Botanical Assessment for a proposed solar energy plant at Klipgats Pan near Copperton, Northern Cape

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Prepared for Aurecon SA (Pty) Ltd

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National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2010.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by Aurecon South Africa (Pty) Ltd to provide specialist botanical consulting services for the Environmental Impact Assessment for the proposed Klipgats Pan Solar Energy Plant near Copperton in the Northern Cape Province. The consulting services comprise an assessment of potential impacts on the flora and vegetation in the designated study area by the proposed project.

Details of Specialist

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 30 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 300 specialist botanical / ecological studies.
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the survey was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation

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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Klipgats Pan Solar Energy Plant at Copperton, Northern Cape

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4.2 The specialist appointed in terms of the Regulations_

I, **David Jury McDonald** , declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Bergwind Botanical Surveys and Tours CC.

Name of company (if applicable):

3 February 2012

Date:

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1. Introduction

Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed by Mulilo Renewable Energy (Pty) Ltd (the applicant) to conduct the environmental assessment process for a proposed solar energy plant on the farm Klipgats Pan (Portion 4 of Farm 117), near Copperton in the Northern Cape. The study is conducted in terms of the National Environmental Management Act (No.7 of 1998) as amended. Bergwind Botanical Surveys & Tours CC was appointed by Aurecon on behalf of the applicant, to carry out a botanical assessment of the designated property to support the environmental impact assessment process. The purpose of the botanical impact assessment is to inform the environmental assessment on (a) the suitability of the site from a botanical viewpoint and (b) to determine any constraints that should be implemented to conserve the vegetation and flora (sensitivity analysis) while permitting the development to continue.

The solar energy plant preferred alternative (Alternative 1) would be a 100 MW (300 ha footprint) array of solar panels located north of the R357. A second alternative (Alternative 2) would also be 100 MW (300 ha) but would be located south of the R357. The intention would be to link the solar energy plant to the national grid at the Kronos Sub-station by a new 132 kV distribution line. The location of the solar panel array and supporting infrastructure is assessed as to their potential impact on natural vegetation. The impacts on the vegetation of the proposed layout of solar panels, access roads and distribution lines are discussed below.

The principles, guidelines and recommendations of CapeNature [Western Cape] (although the study is in the Northern Cape) and the Botanical Society of South Africa for proactive assessment of the biodiversity of proposed development sites are followed (Brownlie 2005, De Villiers *et al*. 2005).

2. Terms of Reference

- Gather information on the botanical status of the project area through a review of existing and available information;
- Provide a broad description of the botanical characteristics of the site and surrounds;
- Identify and describe biodiversity patterns at community and ecosystem level (main vegetation type, plant communities in vicinity and threatened/ vulnerable ecosystems species), at species level (Red Data Book species, presence of alien species) and in terms of significant landscape features;
- Compile an assessment of the potential direct and indirect and cumulative impacts resulting from the proposed development (including the solar (PV) panels, associated

infrastructure e.g. access roads), both on the footprint and the immediate surrounding area during construction and operation;

- Comment on whether or not biodiversity processes would be affected by the proposed project, and if so, how these would be affected;
- Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and improve positive impacts for each phase of the project, where required; and
- Cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005) as well as the requirements of the Botanical Society of South Africa (BotSoc) and CapeNature in developing an approach to the botanical investigation.

Figure 1. Location of Copperton (black dot) in the Northern Cape Province.

