MOUNT ROPER

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 27, 2012

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SUMMARY - MAIN CONCLUSIONS

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MAIN VEGETATION TYPES	**Kuruman Thornveld:** Kuruman Thornveld is described as occurring on flat rocky plains and slopping hills with a very well-developed, closed shrub layer and well-developed open tree stratum consisting of *Acacia erioloba*. **Least Threatened:** Although more than 98% of this vegetation type remains, none is formally conserved.
LAND USE AND COVER	The study area is situated in a shallow north-south valley within the northern portion of the Kuruman hills. The property and its immediate surroundings are used primarily as a game camp. Natural game is still present or has been re-introduced.
RED DATA PLANT SPECIES	None encountered or expected Protected Trees: A number of *Acacia erioloba* as well as *Boscia albitrunca* trees have been observed. The final solar site location was chosen to avoid watercourses, but a number of the protected tree species is still located within the proposed final site (and will most probably be compromised). It is imperative that a botanist/ECO be present during the initial layout of the infrastructure in order to reduce the impact on these species and to exercise good environmental control during construction.
IMPACT ASSESSMENT	Development without mitigation: Sig. rating = 40% Development with mitigation Significance = 16% 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 proposed final Mount Roper site location was fairly well chosen from a biodiversity viewpoint. 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, a number of protected tree species will most likely be compromised and 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 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 at the author's disposal it is recommended that the project be approved, but that all mitigation measures described in this document is implemented and that a botanist or suitably qualified ECO be appointed during the initial layout of the structures in order to minimise the impact on the protected tree species.

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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 on the remainder of the Farm Mount Roper No. 321, Kuruman (Northern Cape Province, Gamagara Local Municipality). The facility will be established on an area of approximately 20 ha, on a portion of Farm 321, located approximately 31 km north-west of Kuruman just of (and to the south) of the R31. 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

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PROJECT DESCRIBTION

Keren Energy Holdings is proposing the establishment of a 10 MW concentrated photovoltaic solar energy facility on the remainder of the Farm Mount Roper, No. 321, Kuruman (Northern Cape Province, Gamagara Local Municipality). The facility will be established on an area of approximately 20 ha, on a portion of Farm Mount Roper no. 321, located approximately 31 km north-west of Kuruman just of (and to the south) of the R31.

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, 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

The proposed Mount Roper Solar Site is located in the Northern Cape Province (Gamagara Local Municipality), on the Remainder of the Farm Mount Roper, No. 321, Kuruman. The facility will be established on an area of approximately 20 ha, on a portion of Farm 321, located approximately 31 km north-west of Kuruman just of (and to the south) of the R31. (Refer to Figure 1).

Figure 1: The general location of the proposed Mount Roper Keren Energy Solar Facility

Please note that the original site was larger than 20 ha (Refer to Figure 2). This was also the broad area evaluated during the initial biodiversity assessment. The proposed final solar site was located within this broad site (Refer to Figure 4).

Figure 2: Broad proposed site location for the proposed Mount Roper solar site

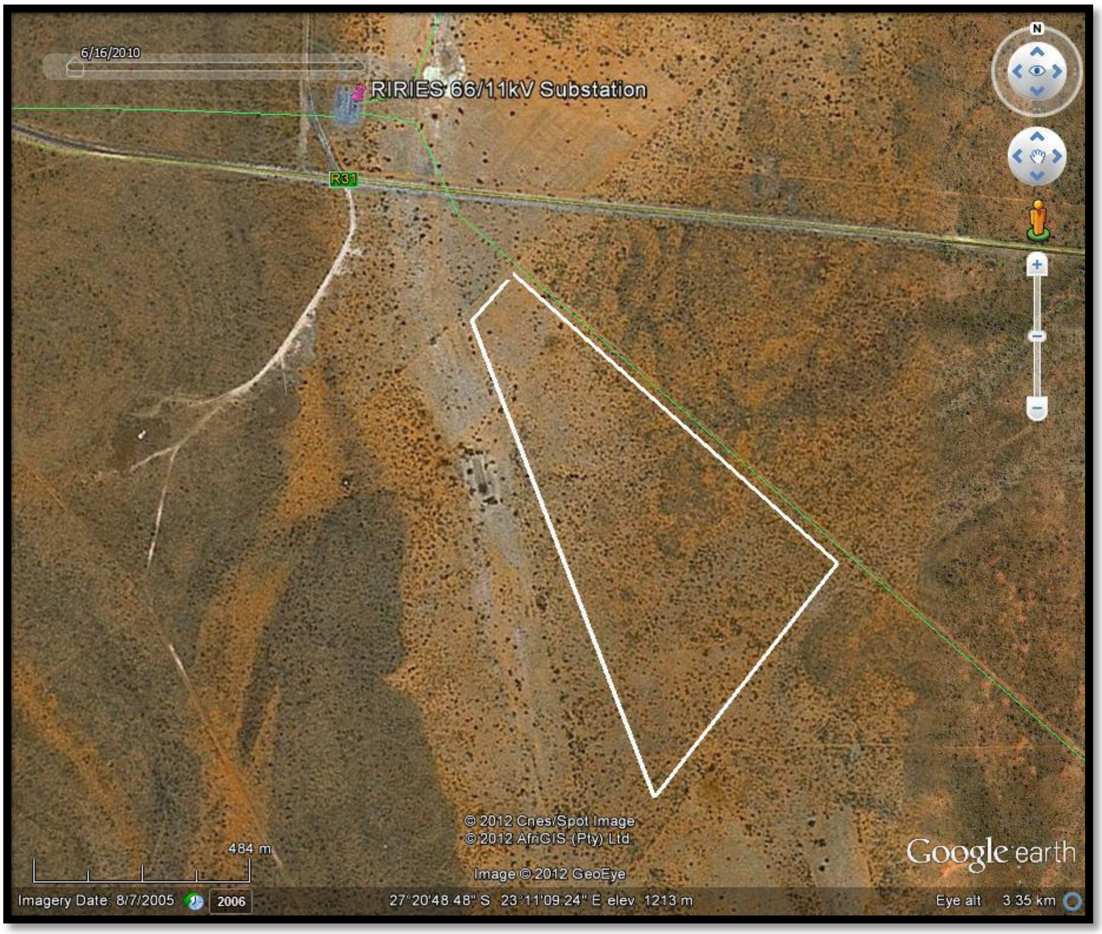


Figure 3 and Figure 4 indicates the proposed final site location.

