EIA REPORT – FIRST DRAFT

ASSESSMENT OF THE SOILS AND AGRICULTURAL POTENTIAL FOR THE PROPOSED KLIPGAT SOLAR ENERGY FACILITY SITE (75 MW)

TO BE LOCATED ON PORTION 2 OF THE FARM KLIP GAT NO. 80, EMTHANJENI LOCAL MUNICIPALITY, NORTHERN CAPE

NOVEMBER 2012

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I, Louis George du Pisani, hereby confirms my independence as specialist and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which I was appointed other than fair remuneration for work performed on this project.

_____ 16 November 2012

L G du Pisani **Date**

Dr L G du Pisani (B.Sc. Agric., Hons B.Sc. Agric., M.Sc. Agric., Ph.D. Agric.)
(Pr. Sci. Nat.)

Summary of Expertise

>>More than 20 years experience in pasture and natural resource management in the arid and semi-arid regions of the Eastern Cape, Northern Cape and Free State

>>Author or co-author of 20 publications in international and national journals

>>Presented 5 papers at International Conferences, as well as 2 at Regional and 10 at National Conferences

>>Was a member of 13 National Committees of the Department of Agriculture

>>Completed several agricultural potential studies in South Africa, Namibia and Argentina

>>Registered as professional member of The South African Council for Natural Scientific Professions (SACNASP) (Agricultural Science), with registration number 400178/2012

the full fee for the work as agreed, shall be entitled to use them for its own benefit and for the specified project only.

EXECUTIVE SUMMARY

Site name and location: Klipgat Solar Energy Facility: A site of ~300ha is proposed on Portion 2 of the Farm Klip Gat No. 80 (845ha), which is situated in the Emthanjeni Local Municipality (Northern Cape Province), ~20km west of the town of Noupoort where a commercial photovoltaic solar energy facility of ~75 MW is planned.

Purpose of the study: To carry out a soils and agricultural potential assessment of the site for the establishment of a solar energy facility and provide a professional opinion on (i) whether the proposed site is of such high agricultural potential that the proposed development would lead to a significant loss of agricultural potential in the area and the property it is situated upon, (ii) whether the site is situated within agricultural sensitive areas and (iii) to assess the direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified during the EIA phase, on the soil and agricultural resources.

The facility would include the following infrastructure:

i An array of photovoltaic (PV) panels
ii A new on-site substation to evacuate the power from the facility into the Eskom grid
iii Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
iv Cabling between the project components, to be lain underground where practical.
v Internal access roads and fencing.
vi Workshop area for maintenance, storage, and offices.

Specialist: **Dr L G du Pisani** (B.Sc. Agric., Hons B.Sc. Agric., M.Sc. Agric., Ph.D. Agric.)
Pr. Sci. Nat. 400178/2012

Date of Report: 16 November 2012

CONCLUSIONS OF THE EIA PHASE OF THE ASSESSMENT

1 The long term impact on the agricultural potential and productivity of the proposed Klipgat Solar Energy Facility Site will be negligible as long as the

development adheres to the Environmental Management Plan proposed in this report. In the event of the site being made available for livestock production again during the commercial energy production phase of the project, the impact on agricultural production will only be temporary. Even if the site is not utilized for agricultural production during the lifetime of the project the loss of agricultural potential and food production is still considered to be negligible due to the relatively small size of the site (~300ha) and its relatively low grazing and carrying capacities (17 LSU's or 71 sheep ewes respectively).

2 The soils present on the site are susceptible to water erosion, specifically when subjected to high volumes of fast flowing runoff water. With the necessary mitigation measures in place, though, water erosion need not be a major concern. It is therefore important that there should be strict adherence to the Environmental Management Plan and measures should be implemented regarding the management of storm water runoff and water erosion control during the construction phase of the project, as well as thereafter.

3 There are no agricultural sensitive areas, areas of high agricultural value, wetlands, watercourses or cultivated lands on the site that shall be interfered with. Apart from a fence running through the eastern section of the site there are no important agricultural infrastructure present on the site.

4 The slope of the land is flat and on average 0.8%.

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1. INTRODUCTION

The consultant had the following brief:

i To conduct a soils and agricultural potential assessment of a site of ~300ha on Portion 2 of the Farm Klip Gat No. 80 (845ha), which is situated in the Emthanjeni Local Municipality (Northern Cape Province), ~20km west of the town of Noupoort where a commercial photovoltaic solar energy facility of ~75 MW is planned (see Appendix 1 & 2).

ii To compile a report and provide a professional opinion on (i) whether the proposed site is of such high agricultural potential that the proposed development would lead to a significant loss of agricultural potential, (ii) whether the site is situated within agricultural sensitive areas and (iii) to assess the direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase, on the soil and agricultural resources.

2. BACKGROUND INFORMATION

The Department of Agriculture, Forestry and Fisheries (DAFF, 2010) published a draft report on ''Regulations for the evaluation and review of applications pertaining to wind farming on agricultural land''. It is assumed that the same draft regulations apply for ''solar farming''. This report states that ''*it is important to conduct land use in a way that it optimally adheres to the potential of the land. Consequently, it is imperative that all available land with the potential for producing sustained high crop yields, thus land with a high agricultural production potential, as well as land with a potential carrying capacity for livestock, be effectively utilized and protected for agricultural use. Agricultural production or the use of land for any other purpose should nevertheless not be conducted in a way that it could result in the degradation or loss of the available natural resources. This especially has reference in ensuring that high potential and unique agricultural land is preserved for current and future production thereby ensuring sustainable utilization of the country's natural resource base and adhering to food security*.''

This report by DAFF (DAFF, 2010), although in a draft format, provides a list of guidelines when assessing the agricultural impact of Wind Farms on agricultural land. They are:

2.1 No development will be allowed on high potential or unique agricultural land.

2.2 No development will be allowed on areas currently being cultivated (cultivated fields/ production areas) or on fields that have been cultivated in the last ten years. This is relevant to cultivated land utilized for dry land production as well as land under any form of irrigation.

2.3 No development will be allowed should it intervene with or impact negatively on existing or planned production areas (including grazing land) as well as agricultural infrastructure (silos, irrigation lines, pivot points, channels, feeding structures, dip tanks, grazing camps, animal housing, farm roads etc).

2.4 No development will be allowed should it result in the degradation of the natural resource base of the farm or surrounding areas. These include, but are not limited to, soil degradation or soil loss through erosion or any manner of soil degradation, the degradation of water resources (both quality and quantity) and the degradation of vegetation (composition and condition of both natural or established vegetation). It also includes establishment on or impacting on:

2.4.1 Wetlands (*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*). No development is allowed on a wetland, vlei, pan or any other water body unless otherwise approved by DAFF.

2.4.2 Flow pattern of run-off water and shall not in any manner divert any run-off water from a water course to any other watercourse or obstruct the natural flow pattern of run-off water.

2.4.3 Utilization and protection of vegetation. Every care should be taken to protect the vegetation and veld condition against deterioration and destruction.

2.5 No development will be allowed should it result in a degradation of existing soil conservation work. This includes but are not limited to:

2.5.1 Contour banks.

2.5.2 Waterways/Watercourses

2.6 No development will be allowed on slopes (*the vertical difference in height between the highest and the lowest points of that portion of land, expressed as a percentage of the horizontal distance between those two points*) of more than 20%.

3. METHODOLOGY

During the scoping phase of the study the consultant prepared a compendium of available published data, information, maps and satellite images for the site.

During the field verification phase the site was traversed on foot and by vehicle (9 November 2012), listing, assessing and verifying the agricultural attributes described during the scoping phase.

The following methodology was adopted to produce a soil map for the study site:

i) According to Vorster (1985) there is a close correlation between the soils present, vegetation present and relief of the land in the Karoo. Consequently, the contour map and recent satellite images of the site were used to produce a preliminary soil map by delineating the different terrain units on the site and mapping out areas of ''similar terrain units'' with expected ''similar soils present''.

ii) The soils that was expected per terrain unit, was taken from the data of the Land Type Survey Staff (1976 - 2006) for land types Da6 and Da14.

iii) Points were identified on this preliminary map where soil core samples were to be taken to verify the preliminary soil map.

iv) During the reconnaissance of the site on 9 November 2012, soil cores were taken with a soil auger at the pre-identified points (see paragraph iii above), as well as at other points deemed necessary during the field work. The soil forms present were identified according to the classification methods of MacVicar *et al* (1977 & 1991).

The data collected during both the scoping and verification phases were used to prepare a professional opinion on whether any of the draft DAFF-guidelines (as was discussed in paragraph 2 of this report) will be contravened upon, after which an environmental impact assessment of the agricultural resources on the site was conducted.

4. SITE INFORMATION

The site of ~300ha is located on Portion 2 of the Farm Klip Gat No. 80 (845ha), which is situated in the Emthanjeni Local Municipality (Northern Cape Province), ~20km west of the town of Noupoort. The position of the site is indicated in the maps indicated in Appendix 1 & 2.

The facility would include the following infrastructure:

i An array of photovoltaic (PV) panels

ii A new on-site substation to evacuate the power from the facility into the Eskom grid

iii Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.

iv Cabling between the project components, to be lain underground where practical.

v Internal access roads and fencing.

vi Workshop area for maintenance, storage, and offices.

5. SPECIALIST

Dr L G du Pisani (B.Sc. Agric., Hons B.Sc. Agric., M.Sc. Agric., Ph.D. Agric.)
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6. SCOPING PHASE RESULTS

Appendix 3 provides a compendium of the more important agricultural characteristics of the site as was collected from published sources during the scoping phase of the study.

6.1 Land capability and land-use

The site falls within Veld Type 36 (False Upper Karoo) (Acocks, 1988) and Biome NKu4 (Eastern Upper Karoo) (Mucina & Rutherford, 2006). This biome occurs on flats and gently sloping plains, interspersed with hills and rocky areas between Carnarvon and Loxton in the west, De Aar, Petrusville and Venterstad in the north and Burgersdorp, Hofmeyr and Cradock in the east, with the great escarpment in the south. This veld type constitutes the most spectacular of all the changes in the vegetation of South Africa (Acocks, 1988). This former primarily grass veld changed to a mixture of grasses and karoo shrubs and is dominated by dwarf microphyllous shrubs, with white grasses of the genera *Aristida* and *Eragrostis*.

The grazing capacity of the region varies between 18 ha/LSU and 25 ha/LSU (Botha, 1998; Dept. Agric. Dev., 1991; Vorster, 1985; Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za) (see Appendix 3 & 5). The site is situated in a Relative Homogenous Farming Area with an area of 208 350ha. The area of the site (845ha) represents less than 0,5% of this area, while the carrying capacity is at best 53 large stock units, making the site insignificant in terms of agricultural production and food security. According to Mucina & Rutherford (2006) the conservation status of this biome is categorized as ''least threatened''.

This region is categorized as non-arable with low to moderate potential grazing land (see Appendix 3 & 4). The "best use" for the area is for grazing with sheep, goats and beef cattle (Vorster, 1985).

