

EIA REPORT:

Specialist ecological study on the potential impacts of the proposed INCA Vredendal PV Solar Energy Facility near Vredendal, Western Cape Province

Prepared by

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EIA REPORT: 1st draft



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

REGULATIONS GOVERNING THIS REPORT

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

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

Regulation 32. (2): The person referred to in subregulation (1) must comply with the requirements of regulation 17.

Regulation 32. (3): A specialist report or a report on a specialised process prepared in terms of these Regulations must contain:

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

Section 17 relates to General requirements for EAPs or a person compiling a specialist report or undertaking a specialized process, as follows:

An EAP appointed in terms of regulation 16(1) must-

- (a) Be independent;
- (b) Have expertise in conducting environmental impact assessments, including knowledge of the Act, these regulations and any guidelines that have relevance to the proposed activity;
- (c) Perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- (d) Comply with the Act, the Regulations and all other applicable legislation;
- (e) Take into account, to the extent possible, the matters referred to in regulation 8 when preparing the application and any report relating to the application; and
- (f) Disclose to the applicant and the competent authority all material information in the possession of the EAP that reasonably has or may have the potential of influencing-
 - i. Any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or
 - ii. The objectivity of any report, plan or document to be prepared by the EAP in terms of these Regulations for submission to the competent authority.

Appointment of specialist

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

Details of specialist

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- 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.
- Referee for 3 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with INCA Vredendal Solar (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.

Conditions relating to this report

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

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

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INTRODUCTION

Terms of reference and approach

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

On 21 March 2011 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological scoping 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;
- Direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:
 - the **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected;
 - the **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- A statement regarding the desk-top evaluation of full site, with high-level identification of potential areas of sensitivity (for input into a sensitivity map)
- identification of potentially significant impacts to be assessed within the EIA phase;
- to provide recommendations regarding the methodology to be adopted in assessing potentially significant impacts in the EIA phase (sufficiently detailed to be included within the Plan of Study for EIA and must include a description of the proposed method of assessing the potential environmental impacts associated with the project).

This report provides details of the results of the Scoping phase. The findings of the study are based on a desktop assessment of the study area.

Study area

At a regional level the study area falls within the Eastern Cape Province near the town of Riebeek East. A more detailed description of the study area is provided in a section below.

METHODOLOGY

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

Assessment philosophy

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

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

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

Species

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

Ecosystems

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

Processes

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

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which 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 Of 2004)

Plant and animal species of concern

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

Lists were compiled specifically for any species of conservation concern previously recorded in the area and any other species with potential conservation value. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute for the quarter degree squares within which the study area is situated.

Regulations published for the National Forests Act provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area.

Provincial and National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following: *National Environmental Management: Biodiversity Act (Act No 10 of 2004)*.

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

- *Habitat requirements*: most Red List 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 List 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 List species within the study area.

For all threatened or protected organisms (flora and fauna) that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

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

Habitats of concern

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

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA), Western Cape Biodiversity Conservation Plan. 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.

Limitations

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

DESCRIPTION OF STUDY AREA

Location

The study site is situated in the Western Cape Province, approximately 10 km north-west of the town of Vredendal (Figure 1). The R362 road from Vredendal to Lutzville passes within 1 km of the south-western side of the site. There is a railway line that marks this south-western boundary of the site. A small gravel road provides access to the site from the R362. The site falls within the quarter degree grid 3118CB.

The solar energy facility is proposed on the Remainder of Farm Seekoigat 277. The site proposed for the facility falls within the Matzikama Municipality.

Landuse and landcover of the study area

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that most of the study area consists of natural vegetation. This landcover information is based on coarse-scale satellite imagery, which is poor at resolving detailed information at a site-specific scale. The landcover map was also produced at a broad scale, which introduces spatial and contextual errors when being used for assessment of a small site, such as the current study area.

The 1:50 000 topocadastral maps for the area indicates that the entire site has been previously cultivated (see Figure 1). A Google image of the site supports this map



Figure 1: Location of the proposed INCA Vredendal PV Solar Energy Facility.

classification and shows typical parallel striations associated with commercial cultivation of land in comparison to surrounding natural vegetation (Figure 2). It is apparent from this Google image (Figure 2) that secondary vegetation growth occurs on the site. A recently cultivated area occurs on the north-western boundary of the site and is shown as bare soil (Figure 2). The areas along the southern and western boundaries of the site are also cultivated, whereas the areas to the north and the east consist of natural vegetation.

Climate

The climate is semi-arid and is very hot and dry in summer (). Winters are mild with low rainfall and occasional morning fog.

Broad vegetation types of the region

The study area is within the Succulent Karoo Biome (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). According to this vegetation map of the country the study area falls entirely within a single vegetation type, Namaqualand Spinescent Grassland. No other vegetation type occurs anywhere within two kilometres of the site. The Namaqualand Spinescent Grassland vegetation type is described in more detail below.

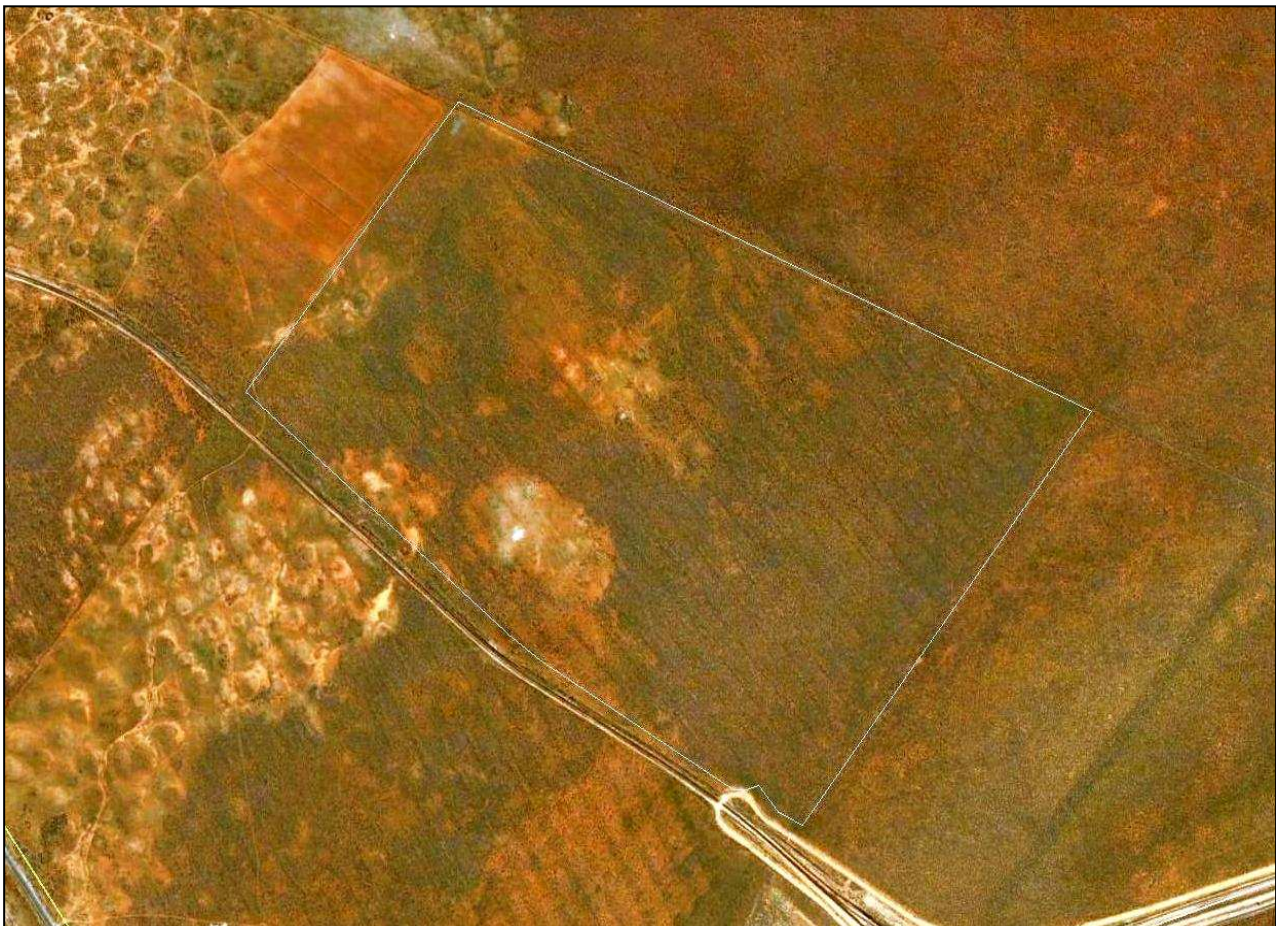


Figure 2: Google image of the proposed INCA Vredendal PV Solar Energy Facility.

Namaqualand Spinescent Grassland

This vegetation occurs in Namaqualand in a strip in the Knersvlakte from Lutzville and Koekenaap eastwards to north of Vanrhynsdorp, occupying a total area of 315.7 km². The town of Vredendal is just to the south of the central distribution of this vegetation type. It occurs in level landscapes on deep, coarse, unstructured red sands originating from the mouth of the palaeo-Orange River (Mucina et al. 2006b). Typical landscapes include gently rolling sand plains and inland dunes (Helme 2007). This vegetation type occurs throughout the study area and surrounding landscapes with no other vegetation type occurring within 2 km of the site.

It is a vegetation dominated by spinifex-like grass (*Cladoraphis spinosa*) and a few scattered emergent taller shrubs (Mucina et al. 2006b). The shrubs are both succulent (*Euphorbia*, *Ruschia*, *Othonna*, *Salsola*, *Zygophyllum*) and non-succulent (*Hermannia*, *Justicia*, *Lebeckia*, *Lycium*, *Wiborgia*). Geophytes and annuals (especially obvious in wet years) occur in the shrub-grass matrix (Mucina et al. 2006b). Species endemic to this vegetation are the geophytic herb, *Ornithogalum autumnulium*, and the succulent herbs, *Quaqua pulchra* and *Tridentia peculiaris* (Mucina et al. 2006b). Another stapeliad, *Quaqua framesii*, is largely restricted to this vegetation type and *Hermannia ciliata* is possibly endemic to this unit (Helme 2007).

Conservation status of broad vegetation types

The vegetation types of South Africa have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation and rates of conservation. 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 1, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Table 1: 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

The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protected on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are potentially fewer ecosystems of concern listed in the Draft Ecosystem List versus in the scientific literature.

According to the scientific literature (Driver et al. 2005; Mucina et al., 2006), the national vegetation type that occurs in the study area is listed as Least Threatened (Table 2). In addition, the vegetation type is not listed in the Draft National List of Threatened Ecosystems (GN1477 of 2009).

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

Vegetation Type	Conservation status	
	Scientific literature	NEM:BA Draft Ecosystem List
Namaqualand Spinescent Grassland	Least Threatened	Not listed

Critical Biodiversity Areas have been identified for all municipal areas of the Western Cape Province and are published on the SANBI website (bgis.sanbi.org). These maps identify natural vegetation surrounding the site as being of high conservation value (Figure 3). The site itself, however, contains no vegetation of conservation importance. This is consistent with patterns identified from other sources within the current scoping document.

Red List plant species of the study area

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Plant species are classified into various categories, depending on the degree of conservation concern (see Table 3 for categories). Only those species classified as Critically Endangered, Endangered or Vulnerable are threatened and therefore of potential concern. All other species are in categories of lesser concern.

