The vegetation types on site is Eastern Upper Karoo, which is classified as Least Threatened.

Impact 2: Loss of individuals of 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, Near threatened or Declining plant species that are likely to occur on site. This impact is therefore not assessed further.

Impact 3: Loss of individuals of protected tree species
There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms

of section1 5(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”.

Three species have a geographic distribution that includes the study area, *Catha edulis, Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius*, *Prunus africana and Sideroxylon inerme* subsp. *inerme*. None of these occur on site. This impact is therefore not assessed further.

Impact 4: Loss of habitat for threatened and protected animals and birds

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.

There are seven threatened bird species (all classified as vulnerable) that may utilize available habitats on site for foraging. These species are the Lesser Kestrel, Blue Crane, Cape Vulture, Martial Eagle, Tawny Eagle, Kori Bustard and Ludwig’s Bustard.

The protected Giant Bullfrog could occur on site.

Impact 5: Collisions of individuals of threatened birds with overhead power lines

Nature: Threatened bird species may be directly affected by collisions with overhead powerlines. Cranes, bustards, flamingos, waterfowl, shorebirds, gamebirds and falcons are among the most frequently affected (Jenkins et al. 2010). Ludwig’s Bustard is especially affected by collisions with overhead power lines.

There are seven threatened bird species (all classified as vulnerable) that may utilize available habitats on site for foraging. These species are the Lesser Kestrel, Blue Crane, Cape Vulture, Martial Eagle, Tawny Eagle, Kori Bustard and Ludwig’s Bustard.

Impact 6: Impacts on watercourses and drainage areas

Nature: The site is in an arid area, but there are significant areas on site that may be considered to be drainage areas and/or watercourses and are therefore important for hydrological processes in the landscape. According to the National Water Act, these are classified as wetlands or water resources. Construction, if it occurred within any of these

areas, would 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.

Impact 7: 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.

There are a number of alien species that may become problematic in the study area. This may include prickly pears that are grown as fodder on the property, although cultivated varieties of prickly pear seldom spread into natural vegetation to any significant degree. 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 dryer parts of the country. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions. There is therefore the potential for alien plants to spread or invade following disturbance on site.

SOLAR PARK 1: ASSESSMENT OF POTENTIAL IMPACTS

Impacts are assessed for grouped components of infrastructure for the proposed solar plant, as follows:

- solar array, and ancillary infrastructure (buildings),
- internal substation,
- overhead power line to local substation.

Solar array and buildings

The solar array and other required infrastructure will have an impact in terms of direct loss of habitat. This will also affect drainage areas / watercourses.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: The impact will be permanent due to the fact that clearing of vegetation for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed facility, which is scored as local.

Magnitude: The potential magnitude of this impact will be low due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	low (4)	Small to low (3)
Probability	Definite (5)	Definite (5)
Significance	**medium (50)**	**medium (45)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation		

type.

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the solar array is small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: In localised areas, the impact will be permanent due to the fact that clearing of habitat for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed solar array. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	small (2)	small (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. Construction will 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 solar array, 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 result in impacts that have a permanent 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 plan, it is definite that the impact will occur.

Mitigation measures:

1. Ground surfaces within the solar array must be properly maintained to avoid erosion impacts.
2. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
3. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.
4. A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.

Nature: Damage to wetland / watercourse 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)	Low (4)
Probability	definite (5)	Highly probable (4)
Significance	**medium (60)**	**medium (40)**
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) Ground surfaces within the solar array must be properly maintained to avoid erosion impacts. (2) 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. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity. (3) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act. (4) A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape		

will be accommodated.
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the solar array will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the solar array and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
(1) Keep disturbance of vegetation surrounding array to a minimum
(2) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area
(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 on-going monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts:
Other disturbance to parts of the site could lead to similar impacts.
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.

Internal substation

There are two possible locations for the on-site sub-station. Both are within an area of natural habitat. The expected impacts are identical for both substation options.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: The impact will be permanent due to the fact that clearing of vegetation for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed sub-station, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (2)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**medium (40)**	**medium (35)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation:		

(2) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the substation is very small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: In localised areas, the impact will be permanent due to the fact that clearing of habitat for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed substation. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	small (1)	small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. Construction will 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 solar array, 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 result in impacts that have a permanent 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 plan, it is definite that the impact will occur.

Mitigation measures:

5. Ground surfaces within the solar array must be properly maintained to avoid erosion impacts.
6. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
7. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.
8. A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.

Nature: Damage to wetland / watercourse 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)	Low (4)
Probability	definite (5)	Highly probable (4)
Significance	**medium (60)**	**medium (40)**
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: (5) Ground surfaces within the solar array must be properly maintained to avoid erosion impacts. (6) 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. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the		

activity. (7) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act. (8) A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the substation will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the substation and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)

Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: (6) Keep disturbance of vegetation surrounding array to a minimum (7) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area (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 on-going monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Other disturbance to parts of the site could lead to similar impacts.		
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.

Powerline

There are two power line alternatives, Option 1 a very short one (210 m) and Option 2 somewhat longer (1150 m). The main impact of the power line will be due to bird impacts, but there will be some loss of habitat in the footprint of tower structures.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: Indications from existing power lines on site are that the base of tower structures becomes re-vegetated. The impact will therefore be medium-term.

Extent: The impact will occur at the site of the proposed power line, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	small (2)	Small (1)
Probability	Definite (5)	Definite (5)

Significance	**medium (30)**	**low (25)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.		

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the solar array is small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: Indications from existing power lines on site are that the base of tower structures becomes re-vegetated. The impact will therefore be medium-term.

Extent: The impact will occur at the site of the proposed power line tower structures. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	small (1)	small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (10)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation:		

None required.
Cumulative impacts:
None
Residual Impacts:
None likely

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

Impact 5: Bird collisions with powerlines

There is a low to moderate likelihood of threatened or near threatened bird species occurring along the proposed overhead power line routes. The potential impact on them due to collisions is therefore not considered to be likely to be of high frequency, but could potentially have a serious impact on some species.The construction of the power line will add to an existing impact (there is an existing power line on site).

Duration: The impact will be long-term.

Extent: The impact will occur at the site of the proposed power line.

Magnitude: At a local scale, the potential magnitude of this impact for will probably be small (will not have an effect on population processes). The fact that it is situated adjacent to an existing line means that only the additional impact is considered, which is expected to be small.

Probability: The probability of the impact occurring is rated as probable (option 2) to improbable (option 1).

