

**PROPOSED KHOI-SUN SOLAR FACILITY**  
**FAUNA & FLORA SPECIALIST REPORT FOR IMPACT ASSESSMENT**



**Produced for CapeEAPrac**

**on behalf of**

**KHOI-SUN DEVELOPMENT (previously Anjumode (Pty) Ltd.)**

**By**



**[Simon.Todd@3foxes.co.za](mailto:Simon.Todd@3foxes.co.za)**

**October 2012**

## CONTENTS

Declaration of Consultants Independence .....	3
Executive Summary.....	4
1 Introduction .....	6
1.1 Terms of Reference .....	6
1.2 Study Approach.....	8
2 Regulatory and Legislative Overview .....	10
3 Methodology.....	13
3.1 Site Visit.....	13
3.2 Data Review & Sourcing.....	13
3.3 Sensitivity Mapping & Assessment .....	15
3.4 Sampling Limitations and Assumptions .....	16
3.5 Relevant Aspects of the Development.....	16
4 Description of the Affected Environment- Baseline .....	18
4.1 Broad-Scale Vegetation Patterns .....	18
4.2 Fine-Scale Vegetation Patterns.....	19
4.3 Critical Biodiversity Areas & Broad-Scale Processes.....	23
4.4 Faunal Communities .....	23
4.5 Site Sensitivity Assessment .....	26
5 Impact Assessment .....	28
5.1 Assessment & Significance Criteria .....	29
5.2 Identification & Nature of Impacts .....	30
5.3 Assessment of Impacts .....	31
6 Conclusion & Recommendations .....	38
7 References .....	39
8 Annex 1. List of Plants .....	40
9 Annex 2. List of Mammals.....	43
10 Annex 3. List of Reptiles .....	47
11 Annex 4. List of Amphibians.....	50
12 Annex 5. List of Birds.....	51
13 Annex 6. Coordinates of Protected Species.....	53
Short CV of Consultant:.....	60

***DECLARATION OF CONSULTANTS' INDEPENDENCE***

The author of this report, Simon Todd, does hereby declare that he is an independent consultant appointed by the Client 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 the specialist performing such work. All opinions expressed in this report are his own.

A handwritten signature in black ink, appearing to read 'Simon Todd'.

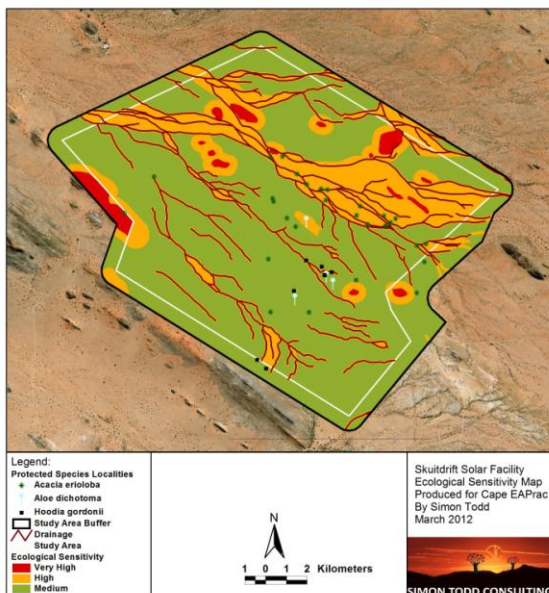
Simon Todd Pr.Sci.Nat

October 2012

## EXECUTIVE SUMMARY

This report details the faunal and botanical impacts likely to be associated with the development of the proposed Khoi-Sun solar PV facility on the farm Skuitdrift in the Northern Cape Province, approximately 68 km north of Pofadder. The facility would have a capacity of 75MW and would require approximately 200 ha of space for the PV panels and associated infrastructure.

A site visit and desktop study were conducted to assess the presence and distribution of ecologically sensitive, species and habitats. The results were integrated to produce a sensitivity map for the site which is depicted below. Sensitive habitats at the site which are not suitable for development and should be avoided, include a number of rocky outcrops at the site as well as an extensive drainage line which traverses the site. There were also a relatively large number of protected plant species at the site, including *Acacia erioloba*, *Aloe dichotoma* and *Hoodia gordonii*. These plants were quite widely distributed across the site and it will not be possible for the development to avoid all the individuals. It is therefore recommended that the affected *Aloe dichotoma* and *Hoodia gordonii* plants be translocated prior to the commencement of construction activities at the site. A permit for any activities involving protected species would be required.



From a general ecological perspective, the site is not viewed as being highly sensitive. No endangered plant species were observed to occur within the proposed development area and there are no listed faunal species with a narrow distribution which occur at the site. The final layout as provided by the developer, largely takes account of the major sensitive features of the site. The development would, by its nature generate a lot of disturbance at the site which would create a number of potential impacts including an increased risk of erosion and alien plant invasion at the site as well as amounting to a loss of vegetation and habitat for fauna.

Six major risk factors associated with the development were identified. These are

- Impacts on vegetation and protected plant species
- Increased risk of alien plant invasion
- Increased erosion risk
- Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna.
- Direct and indirect impacts of the development on avifauna

The majority of impacts can be mitigated to a low level (Summary Impact Table below). However given the extent of disturbance likely to accompany the construction phase of the project, some residual vegetation and faunal impacts are likely to result. Taken in context of the surrounding landscape, the extent of the development is however relatively small and the extent of the residual impacts are likely to be local in nature and are not considered to be of wider significance. Mitigation measures during the construction phase should focus on ensuring that disturbance at the site is kept to a minimum, particularly with regards to vegetation clearing which can difficult to reverse in arid areas. Furthermore, the presence of the panels would generate a flow of runoff which would be concentrated towards the front of the rows of panels. Given the low plant cover at the site, this would potentially increase the erosion risk at the site and specific monitoring and mitigation measures to regulate runoff at the site are recommended. Overall, the final layout as assessed in the this report largely avoids the major sensitive features of the site and provided that the mitigation measures as suggested in the assessment can be successfully implemented, then the development is not likely to result in any significant impacts of wider significance and the long-term degradation of the receiving environment is not likely to occur.

Summary assessment of the pre- and post-mitigation impacts associated with the construction and operation phases of the project

Impact	Project Phase	Pre Mitigation	Post Mitigation
Impacts on vegetation and protected plant species	Construction	Moderate-High	Moderate
	Operation	Low	Low
Increased alien plant invasion risk	Construction	Moderate	Low
	Operation	Moderate	Low
Increased erosion risk	Construction	Moderate	Low
	Operation	Low	Low
Faunal habitat loss and disturbance	Construction	Moderate	Moderate
	Operation	Low	Low
Negative impacts on avifauna	Construction	Moderate	Low
	Operation	Moderate	Low

## **1 INTRODUCTION**

Khoi-Sun Development (Pty) Ltd. (previously Anjumode (Pty) Ltd) is proposing to develop a solar energy facility at Skuitdrift in the Northern Cape Province, approximately 68km north of Pofadder. The development is known as the Khoi-Sun solar facility and would have a maximum generation capacity of 75MW. In terms of the EIA regulations, an environmental authorization is required before the development can proceed. To these ends, Cape EAPrac has appointed Simon Todd Consulting to perform a specialist fauna and flora assessment of the site as part of the Environmental Impact Assessment process.

The development would be situated on the farm Skuitdrift approximately 30 km northwest of the N14 between Pofadder and Kakamas. In order to achieve the desired 75 MW output, approximately 150 ha of space to install the solar panels would be required. The site lies adjacent to the ESKOM Schuitdrift 132/33 KV substation. Various infrastructure and a short transmission line to link the development to the substation would also be required.

The detailed terms of reference for the project are detailed below

### **1.1 TERMS OF REFERENCE**

#### ***Vegetation Study***

- Carry out fieldwork to locate and describe the current state of vegetation on the study area, key focus on the impact footprint(s) for site, so that there is a baseline description/status quo against which impacts can be identified and measured.
- Determine the species present and localities within each vegetation types.
- Generate a vegetation map showing the site in relation to any Critical Biodiversity Areas and links to ecological corridors and support areas, vegetation sensitivity, disturbed, transformed and potential “no-go” areas.
- Determine whether the study area falls wholly or partially within the distribution range of species listed as Vulnerable, Endangered or Critically Endangered and Protected.
- Provide site photos that show the current state of the vegetation (i.e. natural, transformed, disturbed etc.) Identify and describe the conservation value and conservation planning frameworks relevant to this site (Regional Planning) for represented vegetation units.
- A detailed list of species of special concern.
- An indication of the irreplaceability value of vegetation types present on site.
- Describe the areas where indigenous vegetation has been transformed.
- Determine alien species present; their distribution within the study area and recommended management actions.
- A description of different micro-habitats, and the species associated with those habitats.
- Note and record the position of unusually large specimens of trees.

- Describe the potential direct, indirect and cumulative negative and positive impacts of the proposed activity on vegetation species during the construction, operation and decommissioning phases of the project.
- Identification of issues and potential direct, indirect and cumulative biodiversity impacts, which are to be considered in combination with any additional relevant issues that may be raised through the public consultation process. These include:
  - The cumulative impact of clearing for the construction of solar facilities on floral species of concern both on the farm and in the greater area.
- Disclose any gaps in information or assumptions made.
- Recommendations for mitigatory measures to minimise impacts identified.
- An outline of additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP), as well as generic rehabilitation and re-vegetation guidelines.

### *Faunal Study*

- Carry out fieldwork to describe and assesses the current state of terrestrial fauna in the area so that there is a baseline description/status quo against which impacts can be identified and measured.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Describe the different micro-habitats, and the species associated with those habitats.
- Describe the potential direct, indirect and cumulative negative and positive impacts of the proposed activity on inhabitant and reliant faunal species during the construction, operation and decommissioning phases of the project.
- Provide a detailed fauna sensitivity map of the site, including mapping of faunal community disturbance, transformation and potential “no-go” areas on site.
- Clarify species of special concern (SSC) and that are known to be:
  - endemic to the region;
  - that are considered to be of conservational concern;
  - that are in commercial trade (CITES listed species);
  - or, are of cultural significance.
- A description of species composition and conservation status in terms of protected, endangered or vulnerable faunal species.
  - This description will include species which are likely to occur within, traverse across or forage within the proposed project area, as well as species which may not necessarily occur on site, but which are likely to be impacted upon as a result of the proposed development.

- Identification of issues and potential direct, indirect and cumulative biodiversity impact which are to be considered in combination with any additional relevant issues that may be raised through the public consultation process. These include:
  - The cumulative impact of clearing for the construction of solar facilities on faunal species of concern both on the farm and in the greater area.

**General Considerations:**

- Disclose any gaps in information or assumptions made.
- Recommendations for mitigatory measures to minimise impacts identified.
- An outline of additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for faunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided which will be separated into the following project phases:

- Pre-construction
- Construction
- Operational phases

**1.2 STUDY APPROACH**

The ecological specialist study was be conducted according to the ToR provided, the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989 as well as within the guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005). This includes the following activities and studies:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following are identified or described:

- **Community and ecosystem level**
  - The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
  - Threatened or vulnerable ecosystems (*cf. new SA vegetation map/National Spatial Biodiversity Assessment1, fine-scale systematic conservation plans, etc*).
- **Species level**



- Red Data Book species (giving location if possible using GPS).
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).
- **Other pattern issues**
  - Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
  - The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
  - The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

## 2 REGULATORY AND LEGISLATIVE OVERVIEW

A summary of the relevant portions of the Acts which govern the activities and potential impacts to the environment associated with the development are listed below. Provided that standard mitigation and impact avoidance measures are implemented, not all the activities listed in the Acts below would actually be triggered.

### **National Environmental Management Act (NEMA) (Act No 107, 1998):**

NEMA requires that measures are taken that “prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.” In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

### **Environmental Conservation Act (ECA) (No 73 of 1989 Amendment Notice No. R1183 of 1997)**

This Act provides for the effective protection and controlled utilisation of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers must undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations.

### **National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004):**

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEMBA also deals with endangered, threatened and otherwise controlled species. The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.

- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. These activities may not proceed without environmental authorization. Those relevant to the current study are listed below.

Under the **Environmental Impact Assessment Regulations Listing Notice 2 of 2010** (No. R.387) the following activities are likely to be triggered:

Activity 1: The construction of facilities or infrastructure, including associated structures or infrastructure, for -

- (a) the generation of electricity where –
  - (i) the electricity output is 20 megawatts or more; or
  - (ii) the elements of the facility cover a combined area in excess of 1 hectare;

And, under **Environmental Impact Assessment Regulations Listing Notice 3 of 2010** (R.546):

*Activity 14.* The clearing of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation.

*Activity 16 IV:* The construction of infrastructure covering 10 square meters or more where such construction occurs within a watercourse or within 32 metres of a watercourse measured from the edge of the watercourse, excluding where such construction will occur behind the development setback line. Within:

It is important to note that the above thresholds and activities also apply to phased developments *“where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.”*

**National Forests Act (No. 84 of 1998):**

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: *“no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated”*.

Several protected tree species were observed at the site including *Acacia erioloba* and *Aloe dichotoma*. Their location and abundance within the site is discussed in full in the section 4.

#### **Conservation of Agricultural Resources Act (Act 43 of 1983):**

The Conservation of Agricultural Resources Act (CARA) provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

The abundance of alien plant species at the site was very low, which can be ascribed firstly to the aridity of the site as well as the low rainfall in the period preceding the site visit.

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

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires. Landowners may be held responsible for damage to property from fires which begin on their properties.

The site is however arid with very sparse vegetation cover and fires are not a natural phenomenon in the area. However, under exceptional circumstances, such as following years of very high rainfall, sufficient biomass may build up to carry fires. Therefore, management of plant biomass within the site should be part of the management of the facility. Grazing by livestock is the simplest and most ecologically sound way to manage plant biomass and is recommended the preferred method to manage plant biomass at the site. Fires are only likely to be a risk within the sandy pediments at the site and within the rocky areas, it is safe to say that fire risk is minimal on account of the low plant cover associated with this habitat.

#### **Northern Cape Nature Conservation Act, No. 9 of 2009:**

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

#### **Manipulation of boundary fences**

19. No Person may –

- (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under schedule 1 or 2.

### **3 METHODOLOGY**

#### **3.1 SITE VISIT**

The site visit took place on the 29<sup>th</sup> of February 2012. During the site visit, the different biodiversity features, habitat, vegetation and landscape units present at the site were identified and mapped in the field. Walk-through-surveys were conducted across the site and all plant and animal species observed were recorded. Searches for listed and protected plant species at the site were conducted and the location of all listed plant species observed was recorded using a GPS. Active searches for reptiles and amphibians were also conducted within habitats likely to harbor or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site. The site was well covered during the site visit and it is therefore highly unlikely that any features are present within the site that were not observed during the site visit.