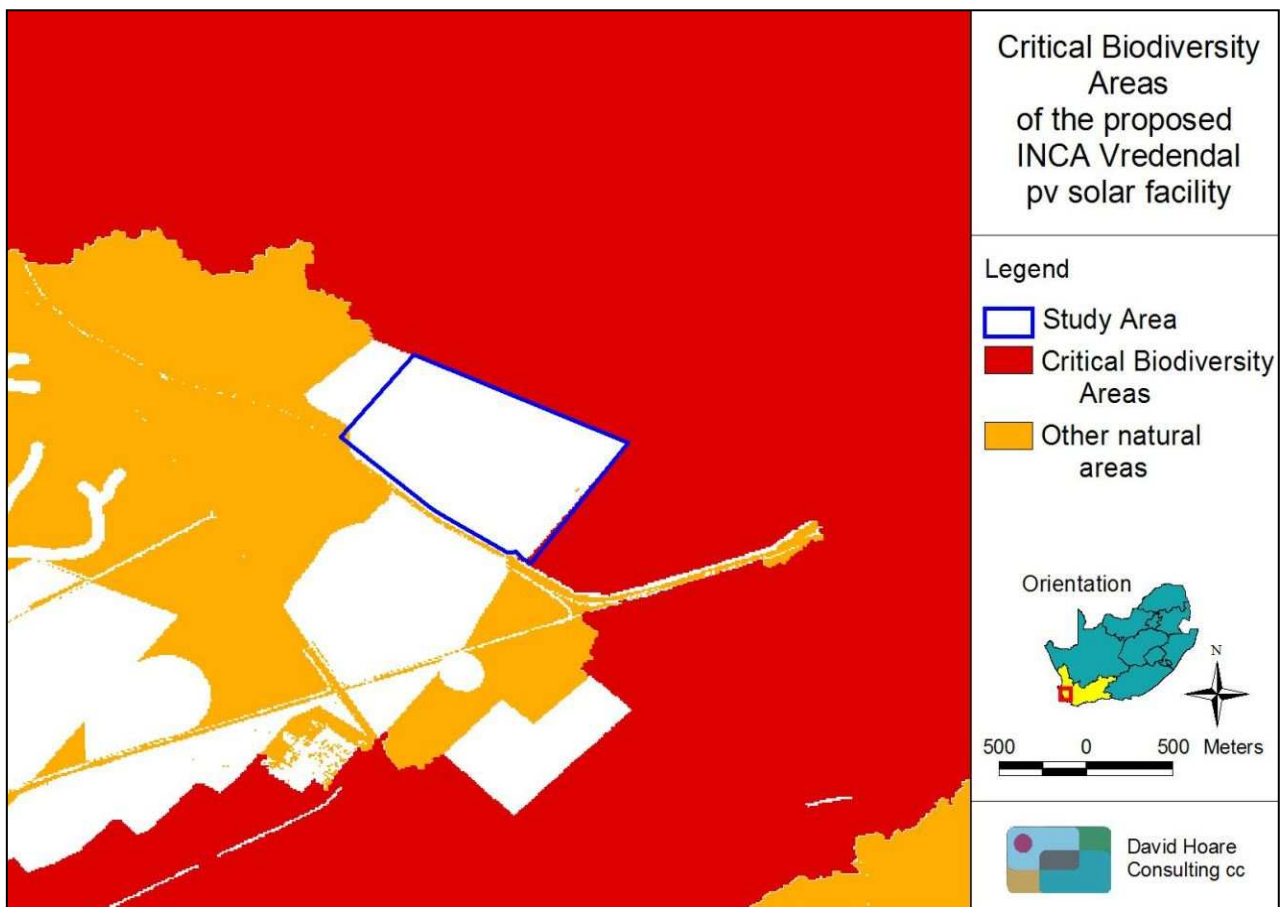


Figure 3: Critical Biodiversity Areas of the study area.

The species on this list were evaluated to determine the probability of occurring on site. Although there are a high number of threatened plant species that occur in this general area (see Appendix 1), there is a very low likelihood of any of them occurring in a previously cultivated area. There is, however, a high possibility of some of these species occurring in the natural vegetation adjacent to the current site. A total of 14 species have been evaluated as having the potential of occurring in these adjacent areas, including nine species listed as vulnerable and three listed as Endangered.

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

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

In summary, there are no plant species of conservation concern that are potentially problematic from the point of view of developing site, on condition there are no impacts on areas adjacent to the site.

Red List animal species of the study area

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

There is one threatened mammal species that could occur in available habitats in the study area. This is the White-tailed Rat, listed nationally as Endangered. The White-tailed Rat occurs in Highveld and montane grassland, but requires sandy to loam soils with good cover. It has been previously recorded in the grids immediately east and west of the study area, which indicates that there is a high probability of it occurring in the study area. The study area contains sandy soils with well-developed secondary vegetation. There is therefore a high probability of these areas being suitable for this species. The potential occurrence of the species on site is difficult to determine due to the sparse nature of existing populations of this species and its wide distribution across South Africa. It is seldom observed during mammal trapping exercises, even when it occurs on a site.

There are an additional seven mammal species classified nationally in various threatened, near threatened or data deficient categories, but which are considered by the IUCN to be globally not threatened, i.e. listed as Least Concern. It is considered improbable that a relatively small site containing secondary vegetation would be important for the survival of any of these species or that development of the site would constitute a significant threat to any of these species that would result in them being listed in a higher conservation status category.

The one species of potential concern within this list of globally Least Concern species is Grant's Golden Mole, which is listed nationally as Vulnerable. The rationale of listing it nationally as Vulnerable and globally as Least Concern is unknown, considering that the species occurs only in South Africa and Namibia. The discrepancy may be due to the fact that the Namibian population occurs within a protected area, whereas the South African population is not protected in any way within a reserve. In South Africa it occurs in loose sands in the Succulent Karoo. The nearest known record of this species in South Africa is two grid squares to the south of the current study area. It is therefore considered possible, but not likely, that it occurs on site.

There are no amphibian species of conservation concern that have a geographical distribution that includes the study area.

There is one reptile species of conservation concern that has a distribution that includes the study area and which could occur on site, the Namaqua Plated Lizard (Near Threatened). This is a terrestrial species that is found in dry sandy areas and bare rocky hillsides in succulent karoo and renosterveld. It shelters in a short burrow dug at the base of a bush or in rodent burrows. It has the habit of wriggling into loose sand so that only the tip of the snout sticks out. It has been previously recorded in the quarter degree grid just to the south of the study area and there is a possibility it could occur on site.

There are thirteen bird species of conservation concern that have a geographical distribution that includes the site, but only two that have breeding or foraging requirements that are met by conditions found on the site. These two species are Ludwig's Bustard (listed as Vulnerable) and the Secretarybird (listed as Near Threatened). Despite the fact that Ludwig's Bustard could occur on site, there is only a low likelihood that this species would use the site for breeding and only a moderate probability of it foraging on site. The secretarybird may use the site for foraging, but would not breed there. The site is therefore not highly important for either of these species.

In summary, the following animal species of conservation concern could potentially occur on site and may therefore be of concern for development of the study area:

1. White-tailed Rat (EN),
2. Grant's Golden Mole (VU),
3. Ludwig's Bustard (VU),
4. Secretarybird (NT),
5. Namaqua Plated Lizard (NT),

Protected animals

There are a number of animal species protected under the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000). These are listed in Appendix 3. According to the Western Cape Nature Conservation Laws Amendment Act, "*No person shall without a permit hunt or be in possession of any endangered wild animal or the carcass of any such animal*". The Act does not imply that habitat for these species should be regarded as sensitive and appears to be primarily concerned with protecting individual animals from hunting or trading. No permit requirements are contained in the Act for cases where such individuals may occur on land for which an application for development is being considered (as in the current case).

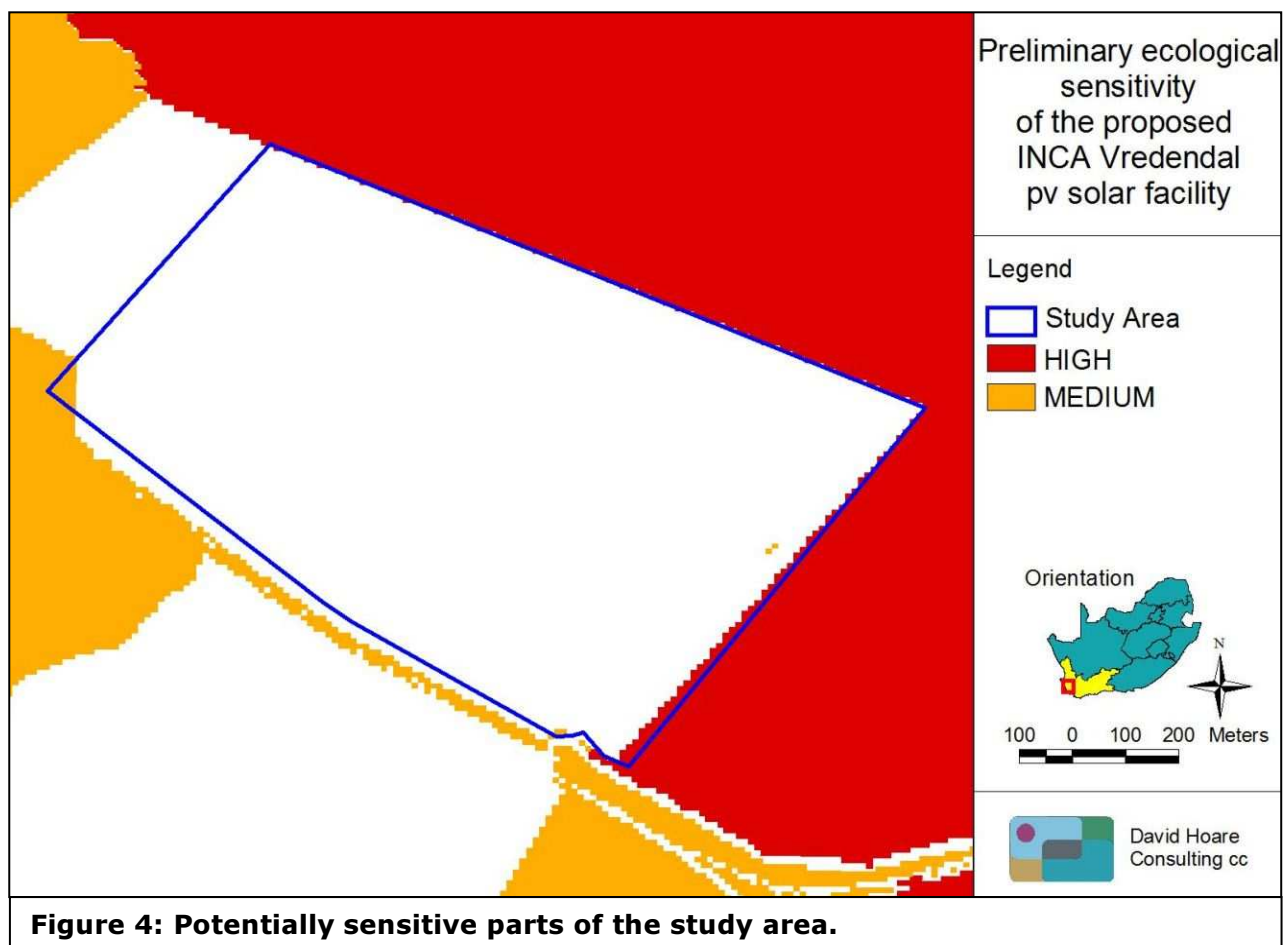
Those species protected according to the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000) that have a geographical distribution that includes the site and that may, therefore, occur on site are listed in Appendix 4, marked with the letter "P".

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site and that may, therefore, occur on site are listed in Appendix 4, marked with the letter "N". This includes the following species: Black-footed Cat, Honey Badger, Leopard, Cape Fox, Giant Girdled Lizard, African Marsh Harrier, Black Stork, Lesser Kestrel, Ludwig's Bustard, Martial Eagle and Peregrine Falcon.

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. There are none that have a geographical distribution that includes the study area.



Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Due to the fact that the site is within a previously cultivated area, it is not considered to be sensitive. Sensitive areas are situated around the site (Figure 4). It is important to ensure that activities on site do not affect these surrounding areas.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

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

Legislation

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

NEMA requires, inter alia, that:

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

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

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

The ECA states that:

Development must be environmentally, socially and economically sustainable.

Sustainable development requires the consideration of inter alia the following factors:

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

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

National Forests Act (Act no 84 of 1998)

Protected trees

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

Forests

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

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

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

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).

- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

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.

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

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

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

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

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

Integrated Coastal Zone Management Act (Act No. 24 of 2008)

The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically

justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management of the coastal zone and contains a number of Chapters dealing with various components. Those that may affect the current project are as follows:

- A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis.
- Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the factors and criteria which the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone.

Sea Birds and Seals Protection Act (Act No. 46 of 1973)

Provides protection for certain species of marine birds, including the Damara Tern and the Bank Cormorant.

National Water Act (Act 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the National 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.

Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000)

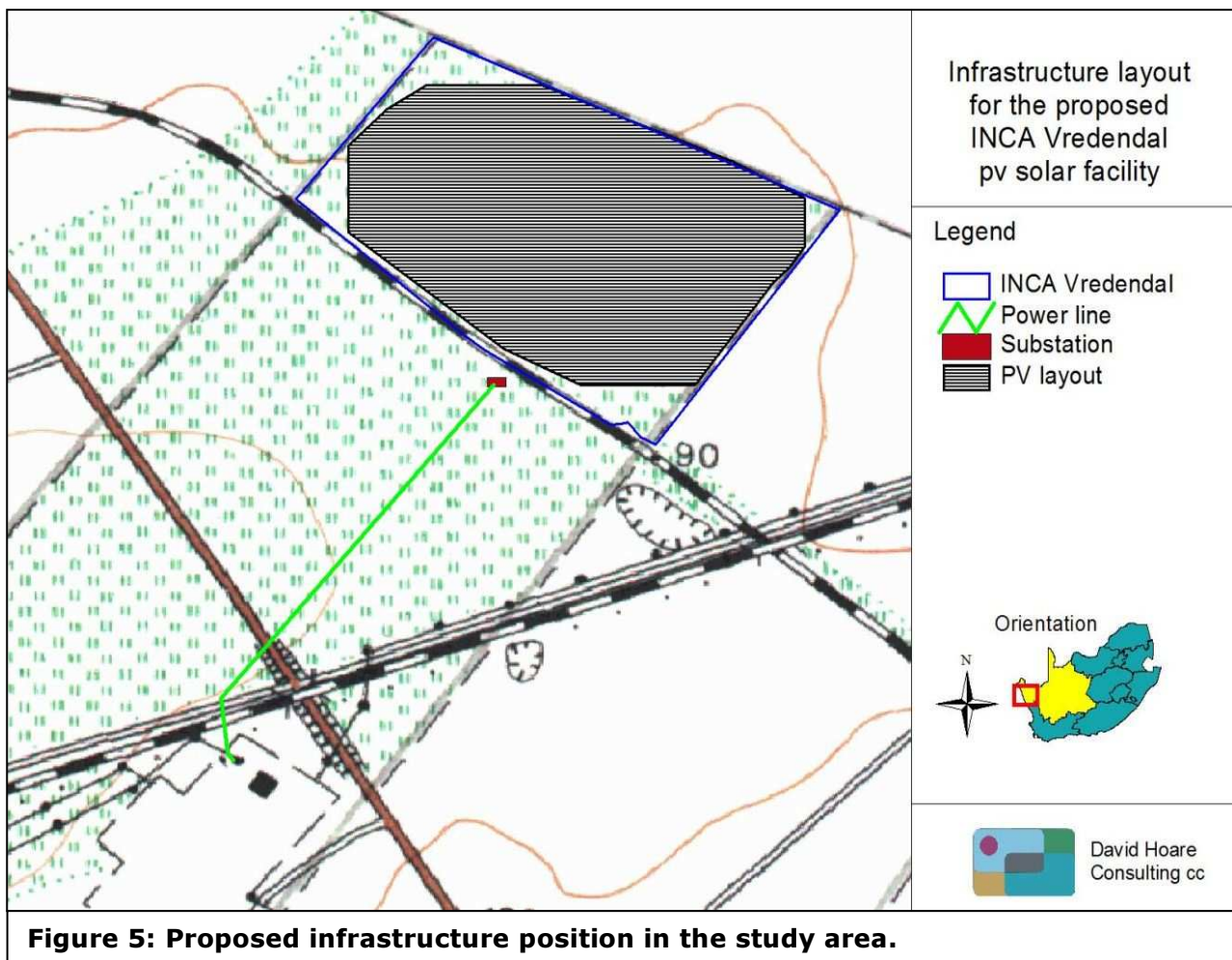
In terms of Section 26 of this Act, "*No person shall without a permit hunt or be in possession of any endangered wild animal or the carcass of any such animal*". Schedule 2 of this Act provides a list of Protected Wild Animals.

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

- Marine Living Resources Act (Act No. 18 of 1998)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Lake Areas Development Act (Act No. 39 of 1975)

DESCRIPTION OF INFRASTRUCTURE

The position of the proposed infrastructure within the study area is indicated in Figure 5. This shows solar panels arranged in across most of the site. An on-site substation will be constructed, which will be just to the south of the area designated for the solar panels. A short power line is proposed that will connect directly to the Juno substation, a distance of less than 2 km to the south of the site. The exact position of the power line is not known. The alignment shown in Figure 5 is indicative.



IDENTIFICATION OF RISKS AND 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)

The vegetation types on site is secondary and therefore of low conservation value. This potential impact is therefore not applicable to the current proposal.

Impact 2: Loss of individuals or populations of threatened plant species

There are no threatened plant species likely to occur on site. This is due to the fact that the vegetation on site is in a previously cultivated area and is therefore of a secondary nature. However, surrounding areas have a high likelihood of containing populations of threatened plant species. Impacts associated with the proposed development must therefore be strictly contained within the site. If this is achieved then this potential impact will not occur.

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). None of these tree species have a geographic distribution that includes the study area. This potential impact is therefore not applicable to the current proposal.

Impact 4: Loss of habitat for threatened animal species

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

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

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

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

It has been evaluated that there are two threatened mammal species, one near threatened reptile and one threatened and one near threatened bird species that could make use of available habitats in the proposed study area. This is the following species:

1. White-tailed Rat (EN),
2. Grant's Golden Mole (VU),
3. Ludwig's Bustard (VU),
4. Secretarybird (NT),

5. Namaqua Plated Lizard (NT).

The two bird species are likely to move away in the event that construction takes place on site, whereas the other three species, if they occur on site, are more likely to be restricted to the site. Both bird species are only likely to use the site for foraging only and not for breeding. It is not certain to what extent the secondary vegetation on site is important for the other three species (White-tailed Rat, Grant's Golden Mole and Namaqua Plated Lizard), but it is assumed that there is the potential for these species to be dependant to some extent on this habitat.

Impact 5: Damage to wetlands and drainage areas

According to aerial imagery of the site (Figure 2), there are no wetlands on site and no dry river beds or drainage areas on site. This potential impact is therefore not applicable to the current proposal.

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

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

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

It is not known to what extent the site contains alien plants. There is, however, the potential for alien plants to invade areas of the site following disturbance on site or spread into surrounding landscapes. This could potentially affect areas surrounding the site, which are considered to have a high conservation value and importance. Declared aliens that are commonly found in the area that includes the site are as follows: *Atriplex lindleyi* subsp. *inflata*, *Atriplex nummularia* subsp. *nummularia*, *Opuntia ficus-indica*, *Prosopis glandulosa* var. *torreyana*, *Ricinus communis*, *Acacia cyclops*, *Acacia saligna*, *Eucalyptus camaldulensis*, *Nicotiana glauca*, *Populus X canescens*, *Schinus molle* and *Sesbania punicea*. The shrub, *Acacia cyclops* (Rooikrans), is by far the most likely to invade disturbed areas on site or in the surroundings. It is known to invade fynbos, dunes, roadsides and watercourses.

Impact 7: Change in natural fire regimes

During construction there is a higher risk of veld fires around construction sites due to the use of fires for cooking and warmth by construction workers. Impacts that may arise from this may include:

1. Damage to sensitive habitats, especially damage to woodland vegetation and change in species composition in grasslands;
2. Damage to populations of sensitive plant species;
3. Loss of vegetation biomass; and

4. Increased soil erosion due to loss of vegetation cover.

The site is within an area of succulent karoo vegetation in which fire does not constitute a natural ecological component on a regular basis. It is possible that there would be a higher risk of fires occurring in the vicinity of the construction of the solar energy facility or during the operation of the facility.

ASSESSMENT OF IMPACTS

Impacts are assessed for each infrastructure component, including solar arrays, substation and overhead power line.

Solar arrays

Impact 4: Loss of habitat for threatened animals

There are two threatened mammal species, one near threatened reptile and one threatened and one near threatened bird species that could make use of available habitats in the proposed study area. The two bird species are likely to move away in the event that construction takes place on site, whereas the other three species, if they occur on site, are more likely to be restricted to the site. Both bird species are only likely to use the site for foraging only and not for breeding. It is not certain to what extent the secondary vegetation on site is important for the other three species (White-tailed Rat, Grant's Golden Mole and Namaqua Plated Lizard), but it is assumed that there is the potential for these species to be dependant to some extent on this habitat even though they were not found on site.

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 arrays. In all cases, the area of concern is likely to 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 secondary habitat that will be lost.

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals – corridor 1, 2 and 4		
	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: Establishment and spread of declared weeds and alien invader plants

There are no concentrations of alien plants on site. The shrub, *Acacia cyclops* (rooikrans), is a common invader in this area and can cause total transformation of natural habitat. It is difficult to clear, once established, and poses a risk to any areas adjacent to an existing invasion. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could lead to general invasion of surrounding vegetation, especially along watercourses and on sandy soils.

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 high for local ecosystems (ecosystem processes may be altered to the extent that they temporarily cease).

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

Mitigation measures: Disturbance of indigenous vegetation adjacent to the site must not take place. Disturbed areas on site 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	high (8)	minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (56)	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 indigenous 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.

Impact 7: Change in natural fire regimes

The site is within an area of succulent karoo vegetation in which fire does not constitute a natural ecological component on a regular basis. It is possible that there would be a higher risk of fires occurring in the vicinity of the construction of the solar energy facility or during the operation of the facility. This could have a negative impact on surrounding natural vegetation.

Extent: The impact will occur at the site of the proposed facility and possibly surrounding areas, if fires spread.

Duration: The impact will be long-term unless fires are adequately controlled.

Magnitude: The potential magnitude of this impact is potentially high for ecosystems surrounding the site due to the low naturally occurring fire frequencies in succulent karoo vegetation.

Probability: There is a low to moderate likelihood that fires will spread from the site to surrounding areas in the absence of control measures. The risk is scored as improbable.

Potential significance: The potential significance of this impact is likely to be medium.

Mitigation measures:

Comprehensive fire and emergency procedures must be established for use during construction and operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

Nature: Change in natural fire regimes		
	Without mitigation	With mitigation
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate to high (7)	Small (2)
Probability	improbable (2)	Highly improbable (1)
Significance	low (26)	low (8)
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) fire and emergency procedures must be established for construction and operation		
(2) personnel must be trained to respond to veld fires to eradicate them as quickly as possible		

(3) fire breaks should be established where appropriate to limit incoming and outgoing veld fires

Cumulative impacts:

Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.

Residual Impacts:

It should be possible to manage this impact effectively.

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

Substation

Impact 4: Loss of habitat for threatened animals

There are two threatened mammal species, one near threatened reptile and one threatened and one near threatened bird species that could make use of available habitats in the proposed study area. The two bird species are likely to move away in the event that construction takes place on site, whereas the other three species, if they occur on site, are more likely to be restricted to the site. Both bird species are only likely to use the site for foraging only and not for breeding. It is not certain to what extent the secondary vegetation on site is important for the other three species (White-tailed Rat, Grant’s Golden Mole and Namaqua Plated Lizard), but it is assumed that there is the potential for these species to be dependant to some extent on this habitat even though they were not found on site.