6.2 Geology, land types and soils

According to the Land Type Survey Staff (1976 - 2006) and Johnson *et. al*. (2006) the site's geology can be categorized as shale, mudstone & sandstone of the Adelaide Subgroup of the Beaufort Group, Karoo Sequence, with dolerite intrusions common.

The site is situated within land types Da14 (95% of the site area) and Da6 (5% of the site area) (Land Type Survey Staff, 1976 - 2006) (see

Appendix 6). The Da land types consist of soils with either prismacutanic and/or pedocutanic diagnostic horizons, with a red colour in the B-horizon. The soils are generally shallow and the effective depth varies between 30mm and 1200mm (Land Type Survey Staff, 1976 - 2006). The clay content varies between 15% and 30% in the A-horizon, and between 10% and 45% in the B21-horizon. Considering the soil types and soil depths occurring in the area puts the site in a category of "not suitable for cultivation".

Generally the site consists of soils with a marked clay accumulation, strongly structured and with a reddish colour (Department of Agricultural Development, 1991; Agis website of the Department of Agriculture, Forestry & Fisheries - www.agis.agric.za) (Appendix 7).

The susceptibility of the soils to wind erosion is categorised as somewhat susceptible, while the susceptibility to water erosion is categorised as low to moderate and the soil loss potential is categorised as moderate (AGIS Website of the Department of Agriculture, Fisheries & Forestry – www.agis.agric.za) (see Appendix 8, 9 and 10).

The slope of the land is generally flat to moderately undulating (see Appendix 11), with approximately 90% of the site having slopes of less than 2% and the rest of the site with slopes between 3% and 5%.

6.3 Climate

The climate of the area is typical of the southern steppe (Schulze, 1980) and is categorized as semi-arid. Rainfall is largely due to showers and thunderstorms, falling mainly in the months between October to March, with the peak of the rainy season between January and April. The longterm average annual rainfall for the area is 290mm (Vorster, 1985) (see also Appendix 12). Violent thunderstorms with high rainfall intensities are common.

The low mean annual rainfall puts the site in a semi-arid category where dry land cropping is not recommended, accept on land with deep soils (deeper than 1000mm) and with a relatively high water table.

6.4 Agricultural sensitive areas or areas of high agricultural value (i.e. lands, wetlands and watercourses)

There are no wetlands or watercourses visible on the topographic maps of the site.

6.5 Cultivated fields

There are no cultivated lands visible on the topographic maps of the site. The absence of cultivated lands should be verified during the EIA verification process to ensure that no development takes place with-in them.

6.6 Agricultural infrastructure

There are no agricultural important infrastructure, i.e. (i.e. silos, irrigation lines, pivot points, channels and feeding structures, etc.) or any conservation works (i.e. contour banks, waterways, etc.) that will be interfered with visible on the topographic maps. It is important to verify this during the full EIA process.

7 FIELD VERIFICATION – EIA PHASE RESULTS

7.1 Land capability and current land-use

The farm upon which the solar facility is planned is currently used exclusively for grazing with sheep.

Water for livestock consumption is extracted from bore holes dispersed over the property.

There are no cultivated lands on the property.

The average annual rainfall for the region is ~350mm (which is too low for dryland cropping).

The above information was supplied by the farm owner.

7.2 Soils

A verified map of the soils present on the Klipgat PV Solar site is shown in Appendix 13, while the detailed soil sample data is presented in Appendix

14 and photographs of the different soils and related veld on the site is depicted in Appendix 15 to 18.

The following soil forms (as per the MacVicar *et al* 1991 classification) were identified on the site, i.e. Oakleaf, Augrabies, Swartland, Glenrosa and Mispah. The relative contribution of the soils present on the site is presented in Appendix 19. The size of land where the Swartland soil form was sampled was too small to map and was therefore omitted from the verified soil map.

The Oakleaf soil form consists of an ortic A-horizon over a neocutanic B-horizon over unconsolidated material (which is the limiting soil layer). It is a moderately deep soil of between 300mm and 500mm, a sandy to loamy texture (15% clay in the A horizon and 25% clay in the B horizon) and a favorable water holding capacity. These are physically and chemically inactive soils and moderately sensitive to water and wind erosion. The current soil surface condition is moderately eroded with a crust (see Appendix 20 for photographs). The Oakleaf soil form is categorized by Fey (2010) as a cumulic soil. Cumulic soils are generally highly suitable for cultivation (Fey, 2010). The relatively low rainfall of the area excludes these Oakleaf soils from dryland cultivation, while the absence of irrigation water excludes it from cultivation under irrigation. The best land use for the Oakleaf soil on this site if for veld grazing.

The Augrabies soil form consists of an ortic A-horizon over a neocarbonate B-horizon (the soil samples of the B horizon effervesced visibly when treated with a 10% hydrochloric acid solution) over unconsolidated material (which is the limiting soil layer). It is a moderately deep soil of 300mm, a sandy to loamy texture (15% clay in the A horizon and 25% clay in the B horizon) and a favorable water holding capacity. These are physically and chemically inactive soils and moderately sensitive to water and wind erosion. The Augrabies soil form is categorized by Fey (2010) as a cumulic soil. Cumulic soils are generally highly suitable for cultivation (Fey, 2010), although factors such as high pH, high salinity, as well as low available P and trace elements (especially Fe) may limit its use for cultivation purposes. The relatively low rainfall of the area excludes these Augrabies soils from dryland cultivation, while the absence of irrigation water excludes it from cultivation under irrigation. The best land use for the Augrabies soil on this site if for veld grazing.

The Glenrosa soil form consists of an Ortic A-horizon over a lithocutanic B-horizon. It is shallow and at the most 100mm deep, moderately physically active and slightly sensitive to both wind and water erosion. The current soil surface condition is generally good with some surface water erosion visible in isolated areas. Glenrosa soils are categorized by Fey (2010) as lithic soils. Livestock ranching and wildlife conservation are the most common types of land use on lithic soils (Fey, 2010).

The Mispah soil form consists of an Ortic A-horizon over hard rock (which is the limiting soil layer). It is shallow and at the most 50mm deep, moderately physically active and slightly sensitive to both wind and water erosion. The current soil surface condition is generally good with some surface water erosion visible in isolated areas. Glenrosa soils are categorized by Fey (2010) as lithic soils. Livestock ranching and wildlife conservation are the most common types of land use on lithic soils (Fey, 2010).

7.3 Vegetation and veld resources

The veld of the site consists of a mixture of karoo bossies and grasses, with the karoo bossies dominating the landscape (see Appendix 15 to 18 for photographs). The dominant plants are *Phymaspermum aciculare, Pteronia glauca* and *Felicia muricata.* A list of plant species encountered on the site is appended as Appendix 21.

The veld condition of the site can generally be described as average with karoo bossies dominating, grasses largely absent (which is expected to be more abundant on the soils present and a veld in a good condition) and with a soil surface condition that can be described as largely crusted due to past wind and water erosion.

The current grazing capacity of the site is estimated at 18 ha/LSU. This gives this ~300ha site a carrying capacity equivalent to 17 large stock units (LSU's) or 71 sheep ewes, the loss of which is regarded as a negligible impact in terms of food security locally and nationally.

7.4 Slope

The site is virtually flat and slopes only gently from a southerly to a northerly direction. The highest and lowest elevations above sea level on the site are 1418m and 1398m respectively, with a distance of 2440m

between these two elevations. The average slope on the site is thus calculated as 0.8%.

7.5 Erosion hazard

The cumulic and lithic soils present on the site are moderately susceptible to water erosion (Fey, 2010), specifically when it is exposed to increased water runoff volumes and rates.

Runoff rate is the product of several factors, including soil cover, rainfall intensity and quantity, the slope of the land and the water holding capacity and water infiltration tempo of the soil. The slope of the land, as well as the water holding capacity and water infiltration tempo of most of the soils on the site is good and will not contribute to an increased water erosion hazard on the site. Single, very rare, heavy showers do occur (Schulze, 1980) and is a contributing factor to the water erosion hazard of the site. Very little water erosion is prevalent on the site. This fact can only be contributed to the fairly good vegetation cover of the soil, although patchy in areas. It is therefore concluded that the single most important factor to take into account to minimize the water erosion hazard of the soils on the site is the maintenance of a healthy vegetation cover. On soil surface areas where it is not possible to maintain a healthy vegetation cover, i.e. internal roads and the buffer zones of buildings, it is recommended that due diligence be observed in terms of storm water drainage management to minimize the concentration of runoff water.

The wind erosion hazard of the soils present on the site is low, as long as a good vegetation cover is maintained.

7.6 Agricultural sensitive areas or areas of high agricultural value

There are no agricultural sensitive areas, areas of high agricultural value, wetlands, watercourses or cultivated lands present on the site.

7.7 Agricultural infrastructure

Apart from a fence running through the eastern section of the site there are no agricultural infrastructure present on the site (see Appendix 22).

7.8 Accessibility of the site and access roads

The site is accessible by road from the dirt road between Noupoort and Hanover Road Station. There is a farm road giving access from the homestead to the site and there is one internal road on the proposed site. The site is also accessible via a road running next to the ESCOM power line running past the site.

7.8 Groundwater, soil and geological stability of the site

	YES	NO
Shallow water table (less than 1.5m deep)		X
Dolomite, sinkhole, or doline areas		X
Seasonally wet soils (often close to water bodies)		X
Unstable rocky slopes or steep slopes with loose soil		X
Dispersive soils (soils that dissolve in water)		X
Soils with high clay content (clay fraction more than 40%)		X
Any other unstable soil or geological feature		X
An area sensitive to erosion	X	

8 ASSESSMENT OF IMPACTS

8.1 Assessment method and criteria

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified during the EIA phase were assessed in terms of the following criteria:

» The **nature**, which include a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high):
» The **duration**, wherein it is indicated whether:

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

» The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» The **probability** *of occurrence*, which describe the likelihood of the impact actually occurring. Probability is estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

» the **significance**, is determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and

» the **status**, which is described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S=(E+D+M)P, where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

8.2 Activities that may have an impact

- » Solar facility footprint (i.e. an array of PV panels, mounting structures to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels, underground cabling between project components and fencing)
- » Construction and positioning of internal access roads
- » Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
- » Construction and positioning of a new on-site substation
- » Construction and positioning of an on-site workshop area for maintenance, storage, and offices

8.3 Agricultural resources that may be impacted upon

- » **Impact 1**: Soil (degradation due to wind and water erosion, as well as by contamination with oil, petrol, diesel and other contaminants used by the construction vehicles and equipment)
- » **Impact 2**: Vegetation and grazing capacity (degradation due to a decrease in species composition and vegetation cover and a loss of grazing capacity)
- » **Impact 3**: Underground water (degradation due to contamination by oil, petrol, diesel and other contaminants used by the construction vehicles and equipment)
- » **Impact 4**: Livestock production systems (interference with farm and livestock management activities and a decline in the long term food production).

