ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED CONSTRUCTION AND IMPLEMENTATION OF GAETSEWE SOLAR DEVELOPMENT NEAR KATHU, NORTHERN CAPE

APPLICANT:
K2018091758 (SOUTH AFRICA) (PTY) LTD

AGRICULTURAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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STUDY CONDUCTED AND

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1. INTRODUCTION

K2018091758 (South Africa) (Pty) Ltd is applying for authorisation to construct a 75 Megawatt PV facility, to be known as Gaetsewe Solar, on Portion 2 of Farm 460 Legoko, Kathu, Northern Cape. The grid connection for this phase will run parallel with the authorised grid connection of AEP Legoko. As part of the EIA, this agricultural scoping study was done.

The objectives of this study were to consider the possibility of temporary and permanent impacts on agricultural production that may result from the proposed construction and operation of the PV Power Plant.

2. APPROACH AND METHODOLOGY

The approach was to compile a natural resource database for the study area. This would include all necessary information to determine the agricultural potential and risks for farming on this land unit. The proposed development was then considered in terms of its possible impacts on agricultural production of the unit or on the surrounding area.

The resource data was obtained from published data (AGIS) that will be compared to field surveys on immediate bordering sites. These surveys were executed on 15 to 17 April and 4 to 6 November 2015. During these surveys, the proposed development area was partly included. As control measure, the strip on which the Eskom overhead transmission line was constructed was surveyed on 7 June 2018. This section was chosen firstly, because it would give a representative distribution of soils diagonal over the site, and secondly to perceive the impacts caused by the construction of the overhead transmission lines.

3. ASSUMPTIONS AND UNCERTAINTIES

As far as regional information is concerned, this is primarily a desktop-based study. Climatic conditions, land use, land type and terrain are readily available from literature, GIS information and satellite imagery.

The 2015 and 2018 field surveys, photos and map analysis will be amalgamated with the published data of the current development area to produce a soil map and other findings.

4. DESCRIPTION OF THE PROPOSED PROJECT

K2018091758 (South Africa) (Pty) Ltd is proposing the establishment of a commercial photovoltaic (PV) Solar energy facility (SEF) called Gaetsewe Solar on the farm known as Legoko Farm 460 portion 2 situated in the District of Kuruman, Northern-Cape Province within the jurisdiction of Gamagara Local Municipality.

5. THE POTENTIALLY EFFECTED ENVIRONMENT

This section provides a general description of the immediate environment potentially effected by the construction, operation and closure of the proposed PV power plant.

5.1 Locality

The Gaetsewe PV facility is to be constructed near Kathu on the farm Legoko 460 portion 2. Access to the site is gained via a dirt road exiting eastward from the N14 provincial road approximately 5 km south of Kathu.

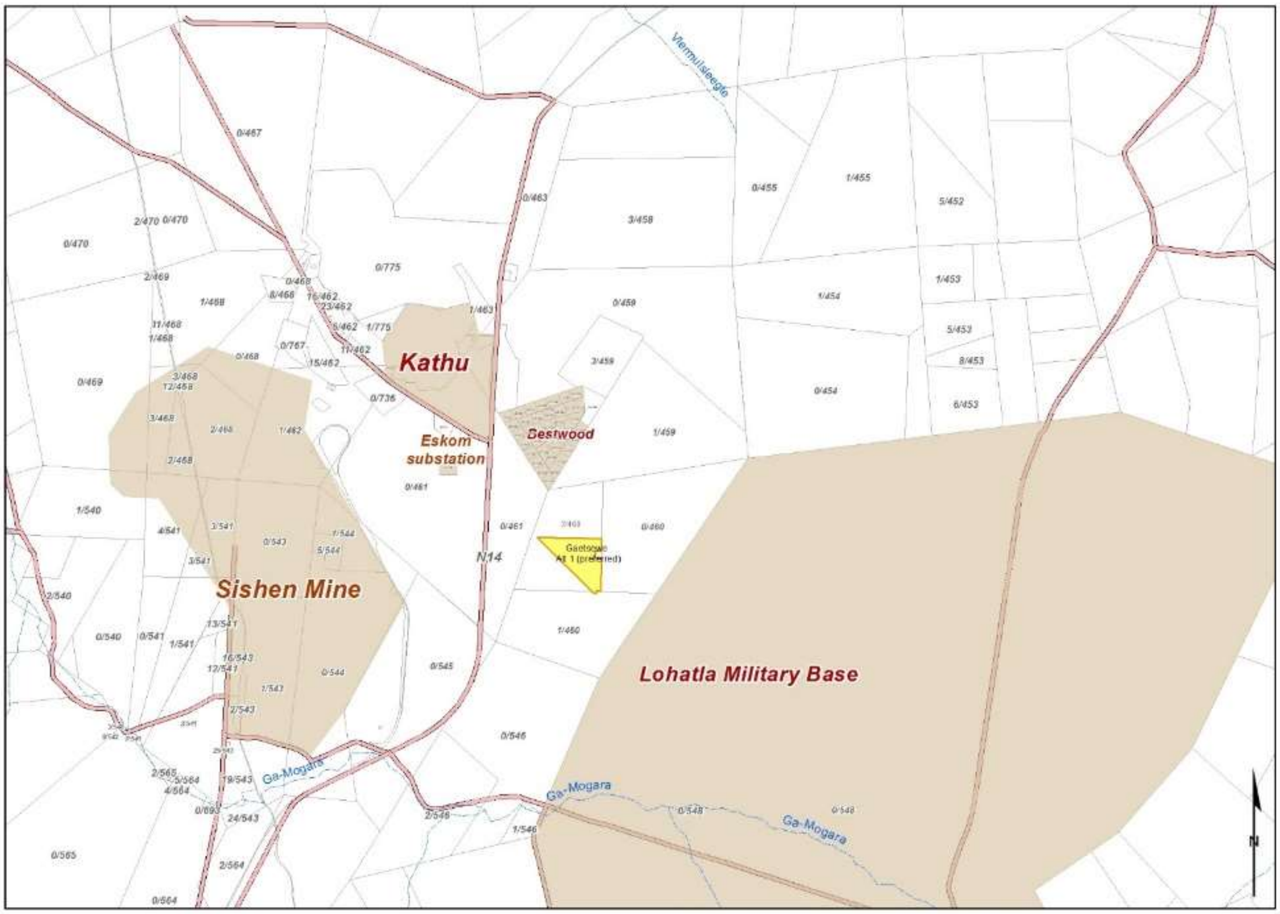


Figure 1: Location of the proposed PV energy facility

The site coordinates are as follows:

Point	**Latitude**	**Longitude**
NW corner	27° 45’ 10.87” S	23° 05’ 18.76” E
NE corner	27° 45’ 12.05” S	23° 06’ 34.95” E
SE corner	27° 46’ 09.28” S	23° 06’ 24.31” E
SW corner	27° 46’ 09.36” S	23° 06’ 34.44” E

5.2 Physical description

The site falls in the Kalahari region. The Kalahari is essentially sandy bushveld. The sand was originally created millions of years ago on the west coast of Africa, when basement rocks were weathered. These sandy deposits were then redistributed mostly by wind and water, on average thought to be some 5 m deep. These sands were blown eastward to form the Kalahari dunes that was vegetated and stabilized some 10 to 20000 years ago.