Mitigation measures: Devices to make power lines more visible to birds should be put in place. The exact configuration of such visibility devices should be established through consultation with avian specialists with knowledge of the relationship between power lines and the bird species in the study area that may be affected.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	small (2)	small (1)
Probability	Option 1: improbable (2) Option 2: probable (3)	Option 1: improbable (2) Option 2: probable (3)
Significance	**Option 1: low (14)** **Option 2: low (21)**	**Option 1: low (12)** **Option 2: low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree	
Mitigation: Devices to make lines more visible must be attached to overhead power lines.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. For the power line option 2, construction will lead to some direct or indirect loss of or damage to these affected areas or changes to the catchment of these areas. Option 1 does not affect any of these areas.

Extent: The impact will occur at the site of the proposed power line. The extent of the potential impact is therefore at a site scale.

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

Magnitude: In the long-term, impacts could result in a slight impact on processes, which is scored as low.

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

Mitigation measures:

1. Ensure that tower structures are kept a minimum of 50 m from any watercourses.
2. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
3. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.

Nature: Damage to wetland / watercourse areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	low (4)	Small (2)
Probability	Highly probable (4)	Probable (3)
Significance	**medium (36)**	**low (18)**
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) Ensure that tower structures are kept a minimum of 50 m from any watercourses. (2) There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity. (3) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.		
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the power line will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the power line and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: (11)Keep disturbance of vegetation surrounding array to a minimum		

(12) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area (13) Do not translocate soil stockpiles from areas with alien plants (14) Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (15) Establish an on-going monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts: Other disturbance to parts of the site could lead to similar impacts.
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.

Comparison of infrastructure alternatives

Power line Option 1

This option is very short and does not affect any watercourse/drainage areas. It will also have a minimal effect on birds due to collisions with overhead power lines.

Power line Option 2

This option is just over a kilometer long. In comparison to option 1, it affects some drainage/watercourse areas and will probably have a slight effect on birds due to collisions with overhead power lines. However, the significance of both these impacts is low, after mitigation.

SOLAR PARK 2: ASSESSMENT OF POTENTIAL IMPACTS

Impacts are assessed for grouped components of infrastructure for the proposed solar plant, as follows:

- solar array, and ancillary infrastructure (buildings),
- internal substation,
- overhead power line to local substation.

Solar array and buildings

The solar array and other required infrastructure will have an impact in terms of direct loss of habitat. This will also affect drainage areas / watercourses.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: The impact will be permanent due to the fact that clearing of vegetation for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed facility, which is scored as local.

Magnitude: The potential magnitude of this impact will be low due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	low (4)	Small to low (3)
Probability	Definite (5)	Definite (5)
Significance	**medium (50)**	**medium (45)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation		

type.

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the solar array is small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: In localised areas, the impact will be permanent due to the fact that clearing of habitat for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed solar array. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	small (2)	small (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. Construction will 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 solar array, 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 result in impacts that have a permanent 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 plan, it is definite that the impact will occur.

Mitigation measures:

1. Ground surfaces within the solar array must be properly maintained to avoid erosion impacts.
2. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
3. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.
4. A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.

Nature: Damage to wetland / watercourse 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)	Low (4)
Probability	definite (5)	Highly probable (4)
Significance	**medium (60)**	**medium (40)**
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) Ground surfaces within the solar array must be properly maintained to avoid erosion impacts. (2) 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. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity. (3) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act. (4) A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape		

will be accommodated.
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the solar array will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the solar array and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
(1) Keep disturbance of vegetation surrounding array to a minimum
(2) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area
(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 on-going monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts:
Other disturbance to parts of the site could lead to similar impacts.
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.

Internal substation

There is one proposed location for the on-site sub-station within an area of natural habitat.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)
Duration: The impact will be permanent due to the fact that clearing of vegetation for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed sub-station, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (2)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**medium (40)**	**medium (35)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (2) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained,		

as much as possible, within the footprint of the infrastructure.
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the substation is very small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: In localised areas, the impact will be permanent due to the fact that clearing of habitat for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed substation. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	small (1)	small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. Construction will 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 solar array, 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 result in impacts that have a permanent 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 plan, it is definite that the impact will occur.

Mitigation measures:

1. Ground surfaces within the solar array must be properly maintained to avoid erosion impacts.
2. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
3. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.
4. A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.

Nature: Damage to wetland / watercourse 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)	Low (4)
Probability	definite (5)	Highly probable (4)
Significance	**medium (60)**	**medium (40)**
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) Ground surfaces within the solar array must be properly maintained to avoid erosion impacts. (2) 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. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.		

(3) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act. (4) A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated.
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the substation will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the substation and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**

Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: (6) Keep disturbance of vegetation surrounding array to a minimum (7) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area (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 on-going monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Other disturbance to parts of the site could lead to similar impacts.		
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.

Powerline

There is one power line option proposed. The main impact of the power line will be due to bird impacts, but there will be some loss of habitat in the footprint of tower structures.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: Indications from existing power lines on site are that the base of tower structures becomes re-vegetated. The impact will therefore be medium-term.

Extent: The impact will occur at the site of the proposed power line, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained within the footprint of the infrastructure. Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	small (2)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**medium (30)**	**low (25)**
Status (positive or negative)	negative	negative

Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (2) Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.		

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

Impact 4: Loss of habitat for threatened animals

There is a low likelihood of any threatened, near threatened or protected animal species being directly affected by the proposed project. Birds and other animals that could potentially occur on site are relatively mobile and will move away during construction. The footprint of the solar array is small relative to the overall availability of habitat in the general area. The potential impact on them due to a loss of a small area of habitat is therefore not considered to be serious.

Duration: Indications from existing power lines on site are that the base of tower structures becomes re-vegetated. The impact will therefore be medium-term.

Extent: The impact will occur at the site of the proposed power line tower structures. The area of concern will be limited in extent and is scored as local.

Magnitude: At a local scale, the potential magnitude of this impact will probably be small (will have no effect on population processes).

Probability: The probability of the impact occurring is rated as improbable. If any species occur on site, they will not be critically dependant on the small area of habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	small (1)	small (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (10)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Mitigation: None required.		
Cumulative impacts:		

None
Residual Impacts:
None likely

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

Impact 5: Bird collisions with powerlines

There is a low to moderate likelihood of threatened or near threatened bird species occurring along the proposed overhead power line routes. The potential impact on them due to collisions is therefore not considered to be likely to be of high frequency, but could potentially have a serious impact on some species.The construction of the power line will add to an existing impact (there is an existing power line on site).

Duration: The impact will be long-term.

Extent: The impact will occur at the site of the proposed power line.

Magnitude: At a local scale, the potential magnitude of this impact for will probably be small (will not have an effect on population processes). The fact that it is situated adjacent to an existing line means that only the additional impact is considered, which is expected to be small.

