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AGRICULTURAL AND SOILS IMPACT ASSESSMENT FOR PROPOSED KHUBU SOLAR POWER PLANT NEAR VRYBURG NORTH WEST PROVINCE

EIA PHASE REPORT

Report by
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May 2016

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Executive Summary

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is unsuitable for cultivation due to both climate and soil limitations.

The key findings of this study are:

- The development of the solar energy facility will have low negative impacts on agricultural resources and productivity but it will also deliver low positive impacts on agriculture.
- The significance of all agricultural impacts is influenced by the fact that the site has climate limitations, as well as soil imitations, making it unsuitable for cultivation and it is only used as grazing for cattle.
- No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.
- Soils on the site are all shallow, sandy soils on hard rock (Mispah soil form).
- The major limitations to agriculture are the limited climatic moisture availability and the shallow soils.
- The land capability is classified as Class 5 - non-arable, moderate potential grazing land. The site has a grazing capacity ranging from 11-17 hectares per large stock unit.
- Three potential negative impacts of the development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
    - Loss of topsoil in disturbed areas, causing a decline in soil fertility.
    - Soil Erosion caused by alteration of the surface characteristics.
- One potential positive impact of the development on agricultural resources and productivity was identified as:
    - Generation of alternative land use income through rental for energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood.
- All impacts were assessed as having low significance.
- General mitigation measures are proposed for loss of topsoil and erosion.
- Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. Authorisation is promoted by the fact that the site falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors, including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.
- Because the site is uniformly low potential, from an agricultural point of view, there is

no preferred location or layout within the assessed site.

- There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

2 INTRODUCTION

Development of the Khubu Solar Power Plant is proposed on Portion 5 (Shadow Eve) (Portion of Portion 4) of the Farm Champions Kloof 731, approximately 12 kilometres south east of the town of Vryburg (see Figure 1). The facility will deliver a total capacity of 100MW, with maximum 115MW installed. It will consist of arrays of photovoltaic panels supported by mounting structures, inverter stations, internal access roads, cabling, fencing, an on-site substation with a 132kv connection to the Eskom grid, and a building for a workshop, storage, and offices. The footprint of the energy facility will utilise up to 300 hectares, of the total farm portion of 397 hectares.

The objectives of the study are to identify and assess all potential impacts of the proposed development on agricultural resources including soils and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts. Johann Lanz was appointed by Khubu Solar Power Plant (RF) (Pty) Ltd as an independent specialist to conduct this Soils and Agricultural Impact Assessment.