#### **3.2 DATA REVIEW & SOURCING**

##### *Flora*

Vegetation descriptions and conservation status of the vegetation types which occur in the study area are based on Mucina and Rutherford (2006). The Draft National List and Threatened Ecosystems (Notice 1477 of 2009) was also consulted to ensure that no listed ecosystems occur within the site. A species list of plants for the area was derived from the SANBI SIBIS data portal, for the quarter degree squares 2819DA, DB, DC and DD. This is a much larger area than the study area and was extracted for a much larger area in order to account for the likelihood that area has probably not been well sampled in the

past. The conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2011). As not all areas have been adequately sampled in the past, the species lists extracted from the SIBIS database may not be comprehensive. The potential presence of listed plant species at the site was therefore investigated by extracting lists of Threatened plants from a wide area around the site, as well as by investigating the distribution of listed species known from the broad area.

### *Fauna*

Following the site visit and the identification of the different ecological features of the site, lists of mammals, reptiles and amphibians which were observed at the site were augmented with species likely to occur at the site based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases). Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friendmann and Daly (2004) and Skinner and Chimimba (2005) for mammals. Listed bird species for the area were extracted from the SABAP 1 and SABAP 2 databases and Birdlife South Africa's Important Bird Areas was also consulted to ascertain if the site falls within the range of any range-restricted or globally threatened species. The faunal species lists provided are based on species which are known to occur in the broad geographical area as well as an assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:

**Low:** The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.

**Medium:** The habitat is broadly suitable or marginal and the species may occur at the site.

**High:** There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.

**Definite:** Species that were directly or indirectly (scat, characteristic diggings, burrows etc) observed at the site.

The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2012) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

**Table 1.** The IUCN categories used to denote the conservation status of species of conservation concerns with the study area.

IUCN Red List Category	Abbreviation
------------------------	--------------

Critically Endangered (CR)	CR
Endangered (EN)	EN
Vulnerable (VU)	VU
Near Threatened (NT)	NT
Critically Rare	
Rare	
Declining	
Data Deficient - Insufficient Information (DDD)	DDD
Data Deficient - Taxonomically Problematic (DDT)	DDT
Least Concern	LC
<b>Total</b>	

### General

Other potentially important ecological data available from the SANBI BGIS data portal were also interrogated and incorporated into the report where applicable. This includes the National Freshwater Ecosystems Priority Areas assessment (NFEPA) (Nel et al. 2011), as well as the National Protected Areas Expansion Strategy 2008 (NPAES). No fine-scale conservation planning has been conducted for the area, and as a result no Critical Biodiversity Areas have been defined for the region.

### 3.3 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different vegetation and habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category is reserved specifically for areas where the natural vegetation has already been transformed, usually for intensive agricultural purposes such as cropping. Most types of development can proceed within these areas with little ecological impact. There were however no Low Sensitivity areas within the study area.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided at all costs.

### ***3.4 SAMPLING LIMITATIONS AND ASSUMPTIONS***

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be critically evaluated. There had been some rainfall in the period preceding the site visit, and the vegetation within the drainage lines and rocky outcrops was growing or in seed or flower. The rainfall had however not been sufficient to stimulate growth of the vegetation on the open plains. As a result, few annuals, forbs and geophytes were present at the time of sampling and the plant species list obtained for the site can be considered to be representative of the trees, shrubs and grasses only. This is however not viewed as having a significant impact on the outcome of the study as the ecological patterns at the site were clear and it not likely that sampling during a different season would significantly impact the outcome of the sensitivity mapping. In addition, the list of species observed during the site visit was supplemented with a list of those protected or endangered species which are known to occur in the area. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes account of the study limitations.

### ***3.5 RELEVANT ASPECTS OF THE DEVELOPMENT***

A single site is being considered and alternative sites are not being assessed or compared to one another. The site is roughly square in shape, 2 by 2 km in extent and lies to the northwest of the ESKOM Scuitdrift substation. A satellite image of site is depicted below in Figure 1, while the proposed development focus areas are depicted in Figure 2. The proposed development area is an undulating plain dissected by drainage channels, with occasional rocky outcrops. Soil texture and depth across the site varies substantially and ranges from fine aeolian sands to very coarse weathered granitic soils. Many parts of the site have very shallow soils or characterised by exposed granitic bedrock. Trees are abundant on parts of the site, particularly along the larger drainage channels.





**Figure 1.** The proposed development area of the 75 MW Skuitdrift Solar Facility is represented by the red polygon. The ESKOM Schuitdrift substation can be seen in the middle foreground. The Orange River is at the very top of the image and is approximately 11 km from the facility at its nearest point. Note that the orientation of the map is looking northwest.

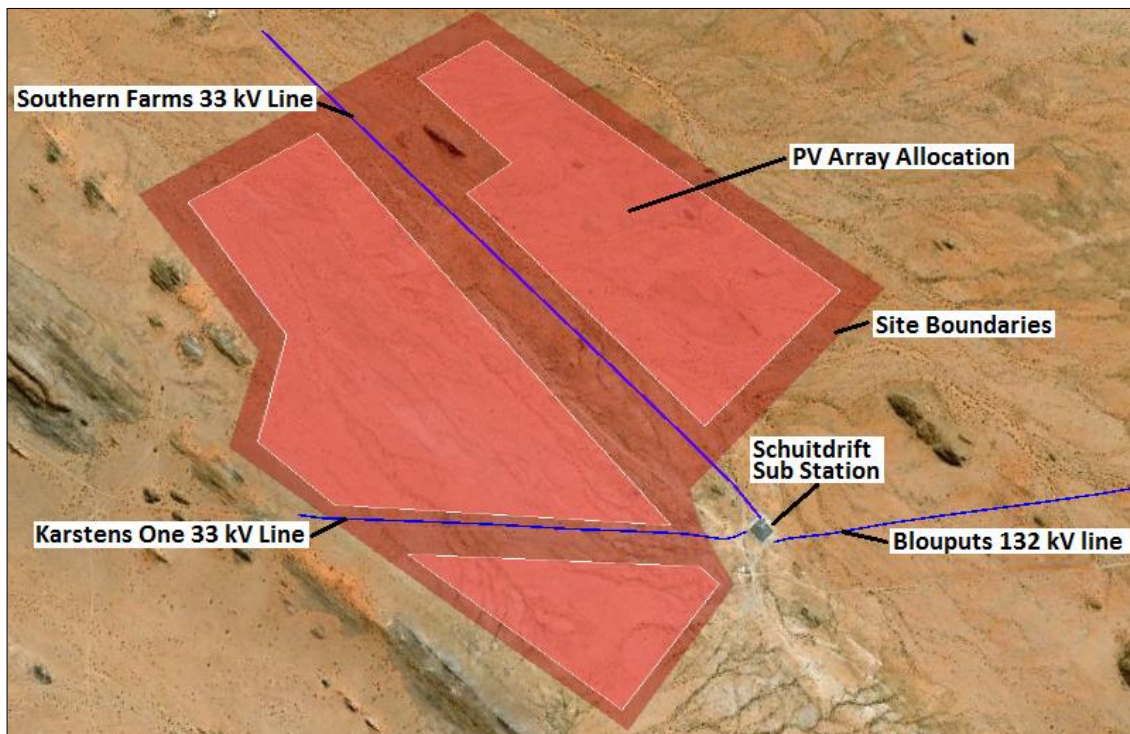
Important aspects of the construction and infrastructure of the development which are potentially relevant to assessing the likely impacts of the activities associated with the development include the following:

- Solar PV Arrays will be installed in rows at the site. They will be mounted on steel structures which will be piled or cemented into the ground depending on soil conditions
- Underground cabling will run the length of the arrays and will link the arrays to inverters.
- A grid connection substation will be constructed which will house the power transformers which will increase the voltage before it connects to the ESKOM grid via a short overhead line.
- Service roads will run between the rows of arrays and will be used for maintenance activities such as cleaning the arrays.

Additional permanent infrastructure and temporary construction activities which will occur at the site will include:

- Auxiliary Electrical equipment
  - Diesel generator sets will supply power to security and monitoring systems in the event of a grid failure;

- Security system, fence and access control;
- Fire detection system;
- Weather monitoring equipment (rainfall, wind speed/direction, solar irradiation, air moisture)
- Plant monitoring equipment and associated telecommunication links;
- Air conditioning equipment inside inverter/transformer enclosures which will regulate the operating temperature of the inverters;
- A small site office and storage facility, including security and ablution facilities
- Temporary construction camp
- A lay-down area for the temporary storage of materials during the construction activities.



**Figure 2.** The focus areas for the 75MW solar layout, as provided by the developer.

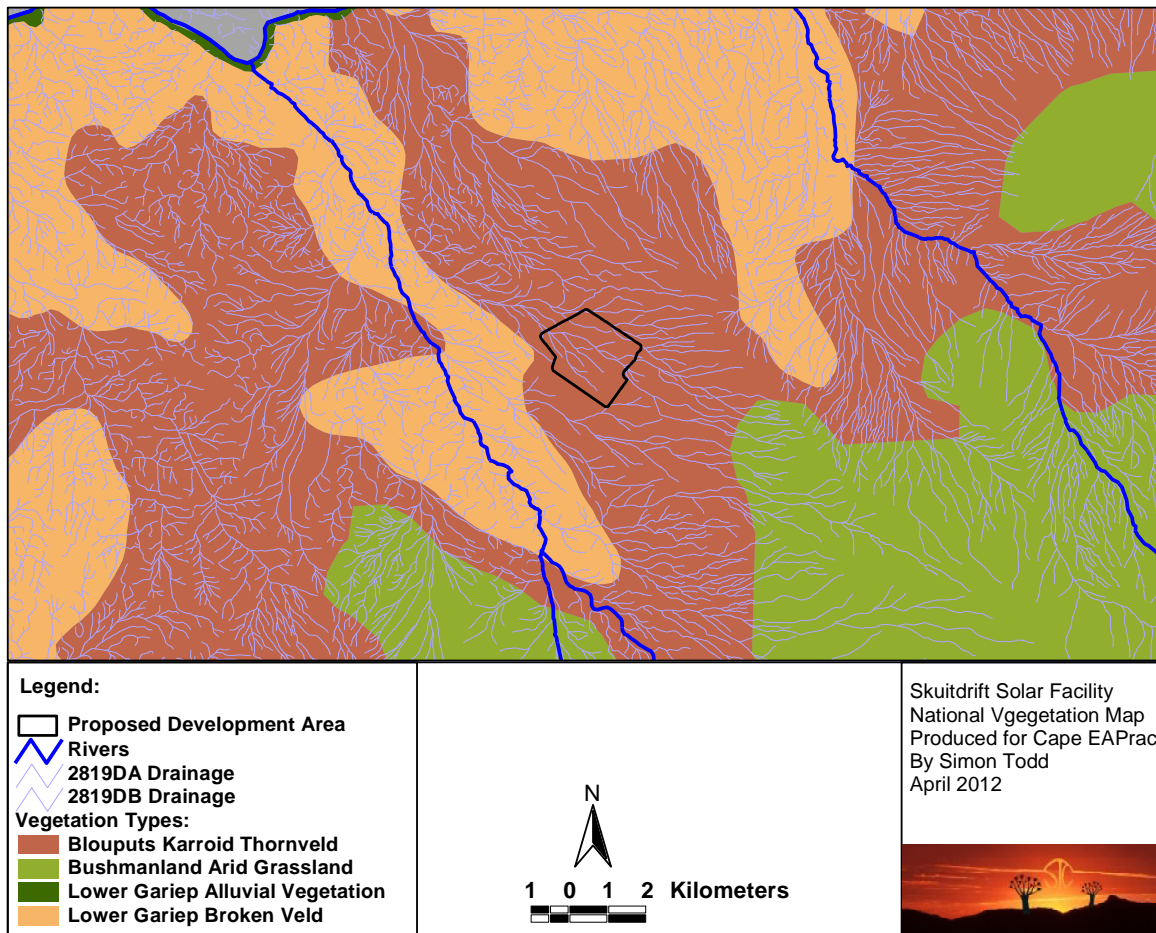
#### **4 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE**

##### **4.1 BROAD-SCALE VEGETATION PATTERNS**

According to the national vegetation map (Mucina & Rutherford 2006), the site lies within the Blouputs Karroid Thornveld vegetation type (Figure 3). Blouputs Karroid Thornveld occurs as a belt of irregular flat areas from the vicinity of Augrabies Falls in the east to Kotie se Laagte and Samoep se Laagte in the west. The vegetation type is listed as Least Threatened and less than 1% has been transformed. It is well conserved (27%) within Augrabies Falls National Park. At 607 km<sup>2</sup> it is however the smallest



mapped vegetation unit within the Nama Karoo Biome. Other vegetation types which occur in the vicinity of the site include Lower Gariep Broken Veld, Bushmanland Arid Grassland and along the banks of the Orange River, Lower Gariep Alluvial Vegetation. Lower Gariep Broken Veld and Bushmanland Arid Grassland are also classified as Least Threatened and have been little impacted by transformation. Lower Gariep Alluvial Vegetation is however classified as Endangered on account of the high degree of transformation it has experienced. This vegetation is however restricted to the banks of the Orange River and would not be affected by the development.



**Figure 3.** The broad-scale vegetation in and around the proposed Skuitdrift Solar Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011) as well as small-scale drainage.

#### 4.2 FINE-SCALE VEGETATION PATTERNS

Although the site appears to lie within a single vegetation type, there are in fact several different plant communities that occur at the site. Each is associated with different soil and physical conditions, and

the landscape can be viewed as a template which determines the distribution of different plant communities. The major communities present at the site are described in detail below.

#### *Drainage Lines and Washes*

The site is dissected by a large number of drainage features. This may be surprising given the arid nature of the area, but results from the fact that there is little vegetation to retard the overland flow of water and in many areas there is also little soil to absorb the rainfall, with the result that when it rains, a large amount of runoff may be generated. The smaller drainage lines are not highly significant from an ecological perspective because they do not receive or retain sufficient water to develop characteristic or unique plant communities. The larger drainage lines are however significant as they contain large trees not found elsewhere on the site, as well as shrub and grass species which are restricted to the drainage lines. Although development could proceed with little ecological impact near the smaller drainage lines, the larger drainage lines should be considered highly sensitive and development should not occur within these areas. The smaller drainage lines are characterized by the presence of large shrubs and low trees such as *Acacia mellifera*, *Boscia foetida*, *Phaeoptilum spinosum*, *Monechma spartioides* and *Rhigozum trichotomum*. The larger drainage lines are characterised by a bed and floodplain of deep coarse sand, and are dominated by species such as *Acacia erioloba*, *Sisymbrium sparteum*, *Stipagrostis namaquensis*, *S. brevifolia* and *Leucophrys mesocoma*.



