# DANIELSKUIL

## KEREN ENERGY HOLDINGS

## BIODIVERSITY ASSESSMENT & BOTANICAL SCAN

A preliminary Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa.

**March 17, 2012**

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## SUMMARY - MAIN CONCLUSIONS

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| | |
|---|---|
| **MAIN VEGETATION TYPES** | **Ghaap Plateau Vaalbosveld**<br>Ghaap Plateau Vaalbosveld is described as flat plateau with well developed shrub layer with *Tarchonanthus camphoratus* and *Acacia karroo* and a tree layer with *Olea europaea* subsp. *africana*, *Acacia tortilis*, *Ziziphus mucronata* and *Rhus lancea*.<br>**Least Threatened**<br>But none formally protected, but 98% still remains |
| **LAND USE AND COVER** | The study area is situated on an Erf within the urban edge of Danielskuil. An Eskom substation and power lines are situated on the property and the Municipal sewerage works just north of the property. Natural vegetation forms a medium-dense cover over the entire area of the study area. The Idwala Lime mine is situated just across the R31 from the site. |
| **RED DATA PLANT SPECIES** | None encountered or expected<br>Protected Trees: A number of *Acacia haematoxylon* as well as individuals of *Acacia erioloba* are located within the boundaries of the final proposed site location. |
| **IMPACT ASSESSMENT** | Development without mitigation: Sig. rating = 31%<br>Development with mitigation Significance = 6%<br><br>Where values of ≤15% indicate an insignificant environmental impact and values >15% constitute ever increasing environmental impact. |

**RECOMMENDATION**

From the information available and the site visit, it is clear that the Danielskuil final location was fairly well chosen from a biodiversity viewpoint. No irreversible species loss, habitat loss, connectivity or associated impact (apart from a potential impact on a small portion of the dry watercourses) can be foreseen from locating and operating the solar facility on the final proposed solar site. However, there is a significant difference between development **without** and development **with** mitigation. As a result it is recommended that all mitigating measures must be implemented in order to further minimise the impact of the construction and operation of the facility.

Although solar energy is presently not seen as a viable stand-alone technology for electricity production it will lighten the pressure on the fossil burning facilities of Eskom and in so doing will add to a more sustainable way of electricity production.

**With the available information to the author's disposal it is recommended that the project be approved, but that all mitigation measures described in this document is implemented.**

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## INTRODUCTION

Renewable energy takes many forms, including biomass, geothermal, hydropower, wind and solar. Of these, solar may be the most promising: it can be used to generate electricity or to heat water, has little visual impact, and scales well from residential to industrial levels. Solar is the fastest growing energy source in the world. It offers a limitless supply of clean, safe, renewable energy for heat and power. And it's becoming ever more affordable, more efficient, and more reliable.

According to various experts (www.thesolarfuture.co.za), building solar plants is in many ways more financially viable and sustainable than erecting coal fired power stations. When a coal power plant has reached its life span, usually after 40 years depending on the technology, it must be demolished and rebuild (at a huge price tag). When panels of a solar plant reach their lifespan, you only need to replace the panels. Replacing panels is becoming cheaper and better in what they do as the technology is continuously improving. South Africa has abundant coal reserves, but its reserves of solar power are even greater, and unlike coal, solar power is inflation-proof and doesn't lead to large scale destruction of landscapes or the pollution of precious water. In addition South Africa is the world's best solar energy location after the Sahara and Australia.

The advantages of Solar and other renewable power sources are clear: greater independence from imported fossil fuels, a cleaner environment, diversity of power sources, relief from the volatility of energy prices, more jobs and greater domestic economic development. All over the world, solar energy systems have reduced the need to build more carbon-spewing fossil-fuelled power plants. They are critical weapons in the battle against global warming. As the cost of solar technologies has come down, solar is moving into the mainstream and growing worldwide at 40-50% annually (www.wikepedia.org).

In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global.

Keren Energy Holdings is proposing the establishment of a 10 MW concentrated photovoltaic solar energy facility next to the town of Danielskuil (Northern Cape Province, Kgatelopele Local Municipality). The facility will be established on an area of approximately 20 ha, on a portion of Erf 753 (Danielskuil), located adjacent and south-east of Danielskuil. The purpose of the proposed facility is to sell electricity to Eskom as part of the Renewable Energy Independent Power Producers Procurement Programme. This programme has been introduced by the Department of Energy to promote the development of renewable power generation facilities.

## TERMS OF REFERENCE

EnviroAfrica (Pty) Ltd was appointed by Keren Energy Holdings as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping/Environmental Impact Assessment (EIA) Process for the proposed development. PB Consult was appointed by EnviroAfrica to conduct a Biodiversity Assessment of the proposed development area.

PB Consult was appointed within the following terms of reference:

- Evaluate the general location of the proposed site and make recommendations on a specific location for the 20
- The study must consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

## INDEPENDENCE & CONDITIONS

PB Consult is an independent consultant to Keren Energy Holdings and has no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

# DEFINITIONS & ABBREVIATIONS

## DEFINITIONS

Environmental Aspect: Any element of any activity, product or services that can interact with the environment.

Environmental Impact: Any change to the environment, whether adverse or beneficial, wholly or partially resulting from any activity, product or services.

No-Go Area(s): Means an area of such (environmental/aesthetical) importance that no person or activity is allowed within a designated boundary surrounding this area.

## ABBREVIATIONS

| | |
|---|---|
| BGIS | Biodiversity Geographical Information System |
| DEA | Department of Environmental Affairs |
| DENC | Department of Environment and Nature Conservation (Northern Cape Province) |
| EAP | Environmental assessment practitioner |
| EIA | Environmental impact assessment |
| EMP | Environmental management plan |

| | |
|---|---|
| NEMA | National Environmental Management Act, Act 107 of 1998 |
| NEM: BA | National Environmental Management Biodiversity Act, Act 10 of 2004 |
| NSBA | National Spatial Biodiversity Assessment |
| SANBI | South African National Biodiversity Institute |
| SKEP | Succulent Karoo Ecosystem Project |
| WWTW | Wastewater Treatment Works |

## REFERENCES

**Acocks, J.P.H. 1953.** Veld types of South Africa. *Mem. Bot. Surv. .S. Afr*. No. 28: 1-192.

**De Villiers C.C., Driver, A., Brownlie, S., Clark, B., Day, E.G., Euston-Brown, D.I.W., Helme, N.A., Holmes, P.M., Job, N. & Rebelo, A.B. 2005.** Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.

**Government Notice No 1002, 9 December 2011.** National list of Ecosystems that are threatened and in need of protections. In terms of section 52(1)(a) of the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004).

**Low, A.B. & Rebelo, A.(T.)G. (eds) 1996.** *Vegetation of South Africa, Lesotho and Swaziland*. Dept of Environmental Affairs and Tourism, Pretoria.

**Mucina, L. & Rutherford, M.C. (eds.) 2006.** The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

**SANBI. 2006.** South African National Botanical Institute: Biodiversity GIS Home. http://bgis.sanbi.org (as updated)

**SANBI, 2007**. South African National Botanical Institute: Red Data Lists. Interim Red Data List of South African Plant Taxa. October 2007.

## PROJECT DESCRIBTION

Keren Energy Holdings is proposing the establishment of a 10 MW concentrated photovoltaic solar energy facility near the town of Danielskuil (Northern Cape Province, Kgatelopele Local Municipality). The facility will be established on a 20 ha portion of land, adjacent and south-east of Danielskuil.

The proposed facility will utilise Concentrated Photovoltaic (CPV) technology, which aims to concentrate the light from the sun, using Fresnel lenses, onto individual PV cells. This method increases the efficiency of the PV panels as compared to conventional PV technology. An inverter is then used to convert the direct current electricity produced into alternating current for connection into the Eskom grid. A single solar generator produces approximately 66kV. In order to produce 10 MW, the proposed facility will require a number of generators arranged in multiples/arrays. The CPV panels will be elevated (2 m above ground) by a support structure, and will be able to track the path of the sun during the day for maximum efficiency. Approximately 1.8 ha is required per installed MW. A 10 MW capacity facility will thus require a development footprint of approximately 20 ha (including associated infrastructure – ancillary infrastructure). Each panel will be approximately 22 m wide by 12.5 m high. When the panels are tracking vertically the structure will have a maximum height of approximately 15 m.