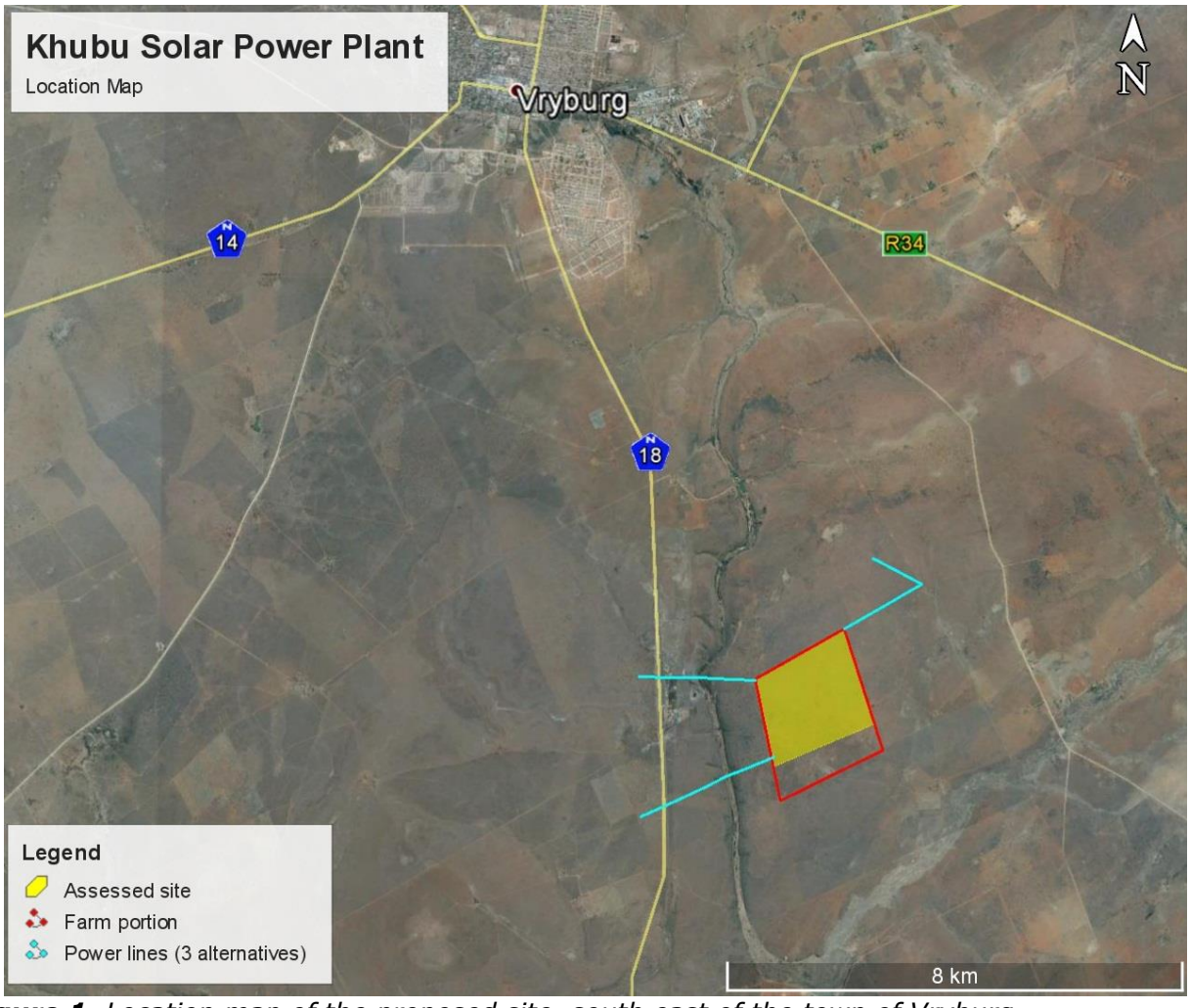

Figure 1. *Location map of the proposed site, south east of the town of Vryburg.*

3 TERMS OF REFERENCE

The terms of reference for the study fulfills the requirements for a soils and agricultural study as described in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011. The study applies an appropriate level of detail for the agricultural suitability and soil variation on site.

The above requirements together with requirements for an EIA specialist report may be summarised as:

- Identify and assess all potential impacts (direct, indirect and cumulative) of the proposed development on soils and agricultural potential.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Map soil survey points.
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine the agricultural potential across the site.
- Determine the agricultural sensitivity to development across the site.
- Provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

4 METHODOLOGY OF STUDY

4.1 Methodology for assessing soils and agricultural potential

The pre-fieldwork assessment was based on existing soil and agricultural potential data for the site. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the site available on Google Earth was also used for evaluation.

The AGIS data was supplemented by a field investigation. This was aimed at ground-proofing the AGIS data and achieving an understanding of specific soil and agricultural conditions, and the variation of these across the site. The soil assessment used a sampling distance that classifies it as detailed, that is a minimum of 6.25 sample points per 100 hectares or a grid spacing of 400 x 400 meters (van der Watt & van Rooyen, 1990). Soil sample points were hand augered or used existing excavations. The field assessment was done on 19 January 2016. An assessment of soils (soil mapping) and long term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the fact that the

assessment was done in summer has no bearing on its results.

Telephonic consultation was done with the current farmer of the land, Mr Bertus Meyer, to get details of farming activities.

4.2 **Methodology for assessing impacts and determining impact significance**

In assessing the significance of each impact the following criteria are used:

GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 –

		30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.

2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.

CUMULATIVE EFFECT

This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.