**Figure 4.** Looking north towards the Orange River down the large drainage line which runs through the site. The drainage line is a sensitive environment and should not be impacted by the development.

#### *Rocky Outcrops*

There were a number of relatively small rocky outcrops within the study area, which varied from low outcrops no more than a meter in height to much larger outcrops 15-20 m in height above the surrounding plain. The rocky outcrops have a distinctive vegetation composition and are also significant

from a faunal perspective. Species which are common or characteristic of the outcrops, include small trees and shrubs such as *Aloe dichotoma*, *Commiphora gracilifrons*, *Hibiscus engleri*, grasses such as *Tricholaena capensis* subsp *arenaria* and *Enneapogon scaber*, and forbs such as *Chascanum garipense*, *Rogeria longiflora*, *Trichodesma africanum* and *Hermannia minutiflora*.



**Figure 5.** One of the larger rocky outcrops at the site. Most of the green shrubs are *Commiphora gracilifrons* and the grass tussocks are *Tricholaena capensis*.

### Sandy Plains

Large parts of the north and western sections of the site consist of open grassland with scattered trees on deeper Kalahari and granitic soils (Figure 6). These areas are dominated by grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.anomala* and in wet years, *Schmidtia kalahariensis*. Common trees include *Acacia erioloba*, *Boscia foetida* and *Parkinsonia africana*. Shrubs are often associated with drainage areas and typical species include *Phaeoptilum spinosum*, *Lycium pumilum*, *Monechma spartioides*, *Kissenia capensis* and *Zygophyllum rigidum*. Forbs include *Cucumis africanus*, *Coccinia rehmannii* and *Pergularia daemia*. The protected succulent *Hoodia gordonii* was also observed within this habitat.

### Rocky Plains

A large proportion of the site, particularly the central area, consists of rocky ground or exposed bedrock (Figure 5). These areas contain less grass than the sandy plains and a high proportion of woody species. Common species in this habitat include trees such as *Acacia mellifera* and *Boscia foetida*, low shrubs such as *Microlooma incanum*, *Hibiscus elliottiae*, *Hermannia spinescens*, *Petalidium lucens*, *Asparagus*



*denudatus*, *Commiphora namaensis*, *Salsola rabieana* and *Hermannia stricta*. The dominant grass in these areas is *Enneapogon scaber*. The protected species *Aloe dichotoma* and *Hoodia gordonii* occur within this habitat.



**Figure 6.** Sandy Plains community type, near the western boundary of the site. The grasses are various *Stipagrostis* species, while the trees are largely *Acacia mellifera* and *Phaeoptilum spinosum*.



**Figure 7.** The Rocky Plains community type. Looking towards the homestead from the south eastern boundary of the site. The central parts of the site are largely shallow soils and exposed bedrock. The majority of woody species are *Acacia mellifera*, with some *Boscia foetida*.

According to the SANBI SIBIS database, only one endangered species *Caesalpinia bracteata* is known from the area, and is classified as Vulnerable. This species has a highly restricted distribution and is known from a total population of about 1000 adult plants (Threatened Species Programme, Red List of South African Plants (2011), but as it occurs on rocky outcrops along the Orange River, it would not occur within the proposed development area and was not observed. The abundance of *Hoodia gordonii* was quite high within certain areas, while a limited number of *Aloe dichotoma* and *Acacia erioloba* trees occur within the proposed development area. The affected *Hoodia* and *Aloe* plants should be translocated outside the development area before construction. A permit would be required for any activities involving the protected species. Permit application forms for provincially protected species are obtainable from DENC, while nationally protected species are regulated by DAFF.

The site was relatively free of alien species and no alien species were observed within the study area. Disturbance at the site would however potentially increase the risk of alien invasion at the site.

#### **4.3 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES**

No fine-scale conservation planning has been conducted for this area. The Namakwa District Biodiversity Sector Plan includes this area as a broad-scale corridor, but since the area is outside of the planning domain of the Plan, the results cannot be considered reliable and are therefore not considered applicable to the current study. Although the site also does not fall within a National Protected Areas Expansion Strategy focus area, a focus area does occur approximately 10 km to the west of the study site. This suggests that the site itself is probably not highly significant from a biodiversity maintenance perspective, but that the broader area is potentially important for the maintenance of biodiversity and broad-scale ecosystem function. The development is relatively small in extent when considered in light of the overwhelmingly intact nature of the surrounding landscape. Furthermore, the proximity of the development to the existing ESKOM substation and powerlines would decrease the cumulative impact of the development on the connectivity of the landscape.

#### **4.4 FAUNAL COMMUNITIES**

##### ***Mammals***

The site falls within the distribution range of 46 terrestrial mammals, indicating the mammalian diversity at the site is potentially quite high. Listed species which may occur in the area include the Brown Hyaena *Hyaena brunnea* (Near Threatened), Black-footed cat *Felis nigripes* (Vulnerable) and Leopard *Panthera pardus* (Near Threatened). Given the agricultural activity that takes place in the area, the abundance of Leopard and Brown Hyaena in the area is likely to be low. The habitat is suitable for the Black-footed Cat which favours a mix of open and more densely vegetated areas. However this species is widely distributed across the arid and semi-arid areas of South Africa, and the development would not amount to a significant amount of habitat loss for this species.

In terms of important mammalian habitats in the vicinity of the development, the rocky outcrops and drainage lines can be singled out as being the most significant. Compared to the adjacent plains the rocky habitats are likely to harbor far greater species richness, particularly of small mammals. Species associated with such rocky outcrops include Rock Hyrax *Procavia capensis*, Klipspringer *Oreotragus oreotragus*, Pygmy Rock Mouse *Petromyscus collinus*, Namaqua Rock Mouse *Aethomys namaquensis* and Western Rock Elephant Shrew *Elephantulus rupestris*. The greater overall plant cover and higher frequency of large tree species such as *Acacia erioloba* within the drainage lines is also likely to be of significance for species such as Duiker *Sylvicapra grimmia*, Acacia Tree Rat *Thallomys paedulus* and Black-tailed Tree Rat *Thallomys nigricauda*. The open plains such as those which occur within the proposed development area are likely to be dominated by species associated with open sandy ground such as various gerbils such as Hairy-footed Gerbil *Gerbillurus paebe* and Highveld Gerbil *Gerbilliscus brantsii*. Other mammals observed at the site include South African Ground Squirrel *Xerus inauris*, Cape Hare *Lepus capensis* and Cape Porcupine *Hystrix africaeaustralis*.

The medium to larger sized mammals which occur at the site all have home ranges which are likely to exceed the extent of the study site. The erection of fencing which prevents the movement of such animals is therefore a concern regarding the development of the site and specific mitigation measures to reduce these impacts may be required.

### **Reptiles**

The site lies in or near the distribution range of at least 45 reptile species (Appendix 3), indicating that the reptile diversity at the site is likely to be quite high. Given the variety of habitats available at the site which range from sandy plains and dunes, to rocky plains and outcrops to drainage lines, a large proportion of these reptiles are likely to occur at the site. Based on distribution maps and habitat requirements, the composition of the reptile fauna is likely to comprise 1 tortoise, 17 snakes, 18 lizards and skinks, one chameleon and 8 geckos.

No listed reptile species are known from the area. Broadley's Flat Lizard *Platysaurus broadleyi* is however a narrow endemic which is associated with rocky, arid savannah along the Orange River between Augrabies and Pella and may occur in the area. This conspicuous species was not observed at the site and it is likely that if it occurs in the area, it is likely to occur in closer proximity to the Orange River. Species observed at the site include the Western Rock Skink *Mabuya sulcata sulcata* which was common on the rocky outcrops, the Namaqua Sand Lizard *Pedioplanis namaquensis* which was abundant on the plains as well as an individual of the Black Spitting Cobra *Naja nigricollis woodi*. As with small mammals, the rocky areas are likely to contain the greatest reptile diversity and the majority of Skinks, Girdled Lizards and Geckos which occur at the site are likely to be associated with rocky areas. The plains are likely to contain fast moving species such as Sand Lizards and nocturnal species such as Barking Geckos.

Apart from a relatively small direct loss of habitat, the shading of the soil by the solar panels is likely to affect reptile composition, as the shading is likely to alter soil temperatures which will have implications for the activity patterns of cold-blooded animals. Most reptiles are also sensitive to the amount of plant cover which is also likely to be affected by the arrays. The presence of the arrays and electrical



infrastructure would however create additional habitat for species which utilise such structures such as tubercled geckos (*Chondrodactylus* spp) and agamas (*Agama* spp). Depending on the management of the vegetation beneath the panels, reptile abundance in the development area could increase as a result of increased habitat diversity as well as a protective effect of the panels on reptiles from avian predators.

### **Amphibians**

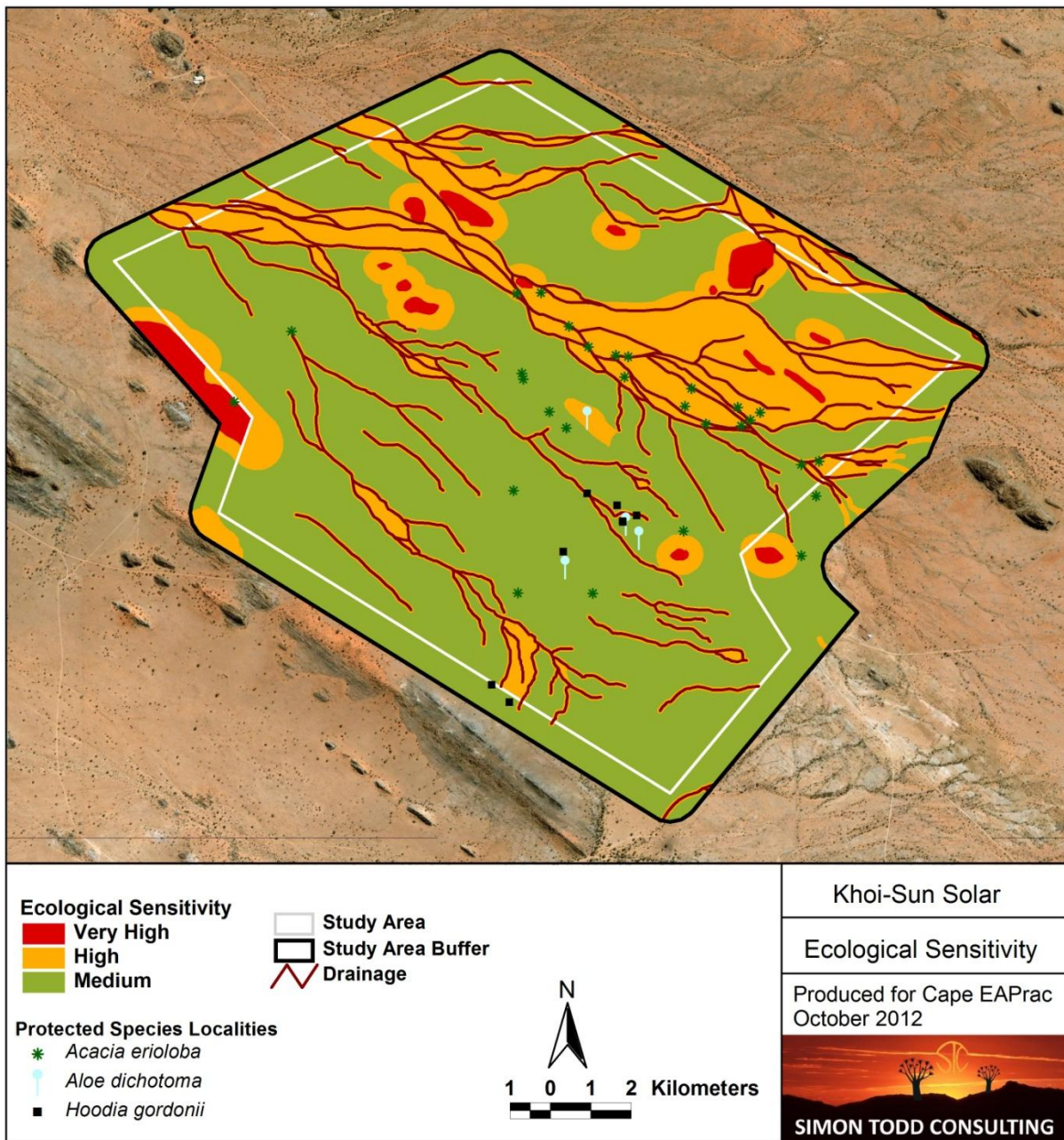
The site lies within the distribution range of six amphibian species. However, given the paucity of surface water at the site, only those species able to persist away from perennial water are likely to occur at the site. The proposed development area is not likely to be an important area for amphibians within the context of the site as there is little suitable cover or habitat present within this area. Given the overall lack of specialized natural amphibian habitats present at the site, amphibians are not likely to be highly sensitive to the development. The greatest risk associated with the development in terms of amphibians is pollution spills which may occur during the construction phase and which could affect amphibians in downstream areas.

### **Avifauna**

According to the SABAP 1 and 2 data sets, 130 bird species are known from the broad area surrounding the Skuitdrift site. The area has however been poorly sampled and the list is probably not comprehensive, particularly with regards to birds that may occur as a result of the proximity of the Orange River. Of the recorded species only Ludwig's Bustard *Neotis ludwigii* (Vulnerable) and Sclater's Lark *Spizocorys sclateri* (Near Threatened) are listed species. Both species are nomadic and would potentially use the site at times, but would also be able to avoid the area when developed. Sclater's Lark would be affected by a very small amount of habitat loss, while Ludwig's Bustard would be potentially more severely impacted due to the possibility of collisions with new transmission lines. However, the planned transmission line for the development is less than 150 m and occurs in very close proximity to the existing substation as well as a large amount of existing transmission infrastructure. The area is therefore likely to already be avoided to some extent and the impact is likely to be very low. Other bird species that were observed to be common at the site include Sociable Weaver *Philetairus socius*, Dusky Sunbird *Cinnyris fuscus*, Capped Wheatear *Oenanthe pileata* and Verreaux's Eagle *Aquila verreauxii*. Verreaux's Eagle is potentially impacted by habitat loss as it may avoid the vicinity of the development and is also vulnerable to electrocution with transmission lines. However, the extent of the development is very small in relation to the home range of this species and the impact on this species is likely to be negligible. Other bird species vulnerable to electrocution which probably occur in the area include the Martial Eagle *Polemaetus bellicosus* which is listed as Vulnerable, and both the Spotted and Cape Eagle-Owl. In this regard it is important to recognize that it is in fact the smaller transmission lines from 11 to 132 kV that are the primary cause of electrocution and not the larger transmission lines. Therefore, the construction of new powerlines at the site would pose an additional risk. In terms of general impacts on avifauna, these are likely to be relatively low as the area does not fall within any of Birdlife South Africa's Important Bird Areas, indicating that the area is not within the range of any range-restricted or globally threatened species.