Probability: The probability of the impact occurring is rated as probable.

Mitigation measures: Devices to make power lines more visible to birds should be put in place. The exact configuration of such visibility devices should be established through consultation with avian specialists with knowledge of the relationship between power lines and the bird species in the study area that may be affected.

Nature: Loss of habitat for threatened animals		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	small (2)	small (1)
Probability	probable (3)	probable (3)
Significance	**low (21)**	**low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree	
Mitigation: Devices to make lines more visible must be attached to overhead power lines.		
Cumulative impacts: None		
Residual Impacts: None likely		

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

Impact 6: Damage to wetlands/watercourses

A significant portion of the site is considered to be drainage areas or watercourses. According to the National Water Act, these are classified as water resources. For the power line option 2, construction will lead to some direct or indirect loss of or damage to these affected areas or changes to the catchment of these areas. Option 1 does not affect any of these areas.

Extent: The impact will occur at the site of the proposed power line. The extent of the potential impact is therefore at a site scale.

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

Magnitude: In the long-term, impacts could result in a slight impact on processes, which is scored as low.

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

Mitigation measures:

1. Ensure that tower structures are kept a minimum of 50 m from any watercourses.
2. There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity.
3. A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.

Nature: Damage to wetland / watercourse areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	low (4)	Small (2)
Probability	Highly probable (4)	Probable (3)
Significance	**medium (36)**	**low (18)**
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: (4) Ensure that tower structures are kept a minimum of 50 m from any watercourses. (1) There is a legal obligation to apply for a Water Use Licence (WUL) for any wetlands that may be affected, since they are classified in the National Water Act as a water resource. Any activity within 500 m of a wetland or watercourse boundary may require a WUL, depending on the activity. (2) A wetland delineation is required to determine the exact boundary of any features protected according to the National Water Act.		
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 7: Establishment and spread of declared weeds and alien invader plants

There are very few concentrations of alien plants on site. The shrub, *Prosopis glandulosa* (honey mesquite), is found in the general area. Construction of the power line will require the total clearing of vegetation within the footprint and this will probably be maintained as clear areas for the lifetime of the project. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could to lead to general invasion of surrounding vegetation.

Extent: The impact will occur at the site of the power line and surrounding areas.

Duration: The impact will be long-term unless alien plants are controlled.

Magnitude: The potential magnitude of this impact is medium for local ecosystems (will result in processes continuing but in a modified way).

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The impact could potentially be of medium significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance further.

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 once construction is completed. 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. An on-going 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	medium (6)	minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: (11)Keep disturbance of vegetation surrounding array to a minimum (12)Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area (13)Do not translocate soil stockpiles from areas with alien plants (14)Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to		

remove (15)Establish an on-going monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts: Other disturbance to parts of the site could lead to similar impacts.
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 four major vegetation types that occur in the study area, namely *Besemkaree Koppies Shrubland*, *Eastern Upper Karoo*, *Karoo Escarpment Grassland* and *Tarkastad Montane Shrubland* (all classified as Least Threatened). Only *Eastern Upper Karoo* occurs within the footprint of the proposed Solar Parks. Most of the study area is still in natural condition, although parts may be degraded due to commercial livestock farming or localised infrastructure development. Taking rates of transformation and conservation into account, which have already been used to classify all national vegetation types, none of the vegetation in the study area is considered to be threatened.

There are a number of non-perennial watercourses and drainage areas on site. Drainage areas and watercourses represent particularly vital 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. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches (Rosenberg *et al.*, 1997).

There are no threatened, near threatened, declining or nationally protected plant species that could occur in available habitats in the study area.

There are a small number of animal species of conservation concern that may occur in habitats within the study area. This includes seven threatened bird species and one protected frog species.

There are no tree species that are protected under the National Forests Act that have a geographic distribution that includes this area (Appendix 3).

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

1. Impacts on indigenous natural vegetation
2. Impacts on threatened plant species
3. Impacts on protected tree species
4. Impacts on threatened bird and animal species
5. Collisions of birds with overhead power lines
6. Impacts on watercourses and drainage areas
7. Establishment and spread of declared weeds and alien invader plants

It has been determined that no threatened plants species or protected tree species occur on site. The remaining impacts were assessed for the proposed infrastructure. A summary of the significance of impacts before and after proposed mitigation measures is provided in Table 4 and 5 (below). This shows that the potential impact on natural vegetation and on watercourses/drainage areas by the solar arrays are the impacts 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. No mitigation measures will reduce the significance of this impact further. All other potential impacts are either “low” or can be reduced to “low” with mitigation.

Recommendations

The following recommendations are made to reduce impacts or provide additional information that can lead to reduction or control of impacts or to a more confident assessment of impacts:

- For Solar Park, either power line / substation option is acceptable, taking the following into account: The power line is shorter for Option 1, but otherwise the effects of the two Options would be similar, except for the fact that the longer power line for Option 2 will result in greater impacts on birds due to collisions and will cause impacts on watercourses / drainage areas. Both these impacts related to Option 2 are considered to potentially be of low significance after mitigation.
- A more comprehensive delineation of water-resource-related features is required to determine potential impacts on these areas. The ecological study has identified significant areas of drainage areas and/or watercourses on site that will be affected by the proposed project. According to the National Water Act, these will have to be delineated and a Water Use License obtained before impacts on these areas can be permitted.

Table 4: Summary of the significance of impacts for different infrastructure components before and after mitigation for Solar Park 1.

SOLAR PARK 1:	Solar array and buildings		Substation		Overhead powerline		
Impact on:	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation		With mitigation
1. Indigenous vegetation	medium (50)	medium (45)	medium (40)	medium (35)	medium (30)		low (25)
2. Threatened and protected animals & birds	low (16)	low (16)	low (14)	low (14)	low (10)		low (10)
3. Bird collisions with power lines	n/a	n/a	n/a	n/a	Option 1	low (14)	low (12)
					Option 2	low (21)	low (18)
4. Damage to watercourses	medium (60)	medium (40)	n/a	n/a	Option 2 only	medium (36)	low (18)
5. Alien plants	medium (36)	low (16)	medium (36)	low (16)	medium (36)		low (16)

*Significance: <30 = low, 30–60 = medium, >60 = high.

Table 5: Summary of the significance of impacts for different infrastructure components before and after mitigation for Solar Park 2.