Figure 3: Proposed final site location (showing an overlay of the proposed solar units)

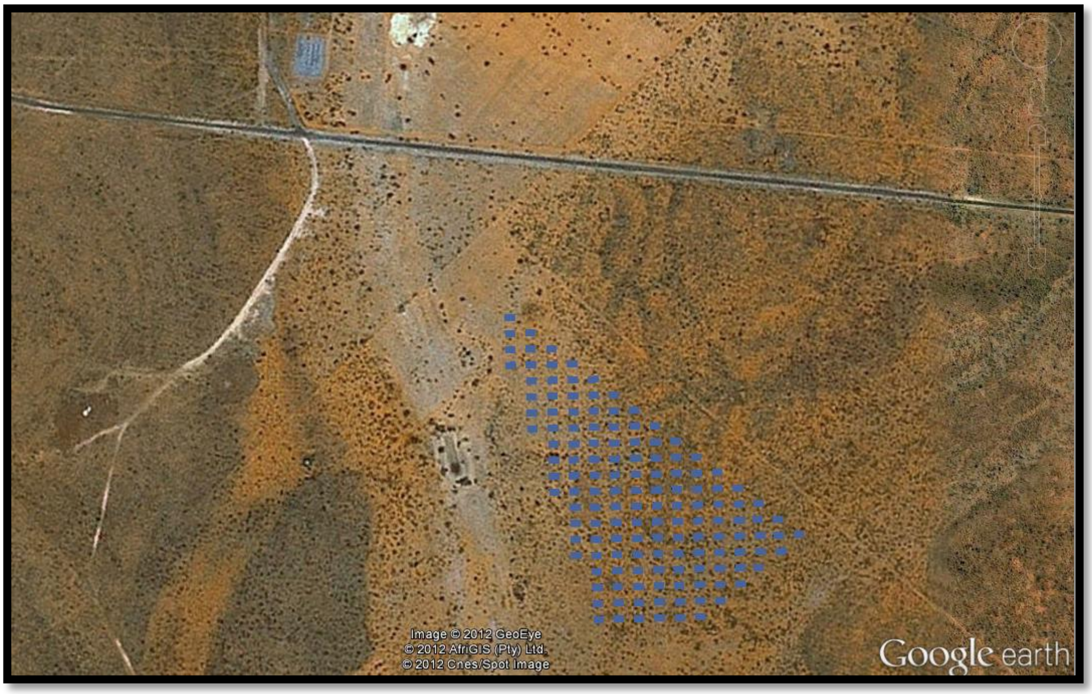


Figure 4: Final solar site location (approximately 20 ha)

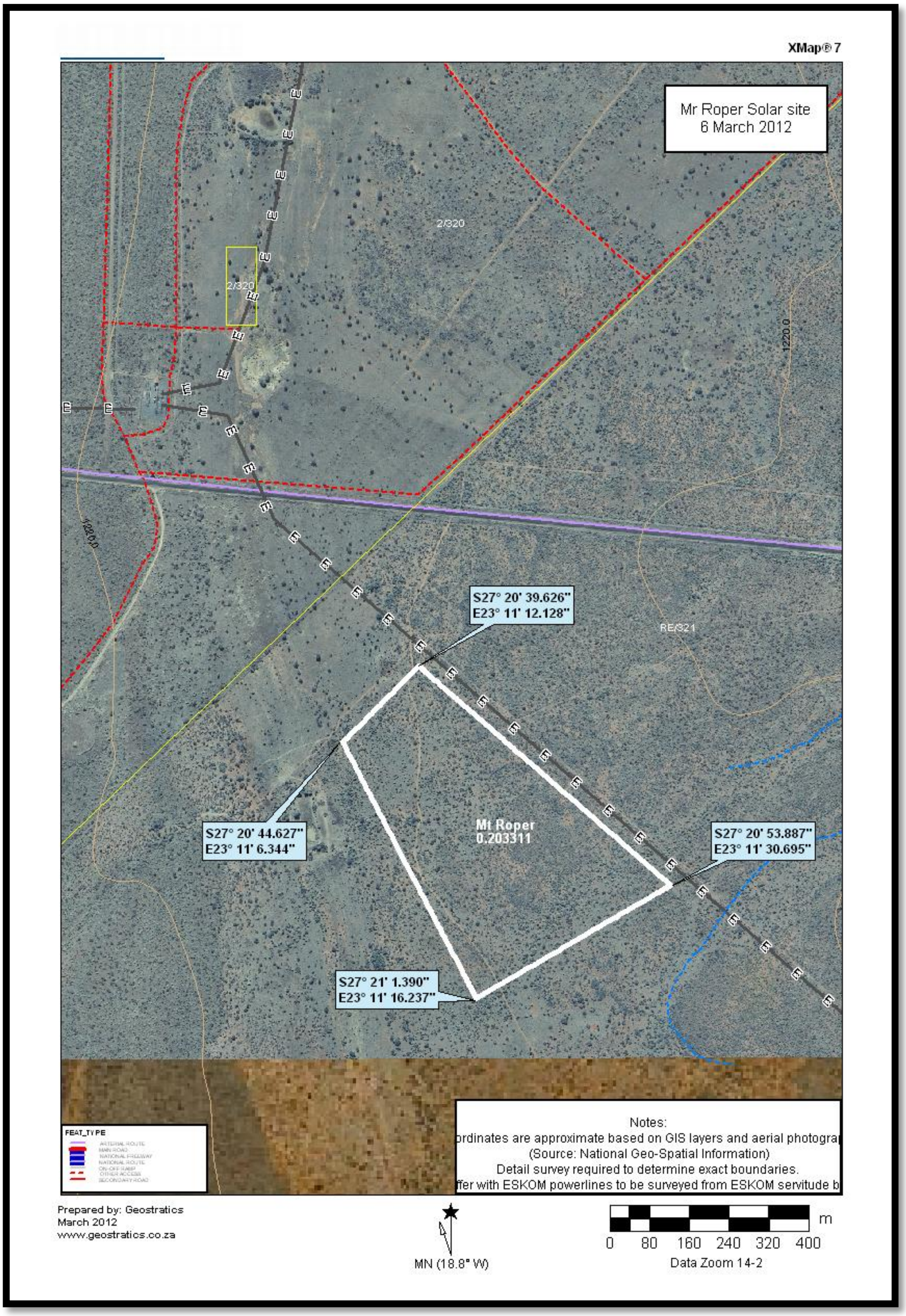


Table 1: GPS coordinates describing the boundaries of the final proposed solar site location (WGS 84 format)