29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

5 CONSTRAINTS AND LIMITATIONS OF STUDY

Data on the spatial distribution of soil types is dependent on the resolution of sampling points. Investigations for different purposes will use different resolutions. These will record the degree of soil variation that occurs naturally, at different levels of accuracy. The intensity of sample points used in this assessment is considered more than adequate for the purposes of this study. A more detailed soil investigation is not considered likely to have added anything significant to the assessment of agricultural soil suitability for the purposes of determining the impact of the facility on agricultural resources and productivity.

The fact that only a hand auger was used to investigate below surface has limitations for identifying deeper subsurface materials. The hand auger is limited to a depth of about 120 cm in unconsolidated material but is also unable to penetrate any hardened or rocky layers that may occur above this depth. The limitation has less relevance for the assessment of agricultural soil suitability than it does for the geotechnical assessment. A layer that cannot be penetrated by the hand auger is also not suitable for crop roots and therefore forms an agricultural depth limitation in the soil. The hand auger data can identify the nature of the top of the limitation and its depth. This is what is important in terms of the agricultural assessment. However it cannot provide information on the nature of the subsurface below that, which depending on its depth, may be relevant to the geotechnical assessment in terms of foundations.

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific constraints, uncertainties and gaps in knowledge for this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A change of land use (re-zoning) for the development on agricultural land needs to be

approved in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). This is required for long term lease, even if no subdivision is required. Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this. The Department of Agriculture, Forestry and Fisheries reviews and approves applications in terms of these Acts according to their Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land, dated September 2011.

7 DESCRIPTION OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

All the information on soils and agricultural potential in this report has been obtained from the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated).

7.1 Climate and water availability

Rainfall for the site is given as 501 mm per annum (The World Bank Climate Change Knowledge Portal, undated). The average monthly distribution of rainfall is shown in Figure 2. One of the most important climate parameter for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into 6 categories across the country (see Table 1). The site falls into the 4th category, which is labelled as a moderate to severe limitation to agriculture.

There are wind pumps on the site, which are used for stock watering. The farm does not have access to water for irrigation.

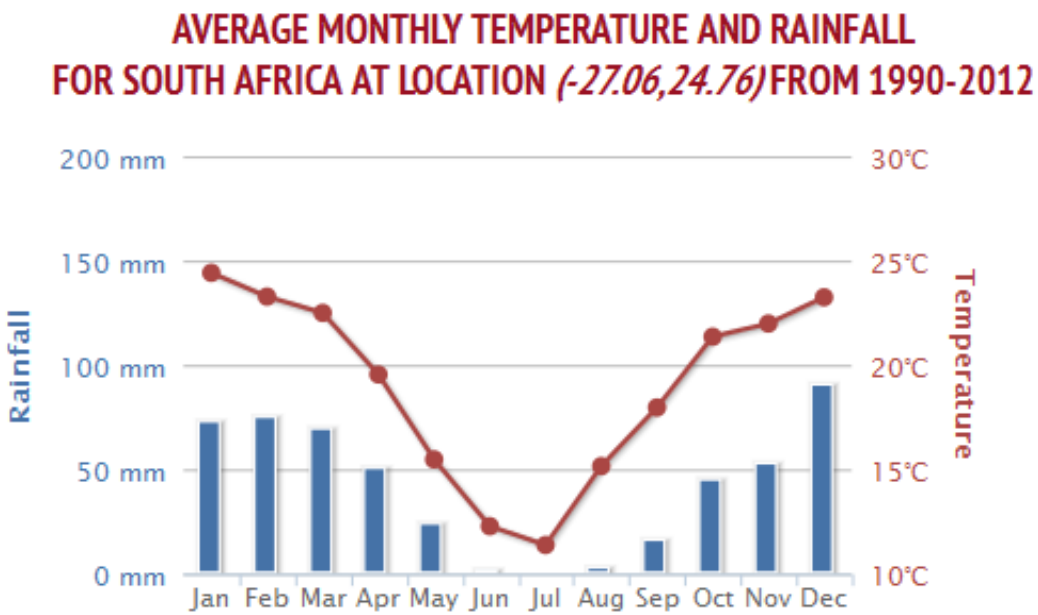

Figure 2. *Average monthly temperature and rainfall for the site (The World Bank Climate*

Change Knowledge Portal, undated).