SOLAR PARK 2:	Solar array and buildings		Substation		Overhead powerline	
Impact on:	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
6. Indigenous vegetation	medium (50)	medium (45)	medium (40)	medium (35)	medium (30)	low (25)
7. Threatened and protected animals & birds	low (16)	low (16)	low (14)	low (14)	low (10)	low (10)
8. Bird collisions with power lines	n/a	n/a	n/a	n/a	low (21)	low (18)
9. Damage to watercourses	medium (60)	medium (40)	n/a	n/a	medium (36)	low (18)

10.Alien plants	medium (36)	low (16)	medium (36)	low (16)	medium (36)	low (16)

*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 indigenous natural vegetation

OBJECTIVE: Control loss of/disruption to indigenous 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/servitude of the infrastructure (2) Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld, use access roads only (3) Where possible, situate infrastructure within or close to existing disturbance	Construction team, management (environmental officer)	Construction

Performance Indicator	Minimum loss of natural vegetation outside ofthe exact footprint of the proposed project
Monitoring	• Before construction, demarcate footprint of proposed infrastructure and construction area and ensure that construction impacts are contained within this area.

Impacts from 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 of power line infrastructure,
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: 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 on-going 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	• On-going monitoring of area by environmental control officer during construction • On-going 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

Bird collisions with power lines

OBJECTIVE: Limit impacts on threatened birds due to collisions with power lines	
Project component/s	Overhead power lines
Potential Impact	Loss of individuals of threatened bird species (especially Bustards) due to collisions with overhead power lines.
Activity/risk source	Operation of power line
Mitigation: Target/Objective	Target: limit loss of individuals of threatened birds due to collision with overhead power lines Time period: operation

Mitigation: Action/control	Responsibility	Timeframe
(1) Attach devices to overhead power lines to make them more visible to affected bird species. The exact nature of such devices should be determioned in consulation with a bird specialist.	Environmental management team, management (environmental officer)	Operation

Performance Indicator	No loss of threatned birds due to collisions with power lines
Monitoring	• Bird mortality along power line due to collisions

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) Ground surfaces within the solar array must be properly maintained to avoid erosion impacts. (2) Water resources (according to the National Water Act) must be delineated according to protocols. (3) A Water Use License is required for any infrastructure that will be placed within delineated areas. (4) A comprehensive storm-water management plan must be compiled for the solar array. This must indicate how water velocities will be reduced before storm water is allowed to enter natural channels and how natural processes for water infiltration of the affected landscape will be accommodated. Current project design already foresees the use of gutter-like rainwater collection channels below the panels, in order to drive runoff water from panels to underground water tanks. (5) Pylons must be positioned a minimum of 50 m outside of watercourse boundaries. (6) Existing roads must be used as service roads, where possible.	Construction team, management, environmental control officer	Planning, construction

Performance Indicator	No permanent infrastructure within watercourses
Monitoring	• None

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APPENDICES:

Appendix 1: Plant species of conservation importance that have historically been recorded in the study area.

*IUCN (3.1) Categories:
VU = Vulnerable
EN = Endangered
CR = Critically Endangered
NT = Near Threatened
LC = Least Concern

Table A: Plant species of conservation concern that have been previously recorded in the study area

Taxon	Family	Distribution relevant to study area	Global IUCN (3.1) category *	Likelihood of occurrence
Boophone disticha (L.f.) Herb.	AMARYLLIDACEAE	The species is currently considered to be LC-declining because large volumes are evident in the medicinal markets, but the species appears to be widespread in southern Africa. It is common in the area.	LC (declining)	HIGH, previously recorded in study area

* 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

Appendix 2: Threatened vertebrate species with a geographical distribution that includes the current study area.

MAMMALS

Common name	Taxon	Habitat	Status[1]	Likelihood of occurrence
Black rhinoceros	*Diceros bicornis bicornis*	Wide variety of habitats.	CR	NONE, only occurs in game reserves
Geoffroy's horseshoe bat	*Rhinolophus clivosus*	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo, widespread. No roosting habitat on site.	NT	LOW, not previously recorded in grids, but overall geographical distribution includes this area.
White-tailed rat	*Mystromus albicaudatus*	Highveld and montane grassland, requires sandy soils with good cover. Found throughout South Africa except Northern Cape and Limpopo. Habitat on site is not grassland.	EN	LOW, not previously recorded in grids, but overall geographical distribution includes this area.

[1]Status according to Friedmann & Daly 2004.

AMPHIBIANS

Common name	Species	Habitat	Status[2]	Likelihood of occurrence
Giant Bullfrog	*Pyxicephalus adspersus*	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. Recorded from the grid 3124BD since 1996. Habitat loss due to crop agriculture and urbanization poses a major threat to this species.	NT	MEDIUM, previously recorded in grid.

[2]Status according to Minter et al. 2004.

REPTILES

Common name	Species	Habitat	Status[3]	Likelihood of occurrence
Yellowbellied house snake	*Lamprophis fuscus*	Old termitaria and under stones. Distribution appears to follow mesic biomes (grassland, fynbos, etc. and not Karoo)	RARE[3], (NEAR THREATENED[4])	LOW, outside known distribution.
Striped harlequin snake	*Homoroselaps dorsalis*	Old termitaria and under stones in grassland. Distribution appears to be centred on Highveld region.	RARE	LOW, outside known distribution. Habitat is not well suited to species.
Plain mountain adder	*Bitis inornatus*	Montane grassland from 1600-1800 m altitude. Known from Kompassberg and Sneeuberg.	RESTRICTED	LOW, not known from site, but habitat on top of mountains is good and near to known distribution

[3]Status according to Branch 1988.

BIRDS

Common name	Species	Habitat	Status[4]	Importance of site for species
Cape Vulture	*Gyps coprotheres*	The Cape Vulture is concentrated in the Lesotho Highlands and the northern provinces of South Africa. It has been reported from grids adjacent to the north-east of the study site. It forages over open grassland and woodland. Reporting rates in the study site and adjacent areas are low as it is the edge of its known range. It is dependent on tall cliffs for roosting and breeding but also roosts on trees and pylons. It has declined dramatically due to threats such as food shortages, electrocutions, poisonings, drownings and disturbance at breeding and roosting sites.	VU A1a,c,d; A2b,c,d; C1; C2b	LOW, breeding, MEDIUM, foraging
Tawny	*Aquila rapax*	This once widespread bird is mainly located in the	VU A1a;	LOW,