8.4 Assessment of the identified impacts

8.4.1 Solar facility footprint

Impact 1: Soil

The soil forms present on the site is susceptible to water erosion.

a) Nature: Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**60 (High)**	**15 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. Care should also be taken to control and contain storm water run-off. Rehabilitate construction sites by establishing it with indigenous grasses.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

b) Nature: Siltation of watercourses and other natural resources downstream as a result of improper storm water management and soil erosion due to increased and concentrated water run-off		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**60 (High)**	**15 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Yes
Mitigation: Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. Care should also be taken to control and contain storm water run-off. Rehabilitate construction sites by establishing it with indigenous grasses. Control and stop soil degradation at the source	
Cumulative Impacts: Little with the necessary mitigation in place	
Residual Impacts: Little with the necessary mitigation in place	

c) Nature: Dust production and dust pollution of grazing plants		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**21 (Low)**	**10 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Apply dust control measures, i.e. water spraying.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Impact 2: Vegetation and grazing capacity

The construction activities, including the construction of the PV pane foundations and the placing of underground cabling between the solar arrays and sites will lead to areas where the soil will be denuded of vegetation.

a) Nature: Denudation of the soil due to construction activities and loss of carrying capacity		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Small (1)
Probability	Definite (5)	Probable (3)
Significance	**40 (Medium)**	**12 (Low)**

Status	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Rehabilitate construction sites by establishing it with indigenous grasses.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Impact 3: Underground water

It is highly unlikely that the wind farm footprint will have any impact on the underground water resources.

Impact 4: **Livestock production systems**

During the construction phase there will be an impact upon the normal day-to-day livestock and grazing management activities due to interference with systems like water reticulation and fencing.

a) Nature: Interference with the day-to-day livestock and grazing management due to construction and other activities on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: When farming infrastructure, i.e. fences, water pipelines, water troughs, etc., is removed or damaged, it should be replaced as soon as possible. Construction and other activities must be communicated and co-ordinated with the land owner to put him in a position to properly plan his livestock and grazing management activities.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

8.4.2 Construction, positioning, maintenance and upgrading of access roads

Impact 1: Soil

The current internal access roads are in a fair condition.

a) Nature: Soil erosion due to roads		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**60 (High)**	**10 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Care should be taken to put gravel on road surfaces to protect the soil against water erosion. Cross mounds and other storm water drainage techniques must be employed to decrease the speed and force of the storm water properly from road surfaces.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Impact 2: Vegetation and grazing capacity

New roads will contribute to the loss of vegetation and carrying capacity, although the impact is considered to be negligible taking into account the relatively low grazing capacity of the veld and the relatively small footprint of the development. Care should be taken, though, to make use of existing roads on the site and to minimise the construction of new roads.

a) Nature: Loss of vegetation and carrying capacity		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short Term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**40 (Medium)**	**10 (Low)**
Status (positive or	Negative	Negative

negative)		
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Make use of existing roads as far as possible to minimise the construction of new roads.		
Cumulative Impacts: Little, as long as the roads do not contribute to water erosion and storm water run-off.		
Residual Impacts: Permanent		

Impact 3: Underground water

No impact expected.

Impact 4: **Livestock production systems**

During the upgrading of roads there will be an impact on the normal day-to-day livestock and grazing management.

a) Nature: Interference with the day-to-day livestock and grazing management due to construction and other activities on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Construction and other activities must be communicated and co-ordinated with the land owner in order for him to properly plan his management activities.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

8.4.3 Use of potential sources of contaminants on the site

Impact 1: Soil

Nature: Contamination and degradation of the soil due to spillages of oil, petrol, diesel and other contaminants used by vehicles and equipment on the site or stored on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**30 (Medium)**	**20 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Vehicles and equipment must be serviced regularly and maintained in a good running condition. Storage of contaminants must be limited to low quantities and done under strict industry standards. There must be strict control over the safe usage of vehicles and equipment to minimise vehicle accidents and damage to vehicles by rocks and boulders which may cause spillages.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Spillages of contaminants will have a long residual effect on the natural resources, specifically to the soil and vegetation, and possibly the underground water depending on the quantum of the spillage.		

Impact 2: Vegetation and grazing capacity

Nature: Contamination and degradation of the soil & vegetation due to spillages of oil, petrol, diesel and other contaminants used by vehicles and equipment on the site or stored on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**30 (Medium)**	**20 (Medium)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Vehicles and equipment must be serviced regularly and maintained in a good running condition. Storage of contaminants must be limited to low quantities and done under strict industry standards. There must be strict control over the safe usage of vehicles and equipment to minimise vehicle accidents and damage to vehicles by rocks and		

boulders which may cause spillages.
Cumulative Impacts: Little with the necessary mitigation in place
Residual Impacts: Spillages of contaminants will have a long residual effect on the natural resources, specifically to the soil and vegetation, and possibly the underground water depending on the quantum of the spillage.

Impact 3: Underground water

Nature: Contamination and degradation of the soil due to spillages of oil, petrol, diesel and other contaminants used by vehicles and equipment on the site or stored on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Very improbable (1)
Significance	**20 (Low)**	**9 (Low)**
Status	Negative	Negative
Reversibility	Unlikely	Unlikely
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Vehicles and equipment must be serviced regularly and maintained in a good running condition. Storage of contaminants must be limited to low quantities and done under strict industry standards. There must be strict control over the safe usage of vehicles and equipment to minimise vehicle accidents and damage to vehicles by rocks and boulders which may cause spillages.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Spillages of contaminants will have a long residual effect on the natural resources, specifically to the soil and vegetation, and possibly the underground water depending on the quantum of the spillage.		

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Impact 4: **Livestock production systems**

No impact expected.

8.4.4 Construction and positioning of a new on-site substation

Impact 1 Soil

The buffer zone surrounding the substation and the storm water runoff from the substation roof may be agents of increased water runoff and water erosion.

Nature: Soil erosion in the area surrounding the substation		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Care must be taken with the ground cover during and after construction on the site and the buffer zone surrounding it. During construction, technologies should be employed to keep the soil covered with agent like straw, mulch, erosion control mats, etc. After construction the buffer zone around the building should be covered with gravel. Care should also be taken to control and distribute the storm water run-off from the roof of the building in such a manner that it does not lead to water erosion of the surrounding soil.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Impact 2 Vegetation and grazing capacity

Very little impact expected as it will only cover a very small area of land. Where possible this facility should be sited on the Glenrosa or Mispah soils, as these soils have the lowest grazing capacity.

Impact 3 Underground water

No impact expected.

Impact 4: **Livestock production systems**

During the construction phase there will be an impact on the normal day-to-day management of the livestock and the veld management system.

Nature: Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)

Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Construction and other activities must be communicated and co-ordinated with the land owner in order for her to properly plan her management activities.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

8.4.5 Construction and positioning of an on-site workshop area

Impact 1 Soil

The buffer zone surrounding the workshop area and the storm water runoff from the roof/s may be agents of increased water runoff and water erosion.

Nature: Soil erosion in the area surrounding the workshop area		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**50 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Care must be taken with the ground cover during and after construction on the site and the buffer zone surrounding it. During construction, technologies should be employed to keep the soil covered with agent like straw, mulch, erosion control mats, etc. After construction the buffer zone around the building should be covered with gravel. Care should also be taken to control and distribute the storm water run-off from the roof of the building in such a manner that it does not lead to water erosion of the surrounding soil.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

Impact 2 Vegetation and grazing capacity

Very little impact expected as it will only cover a very small area of land. Where possible this facility should be sited on the Glenrosa or Mispah soils, as these soils have the lowest grazing capacity.

Impact 3 Underground water

No impact expected.

Impact 4: **Livestock production systems**

During the construction phase there will be an impact on the normal day-to-day management of the livestock and the veld management system.

Nature: Interference with the day-to-day management of the livestock and veld due to construction and other activities on the site		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**35 (Medium)**	**15 (Low)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Construction and other activities must be communicated and co-ordinated with the land owner in order for her to properly plan her management activities.		
Cumulative Impacts: Little with the necessary mitigation in place		
Residual Impacts: Little with the necessary mitigation in place		

8.5 Measures for inclusion in the draft environmental management Plan

a)

OBJECTIVE: Limit water erosion of soil	
Project component/s	Maintenance of soil cover and the correct placement of footprint infrastructure
Potential Impact	Increased water run-off, soil degradation due to water erosion and sediment generation

Activity/risk source	Complete denudation of the soil, poor placement of the site and poor planning of storm water run-off control
Mitigation: Target/Objective	Prevention and control of water erosion on the site. Care must be taken with the ground cover during and after construction on the site. If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. Care should also be taken to control and contain storm water run-off. Rehabilitate construction sites by establishing it with indigenous grasses. Care should be taken to gravel road surfaces to protect the soil against water erosion. Cross mounds and other storm water drainage techniques must be employed to decrease the speed and force of the storm water properly from road surfaces.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan and implement proper soil cover measures and storm water drainage mechanisms	Engineer and construction personnel	Duration of the construction phase

Performance Indicator	Minimum soil surface erosion Immediate action should be taken when negative impacts are experienced
Monitoring	Monitor erosion rates and erosion sites on a weekly basis and after each storm water event.

b)

OBJECTIVE: Limit construction and vehicle impact on dust production and wind erosion	
Project component/s	Covering all access and construction routes with gravel Control of water run-off from road surfaces Proper placement of new roads
Potential Impact	Soil degradation due to increased wind erosion and dust production Soil degradation due to water erosion caused by poor water run-off control from roads
Activity/risk source	Poor road construction and maintenance
Mitigation: Target/Objective	Proper road construction and maintenance. Care should be taken to gravel road surfaces to protect the soil against wind erosion. Apply other dust control measures, i.e. water spraying.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan and implement proper soil cover measures and storm water drainage mechanisms	Engineer and construction personnel	Duration of the project

Performance Indicator	Minimum dust formation and water erosion along roadsides and construction sites Immediate action should be taken when negative impacts are experienced
Monitoring	Monitor roads and construction sites on a regular basis

c)

OBJECTIVE: Prevent contamination of the soil, vegetation and underground water by oil, diesel, petrol and other contaminants use by vehicles and construction equipment	
Project component/s	Preventing spills of contaminants on any part of the site
Potential Impact	Contamination of soil, vegetation and underground water
Activity/risk source	Vehicles and construction equipment on the site
Mitigation: Target/Objective	Vehicles and equipment must be serviced regularly and maintained in a good running condition. Vehicles must be fitted with spill skills. Storage of contaminants must be limited to low quantities and done under strict industry standards. There must be strict control over the safe usage of vehicles and equipment to minimise vehicle accidents and damage to vehicles by rocks and boulders which may cause spillages. Contingency plans must be in place to deal with spillages.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan and implement proper usage and maintenance of vehicle and construction equipment. Plan and document contingency plans and train personal to contain spillages when and where they take place. Keep quantity of contaminants stored on the site to a minimum.	Engineer and construction personnel	Duration of the construction phase

Performance Indicator	Zero spillages of contaminants Immediate action should be taken when spillages take place to contain damage to agricultural resources
Monitoring	Monitor contaminants storage facilities and the condition and maintenance of vehicles/equipment on a regular basis

9 CONCLUSIONS

9.1 The long term impact on the agricultural potential and productivity of the proposed Klipgat Solar Energy Facility Site will be negligible as long as the development adheres to the Environmental Management Plan proposed in this report. In the event of the site being made available for livestock

production again during the commercial energy production phase of the project, the impact on agricultural production will only be temporary. Even if the site is not utilized for agricultural production during the lifetime of the project the loss of agricultural potential and food production is still considered to be negligible due to the relatively small size of the site (~300ha) and its relatively low grazing and carrying capacities (17 LSU's or 71 sheep ewes respectively).