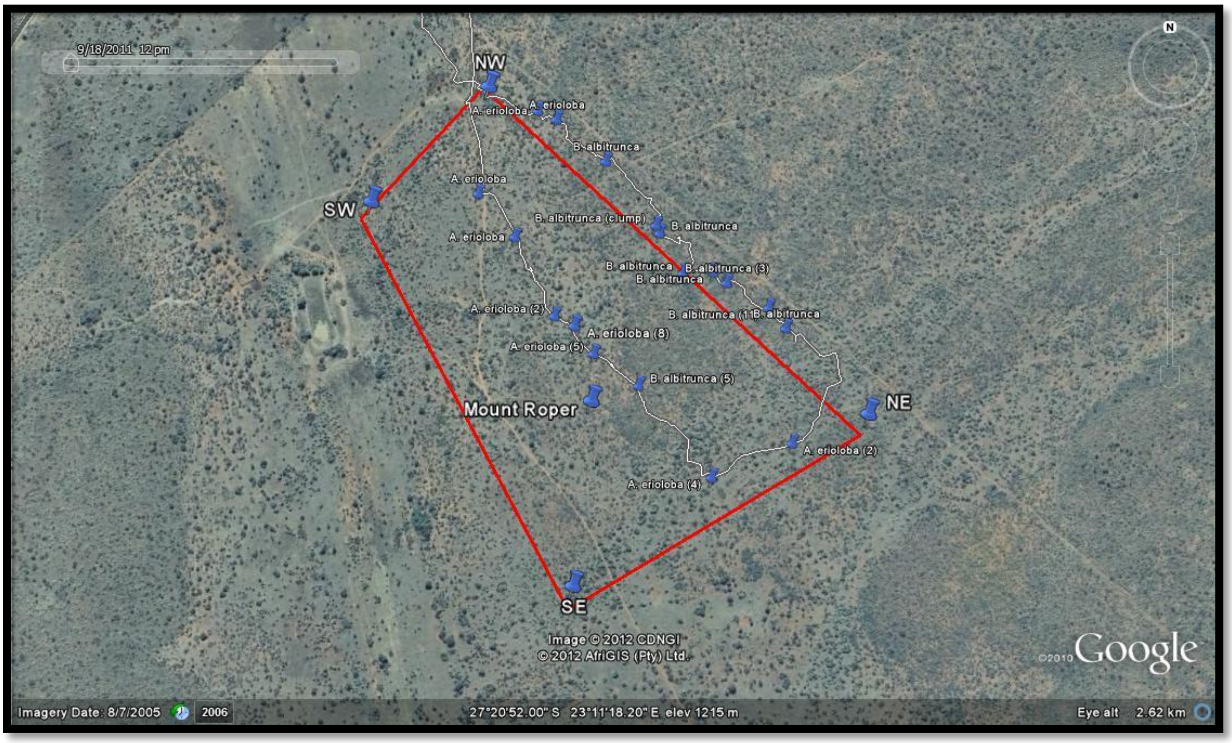
DESCRIPTION	LATITUDE AND LONGITUDE	ALTITUDE
North-west corner	S27 20 39.6 E23 11 12.1	1214 m
North-east corner	S27 20 53.9 E23 11 30.7	1218 m
South-east corner	S27 21 01.4 E23 11 16.2	1214 m
South-west corner	S27 20 44.6 E23 11 06.3	1212 m

METHODS

Various desktop studies were conducted, coupled by a physical site visit at the end of January 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 5) 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 5: A Google image showing the route (white line) that was walked as well as special features encountered



**A. erioloba = Acacia erioloba* (Camel Thorn); *B. albitrunca = Boscia albitrunca* (Sheppard's tree)

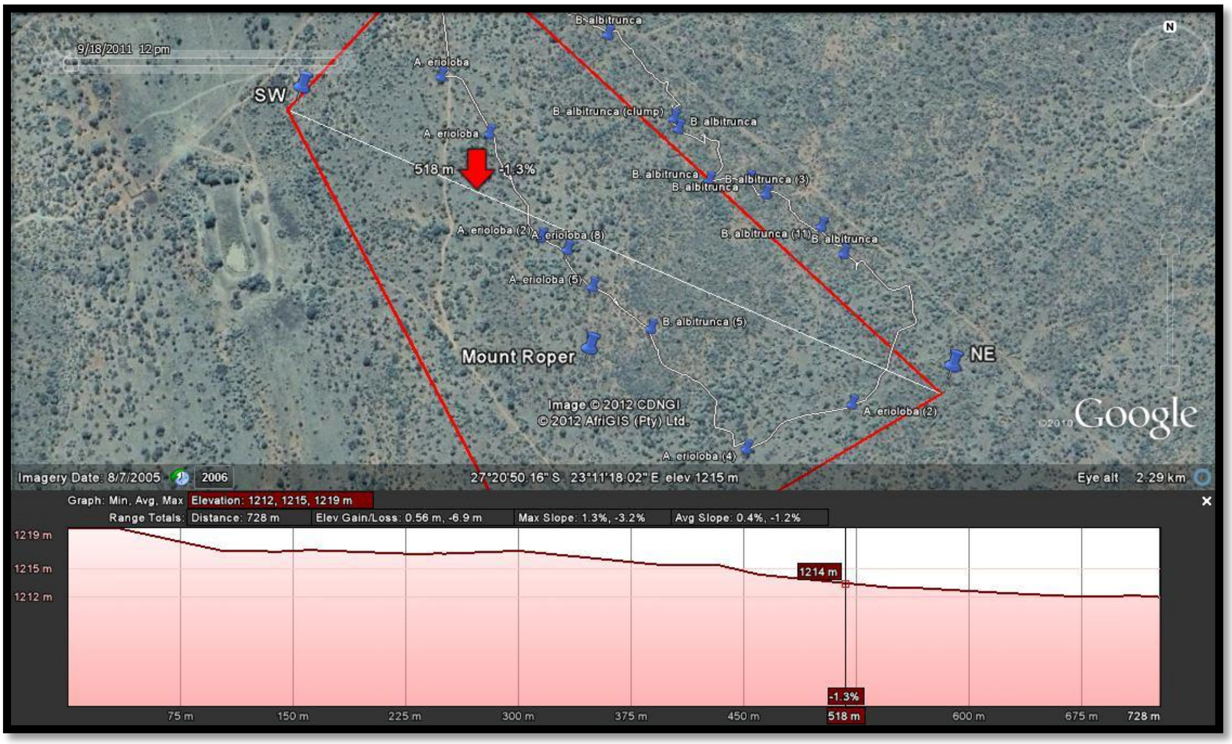
Note that the site visit was based on the original proposed site location (Refer to Figure 2). The final proposed location was situated within this broader site (Refer to Figure 5).

TOPOGRAPHY

The proposed final site is located on an almost level area at the floor of a very shallow north-south valley within the northern portion of the Kuruman hills (north- west of Kuruman). Elevation data in Table 1 and Figure 6, shows that the site slopes very slightly from the north-east towards the south-west (into the valley bottom). Elevation varies from 1218 m (north-east corner) towards the south-west at 1212 m with an average slope of 0.4% and an elevation loss of approximately 7 m.