#### 4.5 SITE SENSITIVITY ASSESSMENT

The ecological sensitivity map for the site is depicted below (Figure 8). The dominant feature in terms of the sensitivity map is the large drainage line which traverses the site in a roughly east to west direction. Typically of drainage lines in sandy, arid environments, it forms a braided channel with a number of anastomosing channels. This is a dynamic and ecologically sensitive area and the development should not impact this area. Outside of the large drainage lines the rocky outcrops are also sensitive features that should be avoided. The sensitivity map includes buffer areas around these features and it is therefore not necessary to implement additional buffers in terms of the placement of infrastructure at the site. There are however a number of protected plant species within the proposed development area, and although it would be preferable to avoid these, those species such as *Aloe dichotoma* which are suitable for search and rescue and cannot be avoided should be translocated outside of the development footprint. This area also contains a number of small drainage lines or washes and the development would also have to accommodate these in some manner. If it is possible to build over the channels without interfering with them, then this would be an acceptable solution. The site is generally quite flat and so the erosion risk associated with the development would be quite low. The large amount of panels that would be used in the development, which would amount to approximately 65 ha of surface area, would generate a lot of runoff during large rainfall events and measures to regulate this runoff would be required. Overall, the site is however not highly sensitive and the final layout provided by the developer in response to the sensitivity map takes account of the major sensitive features of the site, and while it would certainly generate some local impact, there are not likely to be any impacts generated of broader significance.

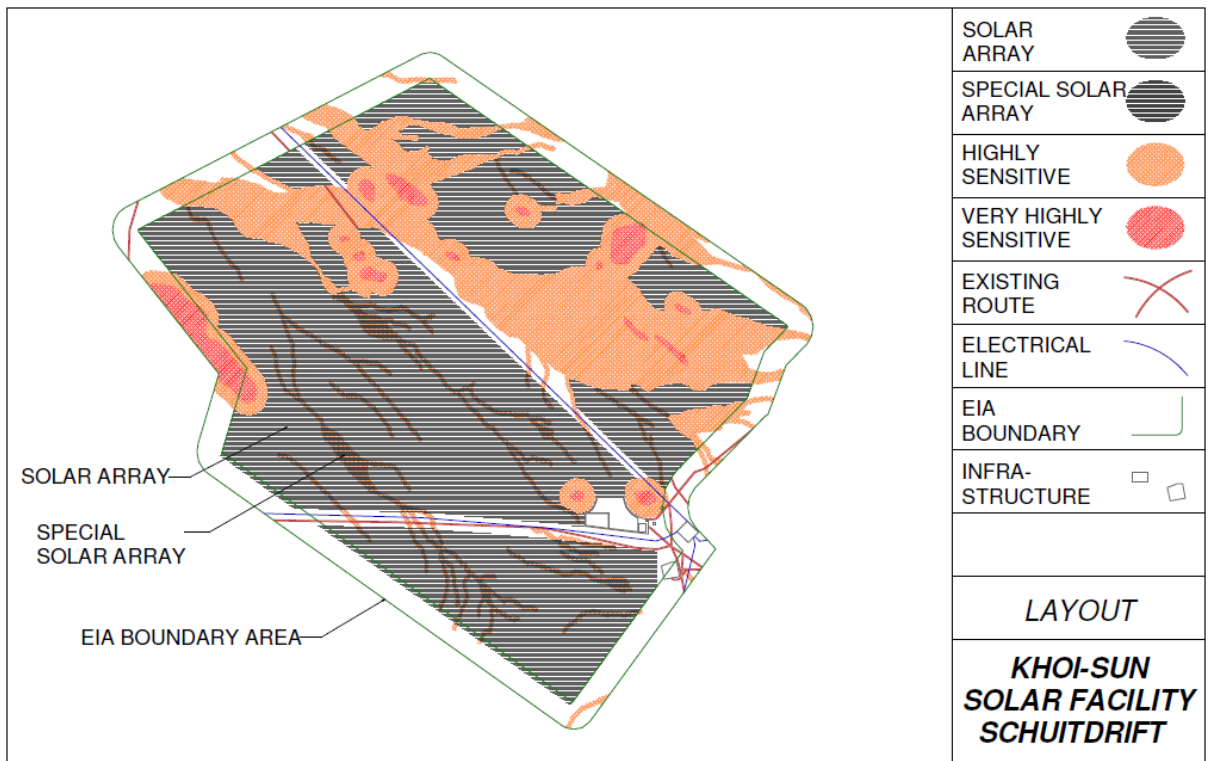


**Figure 8.** Ecological Sensitivity map of the proposed Skuitdrift 75 MW Solar Facility site, including the localities of protected species. Those areas classified as Medium Sensitivity are suitable for the construction of the facility.

## 5 IMPACT ASSESSMENT

### 5.1 ALTERNATIVES CONSIDERED IN THE ASSESSMENT

A single site is being considered and alternative sites were excluded on various grounds such as environmental unsuitability or economic considerations, during the scoping phase of the development. The no-go alternative remains as a potential outcome if the development does not proceed. Under this scenario it is likely that the site will remain under its current land use of extensive livestock farming. Due to the aridity of the area and the lack of alternative land uses, the economic potential of the site under this scenario will remain low in comparison with the potential economic benefits associated with the development of the solar energy facility at the site. The status quo option is inherent in the assessment as it forms the baseline from which the significance of the potential impacts associated with the development of the site as a PV facility is determined. The final preferred layout as provided by the developer in response to the sensitivity map as provided in this report, is depicted below. This final layout is that which is assessed in this report.



**Figure 9.** The final layout as provided by the developer in response to the sensitivity map provided in this report.

## 5.2 ASSESSMENT & SIGNIFICANCE CRITERIA

The assessment criteria used in the assessment are described below and are drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989 as well as Brownlie (2005).

For each impact the following are described:

**Nature of the impact.** A description of positive or negative effect of the project on the affected environment, or *vice versa*. The description includes who or what would be affected, and how.

**Extent of the impact.** This includes assessing the spatial scale of the impact, i.e. is it local (within the boundaries of the study site), regional, national or international.

**Duration of the impact.** The lifespan of the impact is assessed, i.e. is it short term (0 - 5 years) Medium term (6 - 15 years) long term (where the impact will cease after the operational life of the proposed project) or permanent (the impact will persist beyond the operational life of the proposed project). Certain impacts can also be *discontinuous or intermittent* (where the impact may only occur during specific climatic conditions or during a particular season of the year).

**Intensity or magnitude of the impact.** The intensity or severity of the impact would be indicated as either Low (where the impact affects the environment in such a way that functioning and processes are not affected), Medium (i.e. where the affected environment is altered but functioning and processes continue albeit in a modified way) or High (i.e. where functioning and processes are altered to the extent that they will temporarily or permanently cease).

**Probability of occurrence.** The likelihood of the impact actually occurring would be indicated as either Improbable (the possibility of the impact materialising is very low as a result of design or historic experience), Probable (there is a distinct possibility that the impact will occur), Highly probable (it is most likely that the impact will occur), or Definite (the impact will occur regardless of the implementation of any prevention measures).

**Significance of the impact.** Based on a synthesis of the information contained in the criteria above, the potential impact would then be described according to following significance criteria:

- **No significance:** the impacts do not influence the proposed development and/or environment in any way.
- **Low significance:** the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.
- **Moderate significance:** the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.
- **High significance:** the impacts will have a major influence on the proposed development and/or environment and will result in the “no-go” option on the development or portions of the

development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

**Confidence** The level of confidence in predicting the impact can be described as low, where there is little confidence in the prediction, due to inherent uncertainty about the likely response of the receiving ecosystem, or inadequate information; medium, where there is a moderate level of confidence in the prediction; or high, where the impact can be predicted with a high level of confidence.

#### **Cumulative Impact**

Consideration is given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts are evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.

#### **Mitigation**

The objective of mitigation is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats and to maximise re-vegetation and rehabilitation of disturbed areas. For each impact identified, appropriate mitigation measures to reduce or otherwise avoid the potential impacts are suggested. All impacts are assessed without mitigation and with the mitigation measures as suggested appropriately implemented.

### **5.3 IDENTIFICATION & NATURE OF IMPACTS**

The primary impacts on the terrestrial environment likely to be associated with the development of solar PV facility at the site, are as follows:

#### *Impacts on vegetation and protected plant species*

Some loss of vegetation is an inevitable consequence of the development. In addition there are a number protected species within the development footprint including *Acacia erioloba*, *Aloe dichotoma*, *Hoodia gordonii* and *Boscia foetida*. The loss of some individuals of these species is likely to be unavoidable and only the succulent species can be translocated.

#### *Increased risk of alien plant invasion*

The disturbance created during construction will leave the site vulnerable to alien plant invasion. Drainage lines and other areas which receive run-off are likely to be most vulnerable to invasion.

#### *Increased erosion risk*

Increased erosion risk would result from soil disturbance and the loss of plant cover within cleared and disturbed areas. The runoff created from the panels and other hardened surfaces at the site would also increase the erosion risk associated with the development and specific measures to control runoff flow should be implemented to reduce this risk.

#### *Direct Faunal impacts*

Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles such as tortoises would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Some habitat loss for fauna is likely to occur, but would not be of high significance given the scale of the development relative to the intact nature of the surrounding landscape.

#### *Impacts on avifauna*

Negative impacts on avifauna would result from habitat loss as well as from the risk of electrocution and collisions with transmission lines, which is a particular problem for many larger birds such as eagles, flamingos, cranes and bustards. Although this is potentially a significant impact, the development is close to the existing substation and the length of any new power lines required for the development would be very short and not likely to contribute significantly to avifaunal impact, especially after suitable mitigation measures have been applied.

### **5.4 ASSESSMENT OF IMPACTS**

The five major impacts identified above are assessed below, before and after mitigation as well as during the construction and operational phases of the project.

*Impact 1. Impacts on vegetation and protected plant species would occur due to construction activities.*

Extent	Intensity	Duration	Probability	Confidence	Significance & Status Without Mitigation	Mitigation	Significance & Status With Mitigation
<i>Construction Phase</i>							
<i>Local</i>	<i>High</i>	<i>Long term</i>	<i>Definite</i>	<i>High</i>	<i>Moderate-High (-tve)</i>	<ul style="list-style-type: none"> <li>Vegetation clearing to be kept to a minimum. If possible the ground grass layer should be left intact and only the larger woody plants cleared.</li> <li>All areas to be cleared should be clearly demarcated.</li> <li>Sensitive areas as demarcated on the sensitivity map should be avoided, and where such areas cannot be avoided specific mitigation measures to reduce their impact would need to be implemented.</li> <li>Only those individuals of protected plant species directly within the development footprint should be cleared.</li> <li>A search and rescue operation for protected species which could survive translocation such as <i>Hoodia</i> and <i>Aloe</i>, should be conducted prior to construction.</li> <li>Sensitive areas with appropriate buffers at the site such as the washes should be demarcated at the site by an ecologist as part of the preconstruction activities for the site.</li> </ul>	<i>Moderate-Low (-tve)</i>
<i>Operational Phase</i>							
<i>Local</i>	<i>Low</i>	<i>Long term</i>	<i>Definite</i>	<i>High</i>	<i>Low (-tve)</i>	<ul style="list-style-type: none"> <li>Any vegetation clearing that needs to take place as part of maintenance activities, should be done in an environmentally friendly manner, including avoiding the use of herbicides and using manual clearing methods wherever possible.</li> </ul>	<i>Low (-tve)</i>



<i>Impact 2. Increased alien plant invasion risk, resulting from construction-phase disturbance as well as operational phase maintenance activities</i>							
<b>Extent</b>	<b>Intensity</b>	<b>Duration</b>	<b>Probability</b>	<b>Confidence</b>	<b>Significance &amp; Status Without Mitigation</b>	<b>Mitigation</b>	<b>Significance &amp; Status With Mitigation</b>
<i>Construction Phase</i>							
<i>Local</i>	<i>Medium</i>	<i>Long term</i>	<i>High</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>• Soil disturbance and vegetation clearing should be kept to minimum.</li> <li>• Cleared areas that are not going to be used should be revegetated with locally-collected seed of indigenous species.</li> <li>• Regular monitoring to ensure that alien plants are not increasing as a result of the disturbance that has taken place.</li> </ul>	<i>Low (-tve)</i>
<i>Operational Phase</i>							
<i>Local</i>	<i>Medium</i>	<i>Long term</i>	<i>Moderate</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>• All alien plants present at the site should be controlled annually using the best practice methods for the species present.</li> <li>• Bare soil should be kept to a minimum, and at least some grass or low shrub cover should be encouraged under the panels.</li> </ul>	<i>Low (-tve)</i>

*Impact 3. Increased erosion risk as a result of soil disturbance and loss of vegetation cover.*

Extent	Intensity	Duration	Probability	Confidence	Significance & Status Without Mitigation	Mitigation	Significance & Status With Mitigation
<i>Construction Phase</i>							
<i>Local</i>	<i>Medium</i>	<i>Long term</i>	<i>Moderate</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>• Wherever possible, roads and tracks should be constructed so as to run along the contour.</li> <li>• All roads and tracks running down the slope must have water diversion structures present.</li> <li>• Any extensive cleared areas that are no longer or not required for construction activities should be re-seeded with locally-sourced seed of suitable species. Bare areas can also be packed with brush removed from other parts of the site, encourage natural vegetation regeneration and limit erosion.</li> <li>• All construction vehicles should remain on properly demarcated roads. No construction vehicles should be allowed to drive over the vegetation except where no cleared roads are available. In such cases a single track should be used and multiple paths should not be formed</li> </ul>	<i>Low (-tve)</i>
<i>Operational Phase</i>							
<i>Local</i>	<i>Low</i>	<i>Long term</i>	<i>Low</i>	<i>High</i>	<i>Low (-tve)</i>	<ul style="list-style-type: none"> <li>• Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible.</li> <li>• All maintenance vehicles to remain on the demarcated roads.</li> </ul>	<i>Low (-tve)</i>