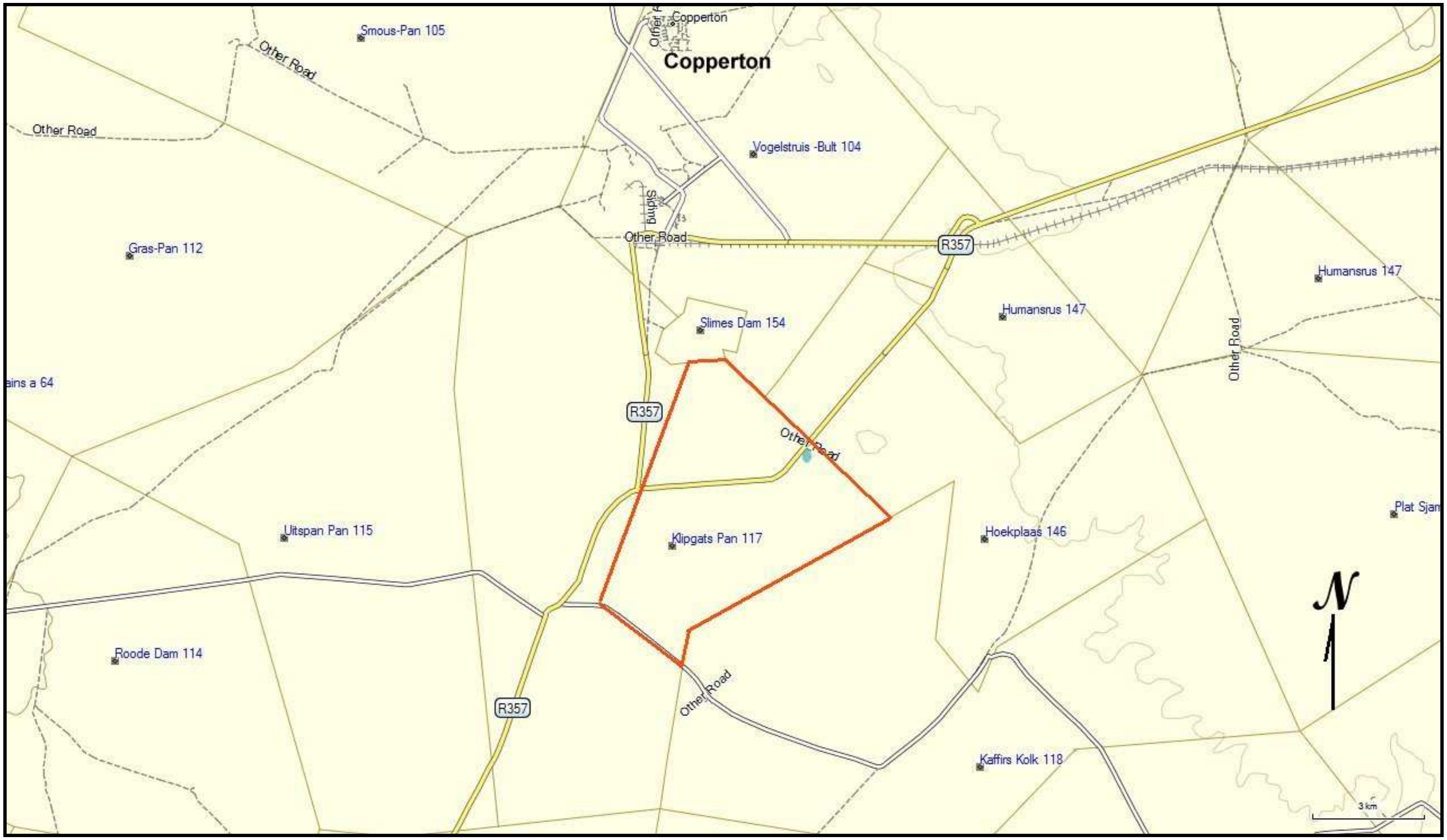


Figure 2. Topographic map of the study site at Klipgats Pan (Welverdiend Farm) - red boundary. Note the low relief.

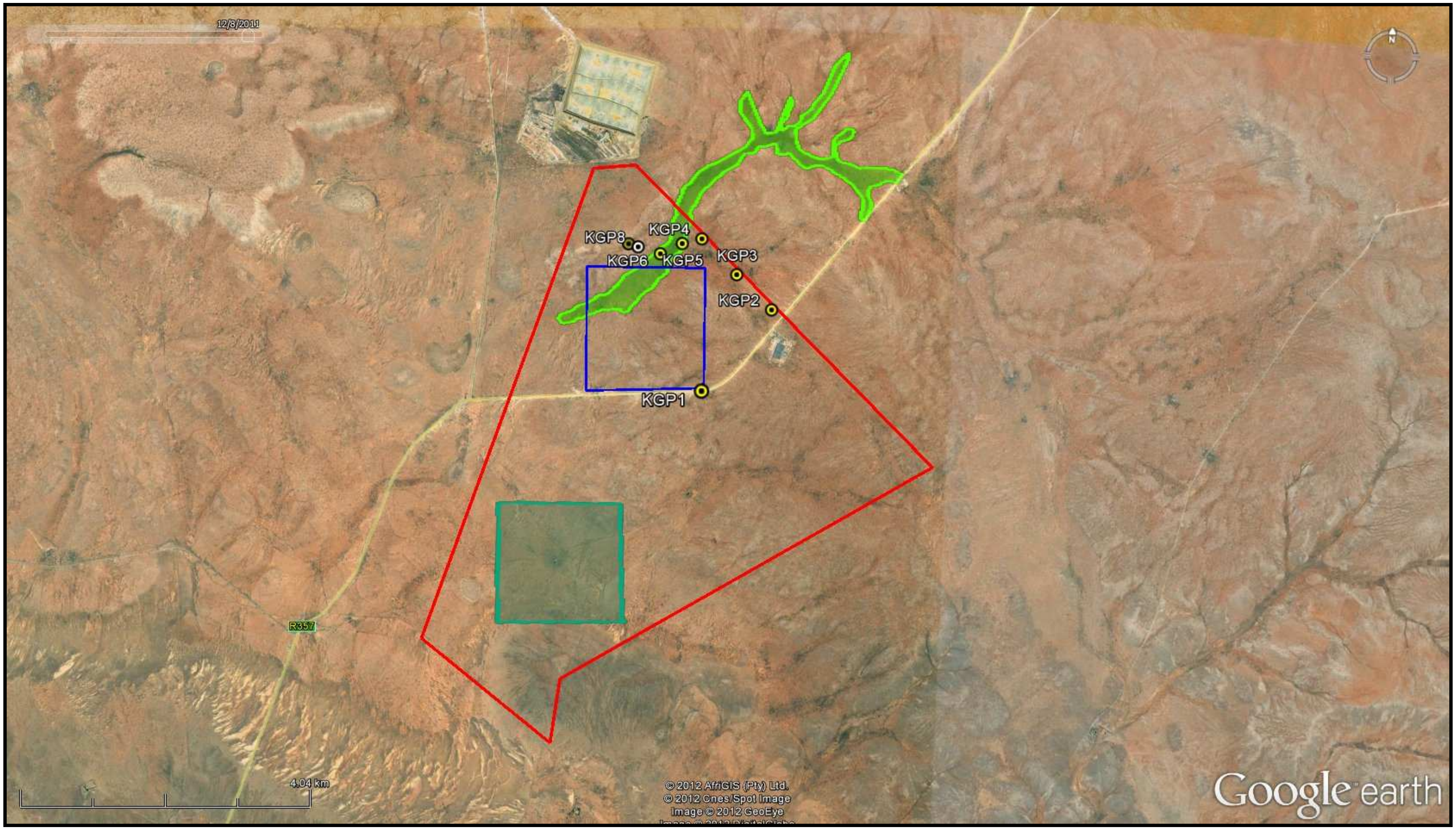


Figure 3. Aerial image (Google Earth ™) of the study area (red boundary). The botanical sample waypoints are shown as KPG# with yellow dots. The dark blue outline.is the proposed PV array (preferred alternative), the green square is the second alternative layout (not preferred). The bright green area is a seasonal watercourse that is botanically and ecologically sensitive.