No natural watercourses or drainage lines have been encountered on the final site location or anywhere near the final site location.

Figure 6: Google image showing the difference in elevation from the NE towards the SW corner of the proposed location



CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Kuruman normally receives about 266 mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (0 mm) in June and the highest (58 mm) in February. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Kuruman range from 17.5°C in June to 32.6°C in January. The region is the coldest during June when the mercury drops to 0°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 7 to Figure 10).

Figure 7: Kuruman average minimum and maximum temperatures (www.weather-and-climate.com)

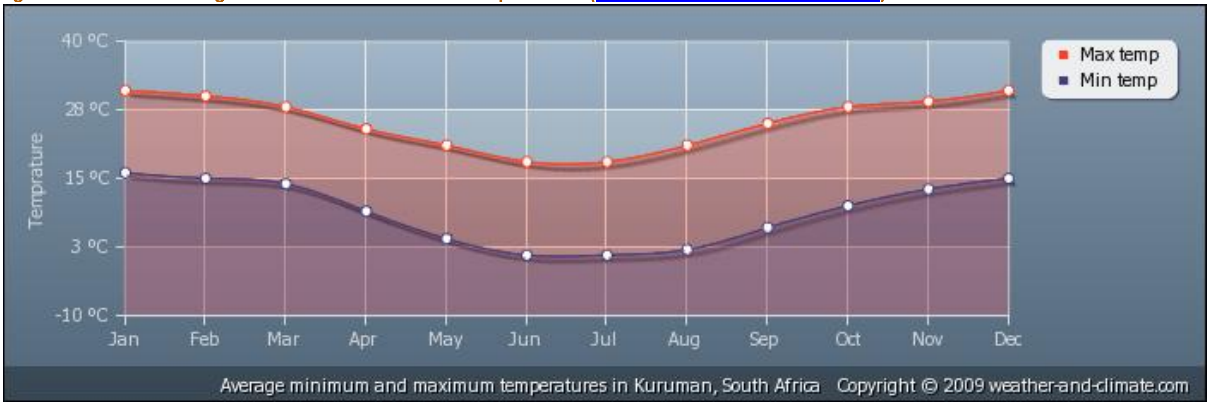


Figure 8: Kuruman average monthly precipitation over the year (www.weather-and-climate.com)

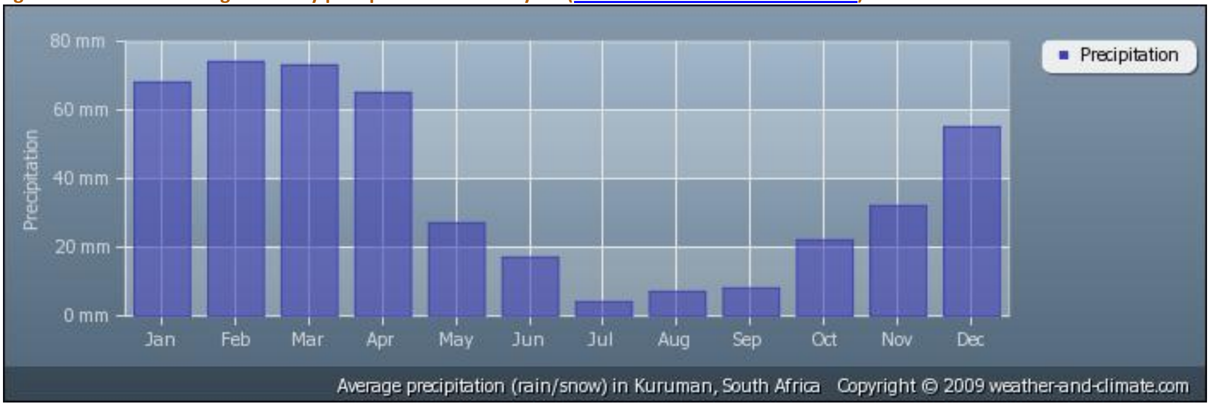


Figure 9: Kuruman average monthly hours of sunshine over the year (www.weather-and-climate.com)

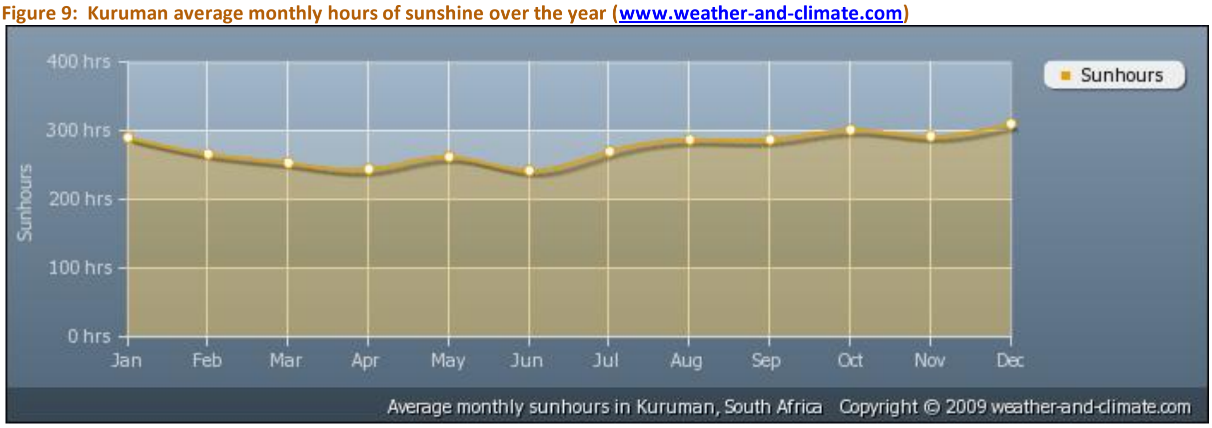
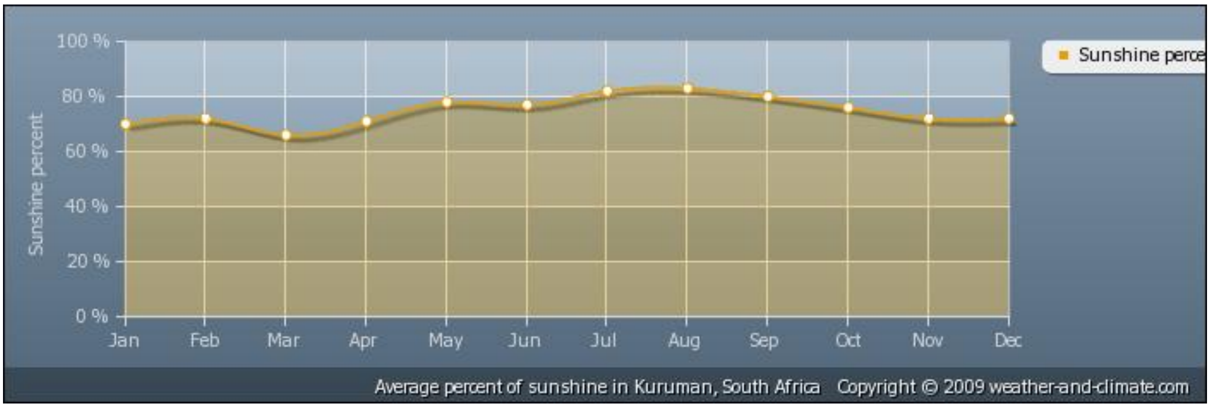