*Impact 4 Faunal habitat destruction, alteration and physical disturbance.*

<i>Impact 4 Faunal habitat destruction, alteration and physical disturbance.</i>							
Extent	Intensity	Duration	Probability	Confidence	Significance & Status Without Mitigation	Mitigation	Significance & Status With Mitigation
<i>Construction Phase</i>							
<i>Local</i>	<i>High</i>	<i>Short term</i>	<i>High</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.</li> <li>The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. The rocky outcrops are particularly sensitive in this regard &amp; construction personnel should not be allowed off the construction site &amp; on these areas.</li> <li>All staff and contractors should undergo an environmental induction course by the ECO.</li> <li>Fires should only be allowed within fire-safe demarcated areas.</li> <li>No fuelwood collection should be allowed on-site.</li> <li>No dogs should be allowed on site.</li> <li>All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.</li> <li>Should the site need to be fenced, the fencing should be constructed in manner which allows for the passage of small and medium sized mammals. Steel palisade fencing (20 cm gaps min) is a good option in this regard as it allows most medium-sized mammals to pass between the bars, but remains an effective obstacle for humans. Alternatively the lowest strand or bottom of the fence should be elevated to 15cm above the ground at least at strategic places to allow fauna to pass under the fence.</li> <li>If electrified strands are to be use, there should be no strands within 20 cm of the ground because tortoises retreat into their shells when electrocuted &amp; eventually succumb from repeated shocks.</li> </ul>	<i>Moderate (-tve)</i>

<i>Operational Phase</i>							
<i>Local</i>	<i>Low</i>	<i>Long term</i>	<i>High</i>	<i>High</i>	<i>Low (-tve)</i>	<ul style="list-style-type: none"> <li>No unauthorized persons should be allowed onto the site.</li> <li>Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.</li> </ul>	<i>Low (-tve)</i>

<i>Impact 6 Negative impacts on avifauna as a result of habitat loss, electrocution and collisions with transmission lines</i>							
<b>Extent</b>	<b>Intensity</b>	<b>Duration</b>	<b>Probability</b>	<b>Confidence</b>	<b>Significance &amp; Status Without Mitigation</b>	<b>Mitigation</b>	<b>Significance &amp; Status With Mitigation</b>
<i>Construction Phase</i>							
<i>Local</i>	<i>Low</i>	<i>Short term</i>	<i>High</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>The length of any new power lines that need to be installed should be kept to a minimum.</li> <li>Ensure that all new lines are marked with bird flight diverters along their entire length. If the new lines were to run parallel to existing unmarked lines this would potentially create a net benefit as this could reduce the collision risk posed by the older line.</li> <li>All new power line infrastructure should be bird-friendly in configuration and adequately insulated (Lehman et al. 2007). These activities should be supervised by someone with experience in this field.</li> </ul>	<i>Low (-tve)</i>
<i>Operational Phase</i>							
<i>Local</i>	<i>Low</i>	<i>Long term</i>	<i>High</i>	<i>High</i>	<i>Moderate (-tve)</i>	<ul style="list-style-type: none"> <li>Ensure that any maintenance on the transmission infrastructure of the site retains the bird-friendly design features.</li> <li>Any electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented.</li> </ul>	<i>Low (-tve)</i>

### Summary Assessment

A summary assessment of the above impacts is provided below with reference to the different phases of the project (construction & operation) as well as pre- and post-mitigation. The majority of impacts can be reduced to a low level through avoiding the sensitive receptors and implementing relatively simple mitigation. There are no highly sensitive ecosystems present within the proposed development area. The washes are more sensitive than the surrounding plains as a result of their associated erosion risk. Cover of the ground layer is generally not significantly higher within the washes and is in fact often lower. As a result these small washes are not highly significant from an ecological and biodiversity perspective, but should not be impacted as they regulate water movement across the site.

The proposed development area is floristically homogenous and is not locally significant from a faunal perspective as this habitat is widely available in the area. Faunal disturbance during the construction phase is inevitable and cannot be fully mitigated. The impact is however restricted to the construction phase and fauna are likely to return to the area during the operational phase of the project. Given the relatively flat nature of the site and the coarse sandy nature of the substrate, erosion risk is likely to be low and provided that vegetation clearing is kept to a minimum, few measures to combat erosion will need to be implemented. Very few alien species were observed at the site which can be ascribed to the arid nature of the area combined with nutrient-poor soils. As a result, the risk of alien plant invasion should be relatively low. Alien plants are however likely to become an issue if the site is highly disturbed during construction or if water runoff is not properly managed.

**Table 2.** Summary assessment of the pre- and post-mitigation impacts associated with the construction and operation phases of the project

Impact	Project Phase	Pre Mitigation	Post Mitigation
Impacts on vegetation and protected plant species	Construction	Moderate-High	Moderate
	Operation	Low	Low
Increased alien plant invasion risk	Construction	Moderate	Low
	Operation	Moderate	Low
Increased erosion risk	Construction	Moderate	Low
	Operation	Low	Low
Faunal habitat loss and disturbance	Construction	Moderate	Moderate
	Operation	Low	Low
Negative impacts on avifauna	Construction	Moderate	Low
	Operation	Moderate	Low

### *Cumulative Impacts*

Cumulative impacts arise from the combined presence of several similar developments within an area which affect ecological processes operating at broader scales or which each have a small impact which becomes significant when combined. At this point, other known development in the vicinity of the Skuitdrift site is a proposed 10 MW solar facility which is adjacent to the substation, but to the northeast of the current site, as well as two other proposed 20 MW facilities on the adjacent property to the east of the current development. However, at this point, these are all proposed facilities and actual developments already present include the ESKOM substation on the site as well as some intensive agriculture northwest of the site. This suggests that the current levels of development in the area are low and the contribution of the current development to cumulative impacts, while significant at a local level would be low at the landscape level and the potential for the development to contribute towards the disruption of broad-scale ecological processes is low.

### *Mitigation*

As a general mitigation strategy, an Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing. Thereafter weekly site compliance inspections would probably be sufficient. However, in the absence of the ECO there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills.

## **6 CONCLUSION & RECOMMENDATIONS**

Although there are some sensitive ecological features present at the site, there is also a large area present where the impacts of the development could be maintained at a low level. The final layout provided by the developer generally meets this goal. Some impact to protected plant species would occur, but these impacts would not be of broader significance given that the affected species are not rare and are widely distributed beyond the study area. The development would create a lot of disturbance at the site which would require careful management in the first few years of the operational phase of the project to ensure that alien plant invasion and erosion risk are minimized. The presence of the panels would generate a significantly larger amount of runoff than the soil and vegetation they have replaced, and specific measures to regulate runoff and water flow across the site are recommended.

Overall, the final layout as assessed in the this report largely avoids the major sensitive features of the site and provided that the mitigation measures as suggested in the assessment can be successfully implemented, then the development is not likely to result in any significant impacts of wider significance and the long-term degradation of the receiving environment is not likely to occur.

## 7 REFERENCES

- Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.
- Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.
- Brownlie, S. 2005. Guideline for Involving Biodiversity Specialists in EIA Processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. 63 pp.
- Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.
- De Villiers CC, Driver A, Clark B, Euston-Brown DIW, Day EG, Job N, Helme NA, Holmes PM, Brownlie S and Rebelo AB (2005) *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape*. Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.
- Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.
- IUCN 2012. IUCN Red List of Threatened Species. Version 2010.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 19 January 2012.
- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
- Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

## 8 ANNEX 1. LIST OF PLANTS

List of plant species which are known to occur in the vicinity of the proposed Skuitdrift 75 MW Solar Facility site according to the SANBI SIBIS database (Accessed & records downloaded 10 February 2012). All species except for those highlighted are classified by the Threatened Species Programme, Red List of South African Plants (2011) as Least Concern. Species observed at the site are highlighted in **bold**.

Family	Species	Family	Species
ACANTHACEAE	<b>Acanthopsis disperma</b>	ACANTHACEAE	<b>Barleria lichtensteiniana</b>
ACANTHACEAE	<i>Barleria rigida</i>	ACANTHACEAE	<b>Blepharis mitrata</b>
ACANTHACEAE	<i>Monechma divaricatum</i>	ACANTHACEAE	<b>Monechma incanum</b>
ACANTHACEAE	<i>Monechma spartioides</i>	ACANTHACEAE	<i>Petalidium lucens</i>
AIZOACEAE	<i>Aizoon canariense</i>	AIZOACEAE	<i>Galenia africana</i>
AIZOACEAE	<i>Galenia sarcophylla</i>	AIZOACEAE	<b>Tetragonia arbuscula</b>
AIZOACEAE	<i>Tetragonia reduplicata</i>	AIZOACEAE	<b>Trianthema parvifolia var. parvifolia</b>
AIZOACEAE	<i>Trianthema parvifolia var. rubens</i>	AMARANTHACEAE	<i>Amaranthus praetermissus</i>
AMARANTHACEAE	<b>Sericocoma avolans</b>	ANACARDIACEAE	<i>Searsia populifolia</i>
APOCYNACEAE	<b>Hoodia gordonii (DDD)</b>	APOCYNACEAE	<b>Microloma incanum</b>
APOCYNACEAE	<b>Pergularia daemia var. leiocarpa</b>	ASPARAGACEAE	<i>Asparagus denudatus</i>
ASPARAGACEAE	<i>Asparagus pearsonii</i>	ASPHODELACEAE	<i>Aloe claviflora</i>
ASPHODELACEAE	<b>Aloe dichotoma var. dichotoma</b>	ASTERACEAE	<i>Amellus tridactylus subsp. arenarius</i>
ASTERACEAE	<i>Arctotis leiocarpa</i>	ASTERACEAE	<b>Berkheya spinosissima subsp. namaensis var. namaensis</b>
ASTERACEAE	<i>Berkheya spinosissima subsp. spinosissima</i>	ASTERACEAE	<b>Dicoma capensis</b>
ASTERACEAE	<i>Didelta carnosa var. carnosa</i>	ASTERACEAE	<i>Dimorphotheca polyptera</i>
ASTERACEAE	<i>Dimorphotheca sinuata</i>	ASTERACEAE	<i>Eriocephalus microphyllus var. pubescens</i>
ASTERACEAE	<i>Foveolina dichotoma</i>	ASTERACEAE	<i>Gazania lichtensteinii</i>
ASTERACEAE	<i>Geigeria filifolia</i>	ASTERACEAE	<i>Gorteria corymbosa</i>
ASTERACEAE	<i>Helichrysum argyrosphaerum</i>	ASTERACEAE	<i>Helichrysum herniarioides</i>
ASTERACEAE	<i>Ifloga molluginoides</i>	ASTERACEAE	<b>Kleinia longiflora</b>
ASTERACEAE	<i>Myxopappus acutilobus</i>	ASTERACEAE	<i>Osteospermum pinnatum var. breve</i>
ASTERACEAE	<i>Pentzia pinnatisecta</i>	ASTERACEAE	<i>Pseudognaphalium luteo-album</i>
ASTERACEAE	<i>Pteronia leucoclada</i>	ASTERACEAE	<i>Pulicaria scabra</i>
ASTERACEAE	<i>Tripteris microcarpa subsp. microcarpa</i>	ASTERACEAE	<i>Ursinia nana subsp. nana</i>
BIGNONIACEAE	<b>Rhigozum trichotomum</b>	BORAGINACEAE	<i>Codon royenii</i>
BORAGINACEAE	<i>Ehretia rigida subsp. rigida</i>	BORAGINACEAE	<i>Heliotropium curassavicum</i>
BORAGINACEAE	<b>Trichodesma africanum</b>	BRASSICACEAE	<i>Heliophila deserticola</i>
BRASSICACEAE	<i>Heliophila deserticola var. deserticola</i>	BRASSICACEAE	<i>Heliophila deserticola var. micrantha</i>
BRASSICACEAE	<i>Heliophila trifurca</i>	BURSERACEAE	<b>Commiphora gracilifronsosa</b>
BURSERACEAE	<b>Commiphora namaensis</b>	CAPPARACEAE	<b>Boscia foetida subsp. foetida</b>
CAPPARACEAE	<i>Cadaba aphylla</i>	CAPPARACEAE	<i>Cleome angustifolia subsp. diandra</i>
CAPPARACEAE	<i>Cleome foliosa var. lutea</i>	CAPPARACEAE	<i>Cleome sp.</i>
CAPPARACEAE	<i>Maerua gilgii</i>	CHENOPODIACEAE	<i>Salsola barbata</i>
CHENOPODIACEAE	<i>Salsola kali</i>	CHENOPODIACEAE	<i>Salsola rabieana</i>
CHENOPODIACEAE	<i>Salsola zeyheri</i>	COLCHICACEAE	<i>Ornithoglossum vulgare</i>