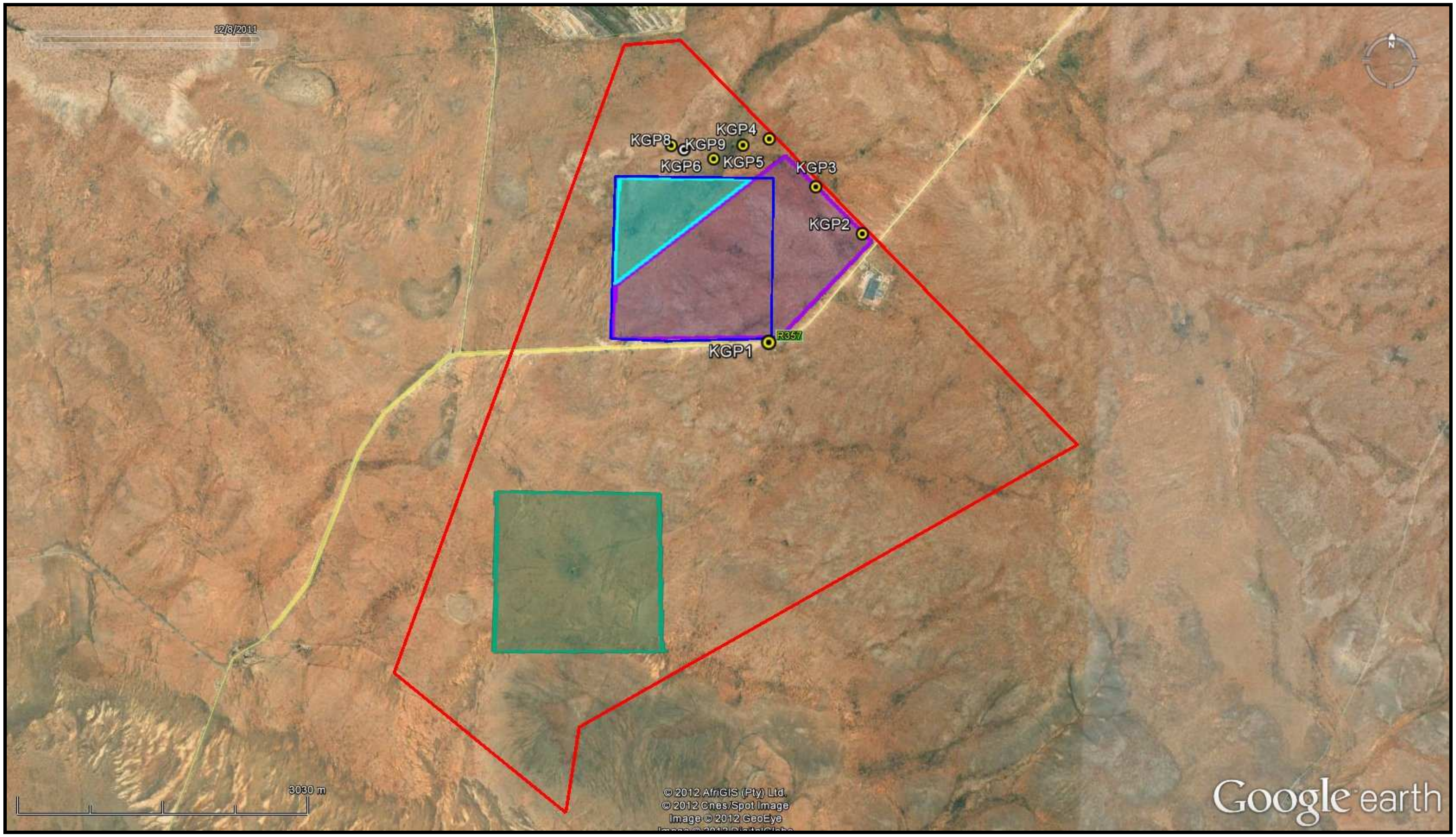


Figure 4. Aerial image (Google Earth ™) of the study area (red boundary). The botanical sample waypoints are shown as KPG# with yellow dots. The dark blue outline.is the proposed PV array (preferred alternative), the green square is the second alternative layout (not preferred). The light blue area is botanically and ecologically sensitive. The purple area is a suggested alternative that avoids the sensitive area.

3. Study Area

3.1 Locality

Historically Copperton in the Northern Cape, which lies 45 km south-west of Prieska, was a thriving mining town associated with the Prieska Copper Mine. Once the mine had reached the end of its viable existence, it was closed and now Copperton has reduced considerably in size. However, associated with the former mine is a well-developed electrical power infrastructure in the form of Cuprum and Kronos Sub-stations. The high insolation experienced around Copperton makes it ideal for the establishment of solar energy which can generate power that can be channeled into the national grid via the abovementioned sub-stations. The farm Klipgats Pan (Portion 4 of Farm 117 – known as Welverdiend) has been earmarked by Mulilo Renewable Energy as a suitable area for a solar energy plant. The study area, referred to further as Klipgats Pan, is located approximately 13 km directly south of Copperton. Its short north boundary is at the old mine slimes dam and the farm is roughly triangular (Figure 2—4). The R357 cuts through the farm from east to west and the two parts of the farm are referred to as the north and south parts respectively. The farm covers an area of 2 679 ha.

The study area falls within the Nama Karoo Biome which covers a large part of the Northern Cape Province. Klipgats Pan is within the Bushmanland Bioregion which extends from the eastern part of Namaqualand in the west to near Prieska in the east and from Upington in the north to the Brandlvlei / Sak River area in the south (Rutherford, Mucina & Powrie, 2006).

3.2 Topography and geology

Klipgats Pan has very low relief as shown in the topographic map (Figure 2). It is slightly higher in the west of the north part where a low rise of calcrete forms a band that impedes drainage. A drainage system arises on the neighbouring farms, Struisbult and Hoekplaas, to the north-east and east. The drainage is onto Klipgats Pan in the form of a wide and shallow seasonal drainage line that runs southwestwards through the centre of the northern part of the farm.

Most of the southern part of Klipgats Pan has low undulating relief with no distinct drainage lines. The terrain rises slightly in the south where low hills are found (Figures 3 & 4).

The land-type is classified as the Ah93-type (Figure 5) which consists of flats with a few rises (Land Type Survey Staff, 1972—2006; MacVicar *et al.* 1974) and some shallow drainage lines.