Characteristic of these soils is the red sandy top layer with calcrete sub layer that surfaces as outcrops where sands are eroded.

5.3 Climate

The Kalahari has consistent temperatures with summer and early autumn rainfall. Winters are very dry. The wettest part appear in the east with a Mean annual precipitation (MAP) of 500mm/annum and driest in the west with 120 mm/annum. The MAP for the whole Ecozone is 250 mm/annum

The region is classified as a semi-arid zone. The following specific parameters are applicable:

Climate				
Rainfall		**Evaporation**	**Temperature**	
Month	**Monthly mm**	**Monthly mm**	**Season**	**Temperature**
January	65	198	Mean Max	33°C
February	74	162	Mean Min	Minus 2
March	83	135	First Frost	11-20 May
April	35	105	Last Frost	01-10 Sep
May	15	72	Hours sunshine	80 %
June	7	60		
July	3	71		
August	5	96		
September	7	126		
October	19	161		
November	24	189		
December	43	201		

5.4 Geology

The geology is of the Kalahari sequence. Sedimentary and Volcanic rocks of this sequence include dolomite, limestone and chert with red windblown sand of the Tertiary to Recent age. Characteristic of this geology is the well-developed calcrete or surface limestone with a thin layer (<1m) Aeolian sand blanket.

5.5 Vegetation

This site falls in the Kalahari Bushveld region and classified by Acocks as tropical bush and savannah bushveld within the Kathu Bushveld Biome. The vegetation in this region is very different from that of other Ecozones in the Cape, as the trees are more closely related to the more eastern and northern parts of South Africa. Camel thorn Acacia (*Acacia erioloba),* Umbrella Acacia (*Acacia tortilis) and* Camphor bush (*Trachonanthus campphortus) occur.*

Indicator grasses include the following:

Common name	Botanical name	Gazing value	Ecological value
Small Bushman Grass	Stipagrostis Obtusa	Very high	Decreaser
Lemann’s Love Grass	Eragrostis Lehmanniana	Medium	Advancer
Tassel Three-awn	Aristida Congesta	Very low	Advancer
Carrying Capacity		11 ha/large stock unit (LSU)	
Land Use		Livestock and Game farming	

5.6 Topography

Topography is the general configuration of the land surface or any part of the Earth’s surface, including its relief and the position of its natural and manmade features. The surface features are revealed by the contour lines on the map.

Relief is the variation in or physical outline of a landscape and is used to describe the toposequence down the length of the slope as shown in Figure 2.

Soils are expected to change in their morphological composition, attributable to its relative position in the landscape. It is expected to find shallower soils on convex slopes and deeper soils on concave soils with water locked soils at foot slopes and valley bottoms.

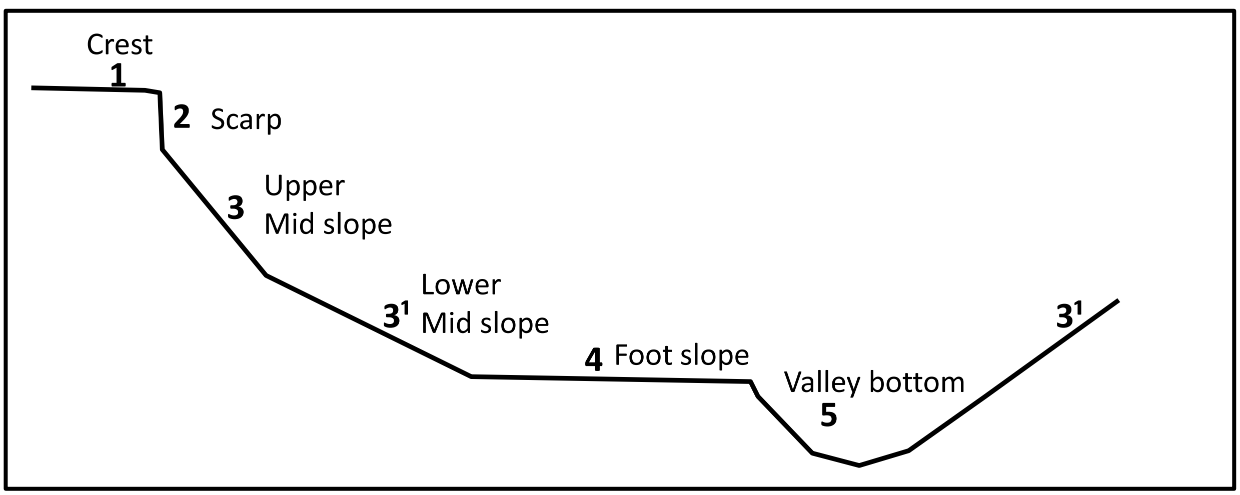


Figure 2: Terrain morphological units.