CONVOLVULACEAE	<i>Ipomoea cairica</i> var. <i>cairica</i>	CUCURBITACEAE	<i>Coccinia rehmannii</i>
CUCURBITACEAE	<b><i>Cucumis africanus</i></b>	CUCURBITACEAE	<i>Cucumis sagittatus</i>
CYPERACEAE	<i>Cyperus marginatus</i>	EBENACEAE	<i>Diospyros acocksii</i>
EUPHORBIACEAE	<i>Euphorbia gariepina</i> subsp. <i>balsamea</i>	EUPHORBIACEAE	<i>Euphorbia gariepina</i> subsp. <i>gariepina</i>
EUPHORBIACEAE	<i>Euphorbia glanduligera</i>	EUPHORBIACEAE	<i>Euphorbia inaequilatera</i> var. <i>inaequilatera</i>
EUPHORBIACEAE	<i>Euphorbia multiceps</i>	EUPHORBIACEAE	<i>Euphorbia rudis</i>
FABACEAE	<b><i>Acacia erioloba</i> (Declining)</b>	FABACEAE	<i>Acacia mellifera</i> subsp. <i>detinens</i>
FABACEAE	<i>Adenolobus garipensis</i>	FABACEAE	<i>Caesalpinia bracteata</i> (VU)
FABACEAE	<i>Caesalpinia</i> sp.	FABACEAE	<i>Calobota spinescens</i>
FABACEAE	<i>Cyamopsis serrata</i>	FABACEAE	<i>Eriosema</i> sp.
FABACEAE	<i>Indigastrum argyraeum</i>	FABACEAE	<i>Indigastrum argyroides</i>
FABACEAE	<i>Indigofera alternans</i> var. <i>alternans</i>	FABACEAE	<i>Indigofera heterotricha</i>
FABACEAE	<i>Indigofera pechuelii</i>	FABACEAE	<i>Lebeckia spinescens</i>
FABACEAE	<i>Lotononis platycarpa</i>	FABACEAE	<i>Lotononis rabenaviana</i>
FABACEAE	<i>Melilotus albus</i>	FABACEAE	<b><i>Parkinsonia africana</i></b>
FABACEAE	<b><i>Prosopis glandulosa</i> var. <i>glandulosa</i></b>	FABACEAE	<i>Sutherlandia microphylla</i>
FABACEAE	<i>Tephrosia dregeana</i> var. <i>dregeana</i>	FABACEAE	<i>Trigonella hamosa</i>
FRANKENIACEAE	<b><i>Frankenia pulverulenta</i></b>	GERANIACEAE	<i>Monsonia parvifolia</i>
GISEKIACEAE	<i>Gisekia africana</i> var. <i>africana</i>	GISEKIACEAE	<i>Gisekia pharnacioides</i> var. <i>pharnacioides</i>
HYACINTHACEAE	<i>Albuca acuminata</i>	HYACINTHACEAE	<i>Albuca setosa</i>
HYACINTHACEAE	<i>Dipcadi glaucum</i>	IRIDACEAE	<i>Moraea venenata</i>
LOASACEAE	<b><i>Kissenia capensis</i></b>	LOPHIOCARPACEAE	<i>Lophiocarpus polystachyus</i>
LORANTHACEAE	<i>Tapinanthus oleifolius</i>	MALVACEAE	<b><i>Hermannia gariepina</i></b>
MALVACEAE	<i>Hermannia marginata</i>	MALVACEAE	<b><i>Hermannia minutiflora</i></b>
MALVACEAE	<i>Hermannia modesta</i>	MALVACEAE	<b><i>Hermannia spinosa</i></b>
MALVACEAE	<b><i>Hermannia stricta</i></b>	MALVACEAE	<i>Hibiscus elliotiae</i>
MALVACEAE	<i>Radyera urens</i>	MELIACEAE	<i>Nymanina capensis</i>
MESEMBRYANTHEMACEAE	<b><i>Aridaria noctiflora</i> subsp. <i>straminea</i></b>	MESEMBRYANTHEMACEAE	<i>Mesembryanthemum crystallinum</i>
MESEMBRYANTHEMACEAE	<i>Mesembryanthemum inachabense</i>	MESEMBRYANTHEMACEAE	<b><i>Phyllobolus lignescens</i></b>
MESEMBRYANTHEMACEAE	<i>Prenia tetragona</i>	MESEMBRYANTHEMACEAE	<i>Psilocaulon coriarium</i>
MESEMBRYANTHEMACEAE	<i>Psilocaulon subnodosum</i>	MESEMBRYANTHEMACEAE	<b><i>Ruschia spinosa</i></b>
MOLLUGINACEAE	<b><i>Hypertelis salsoloides</i> var. <i>salsoloides</i></b>	MOLLUGINACEAE	<b><i>Limeum aethiopicum</i> var. <i>aethiopicum</i></b>
MOLLUGINACEAE	<i>Limeum aethiopicum</i> var. <i>lanceolatum</i>	MOLLUGINACEAE	<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i> var. <i>aethiopicum</i>
MOLLUGINACEAE	<i>Limeum myosotis</i> var. <i>confusum</i>	MOLLUGINACEAE	<i>Limeum sulcatum</i> var. <i>gracile</i>
MOLLUGINACEAE	<i>Limeum sulcatum</i> var. <i>robustum</i>	MOLLUGINACEAE	<i>Mollugo cerviana</i> var. <i>cerviana</i>
NEURADACEAE	<i>Grielum humifusum</i> var. <i>parviflorum</i>	NEURADACEAE	<i>Grielum sinuatum</i>
NYCTAGINACEAE	<b><i>Phaeoptilum spinosum</i></b>	PEDALIACEAE	<b><i>Rogeria longiflora</i></b>
PEDALIACEAE	<i>Sesamum capense</i>	PLUMBAGINACEAE	<i>Dyerophytum africanum</i>
POACEAE	<b><i>Aristida adscensionis</i></b>	POACEAE	<i>Aristida congesta</i> subsp. <i>barbicollis</i>
POACEAE	<b><i>Cenchrus ciliaris</i></b>	POACEAE	<i>Cynodon dactylon</i>
POACEAE	<i>Enneapogon cenchroides</i>	POACEAE	<b><i>Enneapogon desvauxii</i></b>
POACEAE	<b><i>Enneapogon scaber</i></b>	POACEAE	<i>Eragrostis annulata</i>

POACEAE	<i>Eragrostis brizantha</i>	POACEAE	<b><i>Leucophrys mesocoma</i></b>
POACEAE	<i>Odyssea paucinervis</i>	POACEAE	<i>Phragmites australis</i>
POACEAE	<i>Polypogon monspeliensis</i>	POACEAE	<b><i>Schmidtia kalahariensis</i></b>
POACEAE	<i>Setaria verticillata</i>	POACEAE	<b><i>Stipagrostis anomala</i></b>
POACEAE	<b><i>Stipagrostis ciliata var. capensis</i></b>	POACEAE	<i>Stipagrostis hochstetteriana var. hochstetteriana</i>
POACEAE	<b><i>Stipagrostis hochstetteriana var. secalina</i></b>	POACEAE	<i>Stipagrostis namaquensis</i>
POACEAE	<b><i>Stipagrostis obtusa</i></b>	POACEAE	<i>Stipagrostis uniplumis var. neesii</i>
POACEAE	<b><i>Stipagrostis uniplumis var. uniplumis</i></b>	POACEAE	<i>Tragus racemosus</i>
POLYGALACEAE	<i>Polygala leptophylla var. leptophylla</i>	POLYGONACEAE	<i>Persicaria decipiens</i>
POTTIACEAE	<i>Tortula atrovirens</i>	RHAMNACEAE	<b><i>Ziziphus mucronata subsp. mucronata</i></b>
RICCIACEAE	<i>Riccia cavernosa</i>	RUBIACEAE	<i>Kohautia caespitosa subsp. brachyloba</i>
SANTALACEAE	<b><i>Thesium lineatum</i></b>	SCROPHULARIACEAE	<i>Aptosimum elongatum</i>
SCROPHULARIACEAE	<i>Aptosimum junceum</i>	SCROPHULARIACEAE	<b><i>Aptosimum marlothii</i></b>
SCROPHULARIACEAE	<b><i>Aptosimum spinescens</i></b>	SCROPHULARIACEAE	<i>Diascia engleri</i>
SCROPHULARIACEAE	<i>Jamesbrittenia aridicola</i>	SCROPHULARIACEAE	<i>Jamesbrittenia ramosissima</i>
SCROPHULARIACEAE	<i>Jamesbrittenia sp.</i>	SCROPHULARIACEAE	<i>Lyperia tristis</i>
SCROPHULARIACEAE	<i>Peliostomum leucorrhizum</i>	SCROPHULARIACEAE	<i>Selago albida</i>
SCROPHULARIACEAE	<i>Selago dinteri subsp. pseudodinteri</i>	SCROPHULARIACEAE	<i>Veronica anagallis-aquatica</i>
SOLANACEAE	<i>Datura stramonium</i>	SOLANACEAE	<i>Lycium bosciifolium</i>
SOLANACEAE	<i>Lycium oxycarpum</i>	SOLANACEAE	<b><i>Lycium pumilum</i></b>
SOLANACEAE	<i>Nicotiana glauca</i>	SOLANACEAE	<i>Nicotiana longiflora</i>
SOLANACEAE	<b><i>Solanum capense</i></b>	TAMARICACEAE	<i>Tamarix usneoides</i>
TECOPHILAEACEAE	<i>Cyanella lutea</i>	URTICACEAE	<i>Forsskaolea candida</i>
VERBENACEAE	<b><i>Chascanum garipense</i></b>	VISCACEAE	<i>Viscum rotundifolium</i>
ZYGOPHYLLACEAE	<b><i>Sisymbrium sparteae</i></b>	ZYGOPHYLLACEAE	<i>Tribulus cristatus</i>
ZYGOPHYLLACEAE	<b><i>Tribulus pterophorus</i></b>	ZYGOPHYLLACEAE	<i>Tribulus terrestris</i>
ZYGOPHYLLACEAE	<i>Zygophyllum foetidum</i>	ZYGOPHYLLACEAE	<i>Zygophyllum microcarpum</i>
ZYGOPHYLLACEAE	<i>Zygophyllum prismatocarpum</i>	ZYGOPHYLLACEAE	<b><i>Zygophyllum retrofractum</i></b>
ZYGOPHYLLACEAE	<b><i>Zygophyllum rigidum</i></b>	ZYGOPHYLLACEAE	<i>Zygophyllum simplex</i>
ZYGOPHYLLACEAE	<b><i>Zygophyllum suffruticosum</i></b>		

## 9 ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur at the proposed Skuitdrift 75 MW Solar Facility. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2012.

Scientific Name	Common Name	Status	Habitat	Probability
<b>Macroscledidea (Elephant Shrews):</b>				
<i>Macroscelides proboscideus</i>	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
<i>Elephantulus rupestris</i>	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	High
<i>Elephantulus intufi</i>	Bushveld Elephant Shrew	LC	Can occupy arid areas with sparse cover provided there are scattered bushes	Low
<b>Tubulentata:</b>				
<i>Orycteropus afer</i>	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	High
<b>Hyracoidea (Hyraxes):</b>				
<i>Procavia capensis</i>	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	High
<b>Lagomorpha (Hares and Rabbits):</b>				
<i>Lepus capensis</i>	Cape Hare	LC	Dry, open regions, with palatable bush and grass	High
<i>Lepus saxatilis</i>	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Low
<b>Rodentia:</b>				
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	Catholic in habitat requirements.	High
<i>Petromus typicus</i>	Dassie Rat	LC	Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders	High
<i>Pedetes capensis</i>	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	Low
<i>Xerus inauris</i>	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	High
<i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass	High

			cover.	
<i>Thallomys paedulcus</i>	Acacia Tree Rat	LC	Associated with stands of Acacia woodland	Low
<i>Thallomys nigricauda</i>	Black-tailed Tree Rat	LC	Associated with stands of Acacia woodland	Low
<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	High
<i>Parotomys brantsii</i>	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
<i>Gerbillurus paebe</i>	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
<i>Gerbillurus tytonis</i>	Dune Hairy-footed Gerbil	LC	Hot dry areas on shifting red sand dunes	High
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	High
<i>Gerbilliscus brantsii</i>	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	High
<i>Saccostomus campestris</i>	Pouched Mouse	LC	Catholic habitat requirements, commoner in areas where there is a sandy substrate.	High
<i>Malacothrix typica</i>	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
<i>Petromyscus collinus</i>	Pygmy Rock Mouse	LC	Arid areas on rocky outcrops or koppies with a high rock cover	High
<b>Primates:</b>				
<i>Papio ursinus</i>	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
<b>Eulipotyphla (Shrews):</b>				
<i>Crocidura cyanea</i>	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	Low
<b>Carnivora:</b>				

<i>Proteles cristata</i>	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
<i>Hyaena brunnea</i>	Brown Hyaena	NT	Nama and Succulent Karoo and the drier parts of the Grassland and Savanna Biomes	Low
<i>Caracal caracal</i>	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
<i>Felis silvestris</i>	African Wild Cat	LC	Wide habitat tolerance.	High
<i>Panthera pardus</i>	Leopard	NT	Wide habitat tolerance, associated with areas of rocky koppies and hills, mountain ranges and forest	High
<i>Felis nigripes</i>	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
<i>Genetta genetta</i>	Small-spotted genet	LC	Occur in open arid associations	High
<i>Suricata suricatta</i>	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	High
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	High
<i>Vulpes chama</i>	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
<i>Canis mesomelas</i>	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
<i>Otocyon megalotis</i>	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
<i>Ictonyx striatus</i>	Striped Polecat	LC	Widely distributed throughout the sub-region	High
<b>Rumanantia (Antelope):</b>				
<i>Tragelaphus oryx</i>	Eland	LC	Wide habitat tolerance, absent from a large proportion of former range	Low
<i>Oryx gazella</i>	Gemsbok	LC	Open arid country	High
<i>Sylvicapra grimmia</i>	Common Duiker	LC	Presence of bushes is essential	High
<i>Antidorcas marsupialis</i>	Springbok	LC	Arid regions and open grassland.	High
<i>Raphicerus campestris</i>	Steenbok	LC	Inhabits open country,	High
<i>Oreotragus oreotragus</i>	Klipspringer	LC	Closely confined to rocky habitat.	High
<b>Chiroptera (Bats)</b>				
<i>Pipistrellus capensis</i>	Cape Serotine Bat	LC	Wide habitat tolerances, but often found near open water	High
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	In arid areas. often associated with water sources	High
<i>Tadarida pumila</i>	Little free-tailed bat	LC	Wide habitat tolerance	High

<i>Pipistrellus rueppellii</i>	Ruppell's Pipistrelle	LC	Associated with riverine conditions. Recorded at Augrabies falls	Low
<i>Rhinolophus denti</i>	Dent's Horseshoe Bat	LC	Arid areas but require caves or rock crevices	High
<i>Rhinolophus fumigatus</i>	Ruppell's horseshoe bat	LC	Open Savanna woodland extending into north-wetern parts of the Northern Cape	High
<i>Rhinolophus darlingi</i>	Darling's Horsehoe Bat	LC	Savanna woodland species but requires caves	Low
<i>Eidolon helvum</i>	Straw-coloured fruit bat	LC	Occasional migratory visitors within southern Africa	Low

### 10 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur at the proposed Skuitdrift 75 MW Solar Facility site. Habitat notes and distribution records are based on Branch (1988) and Alexander and Marais (2007), while conservation status is from the IUCN Red Lists 2012.