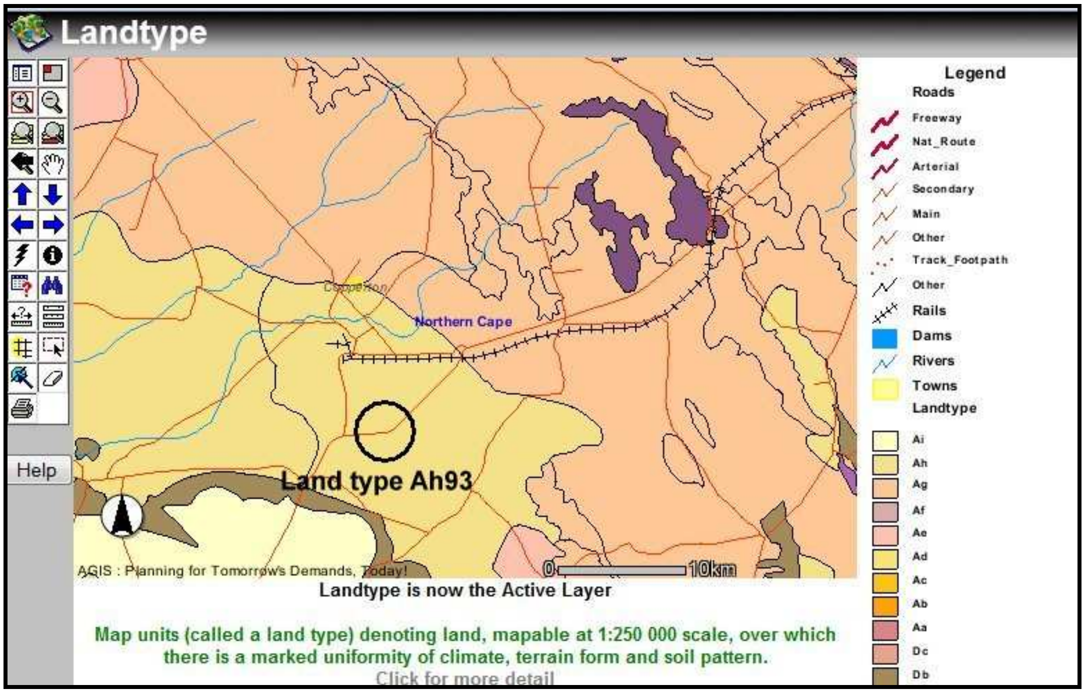
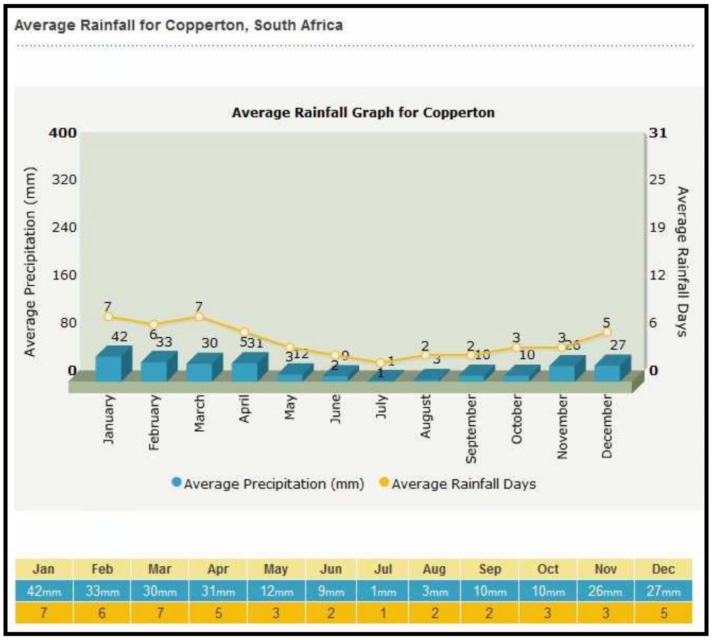


Figure 5. Land-type map for the Copperton area, N. Cape with the Ah93 land-type found in the study area (from http://www.agis.agric.za/agisweb/viewer.htm?pn=2015)

The geology of the Copperton area is complex with the Copperton Formation comprising three members: Vogelstruisbult Member, Prieska Copper Mines Member and Smouspan Member. These rocks are of volcanic origin and comprise various gneiss and amphibolite complexes (Cornell *et al*. 2006). On the surface alluvial material and calcrete (Quaternary deposits) as well as red sand of the Kalahari Group (Mucina *et al.* 2006; Partridge, Botha & Haddon, 2006) are found. It is the superficial sediments that influence the vegetation. The soils are classified as red and yellow, feely drained apedal soil with a high base status and usually <15 % clay (Land Type Survey Staff 1972—2006). Over large areas the soil-surface is scattered with pebbles and small boulders.

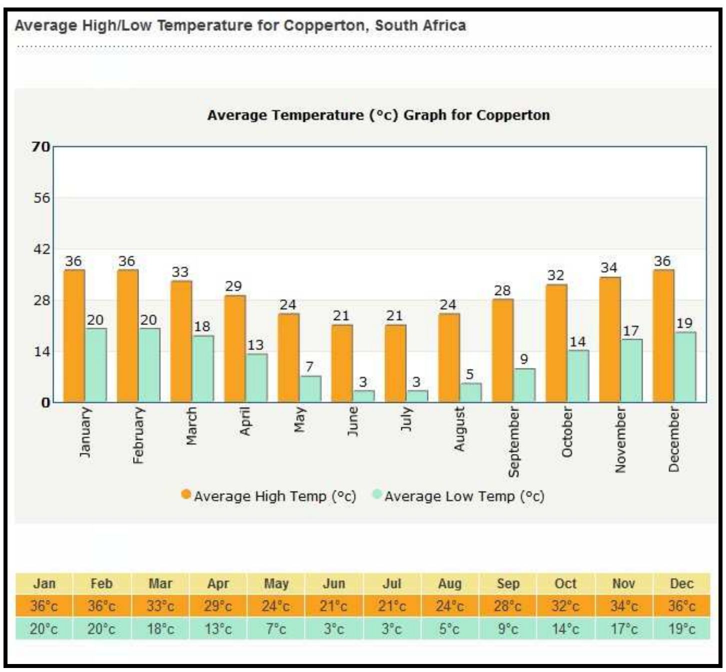
3.3 Climate

The climate of the study area is classified as ‘arid’ with mean annual precipitation of around 200 mm. Rain occurs mainly from late summer to autumn (January to April). The winter to spring months (May to October) are generally dry (Figure 6). Daytime temperatures regularly exceed 30℃ in the summer whereas in the winter day time temperatures are usually in the mid 20℃ range (Figure 7). Winds can be strong with whirlwinds occurring in summer due to thermal convection. Frost occurs up to 35 days a year. A climate diagram for Bushmanland Basin Shrubland (Figure 8--from Mucina *et al.* 2006) represents the typical climate found in the study area.