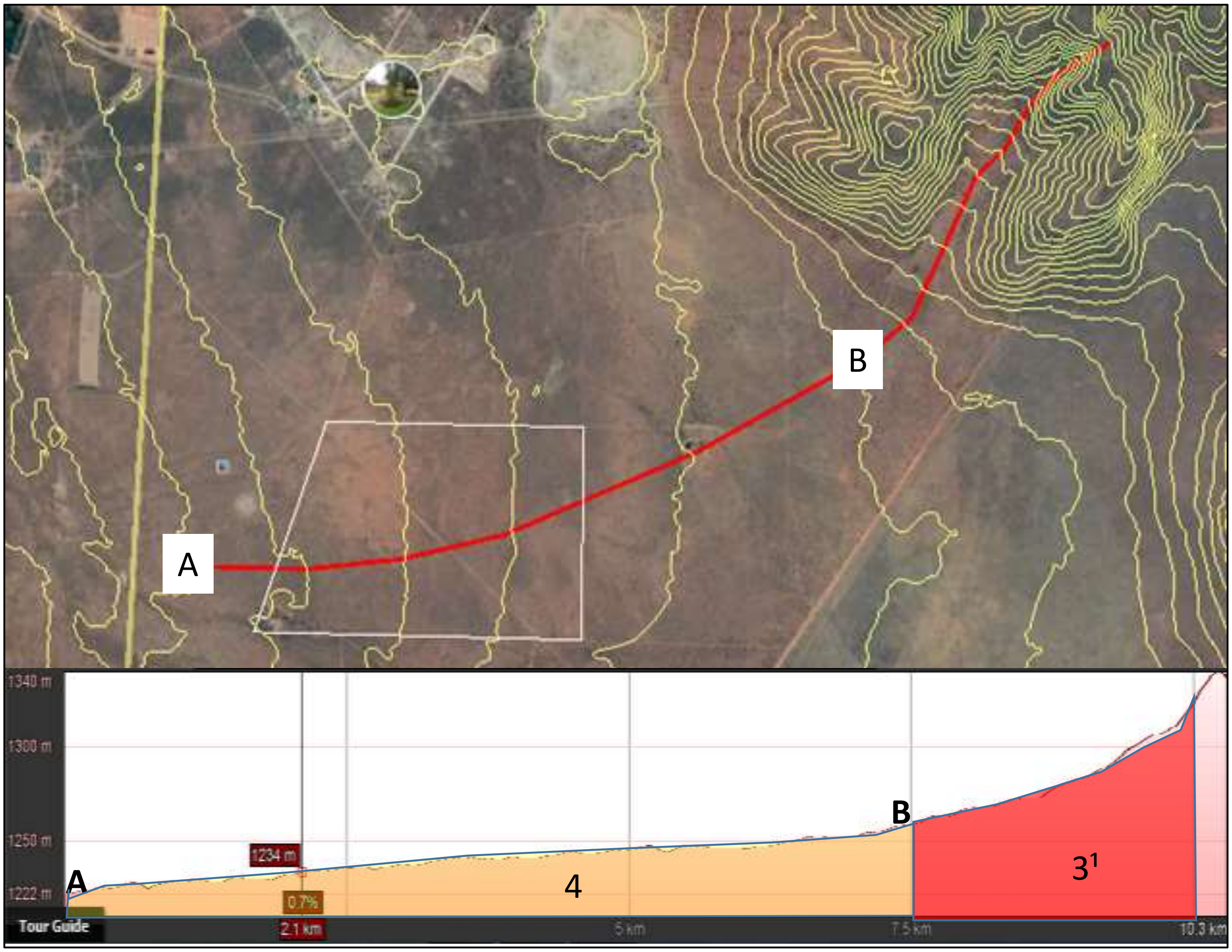


Figure 3: ***Longitudinal cross section of terrain***

Figure 3 shows the topography as level plains with some relief. The contours indicate a straight shape with low confluence of run-off water to be expected. The cross section indicates a concave shape with a low gradient (25 m vertical fall over 7 500m horizontal distance or 0,33%). The morphological unit is a Footslope, which represents the whole surveying unit.

5.7 Infrastructure on the farm

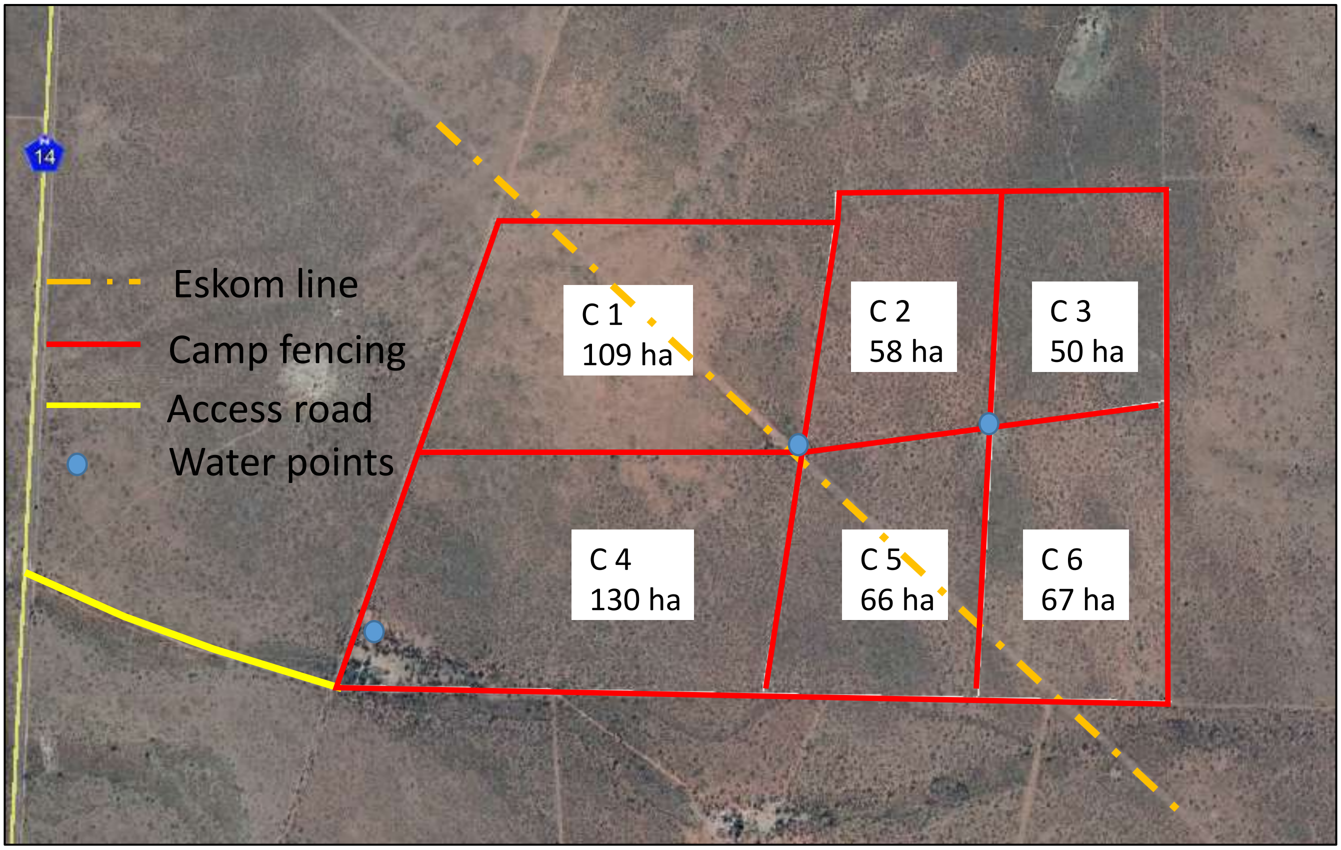


Figure 4: Farm infrastructure

The past and current agricultural activities on site are extensive grazing for livestock. Figure 4 shows that the only infrastructure is the internal fencing (red lines) and stock watering provision (blue dots).

An Eskom servitude runs along the Southwestern border of the site (orange line).

The homestead and handling facilities are situated in the southwestern corner of the site.

Access to the farm is gained from the N14 provincial road via a well-maintained dirt road.

5.8 Soil

Soils do not occur randomly in the landscape, but follow a pattern determined by factors such as geology and topographic position. Normally, soil forms follow each other downhill in a specific sequence. This is called a catena, with well-drained soils on top and water-locked soils at the bottom.

Such a system, where terrain form and soil pattern displays a marked degree of uniformity, is called a pedosystem.

This inter-relationship between soils and landform is a good reason for relating soils to the landscape position in which they occur.

The soils reflected in this report are the result of a desktop study and field visit. Satellite images were studied with the focus on differences in tone and structure, which represent differences in land cover, changes in topography or manmade features. These were then compared to physical soil surveys conducted on bordering properties during 2015. For further comparison, a field visit took place on 7 June 2018.

The land type map 2722 Kuruman of the Department of Agriculture and its accompanying inventory was used – see Figure 5. A copy of the inventory appears in Figure 6.