Table 1. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate class	Moisture availability (Rainfall/0.25 PET)	Description of agricultural limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

7.2 **Terrain, topography and drainage**

The proposed development is located on a terrain unit of rolling or irregular plains with low hills or ridges at an altitude of around 1,190 meters. Slope is less than 2% across the site. A satellite image map of the site is shown in Figure 3. Photographs of site conditions are shown in Figures 4 to 5.

The surface geology is red to flesh-coloured wind-blown sand and surface limestone of Tertiary to Recent age. The underlying geology is dolomite of the Ghaap Group of the Traansvaal Supergroup. This is flat lying and without prominent outcrops.

There is a non-perennial water course that crosses the site running south south west.

7.3 **Soils**

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There is a single land type across the site and surrounding area, namely Ag10. Soils of this land types are predominantly shallow, loamy soils on underlying rock or hardpan carbonate. These soils fall into the Lithic and Calcic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land type is provided in Table A1. The field investigation identified that the entire site is underlain by shallow dolomite bedrock and that all soils are of the Mispah soil form. Data from soil sample points across the site is given in Table A2.

The soils are classified as having low to moderate susceptibility to water erosion (class 2), and moderate susceptibility to wind erosion (class 3d).

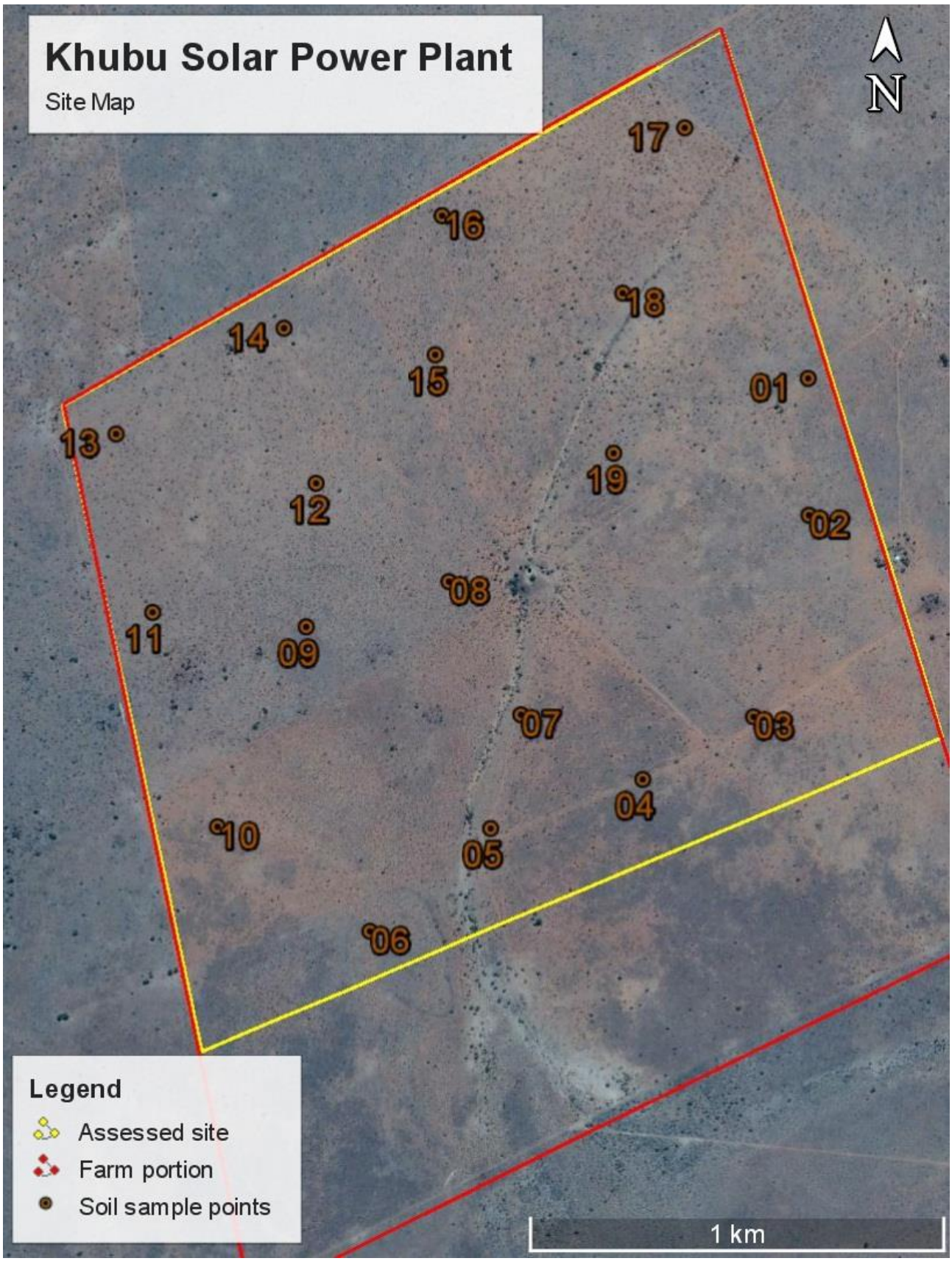

Figure 3. *Satellite image of the assessed site (300 hectares). Soil sample numbers correspond to those in Table A2. The surface coverage of each soil form is given in Table A3.*

Figure 4. *View of typical conditions across the site.*

Figure 5. *View of commonly occurring, flat dolomite outcrops across the site.*

7.4 **Agricultural capability**

Land capability is the combination of soil suitability and climate factors. The site and surrounds has a land capability classification, on the 8 category scale, of Class 5 – non-arable, moderate potential grazing land.

The limitations to agriculture are both climate and soil related. The moisture availability class 4 classification, with high variability of rainfall is a severe limitation to cultivation, which is not viable without irrigation. The low water holding capacity of the soils and their limited depth further limits the dryland potential. Potential maize yield on AGIS (Schulz) is given as low at 1.43 -1.51 tons per hectare and (ISCW) is given as marginal (30%). The grazing capacity is given as ranging from 11 to 17 hectares per large stock unit.