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
42mm	33mm	30mm	31mm	12mm	9mm	1mm	3mm	10mm	10mm	26mm	27mm
7	6	7	5	3	2	1	2	2	3	3	5

Figure 6. Rainfall for Copperton (http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Copperton/2611549/info.aspx)



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
36°c	36°c	33°c	29°c	24°c	21°c	21°c	24°c	28°c	32°c	34°c	36°c
20°c	20°c	18°c	13°c	7°c	3°c	3°c	5°c	9°c	14°c	17°c	19°c

Figure 7. Temperatures for Copperton http://www.worldweatheronline.com/weather-averages/South-Africa/2610093/Copperton/2611549/info.aspx)

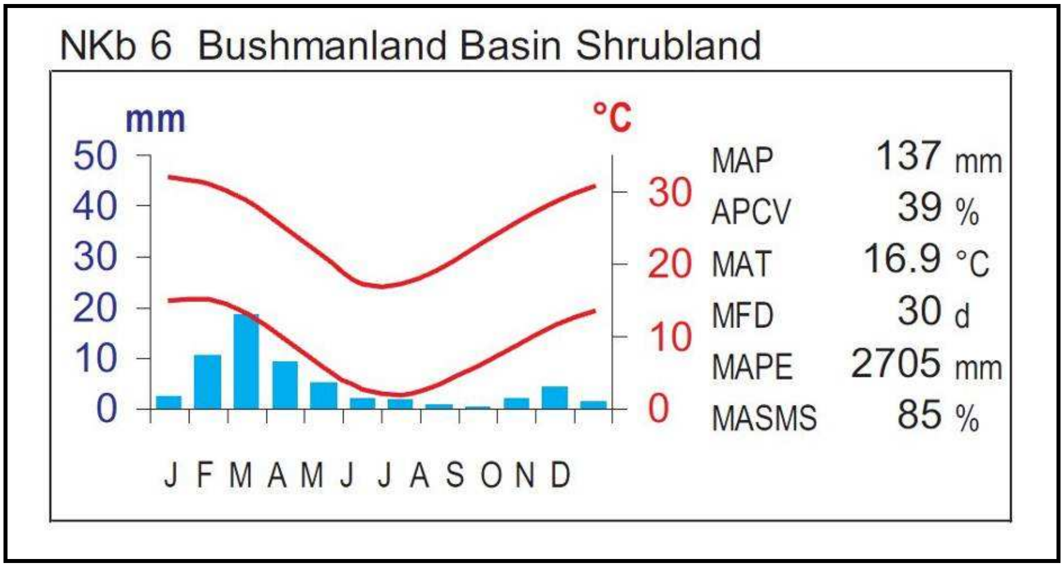


Figure 8. Climate diagram for Bushmanland Basin Shrubland (from Mucina *et al.,* 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress

4. Methodology

The study area was visited on 24 November 2011. The site was traversed by vehicle and on foot. A hand-held Garmin ® GPSMap 62S was used to track the route and record waypoints. Observations were made at nine waypoints and recorded with a photographic record of the vegetation and selected plant species. As is standard practice, particular attention was given to the possibility of finding endemic and 'Red List' species. Focus was placed on the area of the proposed solar PV array (preferred location). The south part of the farm was not visited but it can be stated with confidence that it is the same vegetation, Bushmanland Basin Shrubland, as found on the neighbouring farm, Hoekplaas and over a large part of the north section of Klipgats Pan.

Aerial photography, mainly from Google Earth ©, was used to assist with interpretation of the landscape and the distribution of plant communities and vegetation types.

The impact assessment methodology applied is given in Appendix 1.

5. Limitations and Assumptions

The study area was extremely dry at the time of the field visit. The result was that many of the plants were not in optimal condition. This was a distinct limitation but nevertheless an adequate level of identification to genus level was achieved, with a reasonable number of species identified. Some species were undoubtedly missed due to their absence in the dry conditions. The grasses were particularly dry and this limited the accuracy of identification.

6. Disturbance regime

The principle agricultural activity on Klipgats Pan is sheep-farming. Despite the very dry conditions the vegetation (veld) was in fair condition at the time of sampling with only certain areas such as at watering points more heavily trampled than elsewhere. This, however, has little bearing on the proposed solar energy project.

The concentration of stock at watering points has encouraged the alien invasive tree *Prosopis glandulosa* (mesquite) to become established (see Figure 10).

7. The Vegetation

7.1 The vegetation in context

According to the national classification of the vegetation of South Africa (Mucina *et al.* 2006 in Mucina & Rutherford, 2006) the natural vegetation found in the study area is mainly Bushmanland Basin Shrubland (NKb6). The wide watercourse that is found in the northern part of Klipgat Pan has vegetation that is similar to Bushmanland Vloere (AZi5) (Figure 9). However, it is not separated as a distinct type in this study, since the physiognomy and species composition were not close enough to Bushmanland Vloere vegetation. It is therefore retained as part of the Bushmanland Basin Shrubland. More detailed plant species information collected during the growing season would be required to make fine distinctions between the different plant communities.

7.2 Conservation status

The Bushmanland Basin Shrubland found at Klipgats Pan, and more specifically in the tow alternative areas proposed for the PV installation, occurs over extensive areas in the Northern Cape Province. Although there are few statutory conservation areas in this type, it forms agricultural rangelands and is conserved for its grazing potential. According to the National Spatial Biodiversity Assessment (Rouget *et al.* 2004) this vegetation type is classified as **Least Threatened**. It is not listed in the recently gazetted National List of Threatened Terrestrial Ecosystems (Government Gazette No. 34809. 2011). However, even though a vegetation type may be rated as Least Threatened it is still important to observe caution when developing an area where undisturbed vegetation occurs. No unnecessary disturbance should be permitted.

No rare plant species or plant species of special concern were found during the present survey. Some endemic species may occur but the very dry condition of the vegetation at the time of the survey made a comprehensive survey impossible. Anderson (2010) found three protected species in a survey of Portion 1 of Farm Vogelstruisbult 104 northeast of Klipgats Pan. These species, *Avonia albissima*, *Lithops hallii* and *Ruschia spinosa* may occur at Klipgats Pan but if so would most likely be in the northwest sector on the calcrete ridges within the light-blue area indicated on the map in Figure 4.