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 is limited in extent and is scored as local.

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

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

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals – corridor 1, 2 and 4		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	small (1)	small (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	Low (7)	Low (7)
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: Establishment and spread of declared weeds and alien invader plants

There are no concentrations of alien plants on site. The shrub, *Acacia cyclops* (rooikrans), is a common invader in this area and can cause total transformation of natural habitat. It is difficult to clear, once established, and poses a risk to any areas adjacent to an existing invasion. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could lead to general invasion of surrounding vegetation, especially along watercourses and on sandy soils.

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 high for local ecosystems (ecosystem processes may be altered to the extent that they temporarily cease).

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

Mitigation measures: Disturbance of indigenous vegetation adjacent to the site must not take place. Disturbed areas on site 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	high (8)	minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (56)	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 indigenous 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.

Impact 7: Change in natural fire regimes

The site is within an area of succulent karoo vegetation in which fire does not constitute a natural ecological component on a regular basis. It is possible that there would be a higher risk of fires occurring in the vicinity of the construction of the solar energy facility or during the operation of the facility. This could have a negative impact on surrounding natural vegetation.

Extent: The impact will occur at the site of the proposed facility and possibly surrounding areas, if fires spread.

Duration: The impact will be long-term unless fires are adequately controlled.

Magnitude: The potential magnitude of this impact is potentially high for ecosystems surrounding the site due to the low naturally occurring fire frequencies in succulent karoo vegetation.

Probability: There is a low to moderate likelihood that fires will spread from the site to surrounding areas in the absence of control measures. The risk is scored as improbable.

Potential significance: The potential significance of this impact is likely to be medium.

Mitigation measures:

Comprehensive fire and emergency procedures must be established for use during construction and operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

Nature: Change in natural fire regimes		
	Without mitigation	With mitigation
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate to high (7)	Small (2)
Probability	improbable (2)	Highly improbable (1)
Significance	low (26)	low (8)
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) fire and emergency procedures must be established for construction and operation (2) personnel must be trained to respond to veld fires to eradicate them as quickly as possible (3) fire breaks should be established where appropriate to limit incoming and outgoing veld fires	
Cumulative impacts:	
Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.	
Residual Impacts:	
It should be possible to manage this impact effectively.	

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

Overhead power line

Impact 4: Loss of habitat for threatened animals

The powerline will be a maximum of 1.5 km long. A maximum of 5 – 6 tower structures is likely to be required. The footprint of tower structures is very small compared to the overall extent of vegetation in the area, also taking into account that the vegetation that will be affected is secondary. There are two threatened mammal species, one near threatened reptile and one threatened and one near threatened bird species that could make use of available habitats in the proposed study area. The two bird species are likely to move away in the event that construction takes place on site, whereas the other three species, if they occur on site, are more likely to be restricted to the site. Both bird species are only likely to use the site for foraging only and not for breeding. It is not certain to what extent the secondary vegetation on site is important for the other three species (White-tailed Rat, Grant's Golden Mole and Namaqua Plated Lizard), but it is assumed that there is the potential for these species to be dependant to some extent on this habitat even though they were not found on site.

Duration: The impact will be medium-term. Affected vegetation will recover over time due to the fact that the footprint of the towers is small and vegetation re-growth should repair any other damage associated with construction.

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

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

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

Mitigation measures: None required.

Nature: Loss of habitat for threatened animals – corridor 1, 2 and 4		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	small (0)	small (0)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	Low (4)	Low (4)

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 7: Establishment and spread of declared weeds and alien invader plants

There are no concentrations of alien plants on site. The shrub, *Acacia cyclops* (rooikrans), is a common invader in this area and can cause total transformation of natural habitat. It is difficult to clear, once established, and poses a risk to any areas adjacent to an existing invasion. It is possible that there will be some invasion by aliens along the margins of disturbed areas. This could lead to general invasion of surrounding vegetation, especially along watercourses and on sandy soils.

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 high for local ecosystems (ecosystem processes may be altered to the extent that they temporarily cease).

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

Mitigation measures: Disturbance of indigenous vegetation adjacent to the site must not take place. Disturbed areas on site 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	high (8)	minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (56)	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 indigenous 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.

Impact 7: Change in natural fire regimes

The site is within an area of succulent karoo vegetation in which fire does not constitute a natural ecological component on a regular basis. It is possible that there would be a higher risk of fires occurring in the vicinity of the construction of the solar energy facility or during the operation of the facility. This could have a negative impact on surrounding natural vegetation.

Extent: The impact will occur at the site of the proposed facility and possibly surrounding areas, if fires spread.

Duration: The impact will be long-term unless fires are adequately controlled.

Magnitude: The potential magnitude of this impact is potentially high for ecosystems surrounding the site due to the low naturally occurring fire frequencies in succulent karoo vegetation.

Probability: There is a low to moderate likelihood that fires will spread from the site to surrounding areas in the absence of control measures. The risk is scored as improbable.

Potential significance: The potential significance of this impact is likely to be medium.

Mitigation measures:

Comprehensive fire and emergency procedures must be established for use during construction and operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

Nature: Change in natural fire regimes		
	Without mitigation	With mitigation
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate to high (7)	Small (2)

Probability	improbable (2)	Highly improbable (1)
Significance	low (26)	low (8)
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:		
<ul style="list-style-type: none"> (1) fire and emergency procedures must be established for construction and operation (2) personnel must be trained to respond to veld fires to eradicate them as quickly as possible (3) fire breaks should be established where appropriate to limit incoming and outgoing veld fires 		
Cumulative impacts:		
Due to increased flammability of alien vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.		
Residual Impacts:		
It should be possible to manage this impact effectively.		

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

DISCUSSION AND CONCLUSIONS

The major vegetation type that occur in the study area is Namaqualand Spinescent Grassland, classified in the scientific literature (Mucina et al. 2006) as Least Threatened. This vegetation type is not listed in the Draft Ecosystem List of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). The site is within a previously cultivated area and does not contain any undisturbed natural vegetation. The site is therefore considered to have low ecological sensitivity. However, areas immediately adjacent to the site contain indigenous natural vegetation which is classified in fine-scale conservation plans for the area as being of high conservation value. It is important to ensure that activities on site do not affect these surrounding areas.

Wetlands and drainage lines are protected under national legislation (National Water Act). According to aerial imagery of the site, there are no wetlands on site and no dry river beds or drainage areas on site.

There are no protected tree species that have a geographical distribution that includes the site and none were found on site.

There are a number of threatened and/or near threatened plant species that have a geographic distribution that includes the study area. However, the site is within a previously cultivated area and no undisturbed indigenous vegetation remains on site. There is therefore a low likelihood that any of these threatened or near threatened plant species occur on site. There is, however, a high likelihood of populations of these species occurring in adjacent natural vegetation. There are fourteen plant species of concern that could potentially occur in these adjacent areas. Management of potential impacts on site should therefore be directed towards ensuring that adjacent vegetation is not affected by activities proposed on site.

There are five animal species of conservation concern that may occur in the general area that includes the study area. These are the White-tailed Rat (EN), Grant's Golden Mole (VU), Ludwig's Bustard (VU), Secretarybird (NT) and Namaqua Plated Lizard (NT). The bird species may use the site for foraging, but not for breeding. The habitat on site (secondary vegetation in previously cultivated areas) is not considered to be suitable for the other three species (White-tailed Rat, Grant's Golden Mole and Namaqua Plated Lizard). Habitat requirements for these species are provided in the appendices to this report.

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

1. Loss of habitat for threatened animal species.
2. Establishment and spread of declared weeds and alien invader plants.
3. Change in natural fire regimes.

Impacts were assessed after collection of relevant data in the field. A summary of the significance of impacts before and after mitigation is given in Table 4 below. This shows that the potential impact of alien vegetation on natural vegetation is the only impact with a significance of "medium" before mitigation. Mitigation measures will reduce the significance of this impact to "low". All other potential impacts are either "low" or can be reduced to "low" with mitigation.

Conclusion

The overall impacts of this proposed project are of low or moderate significance. With mitigation measures implemented, it should be possible to reduce all negative impacts to low significance. Taking this assessment into consideration, this project is supported from an ecological point of view, on condition no impacts are allowed to occur in areas of natural vegetation surrounding the site.

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

Impact	Solar arrays		Substation		Overhead power lines	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
1. Loss of habitat for threatened animals	low (14)	low (14)	low (7)	low (7)	low (4)	low (4)
2. Alien plants	medium (56)	low (16)	medium (56)	low (16)	medium (56)	low (16)
3. Change in fire regime	low (26)	low (8)	low (26)	low (8)	low (26)	low (8)

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

MANAGEMENT PLAN

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

Impacts due to alien invasive plants

OBJECTIVE: Control alien invasive plants

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

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid creating conditions in which alien plants may become established: <ol style="list-style-type: none"> a. keep disturbance of indigenous vegetation to a minimum b. rehabilitate disturbed areas as quickly as possible c. do not import soil from areas with alien plants (2) establish an 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	<ul style="list-style-type: none"> • 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.

Change in natural fire regimes

OBJECTIVE: Ensure activities on site do not affect fire regimes in surrounding vegetation

Project component/s	Any activity that could cause fire
Potential Impact	Damage to indigenous natural vegetation surrounding the site due to fire
Activity/risk source	Construction, operation
Mitigation: Target/Objective	Target: no uncontrolled fires emanating from the project area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) fire and emergency procedures must be established for construction and operation (2) personnel must be trained to respond to veld fires to eradicate them as quickly as possible (3) fire breaks should be established where appropriate to limit incoming and outgoing veld fires.	Construction team, management (environmental officer),	Construction, operation

Performance Indicator	No loss of natural vegetation adjacent to site due to fire.
Monitoring	<ul style="list-style-type: none"> None

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APPENDICES:

Appendix 1: Threatened and Near Threatened plant species that have historically been recorded in the study area.

Sources: South African National Biodiversity Institute in Pretoria.