Eagle		northern parts of South Africa, and is not endemic, also having been found in southern Asia. It has been reported from areas in adjacent grids to the north-east of the study site. It occurs mainly in woodlands, including lightly wooded areas. In the treeless Karoo and other predominantly grassland regions, it nests in alien trees and on high-tension pylons. It suffers from poisoning, shooting and gin traps. It also suffers mortalities from collisions with power lines and vehicles.	A2b; C1	breeding, MEDIUM, foraging
Martial Eagle	*Polemaetus bellicosus*	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 areas surrounding the study area.	VU A1a; C1	LOW, breeding, MEDIUM, foraging
Lesser Kestrel	*Falco naumannii*	This species is widespread in South Africa except for most of the Northern Cape, and occurs in other countries. This species occurs in open country and roosts communally in tall trees (mainly *Eucalyptus*), in urban areas. They prefer to forage in pristine grassland, which is scarce since few areas are not transformed by agriculture. Most of the threats, however, exist in the Palearctic part of its range, and conservation is therefore complex as it only occurs in South Africa for part of its cycle. They forage on insect swarms and are beneficial to agriculture in this way. They have been sited within the study area, at relatively high reporting rates.	VU A1a,c,e	LOW, breeding, HIGH, foraging
Blue Crane	*Anthropoides paradiseus*	This species is a near-endemic to South Africa, occurring in every province. It is locally abundant in parts of its range. It has experienced substantial decline due to poisoning of birds and indirect loss of grassland breeding habitat. It occupies dry short grassland, being more abundant in the eastern sour grasslands where natural grazing of livestock is the predominant land use. Not dependent on wetland habitats for breeding. They have been recorded frequently throughout the study area. Nesting sites are secluded open grasslands with full view around the nest for predator evasion.	VU A1acde; A2bc	LOW, breeding, MEDIUM, foraging
Kori Bustard	*Ardeotis kori*	The southern African race of this species occurs in the semi-arid regions of South Africa, inhabiting dry savannas and moist and semi-arid woodlands. It has declined within the Eastern Cape because of habitat destruction. It has been reported from areas east and west of the study area.	VU C1	LOW, breeding, MEDIUM, foraging
Ludwig's Bustard	*Neotis ludwigii*	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 has been reported from the grids east and west of the study site. It inhabits the open plains of the semi-arid Karoo and especially in areas where extensive sheep farming is prevalent.	VU A1a; A2b	LOW, breeding, MEDIUM, foraging

[4]National status, according to Barnes 2000

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

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

None have 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 surrounding areas (including habitats not occurring on site).

Achnatherum clandestinum (Hack.) Barkworth
Acrotome inflata Benth.
Agrostis eriantha Hack. var. eriantha
Agrostis lachnantha Nees var. lachnantha
Aizoon canariense L.
Albuca fastigiata Dryand. var. fastigiata
Alectra pumila Benth.
Aloe broomii Schönland var. broomii
Aloe claviflora Burch.
Aloe lineata (Aiton) Haw. var. lineata
Aloe microstigma Salm-Dyck ssp. microstigma
Alternanthera pungens Kunth
Amaranthus capensis Thell. ssp. capensis
Amaranthus deflexus L.
Amaranthus dinteri Schinz ssp. dinteri var. a
Amaranthus hybridus L. ssp. hybridus var. hybridus
Amellus tridactylus DC. ssp. tridactylus
Anchusa capensis Thunb.
Anomodon pseudotristis (Müll.Hal.) Kindb.
Apium graveolens L.
Aptosimum procumbens (Lehm.) Steud.
Arctotheca calendula (L.) Levyns
Argemone ochroleuca Sweet ssp. ochroleuca
Argyrolobium sp.
Aristida adscensionis L.
Aristida congesta Roem. & Schult. ssp. barbicollis (Trin. & Rupr.) De Winter
Aristida congesta Roem. & Schult. ssp. congesta
Aristida diffusa Trin. ssp. burkei (Stapf) Melderis
Aristida diffusa Trin. ssp. diffusa
Aspalathus acicularis E.Mey. ssp. planifolia R.Dahlgren
Asparagus bechuanicus Baker
Asparagus cooperi Baker
Asparagus exuvialis Burch. forma exuvialis
Asparagus mucronatus Jessop
Asparagus retrofractus L.
Asparagus striatus (L.f.) Thunb.
Asparagus suaveolens Burch.
Asplenium cordatum (Thunb.) Sw.
Aster squamatus (Spreng.) Hieron.
Atriplex erosa G.Brückn. & I.Verd.
Atriplex nummularia Lindl. ssp. nummularia
Atriplex semibaccata R.Br. var. appendiculata Aellen
Atriplex suberecta I.Verd.
Azolla filiculoides Lam.
Ballota africana (L.) Benth.
Bassia diffusa (Thunb.) Kuntze
Berkheya pinnatifida (Thunb.) Thell. ssp. pinnatifida
Berula erecta (Huds.) Coville ssp. thunbergii (DC.) B.L.Burtt
Bidens bipinnata L.
Blepharis capensis (L.f.) Pers. x B. villosa (Nees) C.B.Clarke
Blepharis mitrata C.B.Clarke
Boophone disticha (L.f.) Herb.
Brachiaria marlothii (Hack.) Stent
Bromus catharticus Vahl
Bromus commutatus Schrad.
Bromus diandrus Roth
Bromus leptoclados Nees
Brunsvigia radulosa Herb.
Buddleja glomerata H.L.Wendl.
Buglossoides arvensis (L.) I.M.Johnst.
Bulbine abyssinica A.Rich.
Bulbine frutescens (L.) Willd.
Bulbostylis hispidula (Vahl) R.W.Haines ssp. pyriformis (Lye) R.W.Haines
Cadaba aphylla (Thunb.) Wild
Calobota psiloloba (E.Mey.) Boatwr. & B.-E.van Wyk
Carduus tenuiflorus Curtis
Carex divisa Huds.
Cenchrus ciliaris L.