7.5 **Land use and development on and surrounding the site**

The farm is located within a cattle farming agricultural region and currently used only for grazing.

There are no buildings on the site or farm portion, only on the neighbouring farm portion to the east of the site. The only agricultural infrastructure across the site are wind pumps, stock watering points and fencing into camps.

Road access to the site is off the gravel road D1196, via a farm road over the neighbouring farm, Lockerbie number 727, which will require upgrading.

7.6 **Status of the land**

The biome classification for the site is Ghaap Plateau Vaalbosveld. The vegetation is grazed, but there is no evidence of significant erosion or other land degradation on the site.

7.7 **Possible land use options for the site**

Because of the climate limitations, lack of access to water for irrigation, and soils with limited depth, the site is not suitable for cultivated crops, and viable agricultural land use is limited to grazing only.

The site is within on of South Africa's eight proposed renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

7.8 **Agricultural sensitivity**

Agricultural conditions and potential are uniform across the site and the choice of placement of infrastructure therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the investigated site and no parts of it therefore need to be avoided by the development. There are no required buffers.

8 **IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE**

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the site by the footprint of the facility
- Constructional activities that disturb the soil profile and vegetation, for example for levelling, excavations, etc.

The following four potential impacts of the development on agricultural resources and productivity are identified, and assessed in the table formats below. The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable and important for agricultural production. The proposed site is on land which is unsuitable for cultivation due predominantly to climate limitations, but also due to soil limitations. This means that the consequence of any impact for agricultural production is limited, with the result that the consequence and significance of agricultural impacts is low.

The impacts of the associated power line are negligible because the actual footprint of disturbance is confined to the pylon bases. All grazing can continue undisturbed below the lines themselves. The footprint of the power line is therefore minuscule in relation to available grazing land.

Mitigation and monitoring recommendations are included in the table for each impact.

All four impacts are associated with all the phases of the development - construction, operational, and decommissioning.