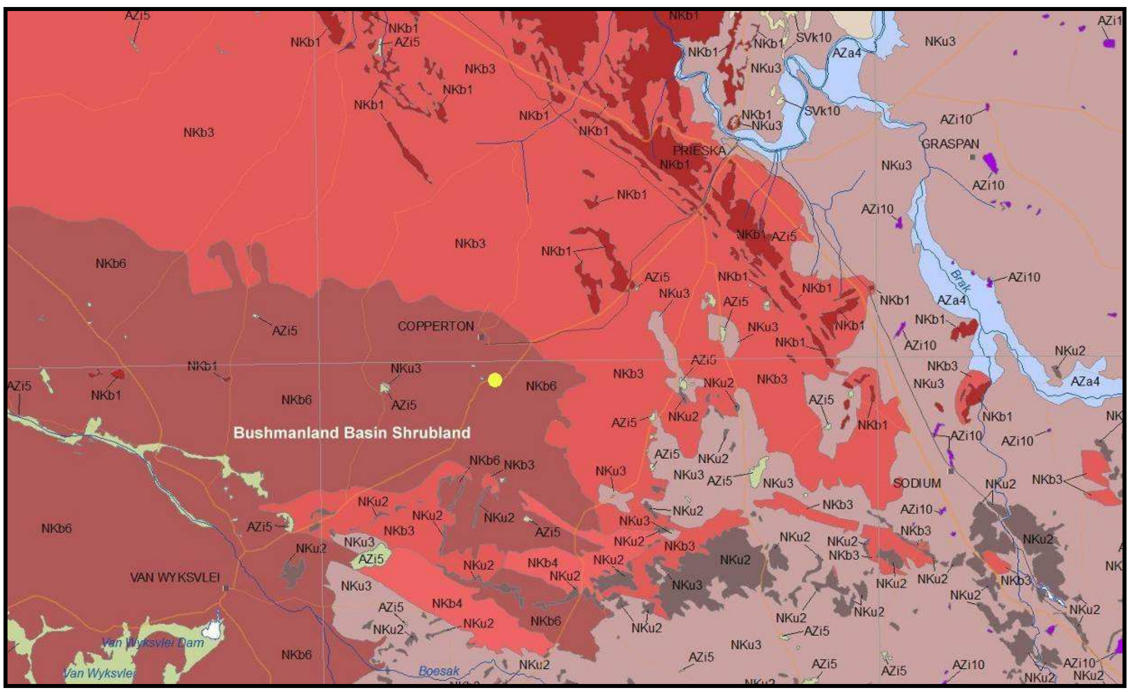


Figure 7. Portion of the vegetation map of southern Africa (Mucina *et al*. 2005) showing the vegetation of the study area (yellow dot) classified mainly as Bushmanland Basin Shrubland (NKb6).

7.3 The vegetation of Klipgats Pan

The climate is uniform over the study area so the distribution of the vegetation types is governed by the soils and drainage patterns (topography). The principle vegetation type which shows some variation is Bushmanland Basin Shrubland. This vegetation type in its typical form covers the entire area of the south part of Klipgats Pan and most of the north part. The exception is the prominent seasonal drainage line in the north part (Figure 3) which has short vegetation over calcrete. It shows affinities to Bushmanland Vloere vegetation. Within the Bushmanland Basin Shrubland two sub-types are recognized as given in Table 1: *Rhigozum trichotomum* Shrubland and Asteraceous Shrubland.

At Klipgats Pan 'heuweltjies' (Midgley & Musil 1990; Milton & Dean 1996; Moore & Picker, 1991; Midgley *et al.* 2002) were found to occur in both *Rhigozum trichotomum* Shrubland and Asteraceous Shrubland.

Table 1. Bushmanland Basin Shrubland with two communities found at Klipgats Pan

Vegetation Type	Community or Association	Substrate
7.3.1 Bushmanland Basin Shrubland	**7.3.1.1 *Rhigozum trichotomum* Shrubland**	Sandy soil at least 150 mm deep
	7.3.1.2 Asteraceous Shrubland	Shallow soil over bedrock, often calcrete

The vegetation was sampled at nine waypoints and the vegetation found at each is classified into the two types as given in Table 2.

Table 2. Sample waypoints, co-ordinates and the vegetation found at each waypoint

Waypoint	Latitude	Longitude	Vegetation Community (see Table 1 for numeric code)
KGP1	30°01'48.0"S	22°19'43.0"E	**7.3.1.2**
KGP2	30° 1' 04.0"S	22°20'17.6"E	**7.3.1.2**
KGP3	30°00'55.2"S	22°19'58.9"E	**7.3.1.1**
KGP4	30°00'39.7"S	22°19'40.2"E	**7.3.1.1**
KGP5	30°00'42.1"S	22°19'30.1"E	**7.3.1.2**
KGP6	30°00'47.1"S	22°19'19.0"E	**7.3.1.2**
KGP7	30°00'46.7"S	22°19'13.2"E	**7.3.1.1**
KGP8	30°00'44.3"S	22°19'07.3"E	**7.3.1.2**
KGP9	30°00'43.1"S	22°19'02.3"E	**7.3.1.2**

7.3.1 Bushmanland Basin Shrubland

7.3.1.1 Rhigozum trichotomum Shrubland

This low to mid-high shrubland is characterized by *Rhigozum trichotomum* (granaatbos), a tough, woody shrub that ranges in height from 0.5 – 1.2 m. This species is scattered throughout the study area but tends to be concentrated and dominant in areas where there are slight depressions and accumulation of red sand. It is prominent in the area around waypoint KPG3 and waypoint KGP7 which is located in the shallow drainage line in the northern part of the study area. Other low shrubs are found only in low numbers whereas *Stipagrostis* spp. and other grasses are co-dominant with *R. trichotomum* (Figure 8). Since this vegetation indicates a shallow-wash drainage line it is considered to be more ecologically sensitive that the broader matrix vegetation described below as Asteraceous Shrubland.

Figure 8. *Rhigozum trichotomum* Shrubland – coarse mid-high shrubland on sandy-loam soils.

7.3.1.2 Asteraceous Shrubland

The Asteraceous Shrubland is the most extensive vegetation type in the study area. It also has the greatest diversity of species, mainly low shrubs but grasses occur patchily and other herbaceous species are present. The vegetation is typically low (< 0.4 m) and coarse, being dominated by low shrubs in the family Asteraceae (daisy family). It may be described as “bossieveld” to distinguish it from areas of ‘true’ grassland. This vegetation occurs on shallow sandy-loam soils often with bedrock, mostly as hardpan calcrete (Figure 9) and is not ecologically sensitive.

Within the low shrublands are patches where grasses, mainly in the genus *Stipagrostis* are abundant. However, due to grazing, grasses are less abundant that would be the case if the land was not grazed.

Figure 9. Low shrubland dominated by members of the Asteraceae (daisy family).

7.3.1.3 Alien invasives

Prosopis glandulosa (mesquite) is a tree species from North and Central America. It is particularly invasive in the arid regions of South Africa and is a major problem in some parts of the Northern Cape Province. At Klipgats Pan, in the north part, it is found as large trees at the stock watering point (windmill) near waypoint KGP5 (Figure 10). This species could become a serious problem if allowed to spread. Any disturbance can enhance its chances of spreading so care must be taken not to introduce disturbance to the area that will allow it to proliferate.