*IUCN (3.1) Categories:

CR PE = Critically Endangered, Possibly Extinct

CR = Critically Endangered

EN = Endangered

VU = Vulnerable

NT = Near Threatened

Species	Global (IUCN) Status	Distribution and habitat	Likelihood of occurrence on site	Likelihood of occurrence in adjacent vegetation
<i>Aspalathus ternata</i>	VU	Near east of Nuwerus (Knervlakte) to Cape Peninsula on coastal sands at altitudes from 30 – 490 m.	LOW	MEDIUM
<i>Babiana lewisiana</i>	VU	Confined to quartz patches on the Knervlakte where it grows between white quartz pebbles in Succulent Karoo Veld. The clay soils in which it occurs are very saline.	LOW	LOW
<i>Bulbine haworthioides</i>	VU	Knervlakte and Bitterfontein where it grows on white quartzite areas in succulent karoo veld..	LOW	LOW
<i>Diplosoma luehmannii</i>	VU	Lutzville on patches of quartz gravel	LOW	LOW
<i>Euphorbia schoenlandii</i>	VU	Vanrhynsdorp area. Sandveld areas with deep, red aeolian sands, on lower loamy slopes, where it often occurs in fairly dense vegetation.	LOW	HIGH
<i>Jordaniella uniflora</i>	NT	Between Kleinzee and Hondeklipbay, on deep sands, scattered populations in open patches amongst shrubs. One specimen collected recently in study area grid in stony / rocky soil.	LOW	MEDIUM
<i>Lachnaea grandiflora</i>	VU	From Swartboskraal in Clanwilliam District S and SE to Cape Peninsula. Sandy flats and sandy areas on lower mountain slopes.	LOW	HIGH
<i>Leipoldtia klaverensis</i>	EN	Previously collected in areas around Springbok, Lutzville and Claver. Found in rocky / stony soil on steep, rocky ridges.	LOW	LOW
<i>Leucadendron foedum</i>	VU	Piketberg to Hopefield with one outlying specimen collected in the study area grid. Found on deep tertiary sands.	LOW	MEDIUM
<i>Leucospermum rodolentum</i>	VU	Namaqualand to Cape Peninsula. This is a widespread species in the Sandveld of the West Coast, and is common from Darling to the Bulshoek Dam. Isolated outliers occur in the Northern Cape, in the Western Cape north of Lambert's Bay, in the Olifants River Valley, in the Swartveld dunes south of Porterville and around the Brandvlei-Kwaggaskloof Dams.	LOW	HIGH
<i>Monilaria pisiformis</i>	EN	Southern Namaqualand to Olifants River Mouth, centred on Vredendal. Quartz patches. Specimen collected in study area grid was on a rocky ridge on a steep slope in gravelly soil.	LOW	LOW
<i>Oedera silicicola</i>	VU	Western Knervlakte. Stony quartzite outcrops. Only ever recorded in study area grid near Koekenaap.	LOW	LOW
<i>Ornithogalum naviculum</i>	VU	Only known from the Holrivier in the Knervlakte, near Vredendal. Succulent karoo on white quartz patches.	LOW	LOW
<i>Othobium incanum</i>	VU	Vredendal to Lambert's Bay (3118CB & CD). Strandveld on red calcareous soils. 80-120 m.	LOW	MEDIUM
<i>Othonna hallii</i>	VU	Holrivier and Koekenaap among quartzite pebbles.	LOW	MEDIUM

<i>Othonna intermedia</i>	Thr*	Distribution centred on Vanrhynsdorp, from west of Vredendal inland to north of Vanrhynsdorp and north-eastwards as well as southwards towards Clanwilliam. Among low bushes in reddish loamy sand, gravel soil or quartz-covered koppies.	LOW	MEDIUM
<i>Quaqua framesii</i>	EN	Southern Knersvlakte. Red sands and stony ground.	LOW	HIGH
<i>Quaqua pulchra</i>	EN	Lutzville to Vanrhynsdorp. Firm red sands and loams.	LOW	HIGH
<i>Serruria decipiens</i>	VU	Olifants River Mountains to Cape Flats. Northernmost subpopulations are relatively fragmented and tend to occur in seeps and moister habitats within sandveld areas.	LOW	MEDIUM
<i>Serruria fucifolia</i>	EN	Gifberg to Hopefield.	LOW	MEDIUM
<i>Tylecodon pygmaeus</i>	Thr*	Knersvlakte to Vredendal. Succulent Karoo. Plain. Stony soil. Gravel. Well-drained. White quartzite.	LOW	LOW
<i>Wahlenbergia asparagoides</i>	VU	Olifantsrivier to Hondeklipbaai. Sandveld: acid/alkaline sand ecotone.	LOW	HIGH

* 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	National status	Global status ²	Likelihood of occurrence
Honey badger	<i>Mellivora capensis</i>	Wide variety of habitats. Probably only in natural habitats.	NT	LC	MEDIUM , previously recorded in neighbouring grid
Lesueur's Wing-gland bat	<i>Cistugo lisueuri</i>	Rock crevices in fynbos. Endemic to southern Africa.	NT	LC	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area; no suitable roosting habitat on site.
Natal long-fingered bat	<i>Miniopterus natalensis</i>	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT	LC	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area; no suitable roosting habitat on site
Cape horseshoe bat	<i>Rhinolophus capensis</i>	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo.	NT	LC	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area; no suitable roosting habitat on site
Geoffroy's horseshoe bat	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	MEDIUM , previously recorded in neighbouring grid; no suitable roosting habitat on site
Cape Golden Mole	<i>Chrysochloris asiatica</i>	Subterranean habitats; arable land; urban areas; renosterveld; fynbos and strandveld succulent karoo; sandy soil	DD	LC	HIGH , previously recorded in neighbouring grid, substrate properties on site considered to be suitable for this species.
Grant's golden mole	<i>Eremitalpa granti</i>	Strandveld Succulent Karoo, Namib Desert, in subterranean habitats in shifting sands	VU	LC	MEDIUM , previously recorded two grids to the south, substrate properties on site considered to be suitable for this species.
White-tailed rat	<i>Mystromus albicaudatus</i>	Highveld and montane grassland, requires sandy soils with good cover. Found throughout South Africa except Northern Cape and Limpopo	EN	-	HIGH , previously recorded in neighbouring grid, substrate properties on site considered to be suitable for this species

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

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

AMPHIBIANS

Common name	Species	Habitat	Status ²	Likelihood of occurrence
None				

²Status according to Minter et al. 2004.

REPTILES

Common name	Species	Habitat	Status ³	Likelihood of occurrence
Armadillo girdled lizard	<i>Cordylus cataphractus</i>	Rock cracks and crevices. Diet consists mainly of termites, beetles and grasshoppers	VU ⁴	LOW , no rocky habitat on site.
McLachlin's girdled lizard	<i>Cordylus mclachlani</i>	Restricted to rocky outcrops, occupying cracks in sandstone outcrops.	VU	LOW , just outside known distribution range. No rocky habitat on site.
Namaqua plated lizard	<i>Gerrhosaurus typicus</i>	Dry sandy areas and bare rocky hillsides	NT	MEDIUM , overall geographical distribution includes this area; suitability of habitat on site not

				known
Namaqua day gecko	<i>Phelsuma ocellata</i>	Boulder strewn hillsides and rocky outcrops, but may also be found in trees and bushes	NT	LOW , no suitable habitat on site.
Southern speckled padloper	<i>Homopus signatus cafer</i>	Rocky outcrops and ridges in regions of relatively low rainfall. Occurs west of Cedarberg to the coast.	NT	LOW , just outside known distribution range. No rocky habitat on site

³Distribution and status according to Alexander & Marais 2007.

BIRDS

Common name	Species	Habitat	Status ³	Importance of site for species	
				Breeding	Foraging
Chestnut banded plover	<i>Charadrius pallidus</i>	Saline lagoons, saline and brackish pans, saltworks; occasionally estuaries and sandy lagoons. Common resident in study area.	NT	NONE	NONE
Black stork	<i>Ciconia nigra</i>	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions.	NT	NONE	NONE
Black harrier	<i>Circus maurus</i>	Grassveld, karoo scrub, mountain fynbos, cultivated lands, subalpine vegetation, semidesert. Common resident in study area.	VU	LOW	LOW
African marsh harrier	<i>Circus ranivorus</i>	Dependent on wetlands, particularly permanent wetlands. Nests usually in reedbeds over water, although they are also occasionally situated in adjacent sedges and scrub. Foraging activity is concentrated in the local wetlands, but birds occasionally range into adjacent grasslands and cultivated areas. Common resident in study area.	VU	NONE	LOW
Lanner falcon	<i>Falco biarmicus</i>	Mountains or open country from semidesert to woodland and agricultural land; also cities (Durban, Harare). Uncommon resident in study area.	NT	NONE	LOW
Lesser Kestrel	<i>Falco naumanni</i>	Occurs in open country and roosts communally in tall trees (mainly <i>Eucalyptus</i>), 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. Uncommon migrant in study area.	VU	NONE	LOW
Peregrine Falcon	<i>Falco peregrinus</i>	Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt pigeons. Uncommon resident or non-breeding migrant in study area.	NT	NONE	LOW
Ludwig's Bustard	<i>Neotis ludwigii</i>	This is a near-endemic to southern Africa, with its range centred on the Nama Karoo and Succulent Karoo biomes. It inhabits the open plains of the semi-arid Karoo and especially in areas where extensive sheep farming is prevalent. Dry open plains, from grassland to desert. Common to uncommon resident in study area.	VU High priority in W Cape	LOW	MEDIUM
White pelican	<i>Pelecanus onocrotalus</i>	Coastal bays, estuaries, lakes, larger pans and dams. Uncommon resident in study area.	NT	NONE	NONE
Lesser flamingo	<i>Phoeniconaias minor</i>	Shallow saline and alkaline wetlands, such as salt pans and coastal lagoons. Uncommon resident in study area.	NT High priority in W Cape	NONE	NONE
Greater	<i>Phoenicopterus</i>	Estuaries and other wetlands along the west	NT	NONE	NONE

flamingo	<i>ruber</i>	coast, endorheic pans on the Highveld. Uncommon resident in study area.	High priority in W Cape		
Martial Eagle	<i>Polemaetus bellicosus</i>	The Martial Eagle is widespread but uncommon throughout South Africa and neighbouring countries. It tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo and woodland. It relies on large trees (and electricity pylons) to provide nest sites. It is found typically in flat country and is rarer in mountains and forests. One of the main reason it is declining is because of persecution on private land. Uncommon resident in study area.	VU High priority in W Cape	NONE	LOW
Secretarybird	<i>Sagittarius serpentarius</i>	Widespread across South Africa, occurring in savanna and open grassland from coastal regions to high altitudes, but avoids thick bush and forest. Sensitive to disturbance and high human population numbers - higher numbers usually found in conservation areas. Uncommon resident in study area.	NT High priority in W Cape	NONE	MEDIUM

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

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

None have a geographical distribution that coincides with the study area.

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

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000) marked with "P"
3. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) marked with "N"

Mammals:

^PSpringbok
^PKlipspringer
^PSteenbok
Cape grysbok
Common duiker
Rock hyrax
Water mongoose
Black-backed jackal
Caracal
Yellow mongoose
^{NP}Black-footed cat
African wild cat
Small grey mongoose
Small-spotted genet
Large grey mongoose
Striped polecat
^NHoney badger
Bat-eared fox
^{NP}Leopard
African weasel
^PAardwolf
Suricate
^NCape fox
^PLeseur's wing-gland bat
^PLong-tailed serotine bat
^PNatal long-fingered bat
^PCape serotine bat
^PEgyptian slit-faced bat
^PCape horseshoe bat
^PGeoffroy's horseshoe bat
^PEgyptian free-tailed bat
Cape golden mole
^PReddish-grey musk shrew
Grant's golden mole
^PLesser dwarf shrew
Cape hare
Scrub hare
Chacma baboon
Namaqua rock mouse
Cape dune mole-rat
Common mole-rat
Grey climbing mouse
Short-tailed gerbil
Cape mole-rat
Hairy-footed gerbil
Spectacled dormouse
Porcupine

Large-eared mouse
Pygmy mouse
Verreaux's mouse
White-tailed rat
Vlei rat
Saunders' vlei rat
Karoo bush rat
Striped mouse
Cape gerbil
^PCape rock elephant-shrew
Aardvark

Reptiles:

^PWestern dwarf chameleon
^PNamaqua chameleon
Puff adder
Many-horned adder
Cape cobra
Black spitting cobra
Rinkhals
Coral snake / coral shield cobra
Boomslang
Dwarf beaked snake
Karoo whip snake
Namib sand snake
Beetz's tiger snake
Brown house snake
Spotted rock snake
Mole snake
Sundevall's shovel-snout
Common egg-eater
Delalande's beaked blind snake
Schinz's beaked blind snake
^PSouthern rock agama
^PSouthern spiny agama
^PSand lizard species
^PLegless burrowing skink species
^PShort-legged dwarf burrowing skink species
^PSkink species
^{NP}Armadillo girdled lizard
^PMcLachlan's girdled lizard
^PKaroo girdled lizard
^PGirdled lizard species
^PGraceful crag lizard
^PNamaqua plated lizard
^PDwarf plated lizard
^PStriped dwarf leaf-toed gecko

^PGiant ground gecko
^PBibron's tubercled gecko
^PAusten's dune gecko
^PRough gecko
^PWestern Cape gecko
^PWestern gecko species
^PMarico gecko
^P**Namaqua day gecko**
^P**Speckled padloper**
^PAngulate tortoise
^PKaroo tent tortoise