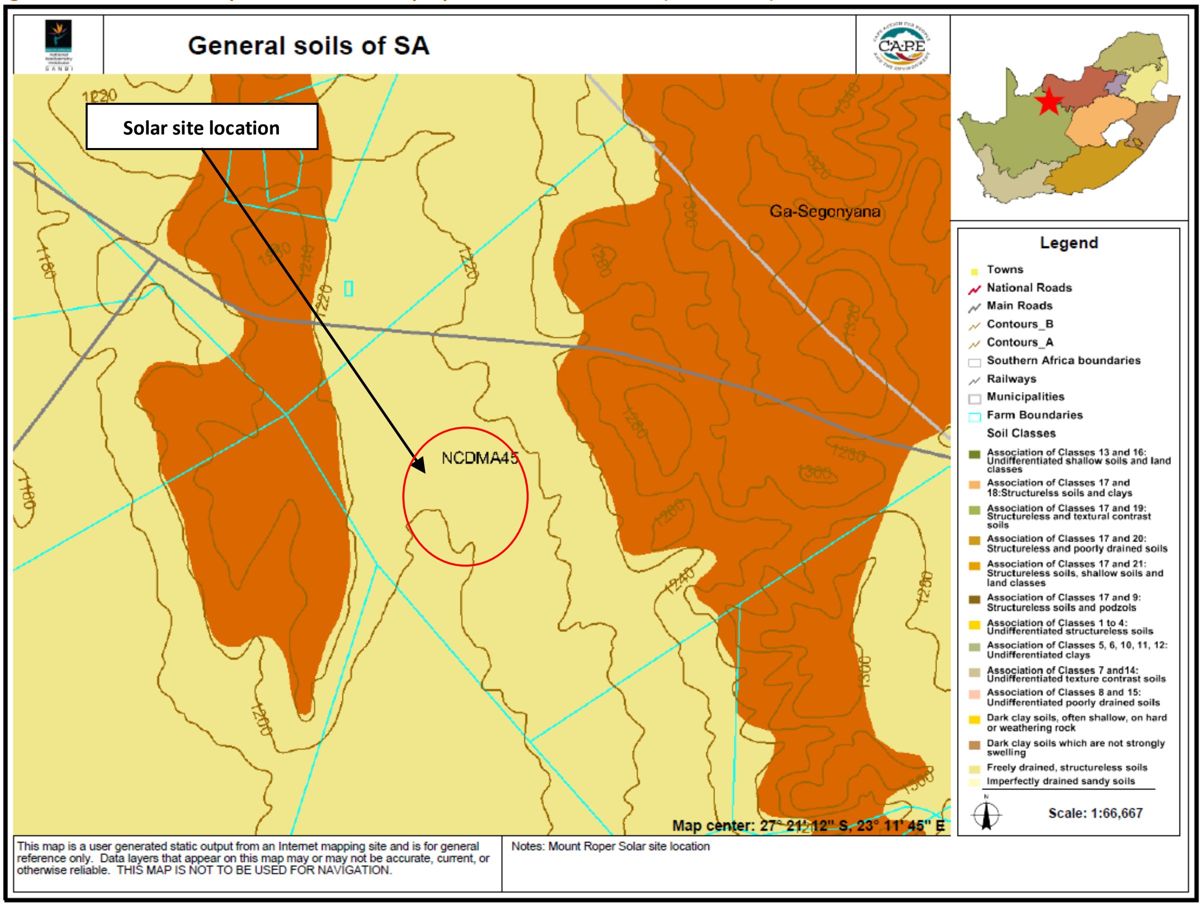
Figure 10: Kuruman average percent of sunshine over the year (mean % of sun hours during the day) (www.weather-and-climate.com)



GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology is described as some Campbell Group dolomite and chert and mostly younger, superficial Kalahari Group sediments with red wind-blown sands. Locally, rocky pavements formed in places. Soils (Refer to Figure 11) are described as red en yellow well drained structure less sandy soils with a high base status. The soils may have restricted soil depth with excessive drainage, high erodibility and low natural fertility. Land types are mainly Fc with some Ae, Ai, Ag and Ah with Hutton soil forms (Mucina & Rutherford, 2006).

Figure 11: General soil map for the area of the proposed solar site location (SANBI BGIS)