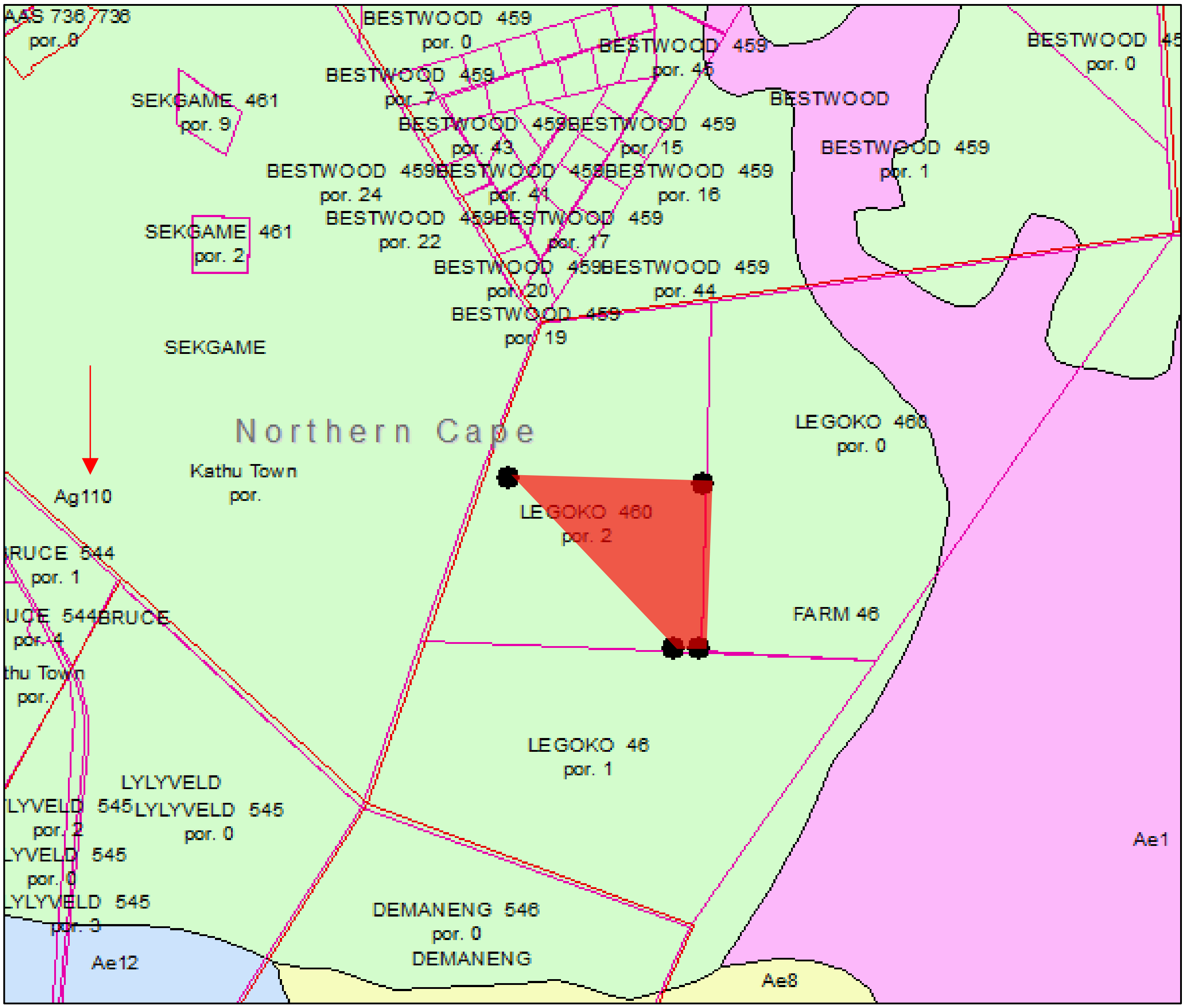


Figure 5: Portion of Land type map 2722 Kuruman

LAND TYPE / *LANDTIP* ....: **Ag110**
CLIMATE ZONE *KLIMAATSONE* ...... : 5S
Area / *Oppervlakte* .... : 170410 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 4370 ha

Occurrence (maps) and areas *Voorkoms (kaarte) en oppervlakte* :
2722 Kuruman (84930 ha) 2822 Postmasburg (85480 ha)

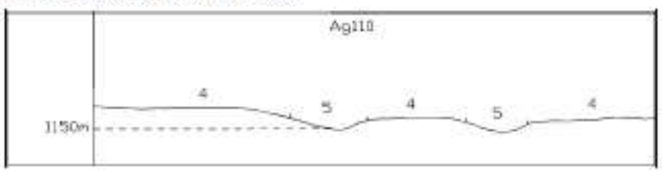
Inventory by *Inventaris deur* :
J F Eloff & S W J Idema

Modal Profiles *Modale profiele* :
None / Geen

Terrain uni *Terreineenhei* :	4	5
% of land type *% van landtipe* :	90	10
Area *Oppervlakte (ha)* :	153369	17041
Slope / *Helling (%)* :	0 - 2	0 - 1
Slope length *Hellingslengte (m)* :	1000 - 5000	50 - 5000
Slope shape *Hellingsvorm* :	Z	Z
MB0, MB1 (ha) :	30674	852
MB2 - MB4 (ha) :	122695	16189

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB	ha (4)	% (4)	ha (5)	% (5)	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Roodepoort Hu30, Mangano Hu33	0-300	3	84353	55	9373	55	93726	55.0	2-6		4-8	B	fiSa	ka,R
Kalkbank Ms22, Loskop Ms12	0-300	3	30674	20	6305	37	36979	21.7	6-15			A	fiSa-LmSa	ka
Mangano Hu33	450-900	1	23005	15	511	3	23517	13.8	4-8		6-15	B	srfiSa-LmfiSa	R,ka
Shorrocks Hu36	450-700	1	7668	5	341	2	8009	4.7	8-15		15-25	B	srfiSaLm-SaClLm	R,ka
Mispah Ms10, Muden Ms20	0-300	3	7668	5			7668	4.5	6-15			A	fiSa-LmSa	R
Stream beds/Stroombeddings		4			511	3	511	0.3						

Terrain type *Terreintipe* : A2
Terrain form sketch *Terreinvormskets*



For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava (Ongeluk Formation).

Geologie Oppervlakkalksteen, alluvium en rooi waaisand van Tersiere tot Resente ouderdom met enkele voorkomste van amandelhoudende andesitiese lawa (Formasie Ongeluk).

Figure 6: Inventory of Landtype map 2722 Kuruman

The map shows that the pedosystem Ag 110 was allocated to the location. **Ag** represents the land type in respect of the terrain form, soil pattern and climate. This indicates a red high base status <300 mm deep. The catena or sequence in which soil forms are predicted to follow from highest (crest) to lowest (valley bottom) indicate a Hutton soil form in this case. The **110** indicates the numerical number of occurrence of this pedosystem.

The area of this Land Type (Ag 110) is 170410 ha with 122695 ha or 90 % of which can be found on a Footslope with a gradient of 0-2% and a straight shape. Of this area, 80% of the soil has an estimated depth of less than 30 cm.

Figure 7 gives an indication of expected textural and depth variations in of soils to be encountered on a Footslope of the Ag 110 polygon on the land type map.