No other alien invasive species were recorded.

Figure 10. A stand of *Prosopis glandulosa* (mesquite) around the watering point on the north part of Klipgats Pan.

8. Qualitative sensitivity analysis

The greater part of Klipgat Pan is not botanically sensitive. There is, however, one important exception and that is the 'low-lying' area which extends from the northeast corner to the centre of the northern part of Klipgats Pan. This is a seasonal watercourse and part of an extensive drainage system that may remain dry for long periods but may also flood after heavy rain. It has a higher sensitivity than the surrounding low Asteraceous shrublands and probably also provides a more attractive habitat for small mammals and birds.

Findings of the present survey indicate that a triangular area in the northwest corner of the proposed Alternative 1 (preferred area) of the solar energy facility (light blue area in Figure 4) is botanically sensitive more sensitive than the remaining portion of the Alternative 1 layout area. It is sensitive enough to indicate that this area should be excluded from development.

9. Development layouts

The preferred alternative (Alternative 1) for the proposed solar energy plant at Klipgats Pan is a 300 ha array of PV panels on the northern part of the study area. The second and less desirable alternative (Alternative 2) is for the PV panels to be located on the southern part of the study area, southwest of the Kronos Sub-station (Figures 3 & 4). According to the Draft Scoping Report (Aurecon, 2011) Alternative 2 has drawbacks such as a longer access route, a longer distance for transmission lines and difficulties with high-voltage crossings.

In terms of the vegetation and flora, the preferred site (Alternative 1) on the northern part of Klipgats Pan would only be acceptable botanically if the layout of PV panels could be reconfigured to avoid impacting the shallow drainage line as shown in Figure 3. The alternative area on the southern part of Klipgats Pan (green square in Figures 3 & 4) is entirely acceptable from a botanical perspective.

On the basis of the present survey it is suggested and recommended that a third alternative should be considered on the northern part of Klipgats Pan. The suggestion is that the area should be reconfigured from a square to an irregular-shaped block as shown by the purple-shaded area in Figure 4. This configuration would avoid impacting the low-lying seasonal watercourse and the low calcrete ridge to the northwest of the watercourse (the calcrete ridge is likely to be more species-rich than the lower-lying areas away from the watercourse).

If either the preferred alternative (Alternative 1) or the 'new' alternative (Alternative 3) is pursued, a relatively short 132 kV distribution line would link the Klipgats Pan solar energy facility to the Kronos Sub-station. If the second alternative (Alternative 2) is pursued a distribution line of approximately 3 km would be required.

10. Impact Assessment

Impacts on the vegetation are assessed for the development of a solar energy facility at Klipgats Pan, near Copperton. The No Go alternative and three alternatives are assessed. The third alternative is a 'new' alternative arising from the botanical survey of Klipgats Pan reported here.

10.1 Direct Impacts

Direct impacts are those that would occur directly on the vegetation of the site as a result of the proposed development. The rating system used is given in Appendix 1. In addition to determining the individual impacts using various criteria, mitigation is also brought into the assessment.

The impacts of the proposed development at Klipgats Pan on the vegetation and habitat are considered with respect to:

- Loss of vegetation type and habitat including plant species due to construction and operational activities.

- Loss of ecological processes due to construction and operational activities.

10.1.1 Loss of vegetation type and habitat including plant species due to construction and operational activities

In the case of the **"No Go"** option where there would be no development at Klipgats Pan, the *status quo* would persist and the farming operation would continue in much the same way as at present. The 'no development' alternative or 'No Go' alternative would thus have a **LOW NEGATIVE** impact on the natural vegetation with no significant loss in the long-term.

If the **development option** is followed most of the vegetation over a 300 ha area where the PV plant is constructed would be lost. In addition there would be some loss of vegetation due to trampling, movement of vehicles etc. In any instance the local effect would be a **HIGH NEGATIVE** impact. In the case of constructing the PV plant in wide-ranging low Asteraceous Shrubland that is not sensitive (Alternatives 2 and 3) the overall impact would be **LOW NEGATIVE**. In contrast, if the Alternative 1 option is pursued the impact would be **HIGH NEGATIVE** with very few on-site mitigation options since the identified seasonal watercourse with high ecological and botanical importance would be impacted (Table 3). Therefore construction of the PV installation will not raise much concern botanically except for in the case of Alternative 1. Mitigation of this impact is possible by re-configuring the layout of PV panels.

Table 3. Impact and Significance – Loss of natural vegetation and habitat in general during construction and operational phases

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 1 (300 ha – preferred)	Loss of natural vegetation	Local	Long- term	High	High	-ve	Probable	High
With Mitigation (re-configured layout)	Alt 1 (300 ha - preferred)	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 2 (300 ha)	Loss of natural vegetation	Local	Long- term	Low	Low	-ve	Probable	High
With mitigation	Alt 2 (300 ha)	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 3 (300 ha)	Loss of natural vegetation	Local	Long- term	Low	Low	-ve	Probable	High

With mitigation	Alt 3 (300 ha)	Loss of natural vegetation	Local	Long-term	Low	Low	-ve	Probable	High

10.1.2 Mitigation

Generally locations of concern are sites where there are shallow depressions and well defined pans. These should be avoided where possible and buffered by at least 30 m The proposed Alternative 3 is a proposal to mitigate for high negative impacts of Alternative 1. Re-configuration of the Alternative 1 layout to the Alternative 3 layout will lessen the impact from **HIGH NEGATIVE** to **LOW NEGATIVE** (Table 3). Even though the impact can be mitigated to **LOW NEGATIVE** it would be necessary to contain construction activities within the PV footprint to minimize disturbance outside the area of influence of the PV plant.

It is anticipated that there would be minimal loss of vegetation due to the installation of the distribution power-line to Kronos Sub-station.

10.2.1 Loss of ecological processes

The **'No Go' option** would allow the *status quo* to continue and the ecological processes in the areas of natural vegetation to continue unhindered. The impact of the 'No-Go' option would therefore be **LOW NEGATIVE,** since there is grazing which could have limited long-term negative effects.