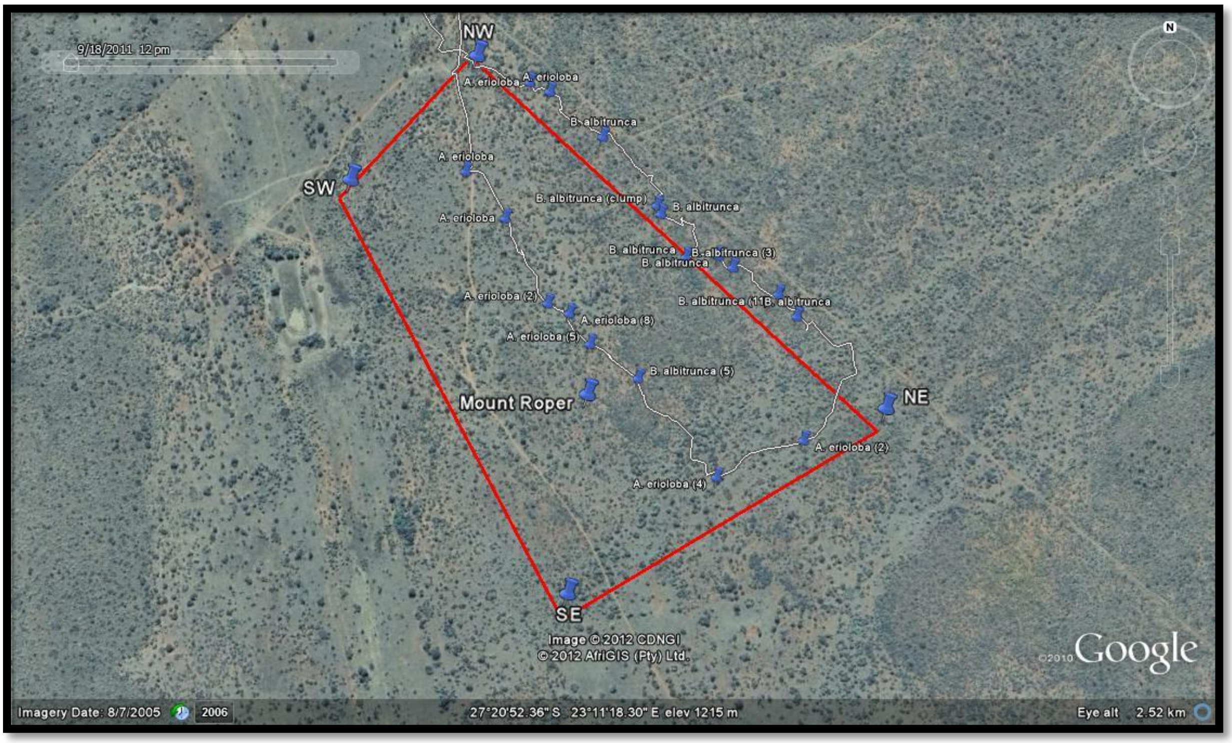
No special soils or geology features (e.g. quartz patches or broken veld), which could support special botanical features, were observed during the site visit (or are expected).

LANDUSE AND COVER

The study area is situated in a shallow north-south valley within the northern portion of the Kuruman hills (north-west of Kuruman). The property and its immediate surroundings are used primarily as a game camp. Various game species have been re-introduced to the site and have been observed (refer to Figure 12).

Natural vegetation forms a medium-dense cover over the entire property, varying in composition from pockets encroached by dense stands of *Acacia mellifera* to areas dominated by a more open woodland with *Tarchonanthus camphoratus*, *Ziziphus mucronata*, *Grewia flava* and *Acacia erioloba* forming bush patches. During the site visit the main biodiversity feature of significance observed, was the remaining natural veld (and the presence of various protected trees, *Acacia erioloba* as well as *Boscia albitrunca*). No watercourses or even drainage lines have been observed on the proposed solar site location.

Figure 12: A Google image giving an indication of the land use on the proposed solar site

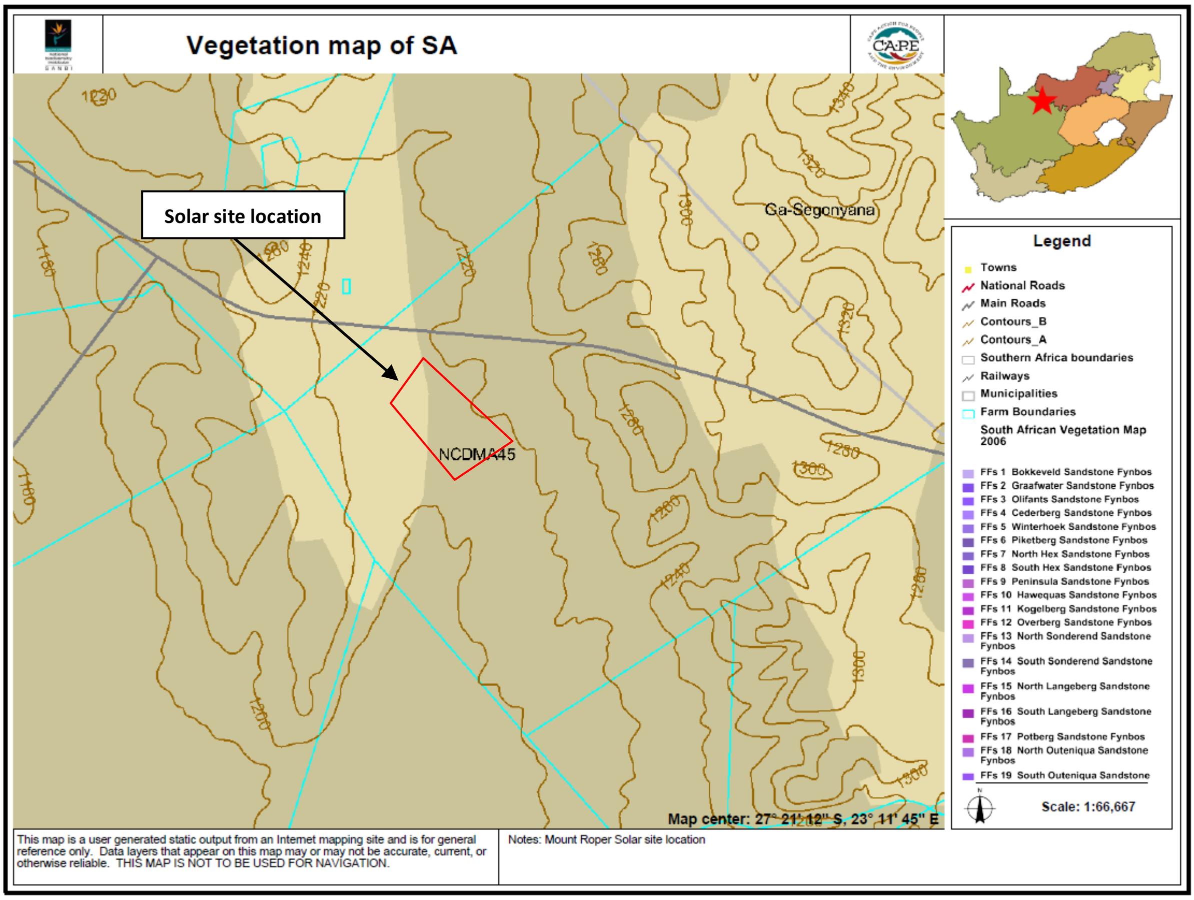


VEGETATION TYPES

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) two broad vegetation types is expected in the proposed area and its immediate vicinity, namely Kuruman Thornveld (Darker brown in Figure 13) with the possibility of Kuruman Mountain Bushveld (Lighter brown in Figure 13) to the south-east of the site. However, during the site visit it was confirmed that only Kuruman Thornveld was encountered in the larger study area and that the Kuruman Mountain Bushveld starts some distance to the south (the vegetation distribution conforming much more to that of the soil map than that of the vegetation map in this instance).

As a result only Kuruman Thornveld is discussed in this report. 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, **Kuruman Thornveld, remains classified as Least Threatened**.