Chaenostoma halimifolium Benth.
Chaenostoma macrosiphon Schltr.
Chascanum pinnatifidum (L.f.) E.Mey. var. pinnatifidum
Cheilanthes eckloniana (Kunze) Mett.
Cheilanthes hirta Sw.
Cheilanthes hirta Sw. var. brevipilosa W.& N.Jacobsen
Chenopodium album L.
Chenopodium glaucum L.
Chenopodium mucronatum Thunb.
Chenopodium schraderianum Roem. & Schult.
Chloris virgata Sw.
Chrysocoma ciliata L.
Cichorium intybus L. ssp. intybus
Cineraria aspera Thunb.
Cirsium vulgare (Savi) Ten.
Cissampelos capensis L.f.
Citrullus lanatus (Thunb.) Matsum. & Nakai
Commelina africana L. var. africana
Commelina africana L. var. lancispatha C.B.Clarke
Conium chaerophylloides (Thunb.) Sond.
Convolvulus arvensis L.
Convolvulus boedeckerianus Peter
Convolvulus multifidus Thunb.
Convolvulus sagittatus Thunb.
Conyza bonariensis (L.) Cronquist
Conyza podocephala DC.
Conyza scabrida DC.
Cotula burchellii DC.
Cotula coronopifolia L.
Cotula zeyheri Fenzl
Cotyledon orbiculata L. var. oblonga (Haw.) DC.
Crassula capitella Thunb. ssp. thyrsiflora (Thunb.) Toelken
Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp. ssp. lanceolata
Crassula lanuginosa Harv. var. lanuginosa
Crassula umbellata Thunb.
Crassula vaillantii (Willd.) Roth
Crotalaria griquensis L.Bolus
Cucumis heptadactylus Naudin
Cucumis myriocarpus Naudin ssp. leptodermis (Schweick.) C.Jeffrey & P.Halliday
Cuscuta campestris Yunck.
Cussonia paniculata Eckl. & Zeyh. ssp. paniculata
Cymbopogon pospischilii (K.Schum.) C.E.Hubb.
Cynodon incompletus Nees
Cynodon transvaalensis Burtt Davy
Cyperus congestus Vahl
Cyperus longus L. var. tenuiflorus (Rottb.) Boeck.
Cyperus marginatus Thunb.
Cyperus sp.
Cyperus usitatus Burch.
Cyrtanthus contractus N.E.Br.
Datura ferox L.
Datura stramonium L.
Deverra burchellii (DC.) Eckl. & Zeyh.
Dianthus micropetalus Ser.
Diclis petiolaris Benth.
Dicoma capensis Less.
Digitaria eriantha Steud.
Dimorphotheca cuneata (Thunb.) Less.
Dimorphotheca sp.
Dimorphotheca zeyheri Sond.
Diospyros austro-africana De Winter var. microphylla (Burch.) De Winter
Diospyros lycioides Desf. ssp. lycioides
Dipcadi ciliare (Zeyh. ex Harv.) Baker
Dipcadi viride (L.) Moench
Drimia macrantha (Baker) Baker
Duvalia caespitosa (Masson) Haw. ssp. pubescens (N.E.Br.) Bruyns
Eberlanzia sp.
Echinochloa crus-galli (L.) P.Beauv.
Echium plantagineum L.
Ehretia rigida (Thunb.) Druce ssp. rigida
Elytropappus rhinocerotis (L.f.) Less.

Enneapogon desvauxii P.Beauv.
Epilobium hirsutum L.
Eragrostis barrelieri Daveau
Eragrostis bergiana (Kunth) Trin.
Eragrostis bicolor Nees
Eragrostis chloromelas Steud.
Eragrostis cilianensis (All.) Vignolo ex Janch.
Eragrostis curvula (Schrad.) Nees
Eragrostis homomalla Nees
Eragrostis lehmanniana Nees var. lehmanniana
Eragrostis mexicana (Hornem.) Link ssp. virescens (J.Presl.) S.D.Koch & Sánchez Vega
Eragrostis obtusa Munro ex Ficalho & Hiern
Eragrostis procumbens Nees
Eragrostis truncata Hack.
Eriocephalus ericoides (L.f.) Druce ssp. ericoides
Eriocephalus eximius DC.
Eriocephalus karooicus M.A.N.Müll.
Eriocephalus tenuifolius DC.
Erodium cicutarium (L.) L'Hér.
Erucastrum strigosum (Thunb.) O.E.Schulz
Euclea crispa (Thunb.) Gürke ssp. ovata (Burch.) F.White
Eucomis autumnalis (Mill.) Chitt. ssp. autumnalis
Euphorbia aequoris N.E.Br.
Euphorbia helioscopia L.
Euphorbia inaequilatera Sond. var. inaequilatera
Euphorbia prostrata Aiton
Euryops galpinii Bolus
Eustachys paspaloides (Vahl) Lanza & Mattei
Felicia burkei (Harv.) L.Bolus
Felicia fascicularis DC.
Felicia filifolia (Vent.) Burtt Davy ssp. filifolia
Felicia hirsuta DC.
Felicia muricata (Thunb.) Nees ssp. muricata
Felicia ovata (Thunb.) Compton
Ficinia gracilis Schrad.
Fingerhuthia africana Lehm.
Fingerhuthia sesleriiformis Nees
Foveolina dichotoma (DC.) Källersjö
Galenia procumbens L.f.
Galenia subcarnosa Adamson
Galium capense Thunb. ssp. garipense (Sond.) Puff var. garipense
Garuleum pinnatifidum (Thunb.) DC.
Gazania jurineifolia DC. ssp. jurineifolia
Gazania krebsiana Less. ssp. arctotoides (Less.) Roessler
Gazania krebsiana Less. ssp. krebsiana
Gazania krebsiana Less. ssp. serrulata (DC.) Roessler
Geigeria burkei Harv. ssp. diffusa (Harv.) Merxm.
Geigeria filifolia Mattf.
Geigeria ornativa O.Hoffm.
Gladiolus permeabilis D.Delaroche ssp. edulis (Burch. ex Ker Gawl.) Oberm.
Gleditsia triacanthos L.
Gnidia polycephala (C.A.Mey.) Gilg
Gomphocarpus fruticosus (L.) Aiton f. ssp. fruticosus
Gomphocarpus tomentosus Burch. ssp. tomentosus
Gomphostigma virgatum (L.f.) Baill.
Gymnosporia karooica Jordaan
Haemanthus humilis Jacq. ssp. hirsutus (Baker) Snijman
Haemanthus humilis Jacq. ssp. humilis
Haworthia venosa (Lam.) Haw. ssp. tessellata (Haw.) M.B.Bayer
Helichrysum argyrosphaerum DC.
Helichrysum cerastioides DC. var. cerastioides
Helichrysum dregeanum Sond. & Harv.
Helichrysum lineare DC.
Helichrysum lucilioides Less.
Helichrysum nudifolium (L.) Less. var. nudifolium
Helichrysum pentzioides Less.
Helichrysum rosum (P.J.Bergius) Less. var. arcuatum Hilliard
Helichrysum rosum (P.J.Bergius) Less. var. rosum
Helichrysum rutilans (L.) D.Don
Helichrysum zeyheri Less.
Helictotrichon turgidulum (Stapf) Schweick.