9.2 The soils present on the site are susceptible to water erosion, specifically when subjected to high volumes of fast flowing runoff water. With the necessary mitigation measures in place, though, water erosion need not be a major concern. It is therefore important that there should be strict adherence to the Environmental Management Plan and measures regarding the management of storm water runoff and water erosion control should be implemented during the construction phase of the project, as well as thereafter.

9.3 There are no agricultural sensitive areas, areas of high agricultural value, wetlands, watercourses or cultivated lands on the site that shall be interfered with. Apart from a fence running through the eastern section of the site there are no important agricultural infrastructure present on the site.

9.4 The slope of the land is flat and on average 0.8%.

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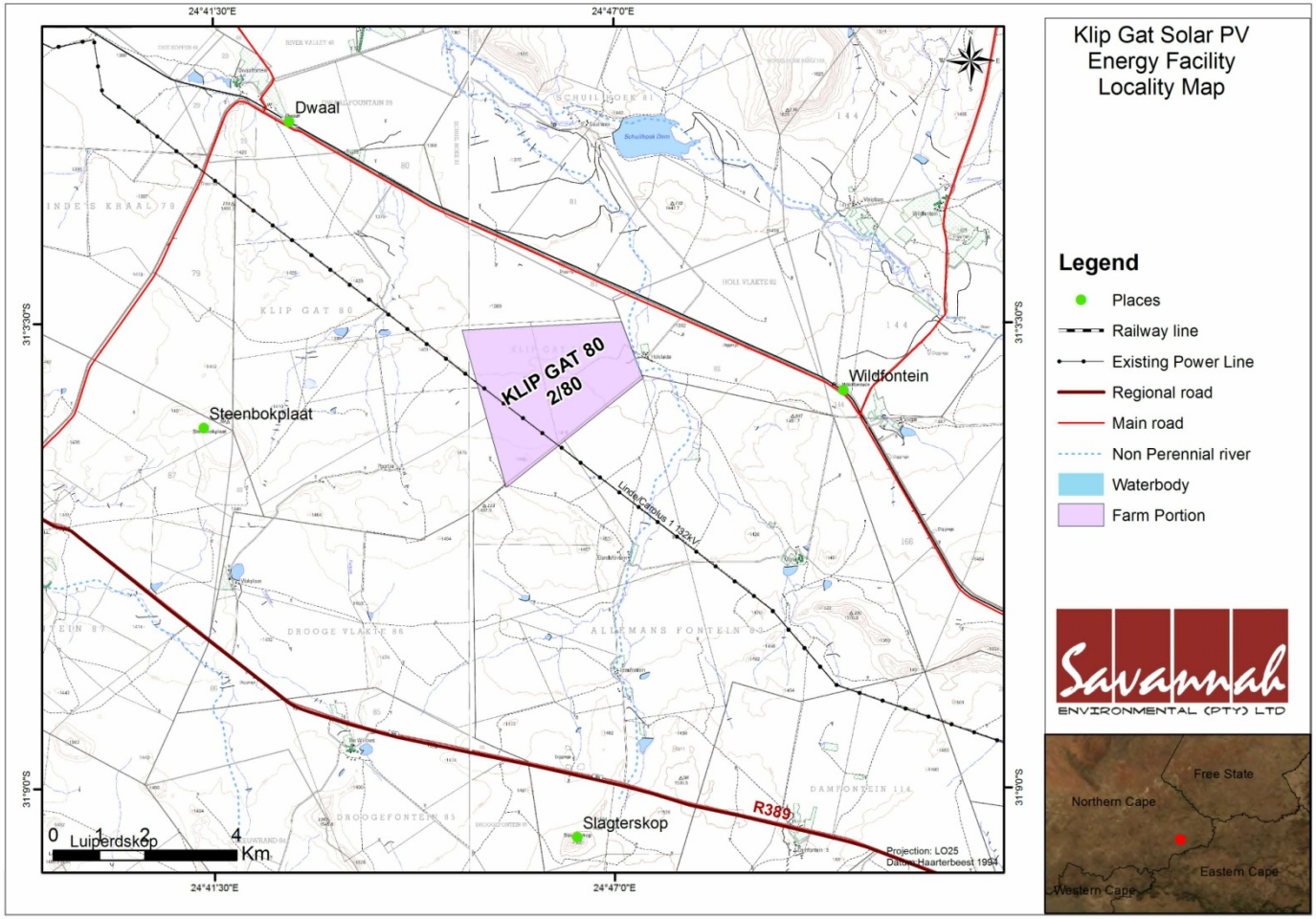
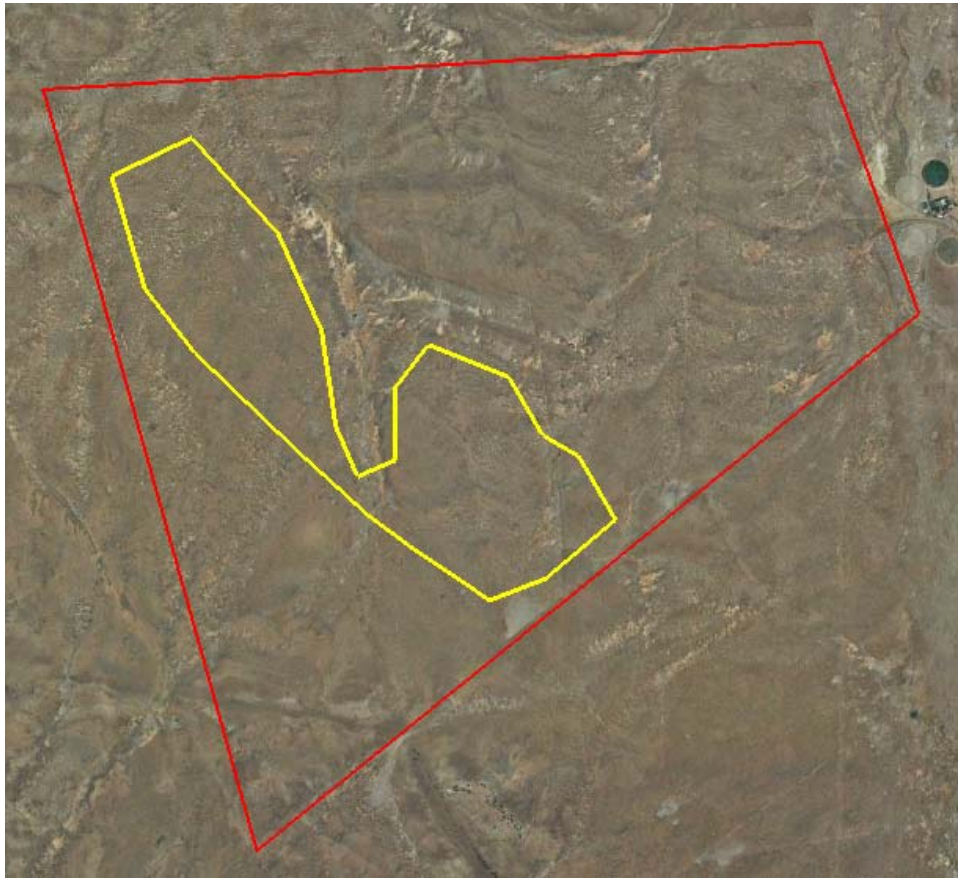
Appendix 1 Locality map of the proposed Klipgat Solar Energy Facility (75MW)



Appendix 2 Satellite image



Proposed Klipgat Solar Energy Site

Farm portion

Solar PV site

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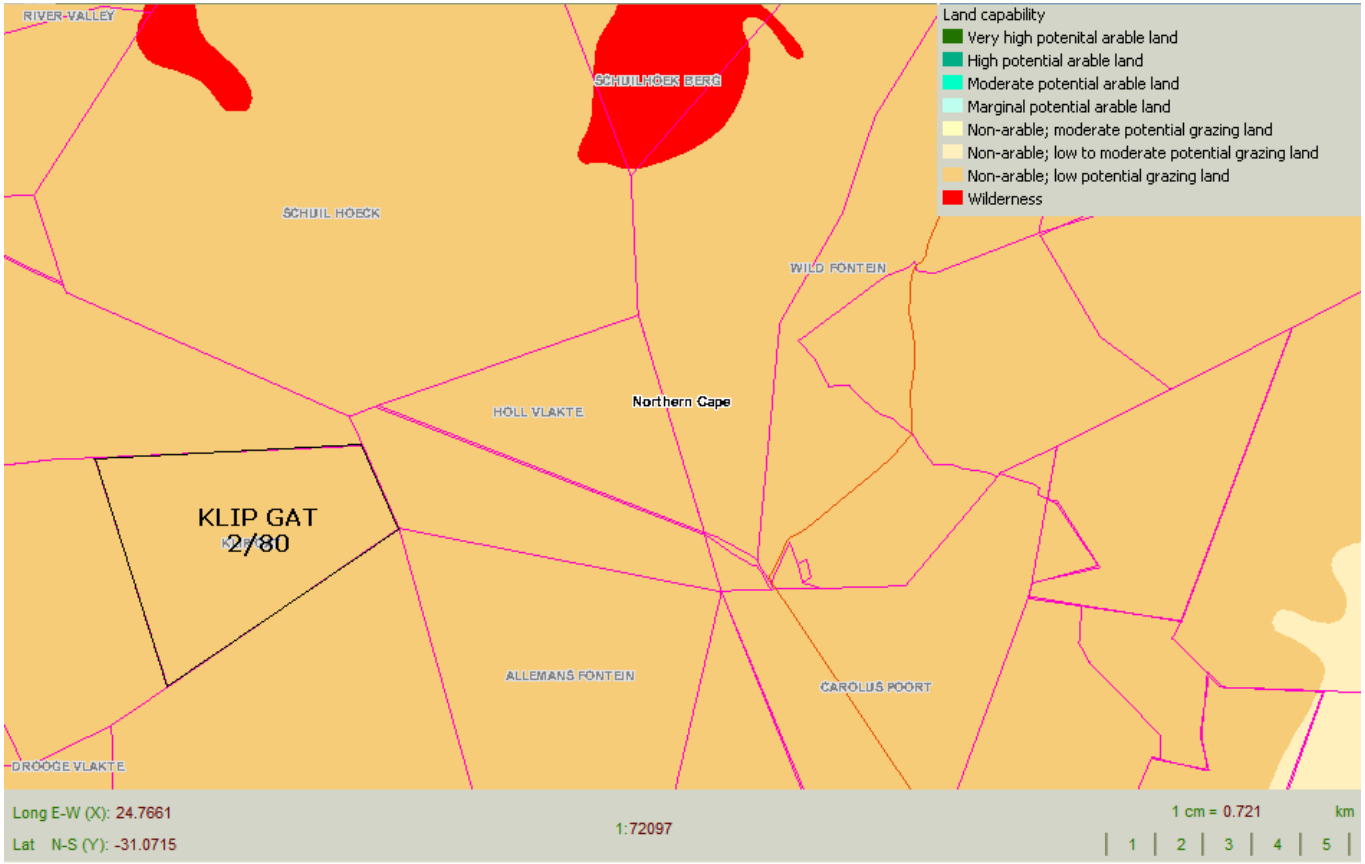
APPENDIX 3 Compendium of the agricultural characteristics of the area where the Klipgat Solar Energy Facility (75MW) is situated