Figure 13: Vegetation map of SA, Lesotho and Swaziland (2006)



According to Mucina & Rutherford (2006), Kuruman Thornveld is found in the North-West and Northern Cape Provinces on flats from the vicinity of Postmasburg and Danielskuil (here west of the Kuruman hills) in the south extending via Kuruman to Tsineng and Dewar in the North at altitudes varying from 1 100 -1 500 m.

KURUMAN THORNVELD

Kuruman Thornveld is described as occurring on flat rocky plains and slopping hills with a very well-developed, closed shrub layer and well-developed open tree stratum consisting of *Acacia erioloba* (Mucina & Rutherford, 2006) with *Tarchonanthus camphoratus* prominent in the shrub layer (Refer to Photo 1).

Acocks (1953) described this vegetation as Kalahari Thornveld and Shrub Bushveld while Low & Rebelo (1996) described this vegetation as Kalahari Plains Thorn Bushveld.

Photo 1: Natural veld in the study area, note *Tarchonanthus camphoratus* and *Acacia mellifera* in the dense shrub layer

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

Tall tree: *Acacia erioloba.*

Small trees: *Acacia mellifera* subsp. *detinens and Boscia albitrunca.*

Tall shrubs: *Grewia flava*, *Lycium hirsutum*, *Tarchonanthus camphoratus* and *Gymnosporia buxifolia*.

Low shrubs: *Acacia hebeclada, Monechma divaricatum, Gnidia polycephala, Helichrysum zeyheri, Hermannia comosa, Pentzia calcarea* and *Plinthus sericeus.*

Graminoides: *Aristida meridionalis, A. stipitata*, *Eragrostis lehmanniana*, *E. echinochloidea* and *Melinis repens*.

Herbs: *Dicoma schinzii*, *Gisekia africana*, *Harpagophytum procumbens, Indigofera daleoides*, *Limeum fenestratum*, *Nolletia ciliaris*, *Seddera capensis, Tripteris aghillana* and *Vahlia capensis*.

VEGETATION ENCOUNTERED

The vegetation encountered conforms (including that of the larger study area) to that of Kuruman Thornveld and supported a well developed woody shrub/small tree layer (varying between 1-2.5 m in height) with open grassy patches in between (probably the result of continual grazing) with occasional individuals of both *Acacia erioloba* and *Boscia albitrunca* commonly present (reaching up to 4 m in height). In fact quite a number of both *Acacia erioloba* and *Boscia albitrunca* trees were observed within the larger study area (a trend which is supported throughout most of the immediate vicinity of the proposed solar site location. In other words moving the proposed solar site location within the larger study area will not lessen the impact on these tree species. The larger study area was fairly uniformly covered by the same vegetation composition. Vegetation cover was between 60-75%.

The woody shrub/small tree layer was dominated by *Acacia mellifera* and *Tarchonanthus camphoratus* (Vaalbos) with *Acacia hebeclada*, *Ziziphus mucronata*, *Searsia dregeana*, *Grewia flava* and *Gymnosporia buxifolia* prominent. Other species encountered includes *Searsia* cf *burchelli*, *Acacia erioloba, Asparagus retrofractus*, *Asparagus capensis Boscia albitrunca* and grass species like *Schmidtia*-, *Fingerhuthia*-, *Themeda*-, *Aristida*- and *Eragrostis* species also present. (Refer to Photo 2Photo 3).

Photo 2: The vegetation encountered on the proposed solar site (note the shrub layer with *A. mellifera and T. camphoratus* prominent)

Both *Acacia erioloba* and *Boscia albitrunca* was regularly observed forming an over layer over the shrub layer (Refer to Photo 3), often encountered in clumps.

Photo 3: *Acacia erioloba* clump, commonly found within the larger area

ENDEMIC OR PROTECTED PLANT SPECIES

According to Mucina & Rutherford (2006), the only endemic taxon which might be encountered is the herb *Gnaphalium englerianum*. This Asteraceae species was not encountered during the site visit and although it might be present within the area on which the solar site is to be located it 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 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 Vaalkameeldoring	169	In bushveld, usually on deep Kalahari sand between dunes or along dry watercourses.
Boscia albitrunca	Shepherds-tree Witgat/Matopie	130	Occurs in semi-desert and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.

Photo 4: Beautiful mature *Boscia albitrunca* (Sheppard's tree) individuals encountered on site

During the site visit, a number of single trees as well as clumps of both *Acacia erioloba* and *Boscia albitrunca* were encountered distributed throughout the proposed final solar site location. All trees and clumps encountered were marked with GPS coordinates (Refer to Table 3) and plotted on a map (Refer to Figure 5). Although a large number of both species was encountered, the same hold true for the surrounding area (the remainder of the farm in the immediate vicinity).

Moving the site within this portion of the farm will not make any sense since the same pattern of distribution holds true for the immediate surroundings. In addition, moving the sites might mean that some of the watercourses (expected to the east of the proposed final location) might be impacted.

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	1	S27 20 36.1 E23 11 08.8
2.	*Acacia erioloba*	Camel thorn	1	S27 20 40.8 E23 11 14.5
3.	*Acacia erioloba*	Camel thorn	1	S27 20 41.1 E23 11 15.4
4.	*Boscia albitrunca*	Sheppard's tree	1	S27 20 43.0 E23 11 17.8
5.	*Boscia albitrunca*	Sheppard's tree	clump	S27 20 45.7 E23 11 20.3
6.	*Boscia albitrunca*	Sheppard's tree	1	S27 20 46.1 E23 11 20.4
7.	*Boscia albitrunca*	Sheppard's tree	1	S27 20 47.8 E23 11 21.6
8.	*Boscia albitrunca*	Sheppard's tree	1	S27 20 47.8 E23 11 23.1
9.	*Boscia albitrunca*	Sheppard's tree	3	S27 20 48.2 E23 11 23.7
10.	*Boscia albitrunca*	Sheppard's tree	11	S27 20 49.3 E23 11 25.8
11.	*Boscia albitrunca*	Sheppard's tree	1	S27 20 50.2 E23 11 26.6
12.	*Acacia erioloba*	Camel thorn	2	S27 20 55.2 E23 11 26.9
13.	*Acacia erioloba*	Camel thorn	4	S27 20 56.7 E23 11 23.0
14.	*Boscia albitrunca*	Sheppard's tree	5	S27 20 52.7 E23 11 19.4
15.	*Acacia erioloba*	Camel thorn	5	S27 20 51.3 E23 11 17.2
16.	*Acacia erioloba*	Camel thorn	8	S27 20 50.1 E23 11 16.3
17.	*Acacia erioloba*	Camel thorn	2	S27 20 49.7 E23 11 15.3
18.	*Acacia erioloba*	Camel thorn	1	S27 20 46.2 E23 11 13.4
19.	*Acacia erioloba*	Camel thorn	1	S27 20 44.3 E23 11 11.6

MAMMAL AND BIRD SPECIES

The farm is managed as a game camp and it is clear that the property still supports a number of game species, birds and other fauna. It was noted that the area in which the final proposed site is to be located seems to have be heavily grazed over a long period of time. However, viewed in the larger context of the game reserve, the 20 ha solar facility will not pose a significant loss of grazing and the proposed solar site facility is not expected to have a major impact on regional biodiversity and with mitigating and good environmental control during construction the impact could be minimised.