The site can be accessed from the R31 running through Danielskuil, using existing secondary roads. However, additional temporary access roads will have to be established on site. Site preparation will include clearance of vegetation at the footprint of the following infrastructure:

- Support structures (approximately 148 units are proposed) (excavations of 1 $m^2$ by 5 m deep)
- Switchgear
- Inverters
- Workshops
- Trenches for the underground cabling

The activities may require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site. All in all, the proposed facility can be likened to light agriculture, with the exception that natural vegetation will be allowed to remain on all the non-disturbed areas. All surfaces not used for the facility and associated infrastructure will remain natural.

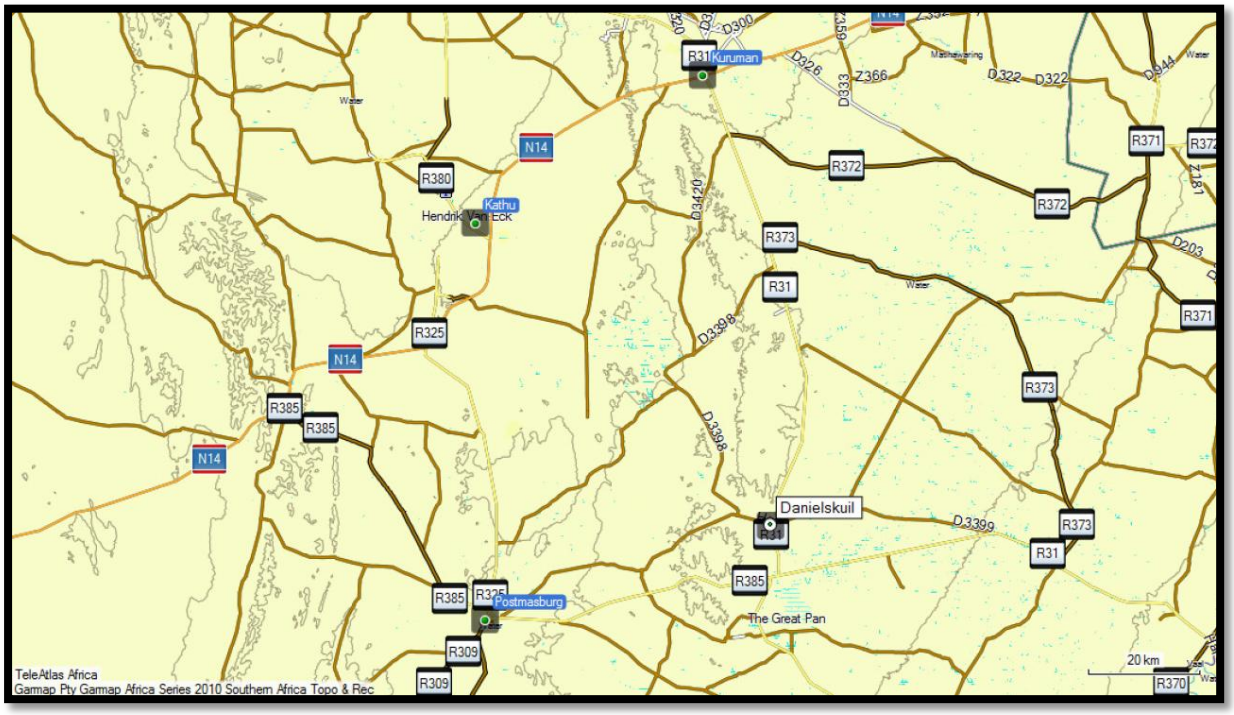
## DESCRIPTION OF ENVIRONMENT

The aim of this description is to put the study area in perspective with regards to all probable significant biodiversity features which might be encountered within the study area. The study area has been taken as the proposed site and its immediate surroundings. During the desktop study any significant biodiversity features associated with the larger surroundings was identified, and were taken into account. The desktop portion of the study also informs as to the biodiversity status of such features as classified in the National Spatial Biodiversity Assessment (2004) as well as in the recent National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004.

## LOCATION & LAYOUT

Danielskuil is located in the Northern Cape Province (Kgatelopele Local Municipality), on the R31, approximately 85 km south of Kuruman and 60 km east of Postmasburg. (Refer to Figure 1). The solar facility is proposed to be located approximately 2.2 km south-east of Danielskuil (directly across from the Idwala Lime Mine) on a 20 ha potion of Erf 753, Danielskuil.

**Figure 1: The general location of the proposed Danielskuil Keren Energy Solar Facility**




During the biodiversity assessment the following general location for the proposed site was evaluated (Refer to Figure 2). **Please note that this area is larger than 20 ha and the purpose of the biodiversity assessment was to evaluate the larger site and then to choose a suitable area (within this larger site) on which the solar facility can be located, which will minimise significant biodiversity features.**

**Figure 2: The area evaluated during the Biodiversity Assessment**


Biodiversity and other specialist inputs after the physical biodiversity assessment site visit was used to decide on the final proposed location for the solar facility (Refer to Figure 3).

**Figure 3: Proposed final solar site location (approximately 20 ha)**

Table 1: GPS coordinates describing the boundaries of the final proposed solar site location (WGS 84 format)

| DESCRIPTION | LATITUDE AND LONGITUDE | ALTITUDE |
|---|---|---|
| North-west corner | S28 12 24.2 E23 33 04.4 | 1460 m |
| South-east corner | S28 12 35.3 E23 33 35.4 | 1458 m |
| South-west corner | S28 12 59.7 E23 33 17.7 | 1457 m |

## METHODS

Various desktop studies were conducted, coupled by a physical site visit at the end of February 2012 and further desktop studies. The timing of the site visit was reasonable in that essentially all perennial plants were identifiable and although the possibility remains that a few species may have been missed, the author is confident that a fairly good understanding of the biodiversity status in the area was obtained.

The survey was conducted by walking through the site (Refer to Figure 4) and examining, marking and photographing any area of interest. Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, including rivers, streams or wetlands, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

Figure 4: A Google image showing the route (white line) that was walked as well as special features encountered


*A. eriol = *Acacia erioloba* (Camel Thorn); A. haemat = *Acacia haematoxylon* (Grey Camel Thorn)

The site visit was also used to inform the client and EAP of potential conflicting areas (e.g. rivers/streams and plant species) in the larger site.

## TOPOGRAPHY

The proposed final site is located on an almost totally flat area, covered with natural veld in relative poor condition (the impact of grazing and urban creep are clearly evident). The elevation data given in Table 1 as well as in Figure 5 (yellow lines) indicates an average slope of only 0.8%. It also shows that the site slopes very slightly from the north-west corner to the south and south-east in the direction of the Danielskuil River (situated approximately 700 m to the south and south-east of the proposed location). Elevation varies from 1457 m to 1460 m, basically a flat area). No natural watercourses or drainage lines have been encountered on the site. However, note the Southern Kalahari Salt Pans areas to the north and east of the property indicated on the vegetation map Figure 12.

**Figure 5: Google image indicating the slope following the boundary of the site (direction NW-SE-SW).**


## CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Danielskuil normally receives about 269 mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (0 mm) in June and the highest (66 mm) in March. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Danielskuil range from 15.8°C in June to 31.8°C in January. The region is the coldest during July when the mercury drops to -0.2°C on average during the night (www.saexplorer.co.za).

The graphs underneath indicate the average climate data for Kuruman (giving an average for the Northern Cape region) (Figure 6 to Figure 9).