Land Types Prevalent (Land Type Survey Staff, 1976 - 2006; Agis Website, Dept. Agric., Forestry & Fisheries - www.agis.agric.za)	Da14 (95% of the site area) Da6 (5% of the site area)
Area covered by Land Types (ha)	208 350ha
Most prominent plant species prevalent (Acocks, 1988; Dept. Agric. Dev., 1991)	*Eragrostis lehmanniana, Eragrostis bicolor, Rosenia humulis, Aristida diffusa, Chrysocoma ciliata, Eriocephalus ericoides*
Climatic Region (Schultze, 1980) Dept. Agric. Dev., 1991)	Southern Steppe (Ss)
Average Rainfall (mm per annum) (Schulze, 1980; Vorster, 1985)	290mm
Main Rainfall Season (Schulze, 1980)	February to April
Average Annual Temperature (°C) (Schulze, 1980)	15 – 17,5
Prevalence of Snowfalls (Schulze, 1980)	Irregular
Geology (Land Type Survey Staff, 1976 - 2006; Johnson *et. al*. 2006; Agis Website, Dept. Agric., Forestry & Fisheries - www.agis.agric.za)	Shale, mudstone & sandstone of the Adelaide Subgroup of the Beaufort Group, Karoo Sequence. Dolerite intrusions are common.
General Soil Patterns (Dept. Agric. Dev., 1991; Agis Website, Dept. Agric., Forestry & Fisheries - www.agis.agric.za)	PL1 - Soils with a marked clay accumulation, strongly structured and a reddish colour
Soil Forms (Land Type Survey Staff, 1976 - 2006; MacVicar, et al, 1977; Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za)	Mispah, Glenrosa, Swartland, Valsrivier, Hutton, Oakleaf, Shortlands, Clovelley
Soil Series (Land Type Survey Staff, 1976 - 2006; MacVicar, et al, 1977; Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za)	Mispah, Williamson, Skilderkrans, Reveillie, Broekspruit, Craven, Lindley, Swartland, Nyoka, Shorrocks, Mangano, Makulek, Letaba, Glendale, Makatini, Limpopo, Mutale, Dudfield, Blinkklip
Susceptibility of Soils to Water Erosion (Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za)	Land with low water erosion susceptibility (95% of the site area) Land with low to moderate water erosion susceptibility (5% of the site area)
Susceptibility of Soils to Wind Erosion (Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za)	Somewhat susceptible
Veld Type (Acocks, 1988) Biome (Mucina & Rutherford, 2006	Veld Type 36 (False Upper Karoo) Biome NKu4 (Eastern Upper Karoo)
Grazing Capacity (ha/LSU) (Botha, 1998; Dept. Agric. Dev., 1991; Vorster, 1985; Agis Website, Dept. Agric., Forestry & Fisheries – www.agis.agric.za)	16 – 25
Best Agricultural Use (Vorster, 1985)	Grazing for sheep, goats & beef cattle