Scientific Name	Common Name	Distribution	Status	Habitat	Probability
<b>Tortoises and Terrapins:</b>					
<i>Psammobates tentorius verroxii</i>	Bushmanland Tent Tortoise	Endemic	Data Deficient	Varied: usually arid karroid areas or rocky sandveld	High
<b>Snakes:</b>					
<i>Rhinotyphlops schinzi</i>	Schinz's Beaked Blind Snake	Endemic	Data Deficient	Semi-desert and arid savanna	High
<i>Leptotyphlops occidentalis</i>	Western Thread Snake	Endemic	Data Deficient	Namib Desert and Karoo scrub	High
<i>Lamprophis capensis</i>	Brown House Snake	Widespread	Data Deficient	Common in highveld grassland & arid karroid regions, but found everywhere & tolerant of urban sprawl	High
<i>Pseudaspis cana</i>	Mole Snake	Widespread	Data Deficient	Sandy scrubland in SW Cape, highveld grassland & mountainous & desert regions	High
<i>Prosymna bivittata</i>	Two-striped Shovel-snout			Acacia sanannah entering sandveld	Low
<i>Dipsina multimaculata</i>	Dwarf Beaked Snake	Endemic	Data Deficient	Rocky, sandy areas. Cape karroid areas.	High
<i>Psammophis notostictus</i>	Karoo Sand or Whip Snake	Widespread	Data Deficient	Arid scrubland & karroid regions	High
<i>Psammophis leightoni</i>	Cape Whip Snake	Endemic	Data Deficient	Coastal fynbos, desert and semi-desert	High
<i>Dasypeltis scabra</i>	Common/Rhombic Egg Eater	Widespread	LC	Absent only from true desert & closed-canopy forest	High
<i>Telescopus beetzii</i>	Namib Tiger Snake	Endemic	Data Deficient	Rocky, arid regions	High
<i>Telescopus semiannulatus</i>	Eastern Tiger Snake	Widespread	Data Deficient	Desert to Karoo, savanna and forest	Low
<i>Aspidelaps lubricus</i>	Coral Shield Cobra	Widespread	Data Deficient	Karroid & sandveld regions, entering dry valley plains in S and E Cape	High
<i>Naja nivea</i>	Cape Cobra	Endemic	Data Deficient	Arid karroid regions, particularly along river courses, entering well drained open areas along the southern coast	High
<i>Naja nigricollis woodi</i>	Black Spitting Cobra	Endemic	SARDB Rare	Namibia to Citrusdal in karroid scrub	High
<i>Bitis arietans</i>	Puff Adder	Widespread	Data Deficient	Absent only from desert & mnt tops	High
<i>Bitis xeropaga</i>	Desert Mountain Adder	Endemic	Data Deficient	Mountain slopes and sparsely vegetated rocky hillsides	Low
<i>Bitis caudalis</i>	Horned Adder	Widespread	Data Deficient	Sandy regions, throughout Karoo	High
<b>Lizard and Skinks:</b>					
<i>Monopeltis infusca</i>	Dusky Spade-snouted Worm Lizard	Widespread		Dry and moist savannay	Low
<i>Acontias lineatus</i>	Striped Legless Skink	Endemic	Data Deficient	Sandy, arid soils	High

<i>Mabuya capensis</i>	Cape Skink	Widespread	Data Deficient	Very varied: arid karroid veld, moist coastal bush, montane grassland, etc	High
<i>Mabuya occidentalis</i>	Western Three-Striped Skink	Widespread	Data Deficient	Arid Savanna karroid veld and desert	High
<i>Mabuya spilogaster</i>	Kalahari Tree Skink	Widespread		Arid Savannah	High
<i>Mabuya sulcata</i>	Western Rock Skink	Widespread	Data Deficient	Karroid areas	High
<i>Mabuya striata</i>	Striped Skink	Widespread	Data Deficient	Varied, except desert areas, succulent karoo and fynbos	Low
<i>Mabuya variegata</i>	Variegated Skink	Widespread	Data Deficient	Extremely varied; desert, karroid veld, montane grassland, savanna, coastal bush & valley bushveld	High
<i>Meroles suborbitalis</i>	Spotted Desert Lizard	Endemic	Data Deficient	Varied, arid savanna to desert	High
<i>Nucras tessellata tessellata</i>	Striped Sandveld Lizard	Widespread	Data Deficient	Open arid savannah & karroid veld	High
<i>Pedioplanis laticeps</i>	Cape Sand Lizard	Endemic	LC	Coastal dunes and succulent karroid veld	Low
<i>Pedioplanis lineoocellata</i>	Spotted Sand Lizard	Endemic	Data Deficient	Very varied: karroid veld, valley bushveld & arid & mesic savannah	High
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	Widespread	Data Deficient	Karroid veld	High
<i>Pedioplanis undata</i>	Western Sand Lizard	Widespread	Data Deficient	Prefers arid, sparsely vegetated desert	High
<i>Cordylus polyzonus</i>	Karoo Girdled Lizard	Endemic	Data Deficient	Karroid regions	High
<i>Platysaurus broadleyi</i>	Broadley's Flat Lizard	Narrow Endemic	Data Deficient	Rocky, arid sanannah, between augrabies and Pella	Low
<i>Agama aculeata</i>	Ground Agama	Widespread	Data Deficient	Semi desert and savanna	High
<i>Agama anchietae</i>	Anchieta's Agama	Widespread	Data Deficient	Semi desert and arid savanna	High
<b>Chameleons:</b>			Data Deficient		
<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	Widespread	LC	Sandy regions (incl coastal dunes) with scrub vegetation	High
<b>Geckos:</b>					
<i>Chondrodactylus angulifer</i>	Giant Ground Gecko	Endemic	LC	Gravel plains, interdune spaces & sandy flats	High
<i>godactylus bradfieldi</i>	Bradfield's Dwarf Gecko	Widespread	Data Deficient	Arid savannah and succulent desert	High
<i>Chondrodactylus bibronii</i>	Bibron's Tubercled Gecko	Endemic	Data Deficient	Rocky outcrops, cliffs and large trees	High
<i>Pachydactylus capensis</i>	Cape Thick-toed Gecko	Widespread	Data Deficient	Karroid veld, grassland and mesic savannah	Low
<i>Pachydactylus turneri</i>	Turner's Thick-toed Gecko	Widespread	Data Deficient	Semi-desert and arid savannah	Low
<i>Pachydactylus rugosus</i>	Rough Thick-toed Gecko	Endemic	Data Deficient	Semi-desert and succulent karroid veld	High
<i>Pachydactylus serval</i>	Western Spotted Gecko	Endemic	Data Deficient	Semi desert and succulent karroid veld	High



<i>Ptenopus garrulus</i>	Common Barking Gecko	Endemic	Data Deficient	Desert and semi-desert on various soil types, preferring flat stable sandy soils with sparse vegetation cover	High
--------------------------	----------------------	---------	-------------------	---	------

# 11 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur at the Skuitdrift 75 MW Solar Facility site. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the IUCN Red Lists 2012.

Scientific Name	Common Name	Status	Habitat	Distribution	Probability
<i>Vandijkophrynus gariensis</i>	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	Low
<i>Vandijkophrynus robinsoni</i>	Paradise Toad	Not Threatened	Natural springs and waterholes in the arid areas of the Richtersveld	Endemic	Low
<i>Phrynomantis annectens</i>	Marbled Rubber Frog	Not Threatened	Arid environments, closely associated with inselbergs and rocky areas	Widespread	High
<i>Xenopus laevis</i>	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	Low
<i>Cacosternum boettgeri</i>	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	Low
<i>Tomopterna tandyi</i>	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	Low

## 12 ANNEX 5. LIST OF BIRDS

List of birds which are likely to occur at the Skuitdrift 75 MW Solar Facility site. The list is derived from the SANBI SIBIS data portal and the South African conservation status from the list of threatened birds available from the Bird Life South Africa website, <http://www.birdlife.org.za>.

Family	Species	SA Status	Family	Species	SA Status
Accipitridae	<i>Aquila pennatus</i>	LC	Accipitridae	<i>Aquila verreauxii</i>	LC
Accipitridae	<i>Buteo rufofuscus</i>	LC	Accipitridae	<i>Elanus caeruleus</i>	LC
Accipitridae	<i>Haliaeetus vocifer</i>	LC	Accipitridae	<i>Melierax canorus</i>	LC
Alaudidae	<i>Calendulauda africanoides</i>	LC	Alaudidae	<i>Calendulauda sabota</i>	LC
Alaudidae	<i>Certhilauda curvirostris</i>	LC	Alaudidae	<i>Chersomanes albofasciata</i>	LC
Alaudidae	<i>Eremopterix australis</i>	LC	Alaudidae	<i>Eremopterix verticalis</i>	LC
Alaudidae	<i>Mirafrapa apiata</i>	LC	Alaudidae	<i>Spizocorys sclateri</i>	NT
Alaudidae	<i>Spizocorys starki</i>	LC	Anatidae	<i>Alopochen aegyptiaca</i>	LC
Anatidae	<i>Anas capensis</i>	LC	Anatidae	<i>Anas sparsa</i>	LC
Anatidae	<i>Netta erythrophthalma</i>	LC	Anatidae	<i>Plectropterus gambensis</i>	LC
Anatidae	<i>Tadorna cana</i>	LC	Anhingidae	<i>Anhinga rufa</i>	LC
Apodidae	<i>Apus affinis</i>	LC	Apodidae	<i>Apus apus</i>	LC
Apodidae	<i>Apus bradfieldi</i>	LC	Apodidae	<i>Tachymarptis melba</i>	LC
Ardeidae	<i>Ardea cinerea</i>	LC	Ardeidae	<i>Ardea goliath</i>	LC
Ardeidae	<i>Ardea melanocephala</i>	LC	Ardeidae	<i>Ardea purpurea</i>	LC
Ardeidae	<i>Bubulcus ibis</i>	LC	Ardeidae	<i>Egretta garzetta</i>	LC
Burhinidae	<i>Burhinus capensis</i>	LC	Capitonidae	<i>Tricholaema leucomelas</i>	LC
Caprimulgidae	<i>Caprimulgus rufigena</i>	LC	Caprimulgidae	<i>Caprimulgus tristigma</i>	LC
Charadriidae	<i>Charadrius tricollaris</i>	LC	Charadriidae	<i>Vanellus armatus</i>	LC
Charadriidae	<i>Vanellus coronatus</i>	LC	Ciconiidae	<i>Ciconia ciconia</i>	LC
Coliidae	<i>Colius colius</i>	LC	Coliidae	<i>Urocolius indicus</i>	LC
Columbidae	<i>Columba guinea</i>	LC	Columbidae	<i>Oena capensis</i>	LC
Columbidae	<i>Streptopelia capicola</i>	LC	Columbidae	<i>Streptopelia semitorquata</i>	LC
Columbidae	<i>Streptopelia senegalensis</i>	LC	Corvidae	<i>Corvus albus</i>	LC
Corvidae	<i>Corvus capensis</i>	LC	Dicruridae	<i>Dicrurus adsimilis</i>	LC
Estrildidae	<i>Amadina erythrocephala</i>	LC	Estrildidae	<i>Estrilda astrild</i>	LC
Falconidae	<i>Falco rupicolis</i>	LC	Falconidae	<i>Falco rupicoloides</i>	LC
Falconidae	<i>Polihierax semitorquatus</i>	LC	Fringillidae	<i>Crithagra albogularis</i>	LC
Fringillidae	<i>Crithagra atrogularis</i>	LC	Fringillidae	<i>Crithagra flaviventris</i>	LC
Fringillidae	<i>Emberiza capensis</i>	LC	Fringillidae	<i>Emberiza impetuani</i>	LC
Fringillidae	<i>Serinus alario</i>	LC	Halcyonidae	<i>Alcedo cristata</i>	LC

Halcyonidae	<i>Ceryle rudis</i>	LC	Hirundinidae	<i>Hirundo albigularis</i>	LC
Hirundinidae	<i>Hirundo cucullata</i>	LC	Hirundinidae	<i>Hirundo fuligula</i>	LC
Hirundinidae	<i>Hirundo rustica</i>	LC	Hirundinidae	<i>Riparia paludicola</i>	LC
Laniidae	<i>Lanius collaris</i>	LC	Laniidae	<i>Lanius minor</i>	LC
Malaconotidae	<i>Nilaus afer</i>	LC	Malaconotidae	<i>Telophorus zeylonus</i>	LC
Meropidae	<i>Merops apiaster</i>	LC	Meropidae	<i>Merops hirundineus</i>	LC
Motacillidae	<i>Motacilla aguimp</i>	LC	Motacillidae	<i>Motacilla capensis</i>	LC
Muscicapidae	<i>Batis pririt</i>	LC	Muscicapidae	<i>Bradornis infuscatus</i>	LC
Nectariniidae	<i>Cinnyris fuscus</i>	LC	Nectariniidae	<i>Nectarinia famosa</i>	LC
Otididae	<i>Eupodotis afra</i>	LC	Otididae	<i>Eupodotis vigorsii</i>	LC
Otididae	<i>Neotis ludwigii</i>	VU	Paridae	<i>Parus cinerascens</i>	LC
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	LC	Phalacrocoracidae	<i>Phalacrocorax lucidus</i>	LC
Phasianidae	<i>Pternistis afer</i>	LC	Phasianidae	<i>Pternistis capensis</i>	LC
Phoeniculidae	<i>Rhinopomastus cyanomelas</i>	LC	Picidae	<i>Dendropicos fuscescens</i>	LC
Ploceidae	<i>Euplectes orix</i>	LC	Ploceidae	<i>Passer diffusus</i>	LC
Ploceidae	<i>Passer domesticus</i>	LC	Ploceidae	<i>Passer melanurus</i>	LC
Ploceidae	<i>Philetairus socius</i>	LC	Ploceidae	<i>Plocepasser mahali</i>	LC
Ploceidae	<i>Ploceus velatus</i>	LC	Ploceidae	<i>Quelea quelea</i>	LC
Ploceidae	<i>Sporopipes squamifrons</i>	LC	Psittacidae	<i>Agapornis roseicollis</i>	LC
Pteroclididae	<i>Pterocles bicinctus</i>	LC	Pteroclididae	<i>Pterocles namaqua</i>	LC
Pycnonotidae	<i>Pycnonotus nigricans</i>	LC	Remizidae	<i>Anthoscopus minutus</i>	LC
Scopidae	<i>Scopus umbretta</i>	LC	Strigidae	<i>Bubo africanus</i>	LC
Sturnidae	<i>Lamprotornis nitens</i>	LC	Sturnidae	<i>Onychognathus nabouroup</i>	LC
Sylviidae	<i>Acrocephalus gracilirostris</i>	LC	Sylviidae	<i>Cisticola subruficapilla</i>	LC
Sylviidae	<i>Eremomela icteropygialis</i>	LC	Sylviidae	<i>Euryptila subcinnamomea</i>	LC
Sylviidae	<i>Malcorus pectoralis</i>	LC	Sylviidae	<i>Parisoma subcaeruleum</i>	LC
Sylviidae	<i>Phragmacia substriata</i>	LC	Sylviidae	<i>Phylloscopus trochilus</i>	LC
Sylviidae	<i>Prinia flavicans</i>	LC	Sylviidae	<i>Prinia hypoxantha?</i>	LC
Turdidae	<i>Cercomela familiaris</i>	LC	Turdidae	<i>Cercomela schlegelii</i>	LC
Turdidae	<i>Cercomela sinuata</i>	LC	Turdidae	<i>Cercomela tractrac</i>	LC
Turdidae	<i>Cercotrichas coryphoeus</i>	LC	Turdidae	<i>Cossypha caffra</i>	LC
Turdidae	<i>Myrmecocichla formicivora</i>	LC	Turdidae	<i>Oenanthe monticola</i>	LC
Turdidae	<i>Oenanthe pileata</i>	LC	Turdidae	<i>Turdus olivaceus</i>	LC
Upupidae	<i>Upupa africana</i>	LC	Zosteropidae	<i>Zosterops pallidus</i>	LC