**Figure 6: Kuruman average minimum and maximum temperatures (www.weather-and-climate.com)**

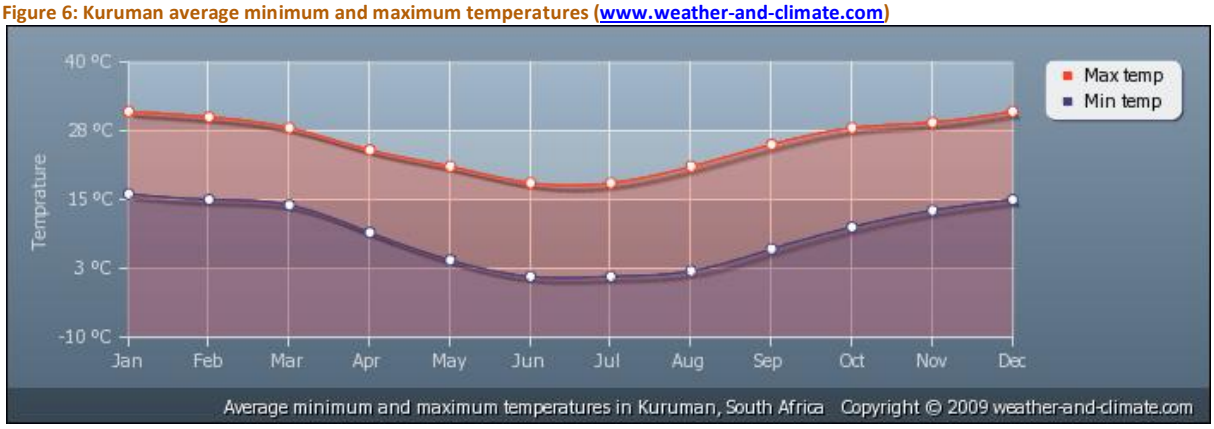



**Figure 7: Kuruman average monthly precipitation over the year (www.weather-and-climate.com)**

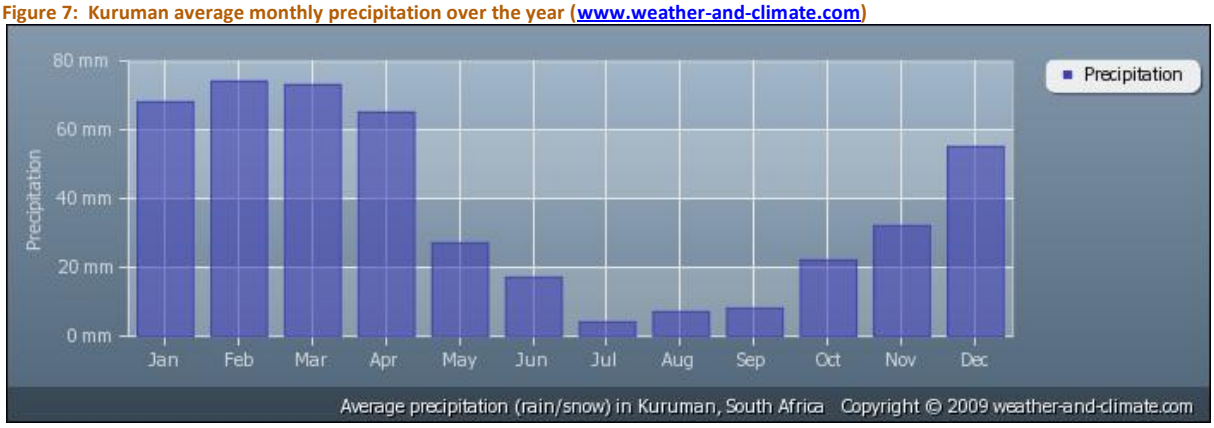



**Figure 8: Kuruman average monthly hours of sunshine over the year (www.weather-and-climate.com)**

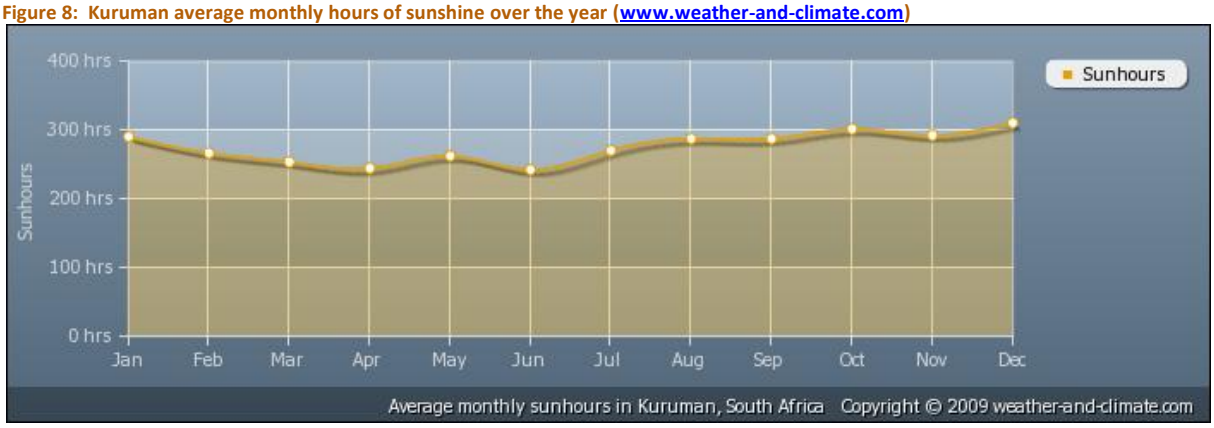
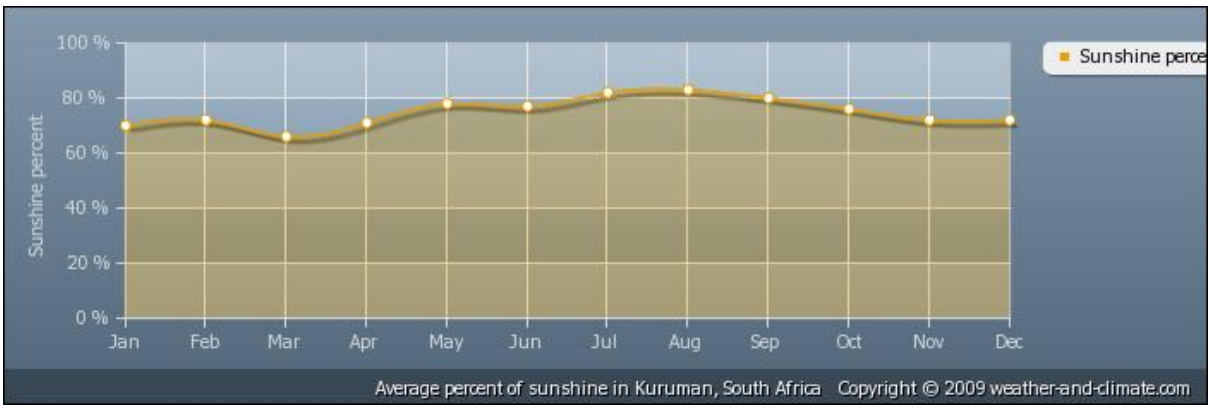


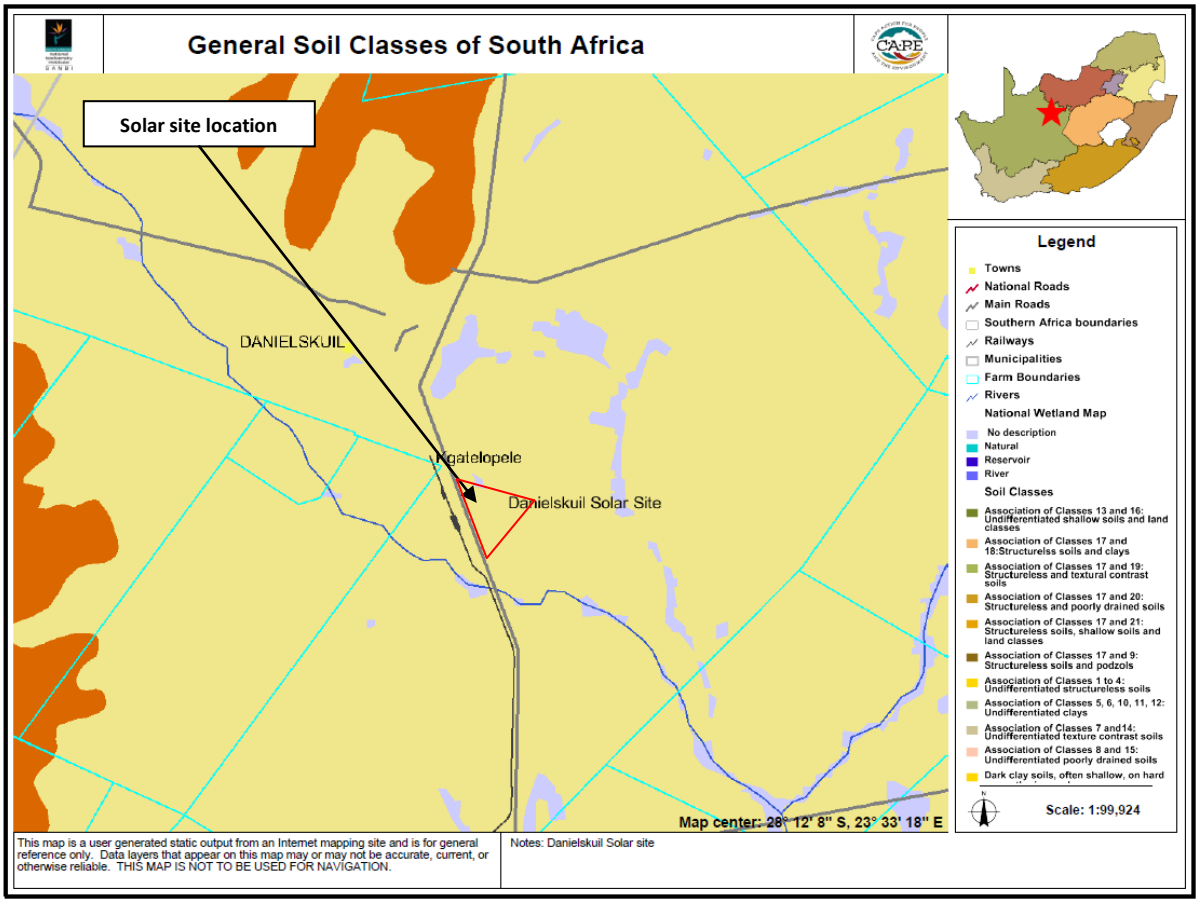

**Figure 9: Kuruman average percent of sunshine over the year (mean % of sun hours during the day) (www.weather-and-climate.com)**



## GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology is dominated by surface limestone of Tertiary to Recent age, and dolomite and chert of the Campbell Group (Griqualand West Super group, Vaalian Erathem). Soils (Refer to Figure 10) are described as red en yellow well drained, structure less sandy soils of mostly shallow dept and with a high base status of the Mispah and Hutton soil forms. Land types are mainly Fc with some Ae and Ag (Mucina & Rutherford, 2006).

**Figure 10: General soil map for the area in the vicinity of the proposed solar site location (SANBI BGIS)**




No special soils or geology features (e.g. quartz patches or broken veld) were observed, which could support significant botanical features were observed or are expected on the terrain.

## LANDUSE AND COVER

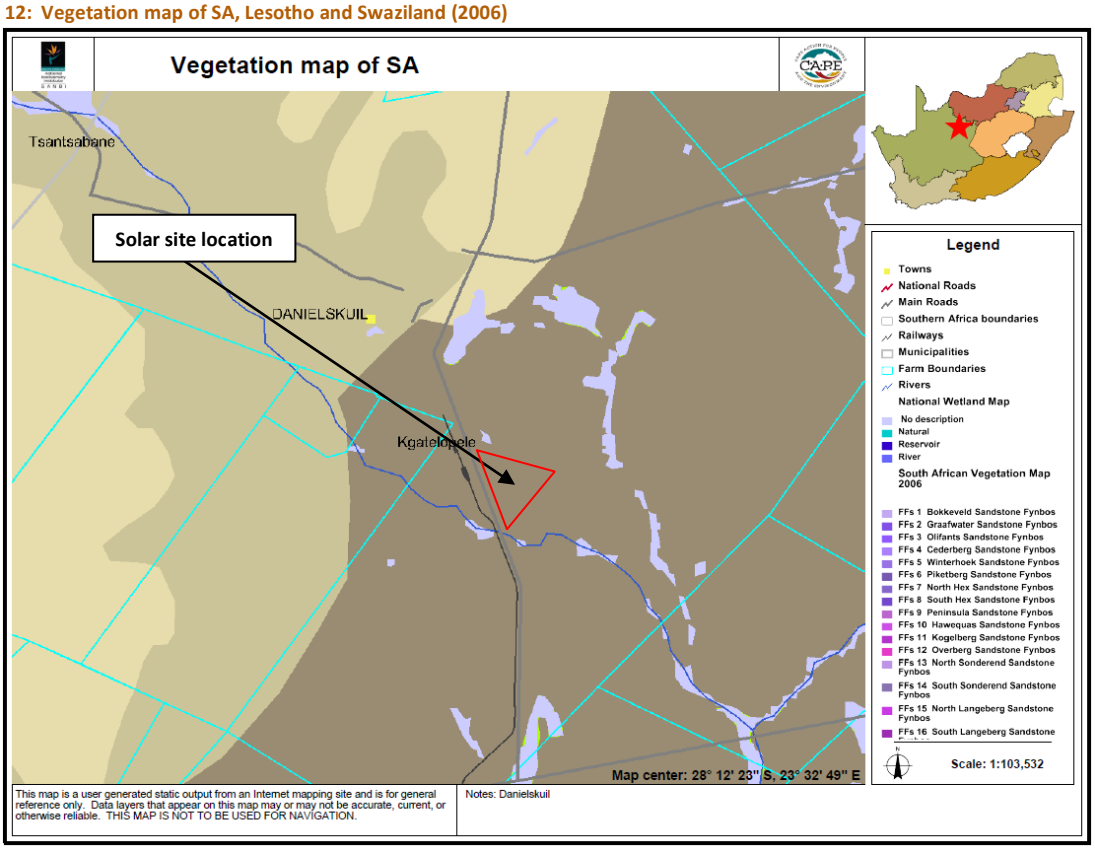
The study area is situated next to the urban edge of the town of Danielskuil. At present it is used for natural and/or communal grazing and by Eskom for the location of a substation. The Municipal sewerage works is located just north of the larger site, while the Idwala Lime Mine is situated just across the R31 from the proposed solar site location (refer to Figure 11). Natural vegetation forms a medium cover over the entire remainder of the Erf. During the site visit the only biodiversity features of significance observed on the site, was the remaining natural veld and the presence of various individuals of the protected trees, *Acacia erioloba* and *Acacia haematoxylon*.

**Figure 11: A Google image giving an indication of the land use on the proposed solar site**


## VEGETATION TYPES

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) only one broad vegetation type is expected in the proposed area and its immediate vicinity, namely Ghaap Plateau Vaalbosveld (Darker brown in Figure 12).

**Figure 12: Vegetation map of SA, Lesotho and Swaziland (2006)**



This vegetation type was classified as "Least Threatened" during the 2004 National Spatial Biodiversity Assessment (NSBA). More than 98% of this vegetation still remains in its natural state, but at present none of this vegetation type is formally protected throughout South Africa. Recently the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011), was promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004. According to this National list, **Ghaap Plateau Vaalbosveld, remains classified as Least Threatened**.

Ghaap Plateau Vaalbosveld is found in the Northern Cape and North-West Provinces on the flat plateau from around Campbell in the south, east of Danielskuil through Reivilo to around Vryburg in the north on altitudes varying from 1 100 -1 500 m (Mucina & Rutherford, 2006).

## GHAAP PLATEAU VAALBOSVELD

Ghaap Plateau Vaalbosveld is described as flat plateau with well developed shrub layer with *Tarchonanthus camphoratus* and *Acacia karroo* and a tree layer with *Olea europaea* subsp. *africana*, *Acacia tortilis*, *Ziziphus mucronata* and *Rhus lancea*. According to Mucina & Rutherford (2006) *Olea* are more important in the southern parts of the unit, while *Acacia tortilis*, *Acacia hebeclada* and *Acacia mellifera* are more important in the north and part of the west of the unit, while much of the central parts of this unit have remarkably low cover of Acacia species for an arid savannah and is dominated by the non-thorny *Tarchonanthus camphoratus*, *Rhus lancea* and *Olea europaea* subsp. *africana*. Acocks (1953) described this vegetation as Kalahari Thornveld and Shrub Bushveld while Low & Rebelo (1996) described this vegetation as Kalahari Plateau Bushveld.

**Photo 1: Natural veld in the study area (*Tarchonanthus camphoratus* prominent), with a single *Acacia erioloba* in the background**

According to Mucina & Rutherford (2006) important taxa includes the following:

Tall tree: *Acacia erioloba.*

Small trees: *Acacia mellifera* subsp. *detinens, Rhus lancea, Acacia karroo, Acacia tortilis* subsp. *heteracantha* and *Boscia albitrunca.*

Tall shrubs: *Olea europaea* subsp. *africana*, *Rhigozum trichotomum*, *Tarchonanthus camphoratus*, *Diospyros austro-africana*, *D. pallens*, *Ehretia rigida* subsp. *rigida*, *Euclea crispa*, *Grewia flava*, *Gymnosporia buxifolia*, *Lessertia frutescens* and *Rhus tridactyla*.