Appendix 4 Land capability (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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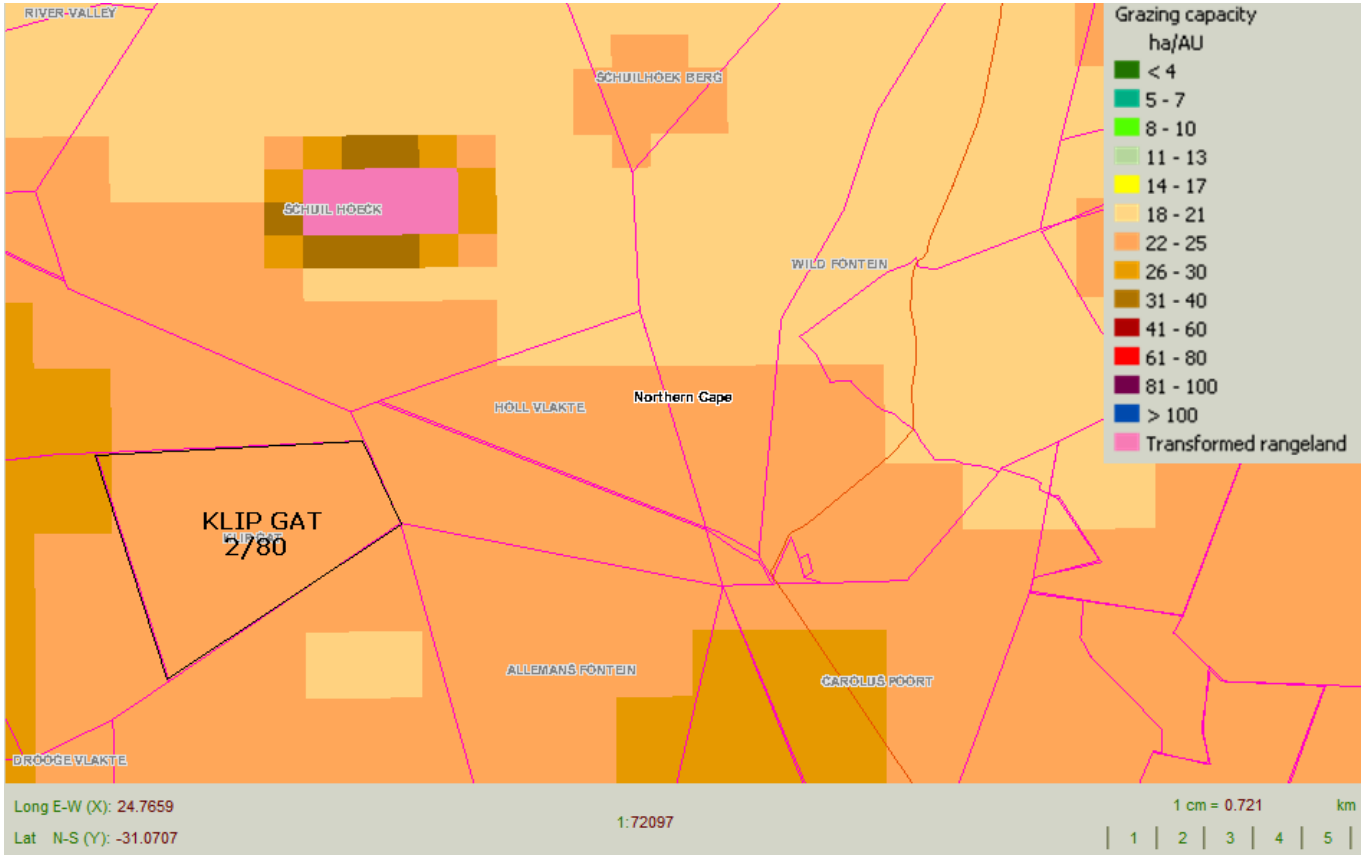
Appendix 5 Grazing capacity (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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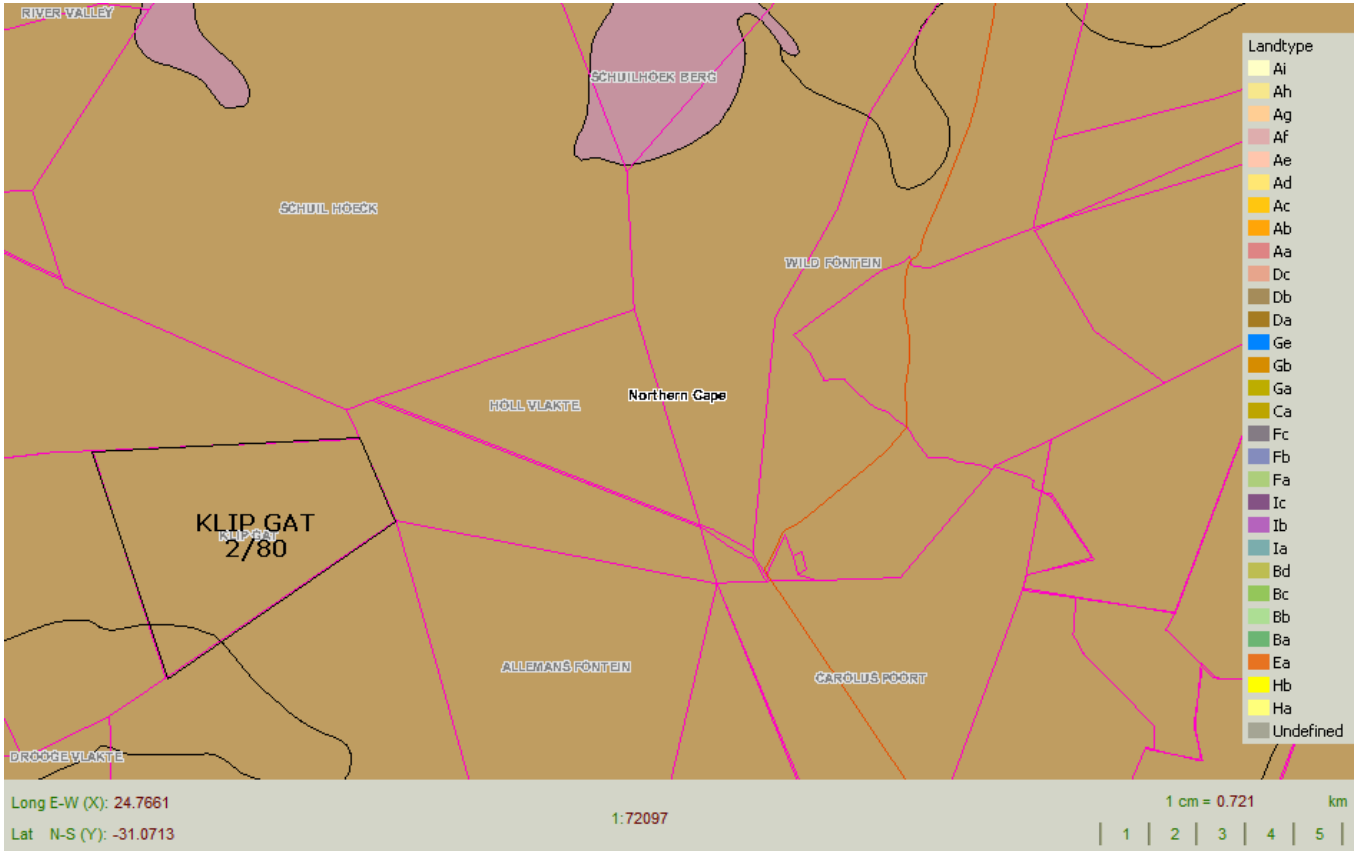
Appendix 6 Land types (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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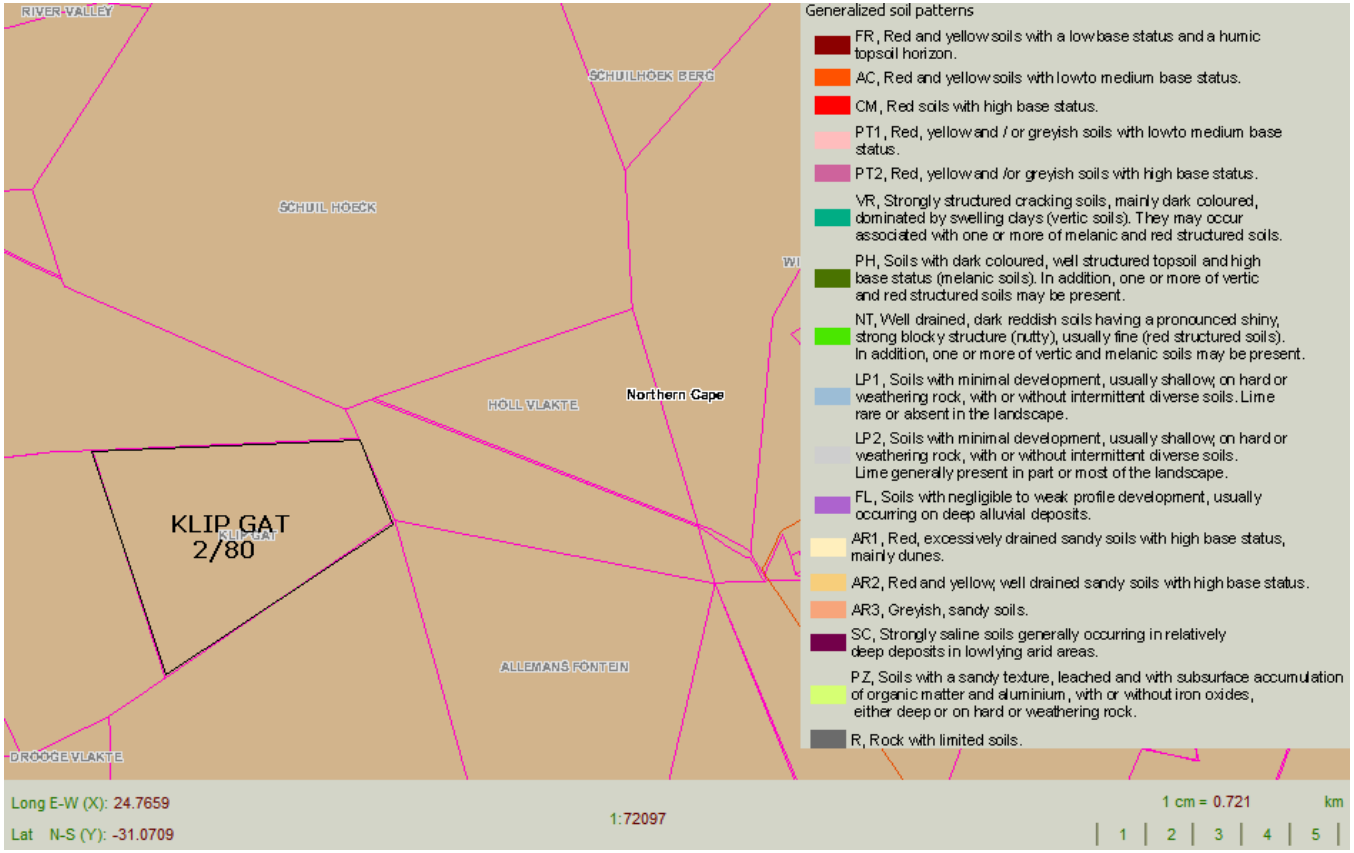
Appendix 7 Generalised soil patterns (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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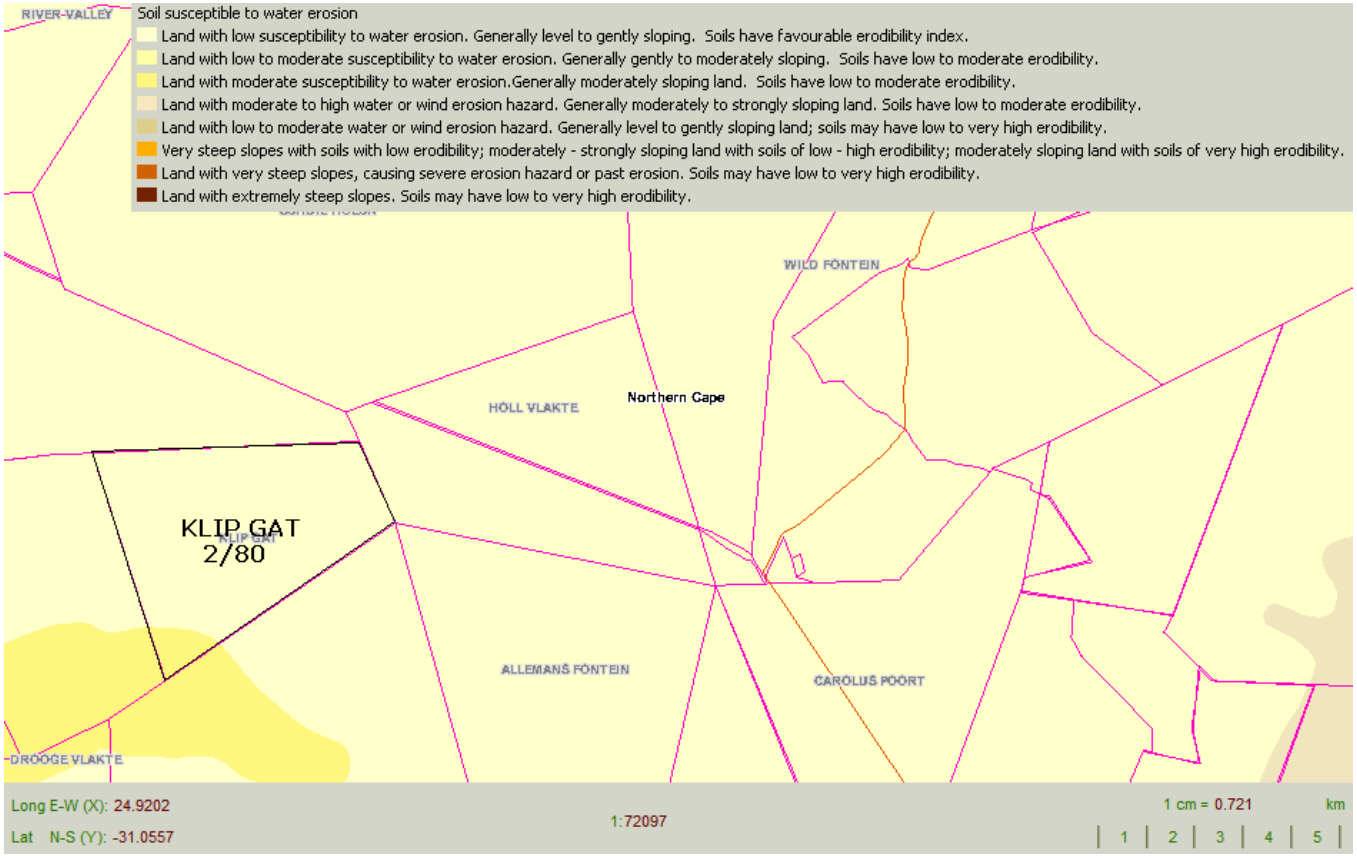
Appendix 8 Soil susceptibility to water erosion (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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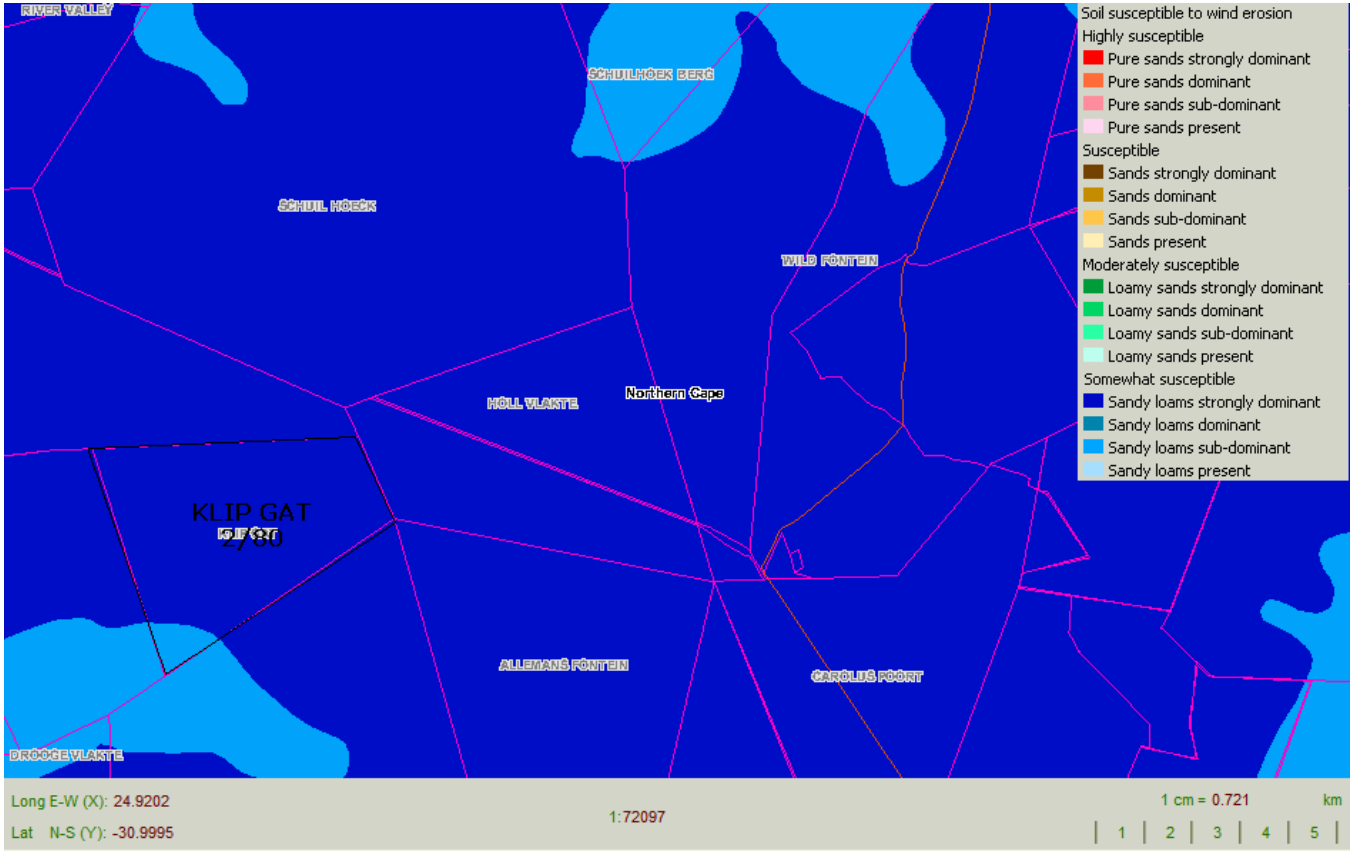
Appendix 9 Soil susceptibility to wind erosion (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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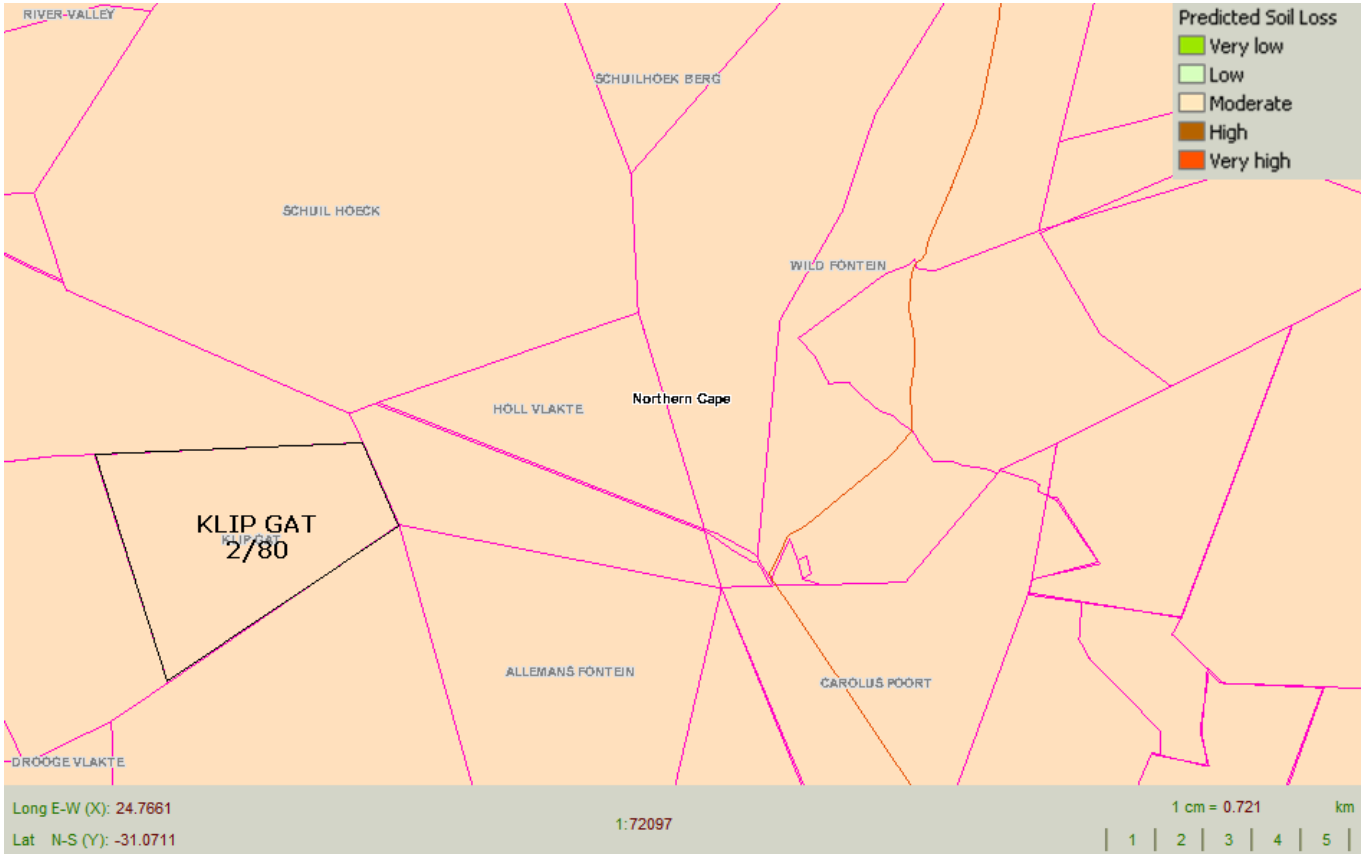
Appendix 10 Predicted soil loss (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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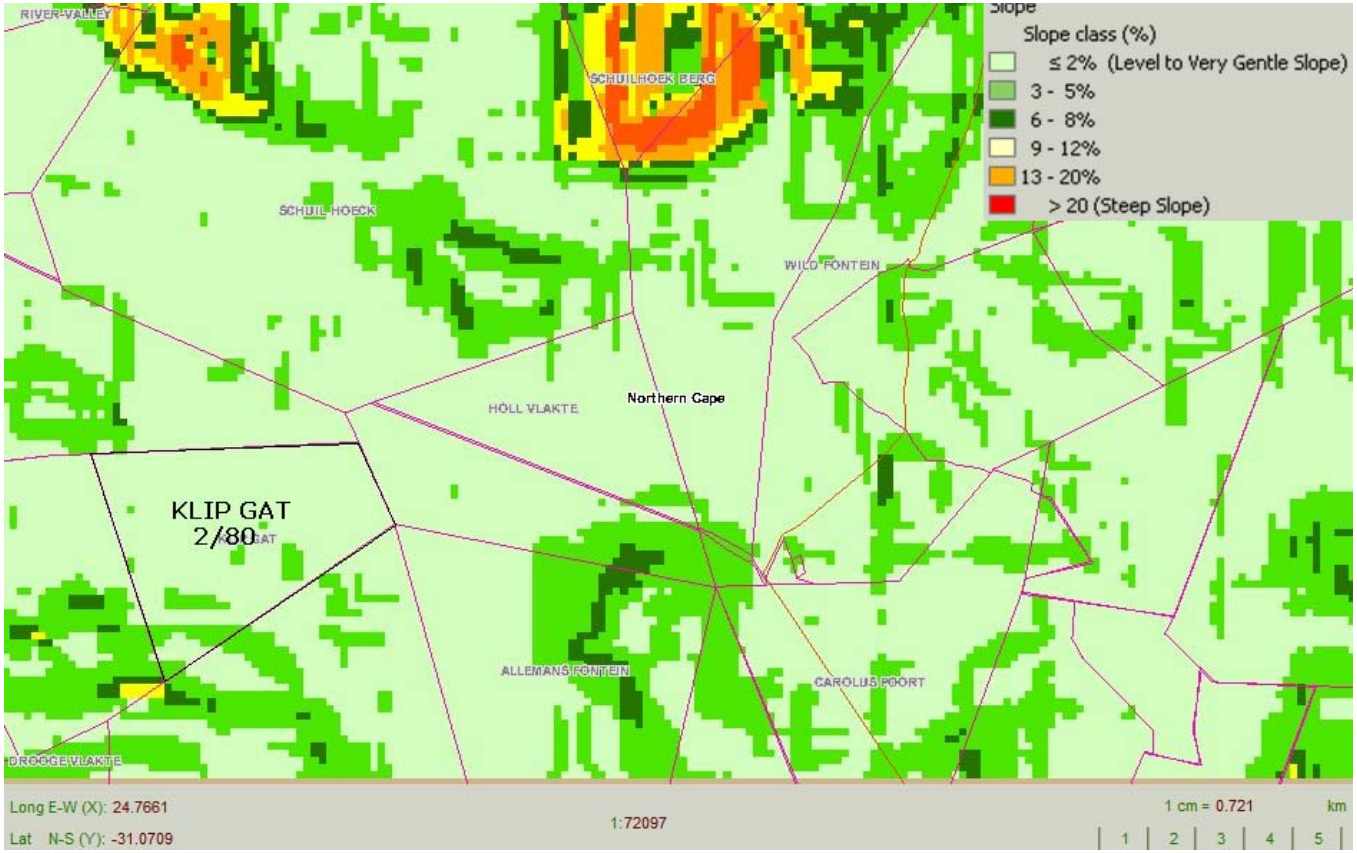
Appendix 11 Slope (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