Amphibians

^PNamaqua rain frog
^PRaucous toad
^PKaroo toad
^PCommon platanna
^PNamaqua caco
^PCape river frog
^PClicking stream frog
^PCape sand frog

Birds:

^PAfrican Black Duck
^PAfrican Fish Eagle
^PAfrican Hoopoe
^{NP}**African Marsh Harrier**
^PAfrican Marsh Warbler
^PAfrican Rail
^PAfrican Sedge Warbler
^PAfrican Spoonbill
^PAlpine Swift
^PAnteating Chat
^PBanded Martin
^PBarn Owl
^PBartailed Godwit
^PBarthroated Apalis
^PBlack Crake
Black Crow
^PBlack Eagle
^P**Black Harrier**
^PBlack Korhaan
^{NP}**Black Stork**
^PBlack Swift
^PBlackbreasted Snake Eagle
^PBlackcrowned Night Heron
^PBlackeared Finchlark
^PBlackheaded Canary
^PBlackheaded Heron
^PBlacknecked Grebe
^PBlackshouldered Kite
^PBlacksmith Plover
^PBlackwinged Stilt
^PBokmakierie

^PBooted Eagle
^PBrownthroated Martin
^PBurchell's Courser
Cape Bulbul
^PCape Bunting
^PCape Canary
^PCape Clapper Lark
^PCape Eagle Owl
^PCape Francolin
^PCape Gull
^PCape Longbilled Lark
^PCape Penduline Tit
^PCape Reed Warbler
^PCape Robin
^PCape Shoveller
Cape Sparrow
^PCape Sugarbird
^PCape Teal
^PCape Turtle Dove
^PCape Wagtail
Cape Weaver
^PCape White-eye
^PCapped Wheatear
^PCaspian Plover
^PCattle Egret
^PChat Flycatcher
^P**Chestnutbanded Plover**
^PCinnamonbreasted Warbler
^PCloud Cisticola
^PCommon Knot
^PCommon Moorhen
^PCommon Quail
^PCommon Sandpiper
^PCommon Waxbill
^PCrowned Plover
^PCurlew
^PCurlew Sandpiper
^PDabchick
^PDamara Canary
^PDarter
^PDiederik Cuckoo
^PDoublebanded Courser
^PDusky Sunbird
^PEgyptian Goose
^PEthiopian Snipe
^PEurasian Bee-eater
^PEurasian Starling
^PEurasian Swallow
^PEurasian Swift
^PFairy Flycatcher
^PFamiliar Chat
^PFantailed Cisticola
^PFeral Pigeon

P Fierynecked Nightjar
 P Fiscal Flycatcher
 P Fiscal Shrike
 P Freckled Nightjar
 P Giant Kingfisher
 P Glossy Ibis
 P Grassveld Pipit
 P Great Crested Grebe
 P **Greater Flamingo**
 P Greater Honeyguide
 P Greater Kestrel
 P Greater Striped Swallow
 P Greenshank
 P Grey Heron
 P Grey Plover
 P Greybacked Cisticola
 P Greybacked Finchlark
 P Greyheaded Gull
 P Greywing Francolin
 P Ground Woodpecker
 P Gymnogene
 P Hadedda Ibis
 P Hamerkop
 P Hartlaub's Gull
 P Helmeted Guineafowl
 P Horus Swift
 P House Martin
 P House Sparrow
 P Jackal Buzzard
 P Karoo Chat
 P Karoo Eremomela
 P Karoo Lark
 P Karoo Prinia
 P Karoo Robin
 P Karoo Thrush
 P Kittlitz's Plover
 P Klaas's Cuckoo
 P **Lanner Falcon**
 P Larklike Bunting
 P Laughing Dove
 P Layard's Titbabbler
 P Lesser Doublecollared Sunbird
 P **Lesser Flamingo**
 NP **Lesser Kestrel**
 P Levillant's Cisticola
 P Little Bittern
 P Little Egret
 P Little Stint
 P Little Swift
 P Longbilled Crombec
 P Longbilled Pipit
 NP **Ludwig's Bustard**
 P Maccoa Duck

P Malachite Kingfisher
 P Malachite Sunbird
 P Mallard
 P Marsh Sandpiper
 NP **Martial Eagle**
 Masked Weaver
 P Mongolian Plover
 P Mountain Chat
 P Namaqua Dove
 P Namaqua Sandgrouse
 P Namaqua Warbler
 P Orange River White-eye
 P Orangethroated Longclaw
 P Ostrich
 P Pale Chanting Goshawk
 P Palewinged Starling
 P Pearlbreasted Swallow
 NP **Peregrine Falcon**
 P Pied Avocet
 P Pied Barbet
 Pied Crow
 P Pied Kingfisher
 P Pied Starling
 P Pintailed Whydah
 P Plainbacked Pipit
 P Pirit Batis
 P Purple Gallinule
 P Purple Heron
 Red Bishop
 P Redbilled Teal
 P Redbreasted Sparrowhawk
 P Redcapped Lark
 P Redchested Flufftail
 Redeyed Bulbul
 P Redeyed Dove
 P Redfaced Mousebird
 P Redknobbed Coot
 Redwinged Starling
 P Reed Cormorant
 P Ringed Plover
 P Rock Kestrel
 P Rock Martin
 P Rock Pigeon
 P Ruddy Turnstone
 P Ruff
 P Rufouseared Warbler
 P Sacred Ibis
 P Sand Plover
 P Sanderling
 P **Secretarybird**
 P Sicklewinged Chat
 P South African Shelduck
 P Southern Grey Tit

^PSouthern Pochard
^PSpeckled Mousebird
^PSpikeheeled Lark
^PSpotted Dikkop
^PSpotted Eagle Owl
^PSpotted Flycatcher
^PSpurwinged Goose
^PSteppe Buzzard
^PStonechat
^PStreakyheaded Canary
^PTerek Sandpiper
^PThickbilled Lark
^PThreebanded Plover
^PTitbabbler
^PTractrac Chat
^PWater Dikkop
^PWattled Starling
^PWhimbrel
^PWhiskered Tern
^PWhite Pelican
^PWhite Stork
^PWhitebacked Mousebird
^PWhitebreasted Cormorant
^PWhitefronted Plover
^PWhitenecked Raven
^PWhiterumped Swift
^PWhitethroated Canary
^PWhitethroated Swallow
^PWhitewinged Tern
^PWillow Warbler
^PWood Sandpiper
^PYellow Canary
^PYellowbellied Eremomela
^PYellowbilled Duck
^PYellowbilled Egret
^PYellowbilled Kite
^PYellowrumped Widow

Appendix 5: Plant species previously recorded in grid that includes the study area.

Family	Species	Status
ACANTHACEAE	<i>Justicia cuneata</i> Vahl subsp. <i>cuneata</i>	LC
AIZOACEAE	<i>Galenia crystallina</i> (Eckl. & Zeyh.) Fenzl var. <i>crystallina</i>	LC
AMARYLLIDACEAE	<i>Brunsvigia bosmaniae</i> F.M.Leight.	LC
AMARYLLIDACEAE	<i>Gethyllis britteniana</i> Baker subsp. <i>britteniana</i>	LC
AMARYLLIDACEAE	<i>Gethyllis linearis</i> L.Bolus	LC
AMARYLLIDACEAE	<i>Hessea breviflora</i> Herb.	LC
AMARYLLIDACEAE	<i>Strumaria truncata</i> Jacq.	LC
AMARYLLIDACEAE	<i>Gethyllis ciliaris</i> (Thunb.) Thunb. subsp. <i>longituba</i> (L.Bolus) D.Müll.-Doblies	DDT
ANTHERICACEAE	<i>Chlorophytum undulatum</i> (Jacq.) Oberm.	LC
APOCYNACEAE	<i>Microlooma sagittatum</i> (L.) R.Br.	LC
APOCYNACEAE	<i>Quaqua framesii</i> (Pillans) Bruyns	EN
APOCYNACEAE	<i>Quaqua pulchra</i> (Bruyns) Plowes	EN
ASPARAGACEAE	<i>Asparagus alopecurus</i> (Oberm.) Malcomber & Sebsebe	LC
ASPARAGACEAE	<i>Asparagus declinatus</i> L.	LC
ASPARAGACEAE	<i>Asparagus retrofractus</i> L.	LC
ASPARAGACEAE	<i>Asparagus undulatus</i> (L.f.) Thunb.	LC
ASPARAGACEAE	<i>Asparagus exuvialis</i> Burch. forma <i>exuvialis</i>	
ASPHODELACEAE	<i>Bulbine haworthioides</i> B.Nord.	VU
ASPHODELACEAE	<i>Bulbine diphylla</i> Schltr. ex Poelln.	LC
ASPHODELACEAE	<i>Bulbine mesembryanthoides</i> Haw. subsp. <i>mesembryanthoides</i>	LC
ASTERACEAE	<i>Oedera silicicola</i> (K.Bremer) Anderb. & K.Bremer	VU
ASTERACEAE	<i>Othonna hallii</i> B.Nord.	VU
ASTERACEAE	<i>Othonna intermedia</i> Compton	Thr*
ASTERACEAE	<i>Leucoptera subcarnosa</i> B.Nord.	Rare
ASTERACEAE	<i>Amellus microglossus</i> DC.	LC
ASTERACEAE	<i>Arctotis fastuosa</i> Jacq.	LC
ASTERACEAE	<i>Arctotis flaccida</i> Jacq.	LC
ASTERACEAE	<i>Arctotis hirsuta</i> (Harv.) Beauverd	LC
ASTERACEAE	<i>Arctotis leptorhiza</i> DC.	LC
ASTERACEAE	<i>Athanasia pubescens</i> (L.) L.	LC
ASTERACEAE	<i>Chrysocoma ciliata</i> L.	LC
ASTERACEAE	<i>Didelta carnososa</i> (L.f.) Aiton var. <i>carnososa</i>	LC
ASTERACEAE	<i>Didelta spinosa</i> (L.f.) Aiton	LC
ASTERACEAE	<i>Dimorphotheca pluvialis</i> (L.) Moench	LC
ASTERACEAE	<i>Eriocephalus racemosus</i> L. var. <i>affinis</i> (DC.) Harv.	LC
ASTERACEAE	<i>Felicia hyssopifolia</i> (P.J.Bergius) Nees subsp. <i>glabra</i> (DC.) Grau	LC
ASTERACEAE	<i>Felicia namaquana</i> (Harv.) Merxm.	LC
ASTERACEAE	<i>Foveolina tenella</i> (DC.) Källersjö	LC
ASTERACEAE	<i>Gnaphalium englerianum</i> (O.Hoffm.) Hilliard & B.L.Burttt	LC
ASTERACEAE	<i>Helichrysum micropoides</i> DC.	LC