Low shrubs: *Acacia hebeclada, Aptosimum procumbens, Chrysocoma ciliate, Helichrysum zeyheri, Hermannia comosa, Lantana rugosa, Leucas capensis, Melolobium microphyllum, Peliostomum leucorrhizum, Pentzia globoza, P viridis* and *Zygophyllum pubescens.*

Succulent Shrubs: *Hertia pallens* and *Lycium cinereum*.

Woody climber: Asparagus africanus.

Graminoides: *Anthephora pubescens*, *Cenchrus ciliaris*, *Digitaria eriantha*, *Enneapogon scoparius*, *Eragrostis lehmanniana*, *Schmidtia pappohoroides*, *Themeda triandra*, *Aristida adscensionis*, A. *congesta*, *A. diffusa*, *Cymbopogon pospischilii*, *Enneapogon* species, *Eragrostis* species, *Heteropogon* species, *Sporobolus* species *Stipagrostis* species and *Tragus* species.

Herbs: *Barleria macrostegia*, *Geigeria filifolia*, G. *ornativa*, *Gisekia africana*, *Helichrysum cerastioides*, *Heliotropium ciliatum*, *Hibiscus marlothianus*, *H. pusillus*, *Jamesbrittenia aurantiaca*, *Limeum fenestratum*, *Lippia scaberrima*, *Selago densiflora*, *Vahlia capensis* and *Aloe grandidentata*.

## VEGETATION ENCOUNTERED

The vegetation encountered conforms to that of Ghaap Plateau Vaalbosveld and supported a low shrub/grassy layer (up to 50 cm) with a woody/shrub over layer varying in height from 1-2.5 m (Refer to Photo 2). A third tree stratum is sometimes present in the form of *Acacia erioloba* trees, which could reach up to 4 m in height. The larger study area was fairly uniformly covered by the same vegetation composition. Vegetation cover was between 80-90%.

**Photo 2: The vegetation encountered on the proposed solar site (note the shrub middle layer with *Acacia erioloba* over layer)**

The woody/shrub middle layer was dominated by *Tarchonanthus camphoratus* (Vaalbos) with *Acacia karroo*, *Acacia hebeclada*, *Ziziphus mucronata*, *Rhus lancea*, *Grewia flava, Gymnosporia buxifolia and Acacia haematoxylon* (Grey Camel Thorn) also prominent. Clumps of a mixture of the above with the woody climber Asparagus africanus also present more often than not (Refer to Photo 3).

**Photo 3: Typical bush clump with *Tarchonanthus*, *Acacia*, *Ziziphus*, *Grewia*, *Rhus* etc.**

The bottom layer consisted mainly of a short shrub layer mixed with grassy content. Apart from the grassy layer, the plant species encountered included, amongst other, the following shrubs namely *Lyceum cinereum*, *Chrysocoma ciliate*, *Helichrysum* sp., *Hermannia* cf. *comosa*, *Brunsvigia* sp, *Boophane* cf. *disticha*, *Jamesbrittenia* cf. *atropurpurea*, *Aptosimum* cf. *procumbens, Geigeria filifolia, Lotononis hirsuta, Felicia sp., Harpogophytum procumbens* (Bobbejaanklou) etc.

**Photo 4: A photo of the low growing *Harpogophytum procumbens* (Bobbejaanklou) with its characteristic seed pod (right)**

## ENDEMIC OR PROTECTED PLANT SPECIES

Endemic taxa which might be encountered include: *Rennera stellata* and a number of biogeographically important taxa. None of these species was encountered, and although some of these species might be encountered, the area on which the solar site is to be located is far from pristine and is not expected to contribute significantly towards regional conservation targets. However, the following protected tree species in terms of the National Forest Act of 1998 (Act 84 of 1998) have a geographical distribution that may overlap with the broader study area (Refer to Table 2).

**Table 2: Protected tree species with a geographical distribution that may overlap the broader study area**

| SPECIES NAME | COMMON NAME | TREE NO. | DISTRIBUTION |
|---|---|---|---|
| *Acacia erioloba* | Camel Thorn<br>Kameeldoring | 168 | In dry woodlands next to water courses, in arid areas with underground water and on deep Kalahari sand |
| *Acacia haematoxylon* | Grey Camel Thorn<br>Vaalkameeldoring | 169 | In bushveld, usually on deep Kalahari sand between dunes or along dry watercourses. |
| *Boscia albitrunca* | Shepherds-tree<br>Witgat/Matopie | 130 | Occurs in semi-desert and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. |

**Photo 5: *Acacia haematoxylon* (Grey Camel thorn)**

During the site visit, both *Acacia erioloba* and a number of relative young *Acacia haematoxylon* were encountered distributed mostly along the eastern boundary of the property (However, *Acacia haematoxylon* is expected to be encountered throughout the site. All of the trees encountered were marked with GPS coordinates (Refer to Table 3) and plotted on a map (Refer to Figure 4 or Figure 11). It was also very clear that some of these trees will be compromised if the solar plant site is to be located where proposed. However, this will be true for most of the adjoining area as well and good environmental control during construction can minimise the impact significantly.

**Table 3: A list of protected trees encountered during the site visit and their GPS co-ordinates**

| NO | SPECIES NAME | COMMON NAME | NUMBER OF TREES | LOCATION |
|---|---|---|---|---|
| 1. | *Acacia erioloba* | Camel thorn | 2 individuals | S28 12 37.2 E23 33 26.2 |
| 2. | *Acacia erioloba* | Camel thorn | Single | S28 12 31.7 E23 33 23.4 |
| 3. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 41.2 E23 33 28.4 |
| 4. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 42.5 E23 33 28.4 |
| 5. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 43.2 E23 33 28.2 |
| 6. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 43.7 E23 33 28.3 |
| 7. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 46.1 E23 33 27.6 |
| 8. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 46.1 E23 33 25.3 |
| 9. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 46.0 E23 33 24.4 |
| 10. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 46.3 E23 33 23.5 |
| 11. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 46.3 E23 33 23.2 |
| 12. | *Acacia haematoxylon* | Grey Camel thorn | 3 individuals | S28 12 46.5 E23 33 23.1 |
| 13. | *Acacia haematoxylon* | Grey Camel thorn | Cluster of trees | S28 12 47.0 E23 33 22.4 |
| 14. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 47.7 E23 33 22.3 |
| 15. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 50.1 E23 33 16.6 |
| 16. | *Acacia haematoxylon* | Grey Camel thorn | Single | S28 12 50.2 E23 33 15.9 |

## MAMMAL AND BIRD SPECIES

Since the property in question is not regarded as pristine and situated within the urban edge of Danielskuil, mammal and bird species were not regarded, as the proposed activity would not pose any additional significant impact on the species (or rather the lack of species) found or expected on the property. Although small game and bird species are still expected (and were observed), the construction of the solar facility will not have a major impact on regional biodiversity and with mitigating and good environmental control during construction the impact on these species could be minimised.

According to the Sanparks website, the nearby Mokala National Park is host to a varied spectrum of birds which adapted to the transition zone between Kalahari and Karoo biomes. Birds that can be spotted are the Kalahari species, black-chested prinia and its Karoo equivalent rufous-eared warbler as well as melodious lark. In rocky hillocks attract species such as freckled nightjar (vocal at night), short-toed rock thrush and cinnamon-breasted bunting. There are also a number of birds making use of the artificial man-made habitat around accommodations, such as mousebirds, martins, robin-chats, thrushes, canaries and flycatchers. Animal species such as Black Rhino, White Rhino, Buffalo, Tsessebe, Roan Antelope, Mountain Reedbuck, Giraffe, Gemsbok, Eland, Zebra, Red Hartebeest, Blue Wildebeest, Black Wildebeest, Kudu, Ostrich, Steenbok, Duiker and Springbok are also present in the Mokala National Park.

The nearby southern Kalahari salt pans is, however, expected to have significant species associated therewith (and although none of these salt pans was found within the site, some of them are expected just east of the solar site location). In her article about the southern Kalahari eco-region with regards to salt pans (www.feow.org/ecoregion_details.php?eco=571), Liz Day (form the freshwater consulting group) mentions that amphibian fauna are limited to hardy, opportunistic species, able to breed at virtually any time of year when water is available, and to aestivate, often over long periods of time. Species of giant bullfrog (Pyxicephalus spp.), for example, aestivate through the dry season in holes in the ground. Buried, they are protected from desiccation by a waxy cuticle, formed from mucus and layers of shed skin. In addition, the frogs store water in bladder-like outgrowths of their digestive tract, while their metabolic rate drops to less than one quarter of its normal resting level. Both the pans and ephemeral rivers of the southern Kalahari form focal points for the large herbivores of the eco-region, providing minerals to animals throughout the year and water during the rainy season. The pans are also used by the Kalahari fauna variously for burrowing, grazing, saltlicks, and seasonal waterholes. In addition, the trees associated with the riverbeds provide locally rare nesting and roosting habitat to birds.