Proposed Klipgat Solar Energy Site

Farm Portion

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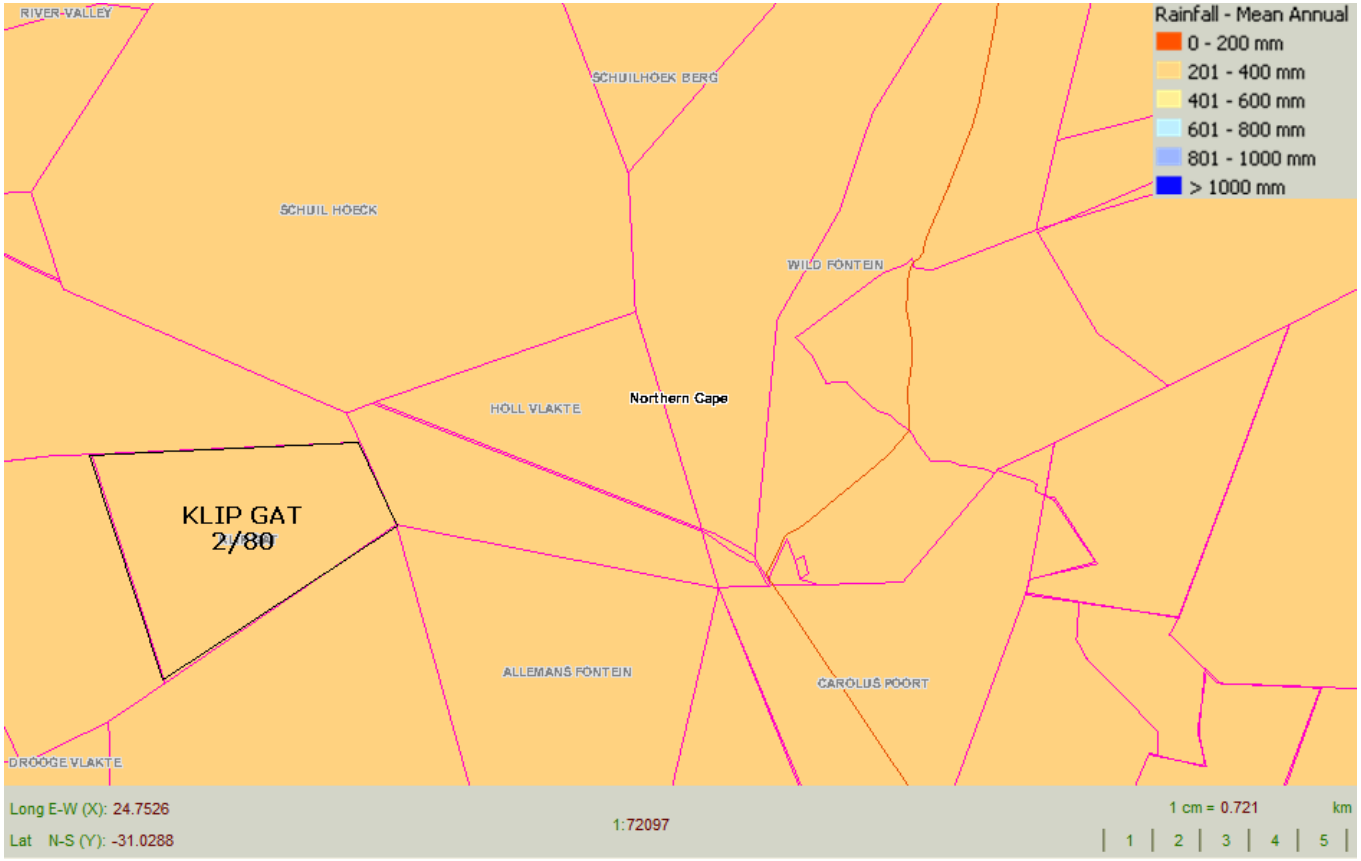
Appendix 12 Mean annual rainfall (Scoping phase)