ASTERACEAE	<i>Helichrysum revolutum</i> (Thunb.) Less.	LC
ASTERACEAE	<i>Helichrysum simulans</i> Harv. & Sond.	LC
ASTERACEAE	<i>Hoplophyllum spinosum</i> DC.	LC
ASTERACEAE	<i>Leysera gnaphalodes</i> (L.) L.	LC
ASTERACEAE	<i>Oncosiphon grandiflorum</i> (Thunb.) Källersjö	LC
ASTERACEAE	<i>Osteospermum grandiflorum</i> DC.	LC
ASTERACEAE	<i>Osteospermum pinnatum</i> (Thunb.) Norl. var. <i>pinnatum</i>	LC
ASTERACEAE	<i>Othonna cylindrica</i> (Lam.) DC.	LC
ASTERACEAE	<i>Othonna floribunda</i> Schltr.	LC
ASTERACEAE	<i>Othonna obtusiloba</i> Harv.	LC
ASTERACEAE	<i>Pteronia ciliata</i> Thunb.	LC
ASTERACEAE	<i>Pteronia divaricata</i> (P.J.Bergius) Less.	LC
ASTERACEAE	<i>Pteronia heterocarpa</i> DC.	LC
ASTERACEAE	<i>Pteronia incana</i> (Burm.) DC.	LC
ASTERACEAE	<i>Pteronia paniculata</i> Thunb.	LC
ASTERACEAE	<i>Rhynchopsidium sessiliflorum</i> (L.f.) DC.	LC
ASTERACEAE	<i>Senecio sarcoides</i> C.Jeffrey	LC
ASTERACEAE	<i>Stoebe nervigera</i> (DC.) Sch.Bip.	LC
ASTERACEAE	<i>Tripteris oppositifolia</i> (Aiton) B.Nord.	LC
ASTERACEAE	<i>Tripteris sinuata</i> DC. var. <i>sinuata</i>	LC
ASTERACEAE	<i>Dimorphotheca pinnata</i> (Thunb.) Harv.	
BRASSICACEAE	<i>Heliophila pusilla</i> L.f. var. <i>pusilla</i>	LC
BRASSICACEAE	* <i>Brassica tournefortii</i> Gouan	
BRUNIACEAE	<i>Berzelia abrotanoides</i> (L.) Brongn.	LC
BRYACEAE	<i>Bryum torquescens</i> Bruch ex De Not.	
CAMPANULACEAE	<i>Wahlenbergia asparagoides</i> (Adamson) Lammers	VU
CAMPANULACEAE	<i>Microcodon linearis</i> (L.f.) H.Buek	LC
CAMPANULACEAE	<i>Wahlenbergia costata</i> A.DC.	LC
CAMPANULACEAE	<i>Wahlenbergia polyclada</i> A.DC.	DDD
CHENOPODIACEAE	<i>Atriplex semibaccata</i> R.Br. var. <i>appendiculata</i> Aellen	LC
CHENOPODIACEAE	<i>Atriplex vestita</i> (Thunb.) Aellen var. <i>inappendiculata</i> Aellen	LC
CHENOPODIACEAE	<i>Salsola glabrescens</i> Burtt Davy	LC
CHENOPODIACEAE	<i>Sarcocornia xerophila</i> (Toelken) A.J.Scott	LC
CHENOPODIACEAE	<i>Suaeda fruticosa</i> (L.) Forssk.	LC
CRASSULACEAE	<i>Tylecodon pygmaeus</i> (W.F.Barker) Toelken	Thr*
CRASSULACEAE	<i>Adromischus marianiae</i> (Marloth) A.Berger var. <i>immaculatus</i> Uitewaal	LC
CRASSULACEAE	<i>Adromischus marianiae</i> (Marloth) A.Berger var. <i>marianiae</i>	LC
CRASSULACEAE	<i>Cotyledon papillaris</i> L.f.	LC
CRASSULACEAE	<i>Crassula elegans</i> Schönland & Baker f. subsp. <i>elegans</i>	LC
CRASSULACEAE	<i>Crassula expansa</i> Dryand. subsp. <i>pyrifolia</i> (Compton) Toelken	LC
CRASSULACEAE	<i>Crassula muscosa</i> L. var. <i>muscosa</i>	LC
CRASSULACEAE	<i>Crassula nudicaulis</i> L. var. <i>herrei</i> (Friedrich) Toelken	LC
CRASSULACEAE	<i>Tylecodon pearsonii</i> (Schönland) Toelken	LC
CRASSULACEAE	<i>Tylecodon reticulatus</i> (L.f.) Toelken subsp. <i>reticulatus</i>	LC

CRASSULACEAE	<i>Tylecodon tenuis</i> (Toelken) Bruyns	LC
CRASSULACEAE	<i>Adromischus mammillaris</i> (L.f.) Lem.	EN
CYPERACEAE	<i>Cyperus textilis</i> Thunb.	LC
CYPERACEAE	<i>Bolboschoenus glaucus</i> (Lam.) S.G.Sm. x <i>B. maritimus</i> (L.) Palla	
EUPHORBIACEAE	<i>Euphorbia schoenlandii</i> Pax	VU
EUPHORBIACEAE	<i>Euphorbia caterviflora</i> N.E.Br.	LC
EUPHORBIACEAE	<i>Euphorbia exilis</i> L.C.Leach	LC
FABACEAE	<i>Aspalathus ternata</i> (Thunb.) Druce	VU
FABACEAE	<i>Otholobium incanum</i> C.H.Stirt.	VU
FABACEAE	<i>Aspalathus spinescens</i> Thunb. subsp. <i>lepida</i> (E.Mey.) R.Dahlgren	LC
FABACEAE	<i>Indigofera exigua</i> Eckl. & Zeyh.	LC
FABACEAE	<i>Lessertia diffusa</i> R.Br.	LC
FABACEAE	<i>Lotononis hirsuta</i> (Thunb.) D.Dietr.	LC
FABACEAE	<i>Lotononis leptoloba</i> Bolus	LC
FABACEAE	<i>Lotononis parviflora</i> (P.J.Bergius) D.Dietr.	LC
FABACEAE	<i>Melolobium candicans</i> (E.Mey.) Eckl. & Zeyh.	LC
FABACEAE	<i>Podalyria leipoldtii</i> L.Bolus	LC
FABACEAE	<i>Sutherlandia frutescens</i> (L.) R.Br.	LC
FABACEAE	<i>Calobota angustifolia</i> (E.Mey.) Boatwr. & B.-E.van Wyk	
FABACEAE	* <i>Melilotus albus</i> Medik.	
GERANIACEAE	<i>Pelargonium capitatum</i> (L.) L'Hér.	LC
GERANIACEAE	<i>Pelargonium crithmifolium</i> Sm.	LC
GERANIACEAE	<i>Pelargonium fulgidum</i> (L.) L'Hér.	LC
GERANIACEAE	<i>Pelargonium oenothera</i> (L.f.) Jacq.	LC
GERANIACEAE	<i>Pelargonium praemorsum</i> (Andrews) F.Dietr. subsp. <i>praemorsum</i>	LC
GERANIACEAE	<i>Pelargonium senecioides</i> L'Hér.	LC
GERANIACEAE	<i>Sarcocaulon l'heritieri</i> Sweet	LC
GIGASPERMACEAE	<i>Chamaebryum pottioides</i> Thér. & Dixon	
HYACINTHACEAE	<i>Ornithogalum naviculum</i> W.F.Barker	VU
HYACINTHACEAE	<i>Albuca navicula</i> U.Müll.-Doblies	LC
HYACINTHACEAE	<i>Albuca paradoxa</i> Dinter	LC
HYACINTHACEAE	<i>Lachenalia patula</i> Jacq.	LC
HYACINTHACEAE	<i>Lachenalia undulata</i> Masson ex Baker	LC
HYACINTHACEAE	<i>Albuca unifolia</i> (Retz.) J.C.Manning & Goldblatt	
IRIDACEAE	<i>Babiana lewisiana</i> B.Nord.	VU
IRIDACEAE	<i>Babiana sinuata</i> G.J.Lewis	LC
IRIDACEAE	<i>Chasmanthe floribunda</i> (Salisb.) N.E.Br.	LC
IRIDACEAE	<i>Gladiolus arcuatus</i> Klatt	LC
IRIDACEAE	<i>Gladiolus equitans</i> Thunb.	LC
IRIDACEAE	<i>Gladiolus orchidiflorus</i> Andrews	LC
IRIDACEAE	<i>Gladiolus watermeyeri</i> L.Bolus	LC
IRIDACEAE	<i>Hesperantha bachmannii</i> Baker	LC
IRIDACEAE	<i>Lapeirousia anceps</i> (L.f.) Ker Gawl.	LC
IRIDACEAE	<i>Lapeirousia arenicola</i> Schltr.	LC

IRIDACEAE	<i>Lapeirousia jacquinii</i> N.E.Br.	LC
IRIDACEAE	<i>Lapeirousia pyramidalis</i> (Lam.) Goldblatt subsp. <i>pyramidalis</i>	LC
IRIDACEAE	<i>Moraea falcifolia</i> Klatt	LC
IRIDACEAE	<i>Moraea serpentina</i> Baker	LC
LAURACEAE	<i>Cryptocarya angustifolia</i> E.Mey. ex Meisn.	LC
MALVACEAE	<i>Hermannia cordata</i> (E.Mey. ex E.Phillips) De Winter	LC
MALVACEAE	<i>Hermannia cuneifolia</i> Jacq. var. <i>cuneifolia</i>	LC
MALVACEAE	<i>Hermannia desertorum</i> Eckl. & Zeyh.	LC
MALVACEAE	<i>Hermannia heterophylla</i> (Cav.) Thunb.	LC
MALVACEAE	<i>Hermannia scordifolia</i> Jacq.	LC
MALVACEAE	<i>Hermannia stipitata</i> Pillans	LC
MALVACEAE	<i>Hermannia trifurca</i> L.	LC
MESEMBRYANTHEMACEAE	<i>Diplosoma luckhoffii</i> (L.Bolus) Schwantes ex Ihlenf.	VU
MESEMBRYANTHEMACEAE	<i>Jordaaniella uniflora</i> (L.Bolus) H.E.K.Hartmann	NT
MESEMBRYANTHEMACEAE	<i>Amphibolia laevis</i> (Aiton) H.E.K.Hartmann	LC
MESEMBRYANTHEMACEAE	<i>Antimima watermeyeri</i> (L.Bolus) H.E.K.Hartmann	LC
MESEMBRYANTHEMACEAE	<i>Aridaria brevicarpa</i> L.Bolus	LC
MESEMBRYANTHEMACEAE	<i>Cephalophyllum framesii</i> L.Bolus	LC
MESEMBRYANTHEMACEAE	<i>Cephalophyllum loreum</i> (L.) Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Cephalophyllum tricolorum</i> (Haw.) Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Cleretum papulosum</i> (L.f.) L.Bolus subsp. <i>papulosum</i>	LC
MESEMBRYANTHEMACEAE	<i>Conophytum uviforme</i> (Haw.) N.E.Br. subsp. <i>uviforme</i>	LC
MESEMBRYANTHEMACEAE	<i>Dorotheanthus bellidiformis</i> (Burm.f.) N.E.Br. subsp. <i>bellidiformis</i>	LC
MESEMBRYANTHEMACEAE	<i>Drosanthemum deciduum</i> H.E.K.Hartmann & Bruckman	LC
MESEMBRYANTHEMACEAE	<i>Drosanthemum diversifolium</i> L.Bolus	LC
MESEMBRYANTHEMACEAE	<i>Jordaaniella cuprea</i> (L.Bolus) H.E.K.Hartmann	LC
MESEMBRYANTHEMACEAE	<i>Leipoldtia schultzei</i> (Schltr. & Diels) Friedrich	LC
MESEMBRYANTHEMACEAE	<i>Malephora crocea</i> (Jacq.) Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Malephora framesii</i> (L.Bolus) H.Jacobsen & Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Malephora purpureo-crocea</i> (Haw.) Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Mesembryanthemum guerichianum</i> Pax	LC
MESEMBRYANTHEMACEAE	<i>Mesembryanthemum nodiflorum</i> L.	LC
MESEMBRYANTHEMACEAE	<i>Oophytum oviforme</i> (N.E.Br.) N.E.Br.	LC
MESEMBRYANTHEMACEAE	<i>Phyllobolus nitidus</i> (Haw.) Gerbaulet	LC
MESEMBRYANTHEMACEAE	<i>Phyllobolus quartziticus</i> (L.Bolus) Gerbaulet	LC
MESEMBRYANTHEMACEAE	<i>Phyllobolus spinuliferus</i> (Haw.) Gerbaulet	LC
MESEMBRYANTHEMACEAE	<i>Psilocaulon salicornioides</i> (Pax) Schwantes	LC
MESEMBRYANTHEMACEAE	<i>Ruschia leucosperma</i> L.Bolus	LC
MESEMBRYANTHEMACEAE	<i>Stoeberia frutescens</i> (L.Bolus) Van Jaarsv.	LC
MESEMBRYANTHEMACEAE	<i>Vanzijlia annulata</i> (A.Berger) L.Bolus	LC
MESEMBRYANTHEMACEAE	<i>Leipoldtia klaverensis</i> L.Bolus	EN
MESEMBRYANTHEMACEAE	<i>Monilaria pisiformis</i> (Haw.) Schwantes	EN
MOLLUGINACEAE	<i>Coelanthum grandiflorum</i> E.Mey. ex Fenzl	LC
MOLLUGINACEAE	<i>Limeum africanum</i> L. subsp. <i>africanum</i>	LC