## RIVERS AND WETLANDS

Rivers maintain unique biotic resources and provide critical water supplies to people. South Africa's limited supplies of fresh water and irreplaceable biodiversity are very vulnerable to human mismanagement. Multiple environmental stressors, such as agricultural runoff, pollution and invasive species, threaten rivers that serve

the world's population. River corridors are important channels for plant and animal species movement, because they link different valleys and mountain ranges. They are also important as a source of water for human use. Vegetation on riverbanks needs to be maintained in order for rivers themselves to remain healthy, thus the focus is not just on rivers themselves but on riverine corridors.

No rivers, wetlands or even drainage lines were observed on the proposed location for the solar site near Danielskuil. However, Southern Kalahari Salt Pans, which is potentially significant biodiversity features are expected to the north, south and east of the location (Refer to the blue patches in Figure 12).

## INVASIVE ALIEN INFESTATION

Most probably because of the aridity of the area, invasive alien rates are generally very low for most of this area and no problem plants were observed within the study area.

## SIGNIFICANT BIODIVERSITY FEATURES ENCOUNTERED

The table underneath gives a summary of biodiversity features encountered during the site visit and a short discussion of their possible significance in terms of regional biodiversity targets.

**Table 4: Summary of biodiversity features encountered on Erf 1654, Danielskuil and their possible significance**

| BIODIVERSITY ASPECT | SHORT DESCRIPTION | SIGNIFICANCE RATING |
|---|---|---|
| Geology & soils | Geology & soils are similar throughout the property. | No special features have been encountered on the final solar location (e.g. true quartz patches or broken veld). |
| Land use and cover | Natural veld, possibly used for grazing. | The property is used for grazing by horses and possibly natural game. |
| Vegetation types | Ghaap Plateau Vaalbosveld. | Ghaap Plateau Vaalbosveld is considered "Least threatened". However, the remaining natural veld shows good connectivity with the surrounding areas. |
| Endemic or protected plant species | No endemic species was observed, but a number of the protected tree species *Acacia erioloba* and *Acacia haematoxylon* was observed (Refer to Table 3). | It is clear that a number of Grey Camel thorn trees as well as possibly Camel thorn trees will be impacted by the development. However, it is possible that with good environmental control the impact could be minimised. |
| Mammal or bird species | Bird and small game can be expected although no game species or activities were observed. | The size and location of the solar facility is not expected to have a significant impact on the movement of game species found on the larger area. |
| Rivers & wetlands | No watercourses, drainage lines or wetlands were observed on the property. | No impact. |
| Invasive alien infestation | No alien invasive trees were observed. | No impact. |

In summary, although all natural areas with remaining natural vegetation, especially when these features show good connectivity with the surrounding natural veld (e.g. corridors) should be considered as significant. However, the placement of a 20 ha solar site on the specific location will have very little effect on any significant biodiversity feature or put pressure on regional conservation targets. The impact on populations of individual species is regarded as very low, the impact on sensitive habitats is regarded as insignificant, the impact on ecosystem function is regarded as very low, cumulative impact on ecology is regarded as very low and finally the impact on economic use of the vegetation is regarded as very low.

## BIODIVERSITY ASSESSMENT

Biological diversity, or biodiversity, refers to the variety of life on Earth. As defined by the United Nations Convention on Biological Diversity, it includes diversity of ecosystems, species and genes, and the ecological processes that supp ort them. Natural diversity in ecosystems provides essential economic benefits and services to human society—such as food, clothing, shelter, fuel and medicines—as well as ecological, recreational, cultural and aesthetic values, and thus plays an important role in sustainable development. Biodiversity is under threat in many areas of the world. Concern about global biodiversity loss has emerged as a prominent and widespread public issue.

The objective of this study was to evaluate the biological diversity associated with the study area in order to identify significant environmental features which should be avoided during development activities and or to evaluate short and long term impact and possible mitigation actions in context of the proposed development.

As such the report aim to evaluate the biological diversity of the area using the Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), with emphasis on:

- Significant ecosystems
    - Threatened or protected ecosystems
    - Special habitats
    - Corridors and or conservancy networks
- Significant species
    - Threatened or endangered species
    - Protected species

## METHOD USED

During May 2001, Van Schoor published a formula for prioritizing and quantifying potential environmental impacts. This formula has been successfully used in various applications for determining the significance of environmental aspects and their possible impacts, especially in environmental management systems (e.g. ISO 14001 EMS's). By adapting this formula slightly it can also be used successfully to compare/evaluate various environmental scenario's/options with each other using a scoring system of 0-100%, where any value of 15% or less indicate an insignificant environmental impact while any value above 15% constitute ever increasing environmental impact.

Using Van Schoor's formula (adapted for construction with specific regards to environmental constraints and sensitivity) and the information gathered during the site evaluation the possible negative environmental impact of the activity was evaluated.

Underneath follows a short description of Van Schoor's formula. In the formula the following entities and values are used in order to quantify environmental impact.

***S* = [(*fd* + *int* + *sev* + *ext* + *loc*) x (*leg* + *gcp* + *pol* +*ia* + *str*) x *P*]** (as adapted for construction activities)

Where

*S* = Significance value

*fd* = frequency and duration of the impact

*int* = intensity of the impact

*sev* = severity of the impact

*ext* = extent of the impact

*loc* = sensitivity of locality

*leg* = compliance with legal requirements

*gcp* = conformance to good environmental practices

*pol* = covered by company policy/method statement

*ia* = impact on interested and affected parties

*str* = strategy to solve issue

*P* = probability of occurrence of impact

## CRITERIA

The following numerical criteria for the above-mentioned parameters are used in the formula.

| *fd* = frequency and duration of the impact | | | | | |
|---|---|---|---|---|---|
| low frequency ; low duration | 1 | medium frequency; low duration | 1.5 | high frequency ; low duration | 2 |
| low frequency; medium duration | 1.5 | medium frequency ; medium duration | 2 | high frequency ; medium duration | 2.5 |
| low frequency ; high duration | 2 | medium frequency ; high duration | 2.5 | high frequency ; high duration | 3 |

| *int* = intensity of the impact | | | | | |
|---|---|---|---|---|---|
| low probability of species loss; low physical disturbance | 1 | medium probability of species loss; low physical disturbance | 1.5 | high probability of species loss; low physical disturbance | 2 |
| low probability of species loss; medium physical disturbance | 1.5 | medium probability of species loss; medium physical disturbance | 2 | high probability of species loss; medium physical disturbance | 2.5 |
| low probability of species loss; high physical disturbance | 2 | medium probability of species loss; high physical disturbance | 2.5 | high probability of species loss; high physical disturbance | 3 |

| *sev* = severity of the impact | |
|---|---|
| changes immediately reversible | 1 |
| changes medium/long-term reversible | 2 |
| changes not reversible | 3 |

| *ext* = extent of the impact | |
|---|---|
| locally (on-site) | 1 |
| regionally (or natural/critical habitat affected) | 2 |
| globally (e.g. critical habitat or species loss) | 3 |

| *loc* = sensitivity of location | |
|---|---|
| not sensitive | 1 |
| moderate (e.g. natural habitat) | 2 |
| sensitive (e.g. critical habitat or species) | 3 |

| *leg* = compliance with legal requirements | |
|---|---|
| compliance | 0 |
| non-compliance | 1 |
| | |

| *gcp* = good conservation practices | |
|---|---|
| conformance | 0 |
| non-conformance | 1 |

| *pol* = covered by company policy | |
|---|---|
| covered in policy | 0 |
| not covered/no policy | 1 |

| *ia* = impact on interested and affected parties | |
|---|---|
| not affected | 1 |
| partially affected | 2 |
| totally affected | 3 |

| *str* = strategy to solve issue | |
|---|---|
| strategy in place | 0 |
| strategy to address issue partially | 0.5 |
| no strategy present | 1 |

| *P* = probability of occurrence of impact | |
|---|---|
| not possible (0% chance)) | 0 |
| not likely, but possible (1 - 25% chance) | 0.25 |
| likely (26 - 50% chance) | 0.50 |
| very likely (51 - 75% chance) | 0.75 |
| certain (75 - 100% chance) | 0.95 |

## EVALUATION OF SIGNIFICANT ECOSYSTEMS

The main drivers in this Vaal bushveld would be fire and grazing pressure (herbivore), and could largely determine plant community composition and occurrence of rare species. Grazing may be an important factor in regulating competitive interaction between plants (*Acacia mellifera* encroachment is often a sign of overgrazing or bad veld management). Certain species can act as important "nursery" plants for smaller species and are also important for successional development after disturbance. Tortoises and mammals can be important seed dispersal agents. No important components such as watercourses, wetlands, upland- down land gradients or vegetation boundaries were observed during the site visit. It was also not evident to what extent the fire regime has been altered in order to improve grazing (if at all).