As a general rule ecological processes are closely linked to vegetation and habitat and therefore can only function where the habitat is in reasonable condition. Ecological processes operate over a wide area and there will no-doubt be some local effects such as loss of small mammal activity associated with 'heuweltjies'. Heuweltjies as a 'living landform' will probably cease to function in the PV array area. Overall, due to the scale of the project in relation to the extent of Bushmanland Basin Shrubland, the loss of ecological processes would be minimal resulting in a **LOW NEGATIVE** effect (Table 4).

Reasons for avoiding the seasonal watercourse in the north part of Klipgats Pan are as much ecological as botanical and the same rationale applies as described above. Therefore reconfiguration of the Alternative 1 PV layout to the proposed Alternative 3 layout is suggested for ecological reasons as well e.g. retaining habitat integrity for birds and small mammals.

Table 4. Impact and Significance – Loss of ecological processes in natural habitat areas during construction and operational phases

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of ecological processes	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 1 (300 ha – preferred)	Loss of ecological processes	Local	Long- term	High	High	-ve	Probable	High
With mitigation re-configure to Alt 3	Alt 1 (300 ha – preferred)	Loss of ecological processes	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 2 (300 ha)	Loss of ecological processes	Local	Long- term	Low	Low	-ve	Probable	High
With mitigation	Alt 2 (300 ha)	Loss of ecological processes	Local	Long-term	Low	Low	-ve	Probable	High
Without mitigation	Alt 3 (300 ha)	Loss of ecological processes	Local	Long- term	Low	Low	-ve	Probable	High
With mitigation	Alt 3 (300 ha)	Loss of ecological processes	Local	Long-term	Low	Low	-ve	Probable	High

10.2.2 Mitigation

The main mitigation measure would be to avoid construction of the PV plant anywhere near the area mapped as 'seasonal drainage-line or watercourse' in Figure 4.

10.3 Indirect impacts

By definition indirect impacts occur away from the 'action source' i.e. away from the development site. The impact assessed here is specifically how the proposed development would have an indirect impact on vegetation and flora away from the development site. Owing to the extensive range of Bushmanland Basin Shrubland no indirect impacts were identified.

10.4 Cumulative impacts

Bushmanland Basin Shubland is in no way threatened and despite the proliferation of renewable energy projects in the Copperton area, the status of this vegetation type will not change. Cumulative impacts on this vegetation type due to the Klipgats Pan solar energy project would be negligible.

11. General Assessment and Recommendations

- A single vegetation type, Bushmanland Basin Shrubland, is found at Klipgat Pan south of Copperton. It is not included as a threatened terrestrial ecosystem in the recently published National List of Threatened Terrestrial Ecosystems.

- Construction of the solar energy plant at Klipgats Pan Alternative 1 (preferred) location would result in a **HIGH NEGATIVE** impact. For this reason a third alternative, Alternative 3, is proposed and recommended where the layout of Alternative 1 is changed to accommodate and avoid the sensitive northwest sector of the 'original' Alternative 1 layout. In this way sensitive vegetation and habitat along drainage lines and on the calcrete ridge in the northwest will not be impacted at all. This is considered to be the best mitigation for lowering the negative impact of Alternative 1.

- Construction of the proposed solar energy plant at the Alternative 2 location would have low detrimental impacts on the vegetation, botanically as well as ecologically. Alternative 2 would be acceptable with no major constraints except for keeping all construction activity within the PV plant footprint.

- In all cases construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV plant.

- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require rehabilitation in the post-construction phase. The restoration of those areas must follow the construction phase. A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to.

- The overall result of the impact assessment is that the 'No Go' option would allow the *status quo* to continue which would have a **LOW NEGATIVE** impact on the site. At the Alternative 1 location (preferred) the proposed renewable energy infrastructure development would have a **HIGH NEGATIVE** impact if pursued and is not advocated. Alternative 2 would result in **LOW NEGATIVE** impact on the vegetation and flora as would Alternative 3.

12. Conclusions

The vegetation found at Klipgats Pan was not in optimal condition for a botanical survey in November 2011. It was extremely dry and this negatively influenced the ability to positively identify many of the plant species. However, an adequate survey was possible and together with available literature and other data, the acceptability or otherwise of a solar energy plant at Klipgats Pan could be successfully assessed.

The construction of the solar energy facility is botanically acceptable at the Alternative 2 and 3 sites but not over the whole of the preferred site (Alternative 1). It is strongly proposed that Alternative 1 should be re-configured to a layout the same as or similar to Alternative 3 where the major seasonal drainage line is avoided.

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Appendix 1: Impact Assessment Methodology

The assessment of impacts needs to include the determination of the following:

- The nature of the impact – see Table 1.1
- The magnitude (or severity) of the impact – see Table 1.2
- The likelihood of the impact occurring - see Table 1.2

The degree of confidence in the assessment must also be reflected.

Table 1.1 Impact assessment terminology

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Assessing significance

There is no statutory definition of '*significance*' and its determination is, therefore, somewhat subjective. However, it is generally accepted that significance is a function of the magnitude of the impact and the likelihood of the impact occurring. The criteria used to determine significance are summarized in *Table 1.2*

Table 1.2 Significance criteria

Impact magnitude	
Extent	*On-site* – impacts that are limited to the boundaries of the rail reserve, yard or substation site. *Local* – impacts that affect an area in a radius of 20km around the development site. *Regional* – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. *National* – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.
Duration	*Temporary* – impacts are predicted to be of short duration and intermittent/occasional. *Short-term* – impacts that are predicted to last only for the duration of the construction period. *Long-term* – impacts that will continue for the life of the Project, but ceases when the Project stops operating. *Permanent* – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.

Intensity	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, species or communities).* **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.* SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood (Probability)	
Negligible	The impact does not occur.
Low	The impact may possibly occur.
Medium	Impact is likely to occur under most conditions.
High	Impact will definitely occur.

Once a rating is determined for magnitude and likelihood, the following matrix can be used to determine the impact significance.

Table 7.5 Example of significance rating matrix

SIGNIFICANCE RATING					
	LIKELIHOOD	**Negligible**	**Low**	**Medium**	**High**
MAGNITUDE	**Negligible**	**Negligible**	**Negligible**	**Low**	**Low**
	Low	**Negligible**	**Negligible**	**Low**	**Low**
	Medium	**Negligible**	**Low**	**Medium**	**Medium**
	High	**Low**	**Medium**	**High**	**High**

In *Table 7.6*, the various definitions for significance of an impact is given.

Table7.6 Significance definitions

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.