According to the Sanparks website (www.sanparks.org.za/parks/mokala), 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 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 watercourses or even drainage lines was observed, or are expected, on the proposed final solar site location. Towards the east and south-east of the site drainage lines and or watercourses are, however, expected.

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 (apart from some bush encroachment by the indigenous *Acacia mellifera*).

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, Mount Roper and their possible significance

BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
Geology & soils	The soils are mostly similar throughout the study area, although varying in depth.	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, used for game grazing.	The property is used as a game camp.
Vegetation types	Kuruman Thornveld.	Kuruman Thornveld 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 *Boscia albitrunca* was observed (Refer to Table 3).	The same species composition is shown throughout the larger study area and its immediate surroundings. Moving the proposed location will not alter the fact that some of these trees will be impacted. However, with good environmental control the impact could be minimised.
Mammal or bird species	The farm is used as a game camp with various game species as well as bird and smaller species present.	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 or drainage lines were observed on the site.	No impact.
Invasive alien infestation	No alien invasive trees were observed.	No impact.

In summary, all 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, although the placement of a 20 ha solar site will have an impact on a number of protected trees (both *Acacia erioloba* and *Boscia albitrunca*) the proposed location is not expected to have significant impact on any biodiversity feature or put pressure on regional conservation targets. The impact on populations of individual species is regarded as medium-low, the impact on sensitive habitats is regarded as medium-low, the impact on ecosystem function is regarded as very low, cumulative impact on ecology is regarded as medium-low and finally the impact on economic use of the vegetation is regarded as medium-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 vegetation type 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 (associated with the final proposed solar site location). 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 Kuruman Thornveld (Refer to Figure 13). 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, **Kuruman Thornveld, remains classified as Least Threatened**.

The proposed location will impact on a number of protected trees, but the impact on threatened or protected ecosystems is regarded as being low. Good environmental control during the construction phase can ensure further mitigation.

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. In addition, by placing the proposed final site location away from the watercourse the impact is further reduced.

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

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 road networks).

Since large areas with good connectivity remains and the site is located away from the watercourse, the 20 ha Mount Roper 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 at the end of February (2012). At the time of the study the veld in the Mount Roper area was generally in very good condition and most of the species was visible/identifiable. The author is of the opinion that in the larger context almost all significant species were observed and mapped.

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 almost be 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 both *Acacia erioloba* (Camel thorn) and *Boscia albitrunca* (Witgat) was observed on the larger property. (All of the trees observed were referenced by GPS and are indicated on Figure 5 and in Table 3). A number of these trees will be impacted by the development.

Acacia erioloba is normally associated with deeper soils. Most of the Acacia erioloba as well as the Boscia albitrunca encountered were registered just north of the proposed site, but a significant number of both these species was observed within the proposed final site location. These trees will most likely be permanently compromised in most cases. It was also noted that this distribution pattern for both these tree species holds true for most of the immediate surroundings (thus changing the location of the site slightly will not necessarily improve the outcome). However, though Acacia erioloba is an important species within Kuruman Thornveld, the number of individuals found on the proposed site would most probably not significantly impact on the gene-pool of this species should it be lost. Still it is important that if this development is approved good environmental control should be exercised and that a botanist or an ECO with suitable experience should be appointed during the initial lay-out of the site. Smaller trees should be rescued where possible while pylon placement should consider clumps of these trees. With good environmental control and careful placement of the solar pylons and the maintenance roads the impact to the trees within the final site location can be greatly reduced or minimised.

The severity of the impact might then be rated as medium to medium-low.

Mitigation:

- A botanist or suitably experienced ECO must be appointed to oversee the initial layout of the construction site, with the aim to identify and minimise the impact on healthy individuals of the above protected trees. Wherever possible the placement of roads and solar structures should endeavour to avoid any of the protected tree species.
- In the case that some of these trees must be removed, permit approval must be obtained beforehand.
- It is also proposed that at least two plants of the same species be replanted for every single tree removed.

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 (Refer to Photo 5). 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 5: 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 22).
- Loss of local biodiversity and threatened plant species (Refer to page 22)
- Loss of ecosystem connectivity (Refer to page 23)

LOSS OF VEGETATION AND ASSOCIATED HABITAT

One broad vegetation type is expected in the study area, namely Kuruman Thornveld (Refer to Vegetation encountered on page 14). Kuruman Thornveld 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 Kuruman Thornveld 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 <u>medium-low</u> 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.

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

- Refer to the mitigation actions under the heading: Protected species (page 24).
- 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. Kuruman Thornveld 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 Kuruman Thornveld 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 4 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. However, a number of protected tree species will not be harmed.

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, however, a number of protected tree species will be conserved. 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 <u>without any mitigation measures</u>. 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.

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

S = [(2 + 1.5 + 2 + 1 + 2) x (1 + 1 +1 + 1 +1) x 0.95] = 40 %

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 <u>with all proposed mitigation measures implemented</u>. 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.

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

S = [(2 + 1.5 + 2 + 1 + 2) x (0 + 1 +0 + 1 +0) x 0.95] = 16 %

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 Mount Roper 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 6: Magnificent *Acacia erioloba* tree on site

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, however, a number of protected tree species will be conserved. 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.

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 and that a botanist or suitably qualified ECO be appointed during the initial layout of the structures in order to minimise the impact on the protected tree species.

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

- Only existing access roads should be used for access to the terrain (solar site).
- A botanist or suitably experienced ECO must be appointed to oversee the initial layout of the construction site, with the aim to identify and minimise the impact on healthy individuals of the above protected trees. Wherever possible the placement of roads and solar structures should endeavour to avoid any of the protected tree species.
- Any significant plant species that may be encountered must be identified and located (e.g. *Acacia erioloba* and *Boscia albitrunca*) and all efforts made to avoid damage to such species.
- In the case that some of these trees must be removed, permit approval must be obtained beforehand.
- It is also proposed that at least two plants of the same species be replanted for every single tree removed.
- 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.