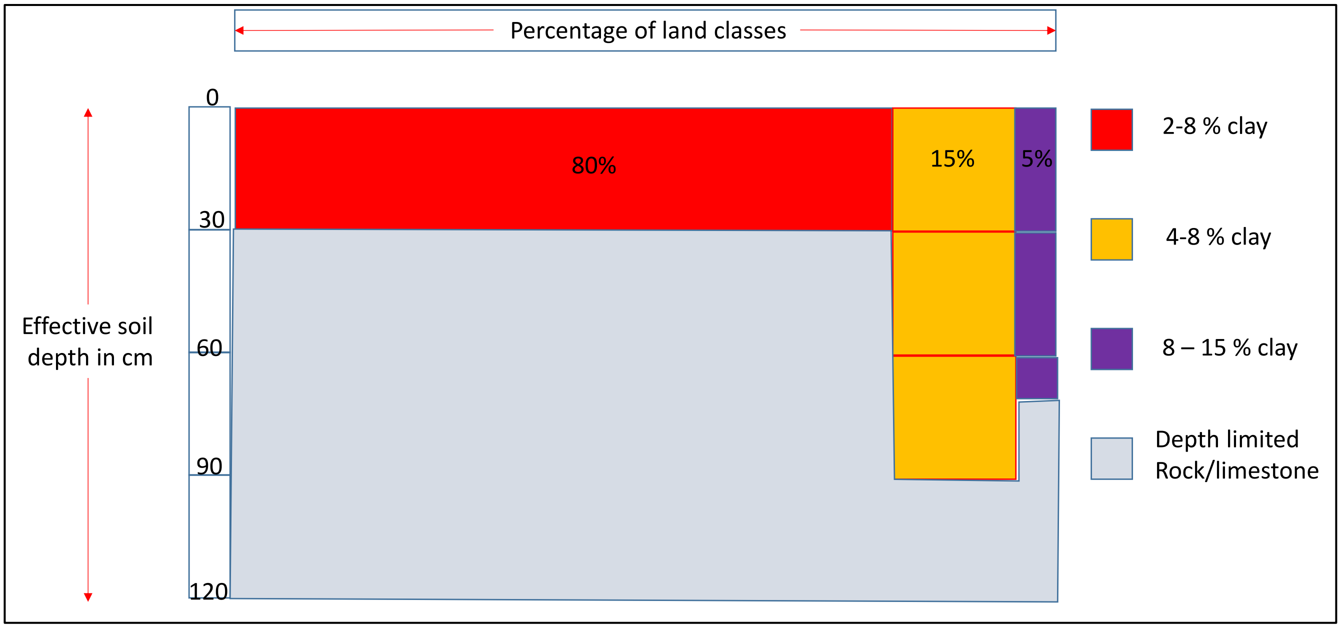


Figure 7: Texture and Depth classes of Land type map 2722 Kuruman

Surveys were made on bordering localities. With the desktop study, these results were incorporated in assessing what soil type and characteristics are expected to be found on the Gaetsewe locality.

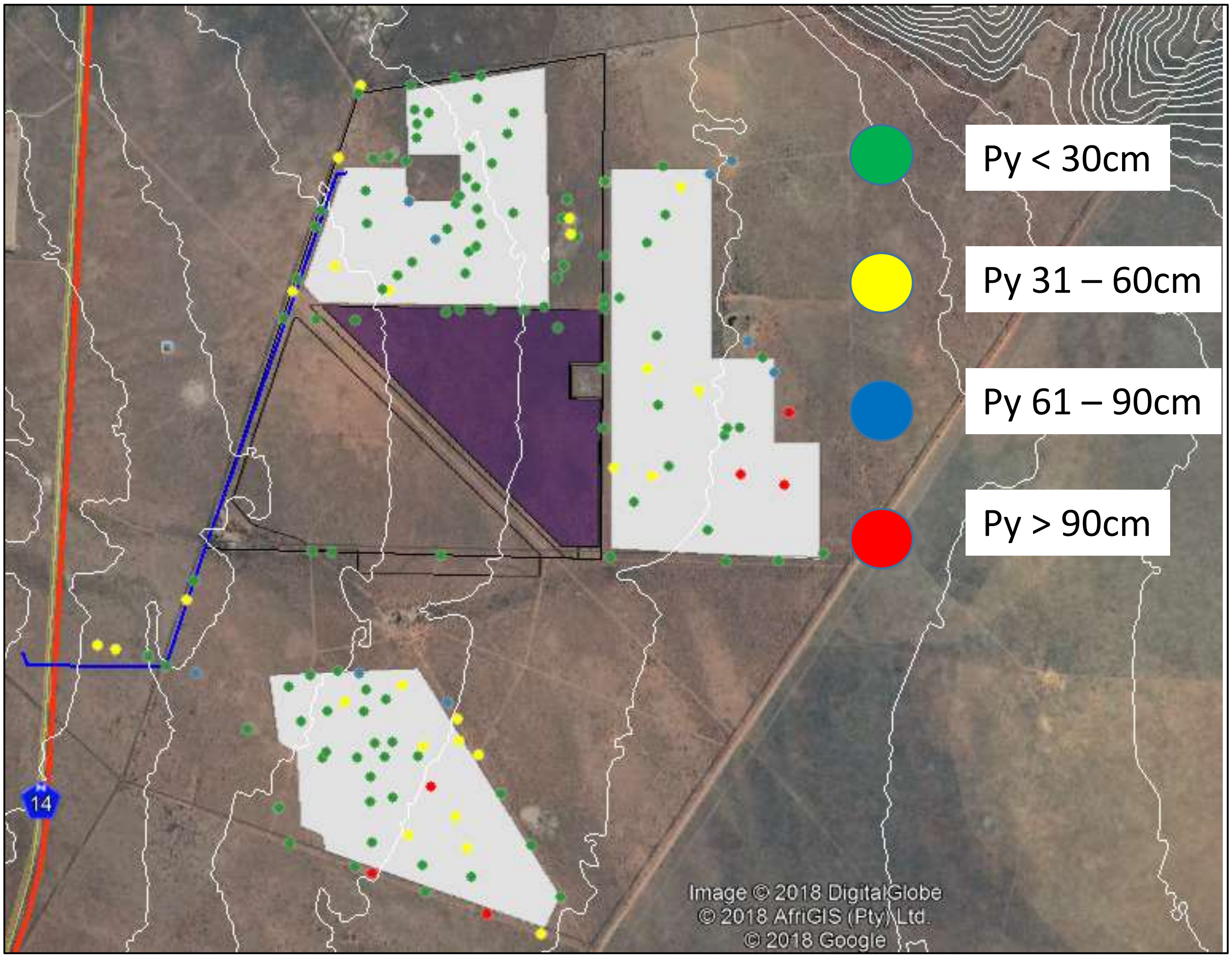


Figure 8: Compilation of existing soil surveys

With all three surveys, the dominant soil form was Plooysburg (Figure 8). The only difference occurring was the effective soil depth. Table 1 contains a calculation of the predicted soil depth on Gaetsewe.

Table 1: Prediction of soil depth to be expected

Count per class					
ET Source	***<30***	***31-60***	***61-90***	***>90***	
Kathu	27	6	3	4	40
Legoka	49	7	0	2	58
Magobe	33	13	3	3	52
Total	109	26	6	9	150
Percentage per class					
ET Source	***<30***	***31-60***	***61-90***	***>90***	
Kathu	67	15	8	10	100
Legoka	85	12	0	3	100
Magobe	64	25	5	6	100

Calculating the mean value for each depth class, the following can be expected on the Gaetsewe locality.					
Gaetsewe	73	17	4	6	100

On 7 June 2018, the site was visited to conduct a reconnaissance survey of Gaetsewe, as illustrated by Figure 8. The details of the survey appear in the representative field forms in Table 2.