MOLLUGINACEAE	Pharnaceum exiguum Adamson	LC
NEURADACEAE	Grielum grandiflorum (L.) Druce	LC
OPHIOGLOSSACEAE	Ophioglossum polyphyllum A.Braun	LC
ORCHIDACEAE	Corycium crispum (Thunb.) Sw.	LC
ORCHIDACEAE	Holothrix aspera (Lindl.) Rchb.f.	LC
PLANTAGINACEAE	Plantago cafra Decne.	LC
POACEAE	Aristida congesta Roem. & Schult. subsp. congesta	LC
POACEAE	Bromus pectinatus Thunb.	LC
POACEAE	Chaetobromus involucratu (Schrad.) Nees subsp. dregeanus (Nees) Verboom	LC
POACEAE	Cladoraphis spinosa (L.f.) S.M.Phillips	LC
POACEAE	Cynodon dactylon (L.) Pers.	LC
POACEAE	Ehrharta brevifolia Schrad. var. brevifolia	LC
POACEAE	Ehrharta brevifolia Schrad. var. cuspidata Nees	LC
POACEAE	Ehrharta calycina Sm.	LC
POACEAE	Ehrharta rupestris Nees ex Trin. subsp. rupestris	LC
POACEAE	Ehrharta thunbergii Gibbs Russ.	LC
POACEAE	Eleusine coracana (L.) Gaertn. subsp. africana (Kenn.-O'Byrne) Hilu & de Wet	LC
POACEAE	Eragrostis curvula (Schrad.) Nees	LC
POACEAE	Eragrostis trichophora Coss. & Durieu	LC
POACEAE	Karoochloa schismoides (Stapf ex Conert) Conert & Türpe	LC
POACEAE	Odyssea paucinervis (Nees) Stapf	LC
POACEAE	Panicum maximum Jacq.	LC
POACEAE	Panicum repens L.	LC
POACEAE	Setaria pumila (Poir.) Roem. & Schult.	LC
POACEAE	Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter	LC
POACEAE	Stipagrostis namaquensis (Nees) De Winter	LC
POACEAE	Stipagrostis zeyheri (Nees) De Winter subsp. macropus (Nees) De Winter	LC
POACEAE	Tribolium pusillum (Nees) H.P.Linder & Davidse	LC
POACEAE	*Bromus catharticus Vahl	
POACEAE	Monelytrum luederitzianum Hack.	
POACEAE	*Paspalum dilatatum Poir.	
POLYGALACEAE	Nylandtia spinosa (L.) Dumort.	LC
POLYGALACEAE	Polygala ephedroides Burch.	LC
POLYGONACEAE	*Emex australis Steinh.	
POTTIACEAE	Tortula atrovirens (Sm.) Lindb.	
PROTEACEAE	Leucadendron foedum I.Williams	VU
PROTEACEAE	Leucospermum rodolentum (Salisb. ex Knight) Rourke	VU
PROTEACEAE	Serruria decipiens R.Br.	VU
PROTEACEAE	Leucadendron loranthifolium (Salisb. ex Knight) I.Williams	NT
PROTEACEAE	Leucadendron teretifolium (Andrews) I.Williams	NT
PROTEACEAE	Leucadendron pubescens R.Br.	LC
PROTEACEAE	Serruria fucifolia Salisb. ex Knight	EN
PROTEACEAE	Leucadendron stellare (Sims) Sweet	CR
ROSACEAE	Cliffortia polygonifolia L. var. polygonifolia	LC

SALICACEAE	<i>Salix mucronata</i> Thunb. subsp. <i>mucronata</i>	LC
SANTALACEAE	<i>Thesium pubescens</i> A.DC.	LC
SCROPHULARIACEAE	<i>Diascia veronicoides</i> Schltr.	LC
SCROPHULARIACEAE	<i>Dischisma clandestinum</i> E.Mey.	LC
SCROPHULARIACEAE	<i>Manulea altissima</i> L.f. subsp. <i>longifolia</i> (Benth.) Hilliard	LC
SCROPHULARIACEAE	<i>Manulea decipiens</i> Hilliard	LC
SCROPHULARIACEAE	<i>Nemesia bicornis</i> (L.) Pers.	LC
SCROPHULARIACEAE	<i>Nemesia euryceras</i> Schltr.	LC
SCROPHULARIACEAE	<i>Nemesia ligulata</i> E.Mey. ex Benth.	LC
SCROPHULARIACEAE	<i>Phyllopodium phyllopodiodes</i> (Schltr.) Hilliard	LC
SCROPHULARIACEAE	<i>Zaluzianskya affinis</i> Hilliard	LC
SCROPHULARIACEAE	<i>Zaluzianskya benthamiana</i> Walp.	LC
SOLANACEAE	<i>Lycium horridum</i> Thunb.	LC
SOLANACEAE	<i>Lycium oxycarpum</i> Dunal	LC
THYMELAEACEAE	<i>Lachnaea grandiflora</i> (L.f.) Baill.	VU
THYMELAEACEAE	<i>Struthiola leptantha</i> Bolus	LC
THYMELAEACEAE	<i>Struthiola striata</i> Lam.	LC
ZYGOPHYLLACEAE	<i>Zygophyllum retrofractum</i> Thunb.	LC

Appendix 6: Plant and animal species protected according to the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000).

FAUNA

Mammals:

African scaly anteater
Cheetah
Black rhinoceros
Square-lipped rhinoceros
Cape mountain zebra
Oribi
Riverine Rabbit

Elephant shrew (Macroscelidae - all species)
Shrews (Soricidae - all species)
Hedgehog
Bush baby
Samango monkey
All bats except Pteropodidae
African lion
Leopard
Black-footed cat
Serval cat
Aardwolf
Brown hyaena
Honey badger
Silver jackal
Bat-eared fox
Snake mongoose
African elephant
Tree dassie
Ant bear
Burchells' zebra
Hartmann's zebra
Warthog
Hippopotamus
Giraffe
Klipspringer
Grey duiker
Blue duiker
Steenbok
Grysbok
Grey rhebok
Kudu
Bush buck
Impala
Reedbuck
Mountain rhebok
Springbuck
Oryx
Eland
African buffalo
Black wildebeest
Blue wildebeest

Red hartebeest
Bontebok
Blesbok

Birds:

Bald ibis
Bearded vulture
All penguins

All birds except all colies, all crows, Black-eyed bulbul, Cape bulbul, Red-eyed bulbul, Cape sparrow, European sparrow, Masked weaver, Cape weaver, Cape widow bird, Red bishop, European starling, Red-billed quelea, Red-winged starling.

Reptiles:

Geometric tortoise

All lizards
All tortoises and turtles
Water snakes (Genus *Lycodonomorphus*)
House snakes (Genus *Lamprophis*)
Wolf snakes (Genus *Lycophidion*)
File snakes (Genus *Mehelya*)
Slug eaters (Genus *Duberria*)
Egg eaters (Genus *Dasypeltis*)
Mole snakes (Genus *Pseudaspis*)
Green and bush snakes (Genus *Philothamnus*)
Shovel-snout snakes (Genus *Prosymna*)

Amphibians

Gill's clawed toad
Micro frog
Cape caco

All frogs and toads

Fish:

Eastern Cape redfin
Whitefish
Smallscale redfin
Burchell's redfin
Berg River redfin
Clanwilliam redfin
Clanwilliam yellow fish
Twee River redfin
Namaqua barb
Gold barb
Straightfin barb
Fiery redfin

Sawfin
Slender redfin
Border barb
Threespot barb
Clanwilliam sandfish
Barnard's rock catfish
Clanwilliam rock catfish
Rock catfish
Eastern Province rocky
Cape curper

Insects:

Cape dung beetle
Stag beetle (all species)
Onychophora (all species)

Aloeides egerides
Aloeides lutescens
Argyrocupha malagrida malagrida
Lepidochrysops bacchus
Oxychaeta dicksoni
Poecilmitis endymion
Poecilmitis lyncurium
Poecilmitis nigricans
Poecilmitis rileyi
Thestor dicksoni dicksoni
Trimenia wallengrenii
Metisella syrinx
Tsitana dicksoni
Charaxes xiphares xiphares f. occidentales
Stygionympha dicksoni
Leto venus

FLORA

Pachypodium namaquanum (halfmens)
Charadrophila capensis (Cape gloxinia)
Aloe pillansii
Aloe buhrii
Aloe erinacea
Mimetes capitulatus
Mimetes hottentoticus
Mimetes stokoei
Orothamnus zeyheri
Protea odorata
Stangeria eriopus
Encephalartos (all species)

Amaryllidaceae (all species)
Pachypodium (all species)
Ilex mitis (Cape holly)
Zantedeschia elliotiana (Yellow arum lily)
Asclepiadaceae (all species)
Echiostachys spicatus
Bruniaceae (all species)
Senecio coleophyllus
Cotula dickitteae
Crassula columnaris

Crassula falcata
Crassula perfoliata
Crassula pyramidalis
Kalanchoe thyrsiflora
Rochia coccineaas
Cunonia capensis
Platylophis trifoliatus
Testudinaria sylvatica
Testudinaria elephantipes
Euphorbia bupleurifolia
Euphorbia fasciculata
Euphorbia globosa
Euphorbia horrida
Euphorbia meloformis
Euphorbia obesa
Euphorbia schoenlandii
Euphorbia symmetrica
Euphorbia valida
Geissomolaceae (all species)
Streptocarpus (all species)
Arundinaria tessellata
Secale africanum
Grubbiaceae (all species)
Iridaceae (all species)
Erythrina acanthocarpa
Erythrina humeana
Liparia comantha
Liparia sphaerica
Liparia splendens
Podalyria calyptrata
Priestleya vestita
Priestleya tomentosa
Aloe (all species except *A.ferox*)
Gasteria beckeri
Gloriosa superba
Haworthia (all species)
Kniphofia (all species)
Lachenalia (all species)
Littonia modesta
Sandersonia aurantiaca
Veltheimia (all species)
Agapanthus walshii
Daubenya aurea
Nymanina capensis
Mesembryanthemaceae (all species)
Strelitzia (all species)
Nymphaea capensis
Orchidaceae (all species)
Oxalis nutans
Harpagophytum procumbens
Penaeaceae (all species)
Muraltia minuta
Adiantum (all species)
Hemitelia capensis
Polystichum adiantiforme
Anacamperos (all species)
Proteaceae (all species)

Anemone capensis
Chondropetalum (all species)
Acockii pillans
Elegia fenestrata
Restio acockii
Restio micans
Restio sabulosus
Retzia capensis
Phylica pubescens
Roridulaceae (all species)
Rutaceae (all species)
Diascia (all species)
Harveya (all species)
Nemesia strumosa
Halleria (all species)
Lachnaeae aurea

Appendix 7: Species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

Flora

Adenium swazicum
Aloe pillansii
Diaphanthe millarii
Dioscorea ebutsniorum
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

ENDANGERED SPECIES

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture

Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

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

Flora

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

VULNERABLE SPECIES

Aves

White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon
Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia

Cheetah
Samango monkey

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

Flora

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

PROTECTED SPECIES

Amphibia

Giant bullfrog
African bullfrog

Reptilia

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

Aves

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

Mammalia

Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger

Sharpe's grysbok
Reedbuck
Cape fox

Flora

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