## 13 ANNEX 6. COORDINATES OF PROTECTED SPECIES

Table of localities of protected species observed within proposed Skuitdrift development area. The coordinates are in decimal degrees and based on the WGS84 datum. The table should be considered reasonably complete for *Acacia erioloba* as the this species is conspicuous and can usually be easily seen, whoever, there may be additional individuals of *Aloe dichotoma* and *Hoodia* present as these species are less conspicuous and given the large extent of the site, it is not likely that all individuals present were observed. The final development footprint should therefore be searched for these species prior to construction. A permit obtainable from the Permit Office of the Northern Cape Department of Environment and Nature Conservation (DENV) for their translocation or removal during construction would be required. Contact person: Marietjie Smit [msmit@half.ncape.gov.za](mailto:msmit@half.ncape.gov.za)

<b>Id</b>	<b>Species</b>	<b>Lat</b>	<b>Long</b>
1	<i>Aloe dichotoma</i>	-28.6097	19.76708
2	<i>Hoodia gordonii</i>	-28.6105	19.76511
3	<i>Aloe dichotoma</i>	-28.611	19.76517
4	<i>Aloe dichotoma</i>	-28.6101	19.7675
5	<i>Hoodia gordonii</i>	-28.6087	19.76586
6	<i>Hoodia gordonii</i>	-28.6091	19.76681
7	<i>Hoodia gordonii</i>	-28.6094	19.76743
8	<i>Aloe dichotoma</i>	-28.6063	19.76586
9	<i>Acacia erioloba</i>	-28.6066	19.76521
10	<i>Hoodia gordonii</i>	-28.6096	19.76698
11	<i>Acacia erioloba</i>	-28.605	19.76705
12	<i>Hoodia gordonii</i>	-28.6096	19.76699
13	<i>Acacia erioloba</i>	-28.606	19.76895
14	<i>Hoodia gordonii</i>	-28.6147	19.76285
15	<i>Acacia erioloba</i>	-28.6065	19.76961
16	<i>Hoodia gordonii</i>	-28.6153	19.76341
17	<i>Acacia erioloba</i>	-28.6066	19.77073
18	<i>Acacia erioloba</i>	-28.6064	19.77102
19	<i>Acacia erioloba</i>	-28.6062	19.77132
20	<i>Acacia erioloba</i>	-28.606	19.77062
21	<i>Acacia erioloba</i>	-28.6054	19.76916
22	<i>Acacia erioloba</i>	-28.6044	19.76716
23	<i>Acacia erioloba</i>	-28.6044	19.76677
24	<i>Acacia erioloba</i>	-28.6041	19.76591
25	<i>Acacia erioloba</i>	-28.6034	19.7653
26	<i>Acacia erioloba</i>	-28.6024	19.76441
27	<i>Acacia erioloba</i>	-28.6024	19.76365
28	<i>Acacia erioloba</i>	-28.6049	19.76381
29	<i>Acacia erioloba</i>	-28.6051	19.76386

30	<i>Acacia erioloba</i>	-28.6061	19.76468
31	<i>Acacia erioloba</i>	-28.6077	19.77318
32	<i>Acacia erioloba</i>	-28.6078	19.77263
33	<i>Acacia erioloba</i>	-28.6088	19.77309
34	<i>Acacia erioloba</i>	-28.6107	19.77263
35	<i>Acacia erioloba</i>	-28.6119	19.76605
36	<i>Acacia erioloba</i>	-28.6118	19.76368
37	<i>Acacia erioloba</i>	-28.6086	19.76355
38	<i>Acacia erioloba</i>	-28.6058	19.75473
39	<i>Acacia erioloba</i>	-28.6099	19.76891
40	<i>Acacia erioloba</i>	-28.6036	19.75654

---

#### 14 ANNEX 7. SPECIES OF CONSERVATION CONCERN OBSERVED AT THE KHOI-SUN SOLAR, SKUITDRIFT SITE

Species of conservation concern are illustrated below. The list includes species listed as threatened under the South African Red Data List of Plants, as well as those species which are provincially protected and are either significant or suitable for search and rescue. Common species within protected genera are not illustrated, but will nevertheless need to be listed on the permit application to clear the site.

##### ***Boscia foetida***

Status	Provincially Protected
Suitable for search rescue	No
Abundance at site	Occasional
Description	Small tree, usually with white stems. Produces small green flowers and small round fruits.

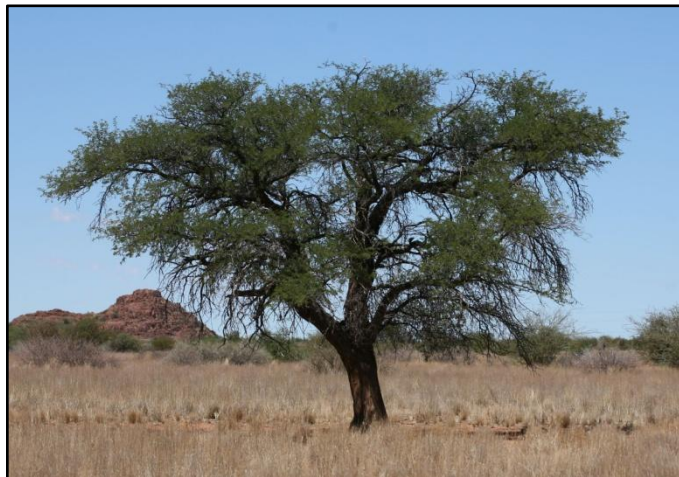


##### ***Hoodia gordonii***

Status	Nationally Protected
Suitable for search rescue	Yes
Abundance at site	Occasional
Description	Stem succulent up to 1m tall, but usually lower. Has spiny upright stems 5-10 cm wide. Produces large brownish flowers.



*Acacia erioloba*



**Description:**

- Medium-sized to large deciduous or semi-evergreen tree; crown usually flat-topped, dome shaped or rounded. Older branches often contorted.
- Bark thick, rough and deeply longitudinally fissured.
- Spines paired, straight, often swollen and fused at the base, white or reddish.
- Leaves bipinnately compound; leaflets prominently veined below.
- Flowers in globose heads, bright golden-yellow.
- Pods large, flat, thick and semi-woody, velvety grey, half moon-shaped, indehiscent.
- Usually on red Kalahari sands, often more abundant along drainage lines.



*Aloe dichotoma*



**Description**

- Small succulent tree with a thickened trunk and dense rounded crown.
- Leaves succulent, in terminal rosettes, blue-green or yellowish green; margin with small yellowish brown teeth.
- Inflorescence branched, borne terminally above a leaf rosette; flower spikes about 300 mm long, bright yellow.
- On rocky hills and sandy flats throughout most of the Northern Cape.

## 15 ANNEX 8. ALIEN INVASIVE SPECIES AT THE SITE

Below are the major woody invaders at the site, which should be regularly cleared.

### ***Prosopis glandulosa***

#### Category 1

Medium to large tree with pinnate leaves and usually thorny. Usually associated with drainage lines, but may grow anywhere. Occasional at the site, but can increase rapidly as a result of disturbance.

When cut down the tree resprouts, so herbicides are usually needed in combination with cutting. The appropriate techniques and herbicides can be obtained from the DWAF website.



### ***Argemone ochroleuca***

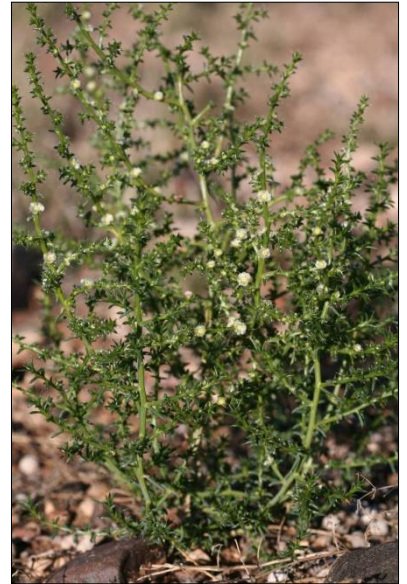
White – flowered Mexican poppy. Category 1.





***Salsola kali***

Tumbleweed, Tolbos. Not Listed.



**SHORT CV OF CONSULTANT:**



**SIMON TODD CONSULTING**

P.O.Box 71  
Nieuwoudtville  
8180

[Simon.Todd@uct.ac.za](mailto:Simon.Todd@uct.ac.za)  
[Grazing.Guidelines@gmail.com](mailto:Grazing.Guidelines@gmail.com)

H: 027 218 1276  
C: 082 3326 502

**SUMMARY OF EXPERTISE:**

*SIMON TODD*

- Profession: Ecological Consultant
- Specialisation: Plant & Animal Ecology
- Years of Experience: 15 Years

*Skills & Primary Competencies*

- Research & description of ecological patterns & processes in Fynbos, Succulent Karoo, Nama Karoo, Thicket, Arid Grassland and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

*Tertiary Education:*

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal

- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

#### *Employment History*

- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute
- 2000-2004 – Specialist Scientist (Contract ) - South African National Biodiversity Institute
- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

#### *General Experience & Expertise*

- Conducted a large number of fauna and flora specialist assessments distributed widely across South Africa. Projects have ranged in extent from <50 ha to more than 50 000 ha.
- Extensive experience in the field and exceptional level of technical expertise, particularly with regards to GIS capabilities which is essential with regards to producing high-quality sensitivity maps for use in the design of final project layouts.
- Strong research background which has proved invaluable when working on several ecologically sensitive and potentially controversial sites containing some of the most threatened fauna in South Africa.
- Published numerous research reports as well as two book chapters and a large number of papers in leading scientific journals dealing primarily with human impacts on the vegetation and ecology of South Africa.
- Maintain several long-term vegetation monitoring projects distributed across Namaqualand and the karoo.
- Guest lecturer at two universities and have also served as an external examiner.
- Reviewed papers for more than 10 international ecological journals.
- Past chairman and current committee member of the Arid Zone Ecological Forum.
- SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400425/11.

A selection of recent work is as follows:

#### *Specialist Assessments:*

Bitterfontein Solar Plant - Fauna & Flora Specialist Assessment. Specialist Report for Cape EAPrac. 2012.

Beaufort West Solar Facility, Erf 7388 - Fauna & Flora Specialist Assessment. Specialist Report for Cape EAPrac. 2012.

Plant Sweeps on Portion 2 of the Farm Demaneng 546, Kuruman District, Northern Cape Province for SA Manganese. 2011.

Proposed Olyven Kolk Solar Power Plant, Northern Cape: Botanical and Faunal Specialist Assessment. Specialist Report for Environmental Resources Management (ERM). 2011.

Klawer Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Witberg Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Lambert's Bay Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Sutherland, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management. 2011.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Beaufort West, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy at Konstabel, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility at Perdekraal, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Victoria West, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management. 2010.

*Research Reports & Peer Reviewed Publications:*

Todd, S.W. 2010. Vegetation and Plant Communities Associated with the Tillite and Dolerite Renosterveld Types of the Avontuur Conservation Area, Nieuwoudtville, South Africa. DRYNET.

Todd, S.W., Milton, S.J., Dean, W.R.J. Carrick, P.J. & Meyer, A. 2009. Ecological best Practice Guidelines for the Namakwa District. The Botanical Society of South Africa.

Todd, S.W. 2009. Field-Based Assessment of Degradation in the Namakwa District. Final Report. Mapping Degradation in the Arid Subregions of the BIOTA South Transect. SANBI.

- Todd, S.W. 2009. A fence-line in time demonstrates grazing-induced vegetation shifts and dynamics in the semi-arid Succulent Karoo. *Ecological Applications*, 19: 1897–1908.
- Todd, S.W. 2007. Characterisation of Riparian Ecosystems. D14 of The WADE Project. Floodwater Recharge of Alluvial Aquifers in Dryland Environments. *GOCE-CT-2003-506680- WADE*. Sixth Framework Programme Priority 1.1.6.3 Global Change and Ecosystems.
- Todd, S.W. 2006. Gradients in vegetation cover, structure and species richness of Nama-Karoo shrublands in relation to distance from livestock watering points. *Journal of Applied Ecology* 43: 293-304.
- Benito, G., Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., **Todd, S.** Botero, B., Morin, E., Grodek, T., Roberts, C. 2010. Management of Alluvial Aquifers in Two Southern African Ephemeral Rivers: Implications for IWRM. *Water Resources Management*, 24:641–667.
- Hahn, B.D., Richardson, F.D., Hoffman, M.T., Roberts, R., **Todd, S.W.** and Carrick, P.J. 2005. A simulation model of long-term climate, livestock and vegetation interactions on communal rangelands in the semi-arid Succulent Karoo, Namaqualand, South Africa. *Ecological Modelling* 183, 211–230.
- Malgas, R.R., Potts, A.J., Oetlé, N.M., Koelle, B., **Todd, S.W.**, Verboom G.A. & Hoffman M.T.. 2010. Distribution, quantitative morphological variation and preliminary molecular analysis of different growth forms of wild rooibos (*Aspalathus linearis*) in the northern Cederberg and on the Bokkeveld Plateau. *South African Journal of Botany*, 76, 72-81.
- Mills, A., Fey, M., Donaldson, J.D., **Todd, S.W.** & Theron, L.J. 2009. Soil infiltrability as a driver of plant cover and species richness in the semi-arid Karoo, South Africa. *Plant and Soil* 320: 321–332.
- Rahlao, J.S., Hoffman M.T., **Todd, S.W.** & McGrath, K. 2008. Long-term vegetation change in the Succulent Karoo, South Africa following 67 years of rest from grazing. *Journal of Arid Environments*, 72, 808-819.
- Hoffman, M.T. & **Todd, S.W.** 2010. Using Fixed-Point Photography, Field Surveys, And Gis To Monitor Environmental Change: An Example From Riemvasmaak, South Africa. Chapter In *Repeat Photography: Methods And Applications In The Natural Sciences*. R.H. Webb, Editor. Island Press. In Press.