OBS	Soil	Coordinates
81	Py20	S27 45.986 E23 04.849
90	Sub	S27 45.281 E23 05.206
91	Py20	S27 45.239 E23 05.271
92	Py20	S27 45.310 E23 05.352
93	Py10	S27 45.359 E23 05.460
94	Py30	S27 45.326 E23 05.586
95	Py 20	S27 45.349 E23 05.636
96	Py20	S27 45.388 E23 05.755
97	Py30	S27 45.367 E23 05.848
98	Py 20	S27 45.437 E23 05.678
99	Py 30	S27 45.518 E23 05.590
100	Py50	S27 45.576 E23 05.536
103	kraal	S27 45.673 E23 05.750
104	Py30	S27 45.677 E23 06.025
105	Py30	S27 45.650 E23 06.216
106	Py30	S27 45.712 E23 05.810
107	Py 20	S27 45.831 E23 05.949
108	Py20	S27 45.917 E23 06.045
109	Py 20	S27 46.009 E23 06.152
110	Py20	S27 46.036 E23 06.181
NE		S27 45.199 E23 06.593
NW		S27 45.153 E23 05.190
SE		S27 46.153 E23 06.573
SW		S27 46.147 E23 06.402

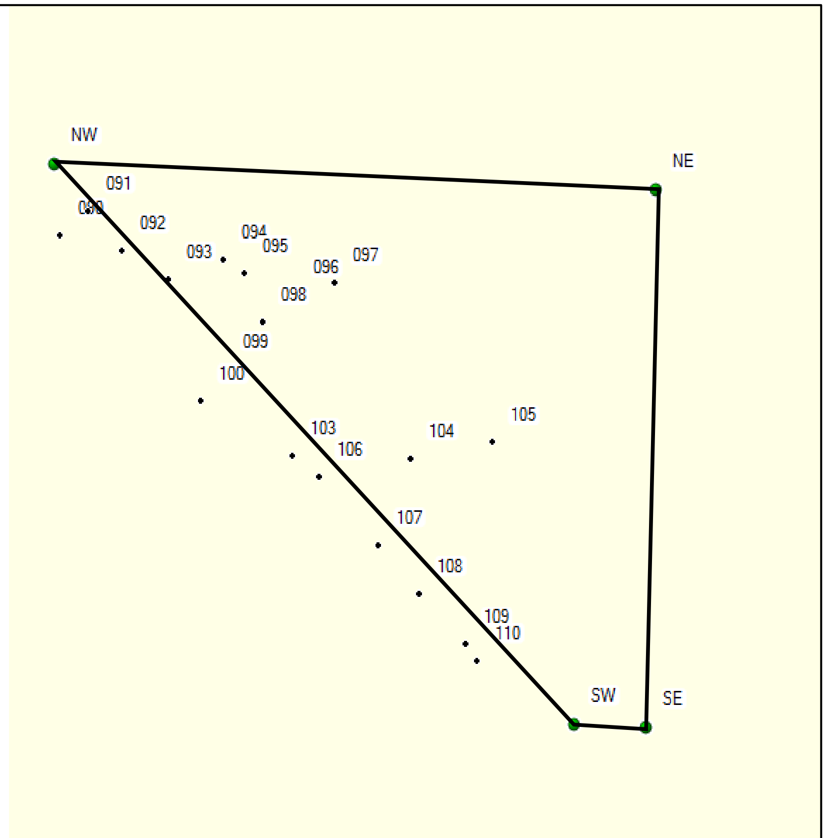


Figure 9: Soil survey Gaetsewe

Survey data from previous fieldwork conducted on bordering premises were incorporated and a soil map was compiled as shown in Figure 10.

Table 2: Representative field forms

OBS	91	COMMENT													
LAT	27.753980	SLOPE GRAD		2			MOISTURE		L						
LONG	23.087850	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	I	1	A	20	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2								
	TERR_POS	1	LTN		PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	97	COMMENT:		fence											
LAT	27.756110	SLOPE GRAD		2			MOISTURE		L						
LONG	23.097461	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	30	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	30	C	I	1	A	30	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2	B							
	TERR_POS	1	LTN	h	PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	100	COMMENT:													
LAT	27.75960	SLOPE GRAD		2			MOISTURE		L						
LONG	23.09227	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	I	1	A	20	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2	B	50	2.5YR 4/6	6	Vf	5	a	0
	TERR_POS	1	LTN		PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	110	COMMENT:		OHL											
LAT	27.76727	SLOPE GRAD		2			MOISTURE		L						
LONG	23.10301	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	30	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	30	C	I	1	A	20	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2	B							
	TERR_POS	1	LTN	h	PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	91	COMMENT													
LAT	27.753980	SLOPE GRAD		2			MOISTURE		L						
LONG	23.087850	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	I	1	A	20	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2								
	TERR_POS	1	LTN		PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	97	COMMENT:		fence											
LAT	27.756110	SLOPE GRAD		2			MOISTURE		L						
LONG	23.097461	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	30	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	30	C	I	1	A	30	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2	B							
	TERR_POS	1	LTN	h	PHOTO		3								
	L.COVER/USE:	Grazing					4								
OBS	100	COMMENT:													
LAT	27.75960	SLOPE GRAD		2			MOISTURE		L						
LONG	23.09227	SLOPE SHAPE		R			EROSION		L						
	FORM	Py	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	I	1	A	20	2.5YR 4/6	6	Vf	5	Sg	0
	ROUGH	1	ASD		GEO	L2	2	B	50	2.5YR 4/6	6	Vf	5	a	0
	TERR_POS	1	LTN		PHOTO		3								
	L.COVER/USE:	Grazing					4								