Heliophila suavissima Burch. ex DC.
Heliophila variabilis Burch. ex DC.
Heliotropium ciliatum Kaplan
Heliotropium curassavicum L.
Hermannia cuneifolia Jacq. var. glabrescens (Harv.) I.Verd.
Hermannia filifolia L.f. var. filifolia
Hermannia linearifolia Harv.
Hermannia pulchella L.f.
Hermannia pulverata Andrews
Herniaria erckertii Herm. ssp. erckertii var. dewetii Herm.
Hertia cluytiifolia (DC.) Kuntze
Hertia pallens (DC.) Kuntze
Heteromorpha arborescens (Spreng.) Cham. & Schltdl. var. arborescens
Heteropogon contortus (L.) Roem. & Schult.
Hibiscus pusillus Thunb.
Hibiscus trionum L.
Holothrix schlechteriana Schltr. ex Kraenzl.
Hordeum capense Thunb.
Hordeum stenostachys Godr.
Hordeum stenostachys Godr.
Hyobanche sanguinea L.
Hyparrhenia hirta (L.) Stapf
Ifloga glomerata (Harv.) Schltr.
Indigofera alternans DC. var. alternans
Indigofera sessilifolia DC.
Ipomoea oenotheroides (L.f.) Raf. ex Hallier f.
Isolepis costata Hochst. ex A.Rich.
Jamesbrittenia atropurpurea (Benth.) Hilliard ssp. atropurpurea
Jamesbrittenia aurantiaca (Burch.) Hilliard
Jamesbrittenia filicaulis (Benth.) Hilliard
Juncus inflexus L.
Juncus punctorius L.f.
Juncus rigidus Desf.
Justicia orchioides L.f. ssp. glabrata Immelman
Kniphofia linearifolia Baker
Koeleria capensis (Steud.) Nees
Kohautia cynanchica DC.
Lantana rugosa Thunb.
Lappula heteracantha Ledeb.
Lasiopogon glomerulatus (Harv.) Hilliard
Lasiospermum pedunculare Lag.
Ledebouria apertiflora (Baker) Jessop
Ledebouria undulata (Jacq.) Jessop
Leonotis ocymifolia (Burm.f.) Iwarsson
Lepidium capense Thunb.
Lepidium desertorum Eckl. & Zeyh.
Leptochloa fusca (L.) Kunth
Lessertia depressa Harv.
Lessertia pauciflora Harv. var. pauciflora
Leysera tenella DC.
Limeum sulcatum (Klotzsch) Hutch. var. robustum Friedrich
Limeum viscosum (J.Gay) Fenzl ssp. viscosum var. glomeratum (Eckl. & Zeyh.) Friedrich
Limonium dregeanum (C.Presl) Kuntze
Limosella grandiflora Benth.
Lobelia thermalis Thunb.
Lolium perenne L.
Lotononis pungens Eckl. & Zeyh.
Lycium afrum L.
Lycium cinereum Thunb.
Lycium horridum Thunb.
Lycium pumilum Dammer
Lycium schizocalyx C.H.Wright
Malva neglecta Wallr.
Malva parviflora L. var. parviflora
Malva pusilla Sm.
Manulea plurirosulata Hilliard
Marasmodes undulata Compton CR: INCORRECT ID!! (Only from Paarl!)
Marrubium vulgare L.
Marsilea sp.
Massonia depressa Houtt.
Massonia jasminiflora Burch. ex Baker

Matthiola torulosa (Thunb.) DC.
Medicago laciniata (L.) Mill. var. laciniata
Medicago lupulina L.
Melianthus comosus Vahl
Melica decumbens Thunb.
Melica racemosa Thunb.
Melilotus albus Medik.
Melilotus indicus (L.) All.
Melinis repens (Willd.) Zizka ssp. repens
Melolobium calycinum Benth.
Melolobium candicans (E.Mey.) Eckl. & Zeyh.
Melolobium microphyllum (L.f.) Eckl. & Zeyh.
Mentha longifolia (L.) Huds. ssp. capensis (Thunb.) Briq.
Mestoklema tuberosum (L.) N.E.Br. ex Glen
Microloma armatum (Thunb.) Schltr. var. armatum
Miscanthus capensis (Nees) Andersson
Mollugo cerviana (L.) Ser. ex DC. var. cerviana
Monsonia angustifolia E.Mey. ex A.Rich.
Moquiniella rubra (A.Spreng.) Balle
Moraea pallida (Baker) Goldblatt
Moraea polystachya (Thunb.) Ker Gawl.
Moraea simulans Baker
Nasturtium officinale R.Br.
Nemesia pubescens Benth. var. pubescens
Nenax microphylla (Sond.) T.M.Salter
Nicotiana glauca Graham
Nolletia ciliaris (DC.) Steetz
Oligocarpus calendulaceus (L.f.) Less.
Oligomeris dregeana (Müll.Arg.) Müll.Arg.
Oncosiphon piluliferum (L.f.) Källersjö
Ornithogalum juncifolium Jacq. var. juncifolium
Ornithogalum prasinum Lindl.
Ornithogalum tenuifolium F.Delaroche ssp. tenuifolium
Ornithoglossum dinteri K.Krause
Ornithoglossum sp.
Oropetium capense Stapf
Orthotrichum diaphanum (Schrad. ex Brid.) Lindb.
Osteospermum leptolobum (Harv.) Norl.
Osteospermum muricatum E.Mey. ex DC. ssp. muricatum
Osteospermum spinescens Thunb.
Osyris lanceolata Hochst. & Steud.
Othonna pavonia E.Mey.
Oxalis depressa Eckl. & Zeyh.
Oxalis obliquifolia Steud. ex A.Rich.
Oxalis smithiana Eckl. & Zeyh.
Pachypodium succulentum (Jacq.) Sweet
Panicum coloratum L. var. coloratum
Panicum impeditum Launert
Panicum stapfianum Fourc.
Papaver aculeatum Thunb.
Paspalum dilatatum Poir.
Pegolettia retrofracta (Thunb.) Kies
Pelargonium abrotanifolium (L.f.) Jacq.
Pelargonium aridum R.A.Dyer
Pelargonium dichondrifolium DC.
Pelargonium griseum R.Knuth
Pelargonium laxum (Sweet) G.Don ssp. laxum
Pelargonium minimum (Cav.) Willd.
Pelargonium tragacanthoides Burch.
Pellaea calomelanos (Sw.) Link var. calomelanos
Pennisetum glaucocladum Stapf & C.E.Hubb.
Pentaschistis glandulosa (Schrad.) H.P.Linder
Pentaschistis microphylla (Nees) McClean
Pentzia globosa Less.
Pentzia incana (Thunb.) Kuntze
Pentzia lanata Hutch.
Pentzia punctata Harv.
Pentzia quinquefida (Thunb.) Less.
Pentzia sphaerocephala DC.
Pentzia tortuosa (DC.) Fenzl ex Harv.
Pentzia viridis Kies