## THREATENED OR PROTECTED ECOSYSTEMS

The site visit confirmed that the vegetation conforms to Ghaap Plateau Vaalbosveld (Refer to Figure 12). This vegetation type was classified as "Least Threatened" during the 2004 National Spatial Biodiversity Assessment (NSBA). More than 98% of this vegetation still remains in its natural state, but at present none of this vegetation type is formally protected throughout South Africa. Recently the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011), was promulgated in terms of the

National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004. According to this National list, **Ghaap Plateau Vaalbosveld, remains classified as Least Threatened**.

## SPECIAL HABITATS

The vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems.

Overall the development of the 20 ha Keren Energy solar facility at Danielskuil is not expected to a have a significant impact on any special habitat. The possibility of such an impact occurring is rated as negligible.

## CORRIDORS AND OR CONSERVANCY NETWORKS

Looking at the larger site and its surroundings it shows excellent connectivity with remaining natural veld in almost all directions. Corridors and natural veld networks are still relative unscathed (apart from through-road networks).

Since large areas with good connectivity remains and the site is located in the general area of most disturbance (Eskom substation, sewerage works and a lime mine across the road), the 20 ha Keren Energy solar facility development is not expected to a have a significant impact on connectivity of the remaining natural veld. The impact is rated as low.

## EVALUATION OF SIGNIFICANT SPECIES

The site visit was performed during November 2011, an area which normally receives some rain from October. At the time of the study the Danielskuil area had not received any rains of significance and as a result only the hardened drought resistant plant species were observed, herbs, bulbs and annuals were mostly absent. This might mean that some of the local endemic species were not in growth or could not be identified. However, the author is of the opinion that in the larger context it will not constitute a significant contribution.

## THREATENED OR ENDANGERED SPECIES

No threatened or endangered species were recorded during the site visit, however, this does not rule out their presence as they may be subject to seasonable rainfall and may not have been observable during the time of the site visit. The composition of the herbaceous layer fluctuates with seasonal rainfall (Van Rooyen *et. all*, 1984, *vide* Mucina & Rutherford, 2006). It must be noted that the vegetation type is considered "Least

Threatened" (Mucina & Rutherford, 2006) and that this classification is based on plant species diversity and turnover as well as habitat transformation. The number of species per broad geographical levels for the savannah biome is relative low (Van Rooyen, 1988, *vide* Mucina & Rutherford, 2006). It is therefore very unlikely that any red data species will be confined to this site alone.

During the site visit no such species were observed and in the regional context the author is of the opinion that the development of the 20 ha solar facility will not lead to irreversible species loss. With good environmental control (e.g. topsoil removal, storage and re-distribution) and rehabilitation after construction (leaving the remaining area as natural as possible) the possibility of such an impact occurring could be almost negated.

The possibility of such an impact occurring is rated as very low.

## PROTECTED SPECIES

Three protected tree species have a distribution which could overlap with the general site location of the solar facility namely: *Acacia erioloba* (Camel thorn) *Boscia albitrunca* (Witgat) and *Acacia haematoxylon* (Grey camel thorn). Of these 3 species only both Camel thorn and Grey Camel thorn was observed on the larger property, and within the proposed development site. (All of the trees observed were referenced by GPS and are indicated on Figure 4 and in Table 3). A number of these trees will undoubtedly be impacted by the development. However, with good environmental control and careful placement of the solar pylons and the maintenance roads any disturbance or impact to these trees could be negated, the possibility of such an impact occurring will then be rated as medium.

Mitigation: Permits must be obtained for the removal of any protected trees. In addition placement of the pylons and access roads should consider these species in order to minimise the impact there-off on these species.

## PLACEMENT AND CONSTRUCTION METHOD

A single solar generator produces approximately 66kV. In order to produce 10 MW, the proposed facility will require a number of generators arranged in multiples/arrays. The CPV panels will be elevated (2 m above ground) by a support structure, and will be able to track the path of the sun during the day for maximum efficiency. Approximately 1.8 ha is required per installed MW. A 10 MW capacity facility will thus require a development footprint of approximately 20 ha (including associated infrastructure – ancillary infrastructure). Each panel will be approximately 22 m wide by 12.5 m high. When the panels are tracking vertically the structure will have a maximum height of approximately 15 m. The excavation needed for each support structures (approximately 148 units are proposed) will be 1 $m^2$ by 5 m deep. It means that apart from the

associated structures, approximately 148 holes of 1 $m^2$ by 5 m deep will be excavated. Each hole must be at least 22 m from the next.

**Photo 6: Typical layout of such a solar site (Image courtesy of Amonix, a leading designer of CPV technology)**

The activities will require the stripping of topsoil (for the pylon holes and access roads only, leaving the remainder as natural as possible), which will need to be stockpiled, backfilled and/or spread on site. All in all the proposed facility can be likened to light agriculture, with the exception that natural vegetation can be allowed to remain on all the non-disturbed areas. All surfaces not used for the facility and associated infrastructure can remain natural.

## DIRECT IMPACTS

As the name suggest, direct impacts refers to those impacts with a direct impact on biodiversity features and in this case were considered for the potentially most significant associated impacts (some of which have already been discussed above).

Direct loss of vegetation type and associated habitat due to construction and operational activities.

- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities. (Refer to page 21).
- Loss of local biodiversity and threatened plant species (Refer to page 21)
- Loss of ecosystem connectivity (Refer to page 22)

## LOSS OF VEGETATION AND ASSOCIATED HABITAT

One broad vegetation type is expected in the study area, namely Ghaap Plateau Vaalbosveld (Refer to Vegetation encountered on page 13). Ghaap Plateau Vaalbosveld was classified as "Least Threatened" and "Not Protected" during the 2004 National Spatial Biodiversity Assessment. Within the more recent "*National list of ecosystems that are threatened and in need of protection"* (GN 1002, December 2011), promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004, the status of Ghaap Plateau Vaalbosveld are still regarded as least threatened. Although none of this vegetation type is formally protected, more than 98% of this vegetation type is still found in a relative natural state. Thus the

vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems.

Even if all of the 20 ha is transformed (such as for intensive cultivation), the impact on the specific vegetation type would most probably only be medium-low as a result of the status of the vegetation and the location of the final proposed solar location. However, with mitigation the impact can be much reduced.

Mitigation: The following is some mitigation which will minimise the impact of the solar plant location and operation.

- Permits must be obtained for the removal of any protected trees. In addition placement of the pylons and access roads should consider these species in order to minimise the impact there-off on these species.
- Any significant plant species that may be encountered must be identified and located (e.g. *Acacia erioloba* and *Acacia haematoxylon*) and all efforts made to avoid damage to such species.
- Only existing access roads should be used for access to the terrain (solar site).
- The internal network of service roads (if needed) must be carefully planned to minimise the impact on the remaining natural veld on the site. The number of roads should be kept to the minimum and should be only two-track/twee spoor roads (if possible). The construction of hard surfaces should be minimised or avoided.
- Access roads and the internal road system must be clearly demarcated and access must be tightly controlled (deviations may not be allowed).
- Indiscriminate clearing of areas must be avoided, only pylon sites and sites where associated infrastructure needs to be placed must be cleared (all remaining areas to remain as natural as possible).
- All topsoil (at all excavation sites) must be removed and stored separately for re-use for rehabilitation purposes. The topsoil and vegetation should be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of the species removed during construction.
- Once the construction is completed all further movement must be confined to the access tracks to allow the vegetation to re-establish over the excavated areas.

## INDIRECT IMPACTS

Indirect impacts are impacts that are not a direct result of the main activity (construction of the solar facility), but are impacts still associated or resulting from the main activity. Very few indirect impacts are associated with the establishment of the solar facility (e.g. no water will be used, no waste material or pollution will be produced through the operation of the facility).