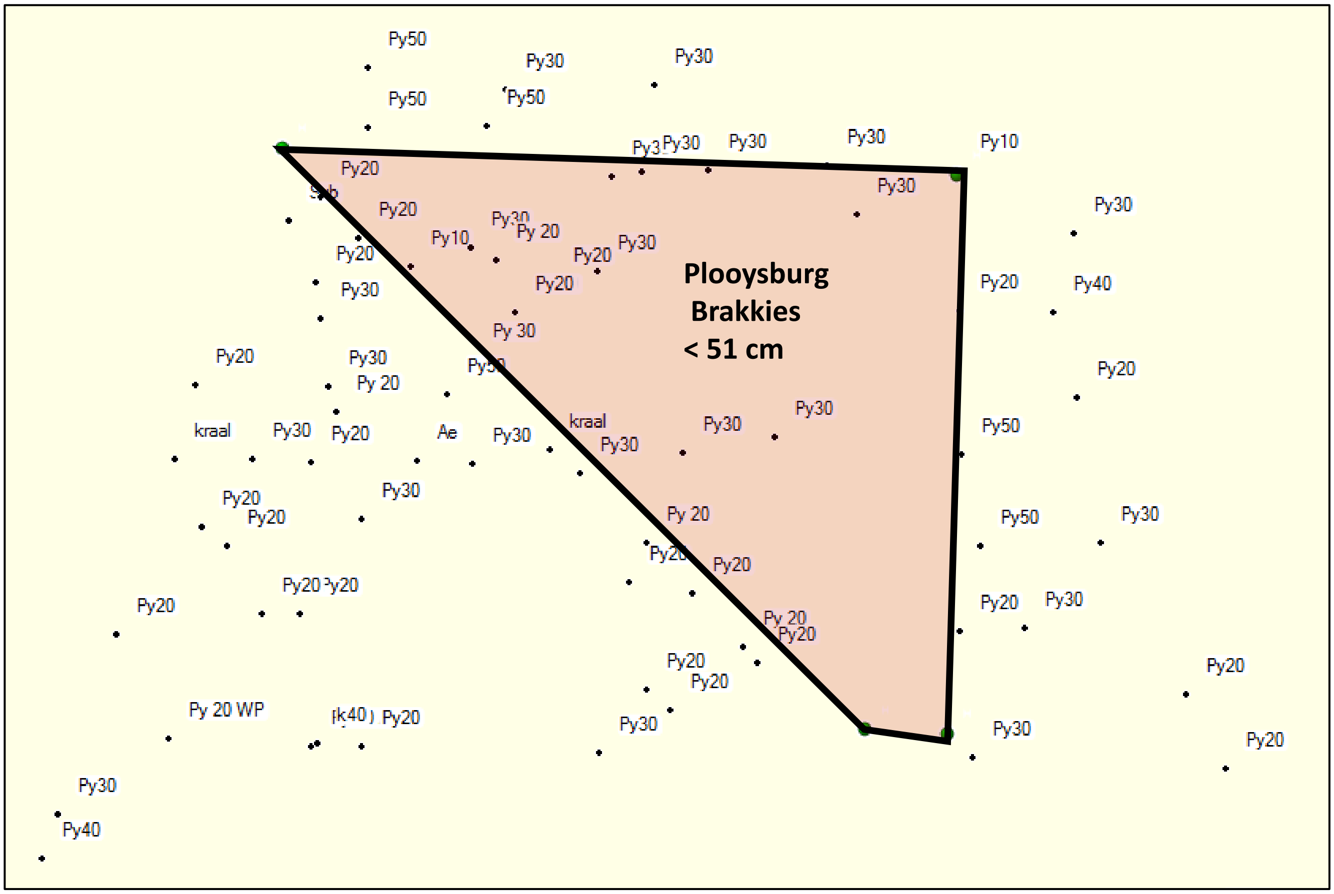


Figure 10: Soil map

5.9 Vegetation

A veld condition assessment was done simultaneous with the soil survey, by visual acknowledgement. Findings are shown in Table 3. The vegetation type is savanna (Kathu biome). The composition of the grazing varies from open grass with low to heavy encroachment of Camphor bush (*Tarchonanthus camohoratus*), as can been seen in Figure 11. Camphor bush is valuable as a grazing shrub and cattle graze from the shrub as well as from fallen leaves on the ground. Encroachment takes place when veld is over-grazed. Grass species observed were Tassel Three–awn (*Aristida congesta*), which has low grazing value but is important to cover bare patches, thus preventing erosion; and Small Bushman Grass (*Stipagrostis obtusa)*, which has high gazing value and good binder of sand.

Table 3: Veld Condition

Veld condition	**Rating**
Plant cover	Cover is sparse with some bare areas.
Types of grasses most common	Moderate (*Stipagrostis Obtusa*) and poor grazing grasses (*Aristida Congesta*).
Soil surface condition	Moderate levels of topsoil loss.
Bush encroachment level	Medium to dense infestation with Camphor Bush
Soil type	Sandy soil

Moderate encroachment **High level of encroachment**

Figure 11: Camphor bush encroachment

The ecological study pays further attention to vegetation.

6. AGRICULTURAL POTENTIAL OF THE SITE

Various characteristics of soil play a role in establishing its agricultural potential. These are next explained and discussed. Table 4 lists the characteristics of the soil on site.

Table 4: Soil characteristics

Plooysburg family Brakkies			
Soil Properties	A Horizon Topsoil	B Horizon Sub-soil	C-Horizon Sub-strata
Texture	Very fine sand	Very fine sand	Hardpan Carbonate
Consistency	Loose to very loose	Loose to very loose	
Structure	Single grain	Apedal	
Colour	Red	Red	
Horizon Depth	300mm	500mm	>500mm
Depth limitation	Hardpan Carbonate hard setting		
Effective Depth	500mm		
Terrain position	Foot Slope		
Geology	Dolomite formations		
Slope shape	Strait		
Slope gradient	2%		
Moisture availability	Low		
Erosion potential	Low		
Soil Form	Plooysburg		
Soil Family	Brakkies		

6.1 Soil form

When comparing the Land type data with the field survey, differences occur. For example, the land type map predicted a Hutton soil form to be dominant, while the field study shows a Plooysburg soil form.

This is because the land type maps and inventories were done according to the 1977 Soil Classification System, while the field studies were done in accordance with the 1991 Soil Classification System, which is a refinement of the previous system.

When the soil is valued for its agricultural potential the taxonomic description of the soil form becomes less important. The differentiation within the soil form (Soil Family) is of more value as it reports on the permeability of the soil profile.

Differentiation is based on texture, sand grade and leaching status.

For a Plooysburg to be classified within the Brakkies family, the criterion is the transition in texture between the A and B-horizons. If the clay percentage of A-horizon is less than 15%, the increase in clay of the B-horizon must be less than 5% and if the clay content of A is more than 15%, the increase in clay of the B must be less than 1.3 times that of the A-horizon. This is called Luvic character.

Therefore, this soil is classified as a Plooysburg Brakkies.

6.2 Leaching Status

Leaching involves the movement of ions such as Ca^2, Mg^2 and Na dissolved in ground water down the soil profile. Depending on the amount of rainfall, leaching can be high (Dystrophic), medium (Mesotrophic) or, as in this case, low (Eutrophic).

Eutrophic refers to soil that has suffered little or no leaching, such that the sum of the exchangeable Ca, Mg, K and Na is more than 15 cmol /kg clay. Such a soil has a high base status.

Simultaneously with leaching, eluviation (or movement of insoluble particles such as clay minerals) takes place when water moves through the profile. Again, in this case, low movement because of low rainfall.

The leached ions (positively charged) are adsorbed by the clay, which is negatively charged to store nutrients in the profile. The ability to adsorb cations is referred to as cation exchange capacity (CEC).

This soil was formed under eutrophic conditions and has a high base status. The agricultural potential is low because of the low clay percentage and low nutrient availability to plants.

6.3 Texture

Soil texture, in its simplest way, is grouped into three broad textural groups: sandy soils (20% clay), loamy soils (20-35% clay) and clayed soils (35+%clay). Sand grade plays an important role in sandy soil in terms of the tendency towards compaction and water storage capacity. See Table 5 for the influence of texture on soil potential.

Table 5: Influence of soil texture on its potential

Properties	Sandy soils	Loamy soils	Clayed soils
Fertility relations			
Nutrient adsorbsion	Low	Medium	High
Fertilizer recommendations	High	Medium	Low
Water relations			
Water infiltration	Rapid	Medium	Rapid if cracks appear
Drainage and leaching	Excessive	Good	Fair – Poor
Water storage	Very Low	Medium	High
Aeration	Very Low	Moderate	Poor
Erosion relations			
Wind erosiveness	High	Low	Moderate
Water erosiveness	Low	High	Low-Medium

Because of the sandy texture, the agricultural potential is graded low to very low.