1. Nature: Loss of agricultural land use Caused by: direct occupation of land by total footprint of energy facility infrastructure; And having the effect of: taking affected portions of land out of agricultural production.		
Comments: The impact is reversible after the life of the project, with effective topsoiling of the land during rehabilitation.		
Geographical extent	Low (1) - Site	

Probability	Definite (4)	
Duration	Long term (3)	
Intensity / Magnitude	Medium (2)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources?	None (1)	
Cumulative effect	Medium (3)	
Significance	Low (28)	
Status	Negative	
Mitigation: No mitigation possible		
Monitoring: None		

2. Nature: Generation of alternative land use income through rental for energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.		
Geographical extent	Low (1) - Site	
Probability	Definite (4)	
Duration	Long term (3)	
Intensity / Magnitude	Medium (2)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources?	None (1)	
Cumulative effect	Low (2)	
Significance	Low (24)	
Status	Positive	
Optimization: None		
Monitoring: None		

3. Nature: Loss of topsoil Caused by: poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.) And having the effect of: loss of soil fertility on disturbed areas after rehabilitation.		
	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Possible (2)	Unlikely (1)
Duration	Long term (3)	Long term (3)

Intensity / Magnitude	Medium (2)	Medium (2)
Reversibility	Partly reversible (2)	Partly reversible (2)
Irreplaceable loss of resources?	Marginal (2)	Marginal (2)
Cumulative effect	Negligible (1)	Negligible (1)
Significance	Low (22)	Low (20)
Status	Negative	Negative

Mitigation:

If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation.

Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.

Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.

During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.

Erosion must be controlled where necessary on topsoiled areas.

Monitoring:

Establish an effective record keeping system for each area where soil is disturbed for constructional purposes. These records should be included in environmental performance reports, and should include all the records below.

Record the GPS coordinates of each area.

Record the date of topsoil stripping.

Record the GPS coordinates of where the topsoil is stockpiled.

Record the date of cessation of constructional (or operational) activities at the particular site.

Photograph the area on cessation of constructional activities.

Record date and depth of re-spreading of topsoil.

Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

4. Nature: Erosion due to alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, presence of panel surfaces, and the establishment of hard standing areas and roads. Erosion will cause loss and deterioration of soil resources

Comments: The erosion risk is low due to the low slope gradients and low to moderate erodibility of the soils.

	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Possible (2)	Unlikely (1)

Duration	Medium term (2)	Medium term (2)
Intensity / Magnitude	Medium (2)	Medium (2)
Reversibility	Partly reversible (2)	Partly reversible (2)
Irreplaceable loss of resources?	Marginal (2)	Marginal (2)
Cumulative effect	Negligible (1)	Negligible (1)
Significance	Low (20)	Low (18)
Status	Negative	Negative
Mitigation: Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.		
Monitoring: Include periodical site inspection in environmental performance reporting that inspects the effectiveness of the run-off control system and specifically records occurrence or not of any erosion on site or downstream.		

8.1 **Cumulative impacts**

Cumulative impacts could arise as other similar projects are constructed in the area. According to the Energy Blog's database only one other solar PV plant has been granted preferred bidders status within close proximity to the proposed PV plant:

- Waterloo Solar Park with a capacity of 75MW near Vryburg, North West Province (Approvals, planning and financing phase)

According to the Department's database numerous other solar plants have been proposed in relative close proximity to the proposed activity, namely:

- The proposed Carocraft Solar Park near Vryburg, North West Province (14/12/16/3/3/2/374);
- Construction of the 75MW Photovoltaic facility and associated infrastructure in Naledi (14/12/16/3/3/2/390).
- The proposed Tiger Kloof Solar Photovoltaic energy facility near Vryburg, North West Province (14/12/16/3/3/2/535).
- The proposed Keren Energy Bosh Pan Solar Plant, Northern Cape Province (14/12/16/3/3/1/563);
- The proposed renewable energy generation project. Carocraft Solar Park in North West Province (14/12/16/3/3/2/699);
- The proposed Renewable Energy Genertion Project rem farm Elda, North West (14/12/16/3/3/2/750);
- The proposed Renewable Energy Project on Farm Doornbult 29 and Doornbult 33, North West (14/12/16/3/3/2/751);

Environamics and other environmental consultants are also in the process of applying for Environmental Authorisation for other PV projects in the area, namely:

- The proposed Meerkat Solar Power Plant near Vryburg, North West Province.
- The proposed Gamma Solar Power Plant near Vryburg, North West Province.
- The proposed Alpha Solar Power Plant near Vryburg, North West Province.
- The proposed Sonbesie Solar Power Plant near Vryburg, North West Province.
- The proposed Protea Solar Power Plant near Vryburg, North West Province.
- Three PV Solar Energy facilities on the farm Klondike - AMDA Developments

The potential for cumulative impacts may therefore exist. The Environmental Impact Assessment (EIA) Report will include a detailed assessment of the potential cumulative impacts associated with the proposed development.