The only indirect impact resulting from the construction and use of the facility is a loss of movement from small game and other mammals, since the property will be fenced. However, it is not considered to result in any major or significant impact on the area as a whole.

## CUMULATIVE IMPACTS

In order to comprehend the cumulative impact, one has to understand to what extent the proposed activity will contribute to the cumulative loss of this vegetation type and other biodiversity features on a regional basis. Ghaap Plateau Vaalbosveld was classified as "Least Threatened", but "Not Protected" during the 2004 National Spatial Biodiversity Assessment. Within the more recent "*National list of ecosystems that are threatened and in need of protection"* (GN 1002, December 2011), promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004, the status of Ghaap Plateau Vaalbosveld is still regarded as least threatened. Although none of this vegetation type is formally protected, more than 98% of this vegetation type is still found in a relatively natural state. Thus the vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems.

Even if all of the 20 ha is transformed (such as for intensive cultivation), the impact on the regional status of this vegetation type and associated biodiversity features would likely still be only medium-low. No irreversible species-loss, habitat-loss, connectivity or associated impact can be foreseen from locating and operating the solar facility on the final proposed solar site. However, all mitigation measures should still be implemented in order to further minimise the impact of the construction and operation of the facility.

## THE NO-GO OPTION

During the impact assessment only the final proposed site (as described in Figure 3 and Table 1 is discussed. From the above, the "No-Go alternative" does not signify significant biodiversity gain or loss especially on a regional basis. In this case the no-go options will only ensure that the *status quo* remains, but it is expected that urban creep will anyway impact on the proposed final solar site location over time.

The site visit and desktop studies described and evaluated in this document led to the conclusion that the "No-Go" alternative will not result in significant gain in regional conservation targets, the conservation of rare & endangered species or gain in connectivity. At the best the No-Go alternative will only support the "*status quo*" of the region. On the other hand the pressure on Eskom facilities, most of which are currently still dependant on fossil fuel electricity generation, will remain. Solar power is seemingly a much cleaner, biodiversity friendly, and more sustainable long term option for electricity production.

## QUANTIFICATION OF ENVIRONMENTAL IMPACTS

Taking all of the above discussions into account and using Van Schoor's formula for impact quantification, impacts of the following can be quantified as follows:

### NO DEVELOPMENT

The no development scenario can only take regional biodiversity into account. In this instance national biodiversity (and even possibly global diversity) may, however, show significant gain over time, if for instance fossil burning electricity generation could be reduced and or replaced by cleaner energy production methods. Although solar energy is presently not seen as a viable stand-alone technology for electricity production it will lighten the pressure on the fossil burning facilities of Eskom and in so doing will add to a more sustainable way of electricity production.

### DEVELOPMENT WITHOUT MITIGATION

The purpose of this scenario is to illustrate, using Van Schoor's formula, the loss should development be allowed without any mitigation measures. It is assumed that the 20 ha will be totally developed into hard surfaces, but still in context of the regional importance of the biodiversity associated with the area.

$$S = [(fd + int + sev + ext + loc) \times (leg + gcp + pol + ia + str) \times P] \text{ (as adapted)}$$

$$S = [(1.5 + 1.5 + 1.5 + 1 + 1) \times (1 + 1 + 1 + 1 + 1) \times 0.95] = 31\ \%$$

In the above any value of 15% or less indicates an insignificant environmental impact, while any value above 15% constitutes ever increasing environmental impact.

### DEVELOPMENT WITH MITIGATION

The purpose of this scenario is to illustrate, using Van Schoor's formula, the environmental gain should development be allowed with all proposed mitigation measures implemented. It is assumed that the 20 ha will be developed, but that all areas not directly impacted by infrastructure placement will remain as natural as possible.

$$S = [(fd + int + sev + ext + loc) \times (leg + gcp + pol + ia + str) \times P] \text{ (as adapted)}$$

$$S = [(1.5 + 1.5 + 1.5 + 1 + 1) \times (0 + 0 + 0 + 1 + 0) \times 0.95] = 6\ \%$$

In the above any value of 15% or less indicates an insignificant environmental impact, while any value above 15% constitutes ever increasing environmental impact.

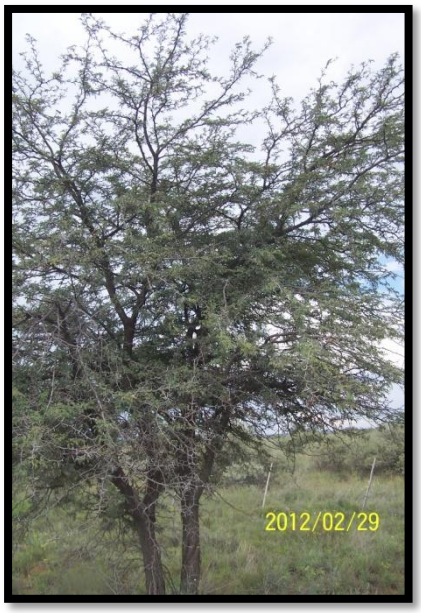
## RECOMMENDATIONS & IMPACT MINIMIZATION

From the information discussed in this document it is clear to see that the Danielskuil final location was relatively well chosen from a biodiversity viewpoint. Even if all of the 20 ha is transformed (such as for intensive cultivation), the impact on the regional status of this vegetation type and associated biodiversity features (e.g. watercourses and drainage lines) would likely still be only medium-low. No irreversible species-loss, habitat-loss, connectivity or associated impact can be foreseen from locating and operating the solar facility on the final proposed solar site.

**Photo 7: *Brunsvigia* species on the property**

The site visit and desktop studies described and evaluated this document led to the conclusion that the "No-Go Alternative" alternative will not result in significant gain in regional conservation targets, the conservation of rare & endangered species or gain in connectivity. At the best the No-Go alternative will only support the "status quo" of the region. On the other hand the pressure on Eskom facilities, most of which is currently still dependant on fossil fuel electricity generation, will remain. Solar power is seemingly a much cleaner and more sustainable option for electricity production. However, the No-Go scenario can only take regional biodiversity into account.

**Photo 8: *Acacia erioloba* on the proposed site**




In this instance national biodiversity (and even possibly global diversity) may show significant gain over time, if for instance fossil burning electricity generation could be reduced and or replaced by cleaner energy production methods. Although solar energy is presently not seen as a viable stand-alone technology for electricity production it will lighten the pressure on the fossil burning facilities of Eskom and in so doing will add to a more sustainable way of electricity production.

Finally, when quantifying the development options, the Van Schoor's formula for impact quantification still shows a significant difference between development **without** and development **with** mitigation. As a result it is recommended that all mitigating measures must be implemented in order to further minimise the impact of the construction and operation of the facility.

**With the available information at the author's disposal it is recommended that the project be approved, but that all mitigation measures described in this document is implemented.**

# IMPACT MINIMIZATION

## GENERAL

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase of the solar plant in terms of the EMP and the Biodiversity study recommendations as well as any other conditions which might be required by the Department of Environmental Affairs.
- An integrated waste management system must be implemented during the construction phase.
- All rubble and rubbish (if applicable) must be collected and removed from the site to a suitable registered waste disposal site.
- All alien vegetation should be removed from the larger property.
- Adequate measures must be implemented to ensure against erosion.

## SITE SPECIFIC

- Permits must be obtained for the removal of any protected trees. In addition placement of the pylons and access roads should consider these species in order to minimise the impact there-off on these species.
- Any significant plant species that may be encountered must be identified and located (e.g. *Acacia erioloba* and *Acacia haematoxylon*) and all efforts made to avoid damage to such species.
- Only existing access roads should be used for access to the terrain (solar site).
- The internal network of service roads (if needed) must be carefully planned to minimise the impact on the remaining natural veld on the site. The number of roads should be kept to the minimum and should be only two-track/ twee-spoor roads (if possible). If possible the construction of any hard surfaces should be minimised or avoided.
- During construction access roads and the internal road system must be clearly demarcated and access must be tightly controlled (deviations must not be allowed).
- Indiscriminate clearing of areas must be avoided, only pylon sites and sites where associated infrastructure needs to be placed may be cleared (all remaining areas to remain as natural as possible).
- All topsoil (the top 15-20 cm at all excavation sites), must be removed and stored separately for re-use for rehabilitation purposes. The topsoil and vegetation should be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of the species removed during construction.
- Once the construction is completed all further movement must be confined to the approved access and maintenance tracks to allow the vegetation to re-establish over the excavated areas.