Source: Department of Agriculture, Fisheries & Forestry – www.agis.agric.za



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Farm Portion

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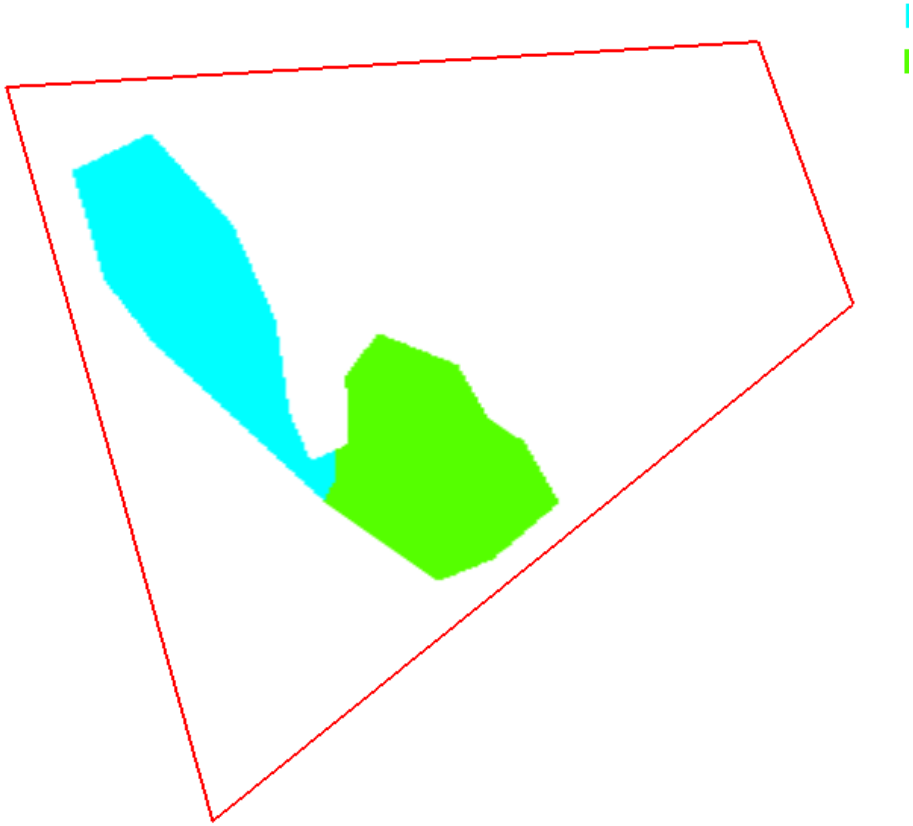
Appendix 13 Verified soil map



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Oakleaf & Augrabies

Glenrosa & Mispah

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Appendix 14 Soil sample information for the Klipgat site

Soil Sample	Soil Form (MacVicar *et al*, 1991)	Soil Form (MacVicar *et al*, 1977)	Effective Depth (mm)	Limiting Layer	Latitude (˚E)	Longitude (˚S)
1	Swartland	Swartland	100	Clay	-31.065	24.753
2	Oakleaf	Oakleaf	500	UM*	-31.066	24.754
3	Oakleaf	Oakleaf	500	UM*	-31.067	24.756
4	Augrabies	Oakleaf	500	UM*	-31.069	24.758
5	Oakleaf	Oakleaf	300	UM*	-31.070	24.759
6	Oakleaf	Oakleaf	300	UM*	-31.072	24.761
7	Mispah	Mispah	50	Rock	-31.075	24.765
8	Mispah	Mispah	50	Rock	-31.076	24.766
9	Mispah	Mispah	50	Rock	-31.073	24.767
10	Mispah	Mispah	50	Rock	-31.072	24.765
11	Glenrosa	Glenrosa	100	Rock	-31.072	24.770
12	Glenrosa	Glenrosa	100	Rock	-31.075	24.767
13	Glenrosa	Glenrosa	100	Rock	-31.078	24.766
14	Glenrosa	Glenrosa	100	Rock	-31.079	24.770
15	Glenrosa	Glenrosa	100	Rock	-31.077	24.771
16	Mispah	Mispah	50	Rock	-31.076	24.774

* Unconsolidated material

Appendix 15 Photographs of the Oakleaf soil form

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Appendix 16 Photographs of the Augrabies soil form

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Appendix 17 Photographs of the Glenrosa soil form

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Appendix 18 Photographs of the Mispah soil form

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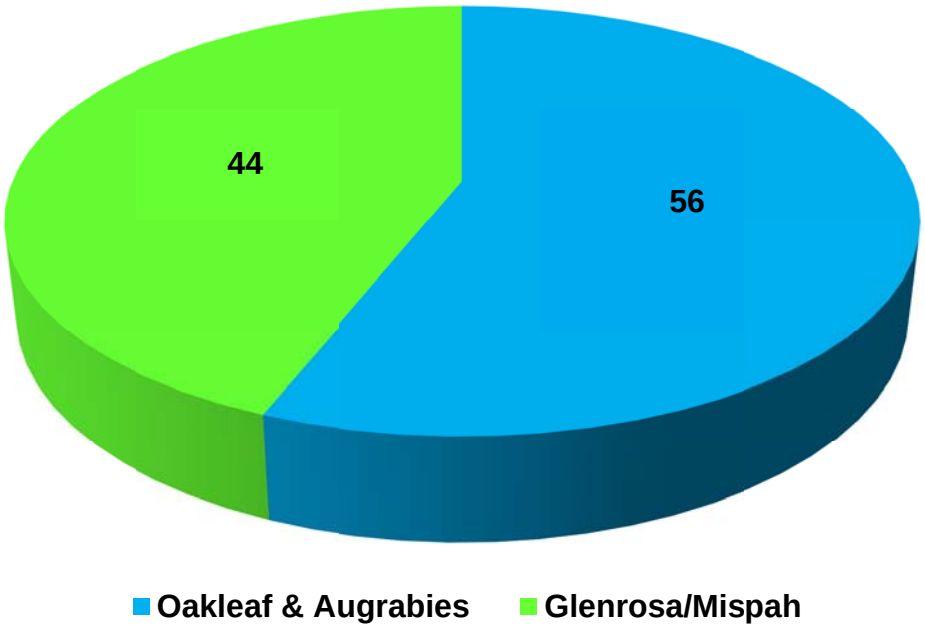
Appendix 19 Relative contribution of the soil forms on the proposed Klipgat Solar Energy Site



Proposed Klipgat Solar Energy Site

Oakleaf & Augrabies
Glenrosa & Mispah

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Appendix 20 Photographs of crust forming

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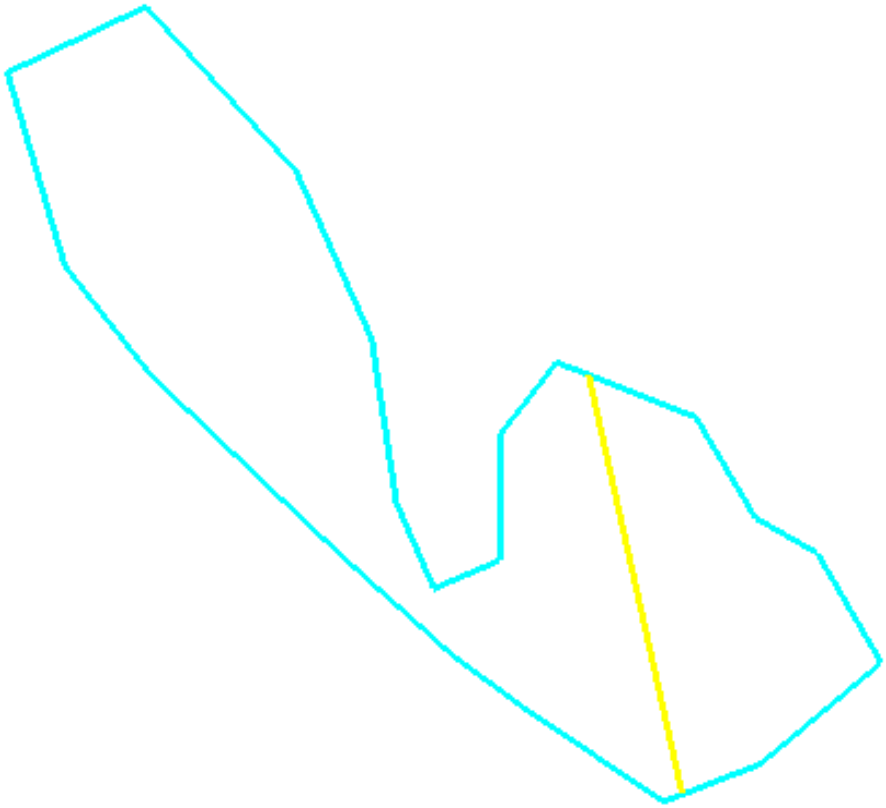
Appendix 21 Plant species list for the Klipgat PV Solar Site

Grasses	Karroo Bushes	Trees & Shrubs	Succulents
Aristida adscencionis	*Eberlanzia ferox*	*Lycium spp.*	*None*
Cynodon incompletus	*Eriocephalus ericoides*	*Protasparagus africanus*	
Eragrostis bicolor	*Eriocephalus spinescens*		
Eragrostis lehmanniana	*Felicia muricata*		
Fingerhuthia africana	*Felicia filifolia*		
Melica decumbens	*Helichrysum lucilioides*		
Sporobolus fimbriatus	*Pentzia globosa*		
Tragus koelerioides	*Phymaspermum aciculare*		
	Plinthus karooicus		
	Pteronia glauca		
	Pteronia sordida		
	Pteronia tricephala		
	Rosenia humulis		
	Walafrida saxatilis		

Appendix 22 Position of fence on the site



Proposed Klipgat Solar Energy Site

Fence

PV Solar Site

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