Although the loss of individual project portions of land has low significance, as discussed above, the cumulative impacts of land loss regionally becomes more significant. However, despite this cumulative impact, it is still agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to regions such as this one, with low agricultural potential. It is preferable to incur a higher cumulative loss in such a region, than to lose agricultural land with a higher production potential elsewhere in the country.

8.2 **Comparative assessment of alternatives**

No proposed grid connection alternatives will have any bearing on agricultural impacts. The 'do nothing' alternative has zero impact on agriculture, compared to the low impact for the development.

9 **CONCLUSION AND RECOMMENDATIONS**

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. Authorisation is promoted by the fact that the site falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors, including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.

Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site. There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

10 **REFERENCES**

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The World Bank Climate Change Knowledge Portal available at http://sdwebx.worldbank.org/climateportal/

APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ag10	5	Hutton	30-60	8-15	10-25	R	28
		Hutton	30-60	13-20	25-35	R	25
		Shortlands	30-60	13-20	30-45	R	12
		Mispah	10-25	10-25		R, ca	10
		Rock outcrop	0			R	5
		Glenrosa	10-30	10-25	15-35	R	5
		Bonheim	30-60	35-45		R, vp	5
		Sterkspruit	20-30	15-25	35-45	R	5
		Arcadia / Rensburg	45-70	35-50	15-35	R	3
		Oakleaf	90->120	10-20		R	2

Land capability classes: 5 = non-arable, moderate potential grazing land.
Depth limiting layers: R = hard rock; ca = hardpan carbonate; vp = dense, structured clay layer.

Table A2. Soil data from all investigated sample profiles on the site. Samples positions correspond to the numbers in Figure 3. Top soil refers to the A horizon, subsoil to the B horizon.

No	Soil series (form)	Effective depth (depth to limiting horizon) (cm)	Clay %		GPS co-ordiantes	
			top soil	sub soil	latitude	longitude
1	Mispah	30	6		-27.0502006263	24.7895199526
2	Mispah	20	6		-27.0530986693	24.7895889357
3	Mispah	20	6		-27.0573902037	24.7883287165
4	Mispah	20	6		-27.0587297995	24.7856951226
5	Mispah	15	6		-27.0597725920	24.7820344940
6	Mispah	5	6		-27.0619633701	24.7791411448
7	Mispah	20	6		-27.0573429298	24.7827291023
8	Mispah	20	6		-27.0545144565	24.7809543181
9	Mispah	25	6		-27.0554735139	24.7775445599
10	Mispah	30	6		-27.0597192831	24.7754561249
11	Mispah	30	6		-27.0551651437	24.7739089094
12	Mispah	20	6		-27.0524338167	24.7777725477

No	Soil series (form)	Effective depth (depth to limiting horizon) (cm)	Clay %		GPS co-ordiantes	
			top soil	sub soil	latitude	longitude
13	Mispah	30	6		-27.0513816364	24.7730349284
14	Mispah	30	6		-27.0491581690	24.7769983113
15	Mispah	30	6		-27.0497190021	24.7805944830
16	Mispah	10	6		-27.0467939693	24.7807293478
17	Mispah	20	6		-27.0449357852	24.7864845302
18	Mispah	20	6		-27.0484147780	24.7850465309
19	Mispah	20	6		-27.0517879911	24.7848950699

Table A3. Surface coverage of different soil forms, according to the soil mapping illustrated in Figure 3.

Soil map unit label	Soil form	Surface coverage (hectares)
Ms	Mispah	300
Total		**300**