Persicaria lapathifolia (L.) Gray
Phragmites australis (Cav.) Steud.
Phyllanthus parvulus Sond. var. parvulus
Phymaspermum aciculare (E.Mey. ex Harv.) Benth. & Hook. ex B.D.Jacks
Phymaspermum parvifolium (DC.) Benth. & Hook. ex B.D.Jacks.
Phymaspermum scoparium (DC.) Källersjö
Physalis viscosa L.
Picris echioides L.
Plantago lanceolata L.
Plantago major L.
Plinthus karooicus I.Verd.
Polygala ephedroides Burch.
Polygonum aviculare L.
Polypogon monspeliensis (L.) Desf.
Portulaca oleracea L.
Portulaca quadrifida L.
Prosopis velutina Wooton
Pseudocrossidium crinitum (Schultz) R.H.Zander
Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt
Pseudognaphalium undulatum (L.) Hilliard & B.L.Burtt
Pseudoschoenus inanis (Thunb.) Oteng-Yeb.
Psilocaulon articulatum (Thunb.) N.E.Br.
Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.
Pterodiscus luridus Hook.f.
Pteronia erythrochaeta DC.
Pteronia glauca Thunb.
Pteronia glomerata L.f.
Pteronia punctata E.Phillips
Pteronia sordida N.E.Br.
Pteronia tricephala DC.
Pterothrix spinescens DC.
Puccinellia fasciculata (Torr.) E.P.Bicknell
Rabiea difformis (L.Bolus) L.Bolus
Ranunculus multifidus Forssk.
Ranunculus rionii Lagger
Rapistrum rugosum (L.) All.
Relhania sp.
Rhigozum obovatum Burch.
Romulea macowanii Baker var. macowanii
Rosenia humilis (Less.) K.Bremer
Rubia petiolaris DC.
Rumex lanceolatus Thunb.
Ruschia cradockensis (Kuntze) H.E.K.Hartmann & Stüber ssp. cradockensis
Salix caprea L.
Salix mucronata Thunb. ssp. mucronata
Salsola calluna Fenzl ex C.H.Wright
Salsola glabrescens Burtt Davy
Salsola kali L.
Salvia runcinata L.f.
Salvia stenophylla Burch. ex Benth.
Salvia verbenaca L.
Sarcocaulon camdeboense Moffett
Sarcocaulon l'heritieri Sweet
Sarcocaulon salmoniflorum Moffett
Sarcostemma viminale (L.) R.Br. ssp. viminale
Schismus barbatus (Loefl. ex L.) Thell.
Schismus inermis (Stapf) C.E.Hubb.
Schkuhria pinnata (Lam.) Kuntze ex Thell.
Schoenoplectus tabernaemontani (C.C.Gmel.) Palla
Scirpoides dioecus (Kunth) Browning
Searsia burchellii (Sond. ex Engl.) Moffett
Searsia ciliata (Licht. ex Schult.) A.J.Mill.
Searsia dregeana (Sond.) Moffett
Searsia erosa (Thunb.) Moffett
Searsia pyroides (Burch.) Moffett var. pyroides
Sebaea compacta A.W.Hill
Sebaea pentandra E.Mey. var. pentandra
Selago geniculata L.f.
Selago magnakarooica Hilliard
Selago paniculata Thunb.
Selago saxatilis E.Mey.

Senecio burchellii DC.
Senecio harveianus MacOwan
Senecio inaequidens DC.
Senecio intricatus S.Moore
Senecio leptophyllus DC.
Senecio radicans (L.f.) Sch.Bip.
Senecio reptans Turcz.
Senecio tanacetopsis Hilliard
Sesamum capense Burm.f.
Setaria italica (L.) P.Beauv.
Silene burchellii Otth var. angustifolia Sond.
Silene undulata Aiton
Sisymbrium burchellii DC. var. burchellii
Sisymbrium orientale L.
Solanum supinum Dunal var. supinum
Solanum tomentosum L. var. tomentosum
Sonchus asper (L.) Hill ssp. asper
Sonchus dregeanus DC.
Sorghum halepense (L.) Pers.
Spergula arvensis L.
Sporobolus fimbriatus (Trin.) Nees
Sporobolus ioclados (Trin.) Nees
Sporobolus ludwigii Hochst.
Stachys hyssopoides Burch. ex Benth.
Stachys linearis Burch. ex Benth.
Stapelia grandiflora Masson var. grandiflora
Stapelia olivacea N.E.Br.
Stenostelma capense Schltr.
Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter
Stipagrostis namaquensis (Nees) De Winter
Stipagrostis obtusa (Delile) Nees
Sutherlandia microphylla Burch. ex DC.
Syringodea concolor (Baker) M.P.de Vos
Tagetes minuta L.
Talinum caffrum (Thunb.) Eckl. & Zeyh.
Tarchonanthus minor Less.
Tetrachne dregei Nees
Tetragonia acanthocarpa Adamson
Tetragonia arbuscula Fenzl
Thesium hystrix A.W.Hill
Thesium namaquense Schltr.
Thesium spartioides A.W.Hill
Thesium triflorum Thunb. ex L.f.
Trachyandra asperata Kunth var. macowanii (Baker) Oberm.
Trachyandra saltii (Baker) Oberm. var. saltii
Tragopogon dubius Scop.
Tragus berteronianus Schult.
Tragus koelerioides Asch.
Tragus racemosus (L.) All.
Tribolium hispidum (Thunb.) Desv.
Tribulus zeyheri Sond. ssp. zeyheri
Trichodiadema pomeridianum L.Bolus
Tridentea gemmiflora (Masson) Haw.
Trifolium africanum Ser. var. africanum
Trifolium burchellianum Ser. ssp. burchellianum
Tripteris aghillana DC. var. aghillana
Tripteris sinuata DC. var. linearis (Harv.) B.Nord.
Troglophyton capillaceum (Thunb.) Hilliard & B.L.Burtt ssp. capillaceum
Typha capensis (Rohrb.) N.E.Br.
Urochloa panicoides P.Beauv.
Urtica dioica L.
Urtica urens L.
Verbascum virgatum Stokes
Veronica anagallis-aquatica L.
Veronica persica Poir.
Vicia sp.
Viscum capense L.f. ssp. hoolei Wiens
Wahlenbergia albens (Spreng. ex A.DC.) Lammers
Wahlenbergia androsacea A.DC.
Wahlenbergia nodosa (H.Buek) Lammers
Withania somnifera (L.) Dunal

Xanthium spinosum L.
Xysmalobium gomphocarpoides (E.Mey.) D.Dietr. var. gomphocarpoides
Zannichellia palustris L.
Zygophyllum gilfillanii N.E.Br.
Zygophyllum incrustatum E.Mey. ex Sond.