6.4 Effective rooting depth

Any plant needs three basic elements to grow successfully, namely air, moisture and nutrients. Normally, a 1.2m deep soil profile is adequate to provide the required air and moisture for growth, with plant nutrition added as required. However, some layers in the soil prevent plant roots development. These include wetness, stone layers, compaction, abrupt change in soil texture or structure and, as in this case, rock. The nearer to the top this restrictive layer occurs, the more negative the effect on the plant.

Because of the shallow effective depth, the agricultural potential of the soil is graded very low.

6.5 Land Capability and Suitability for Agriculture

The land is classified as capability class VI

Land in Class VI has severe limitations that make it generally unsuited to cultivation and limit its use largely to pasture, range and woodland.

Land in Class VI has continuing limitations that cannot be corrected, such as

- Severe erosion hazard:
- Stoniness
- Shallow rooting zone
- Low water holding capacity
- Severe climate

Physical conditions are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming and fertilizing. In some instances, the soil can be safely used to grow common crops, provided unusually intensive management is applied.

7. ASSESSMENT OF ACCESS ROADS AND GRID CONNECTION

K2018091758 (South Africa) (Pty) Ltd proposes to connect the solar energy facility to the planned Sekgame Switching Station ± 5km south of the existing Ferrum MTS. The facility substation will be approximately one ha in size. The overhead line between the switching station and facility substation will be approximately 4km with a height of 24m. The servitude to accommodate the overhead line will have a width of 31m – 51m.

The proposed alternative access roads, grid connections and overhead line are shown in Figure 12 and Figure 13.

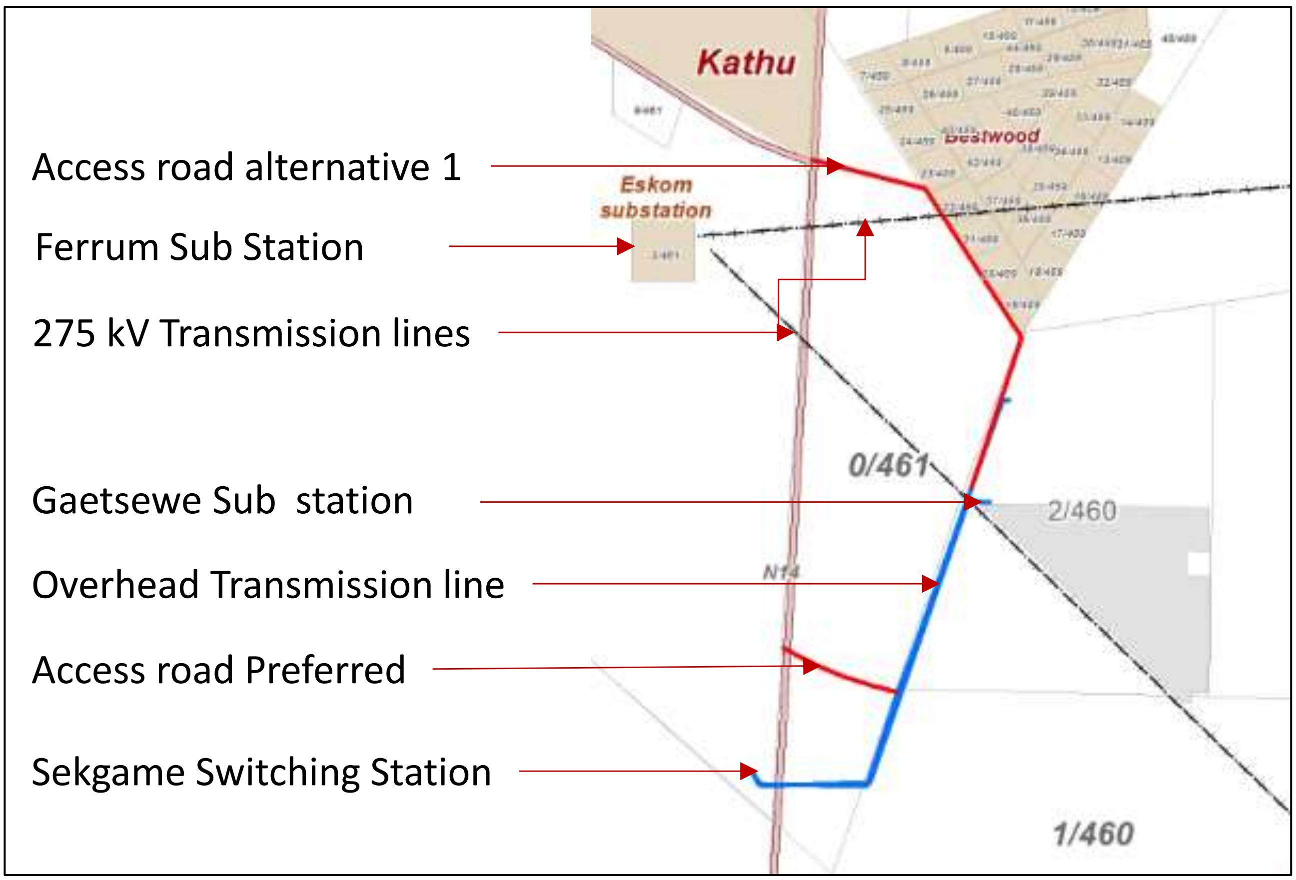


Figure 12: Access roads and grid connections

Access road Alternative: This is an existing road in daily use, tarred from N14 up to a where it diverts towards Reitzhof Agricultural Holdings. The rest of the stretch is a dirt road for access by local owners to Kathu. The agricultural potential of soil on which the road is constructed is low and its influence on drainage very low. With proper maintenance, the road could be an asset for the landowners.

Overhead transmission line: The soil is of very low agricultural potential due to hard carbonate near or at the top of the surface. This is an existing service road. The AEP Legoko facility (already authorised), will use this same alignment.

Sekgame Switching station: The location for the switching station is west of the N14. The area is used for grazing and is of the same low potential soil as the proposed site. Parallel to the N14 and close to this site, a major water pipeline was installed. Excavations to the trench showed limiting rocks close to the soil surface, confirming the shallow depth to be expected on site.

Ferrum Substation: Two 275 kV overhead transmission lines connect to this Eskom substation. One transecting Bestwood Agricultural Holdings and the other over Legoko.

Gaetsewe Substation: This is situated at OBS 90 in the North Western corner of the site. Soil has very low potential (less than 30 cm on hard carbonate depth limiting layer).

Preferred Access road: This is an existing dirt road, which exits from the N14 and is in daily use. The soil is of low agricultural potential.

Figure 13: The area where the access roads and grid connections will be situated.

8. ASSESSMENT OF PROPOSED DEVELOPMENT

The proposed development will have a footprint of 212 ha in addition to the 230 ha permitted for construction of the Legoko PV Solar Energy Facility on the 856.53 ha farm. The compilation of footprints with other PV facilities is shown in Figure 14.

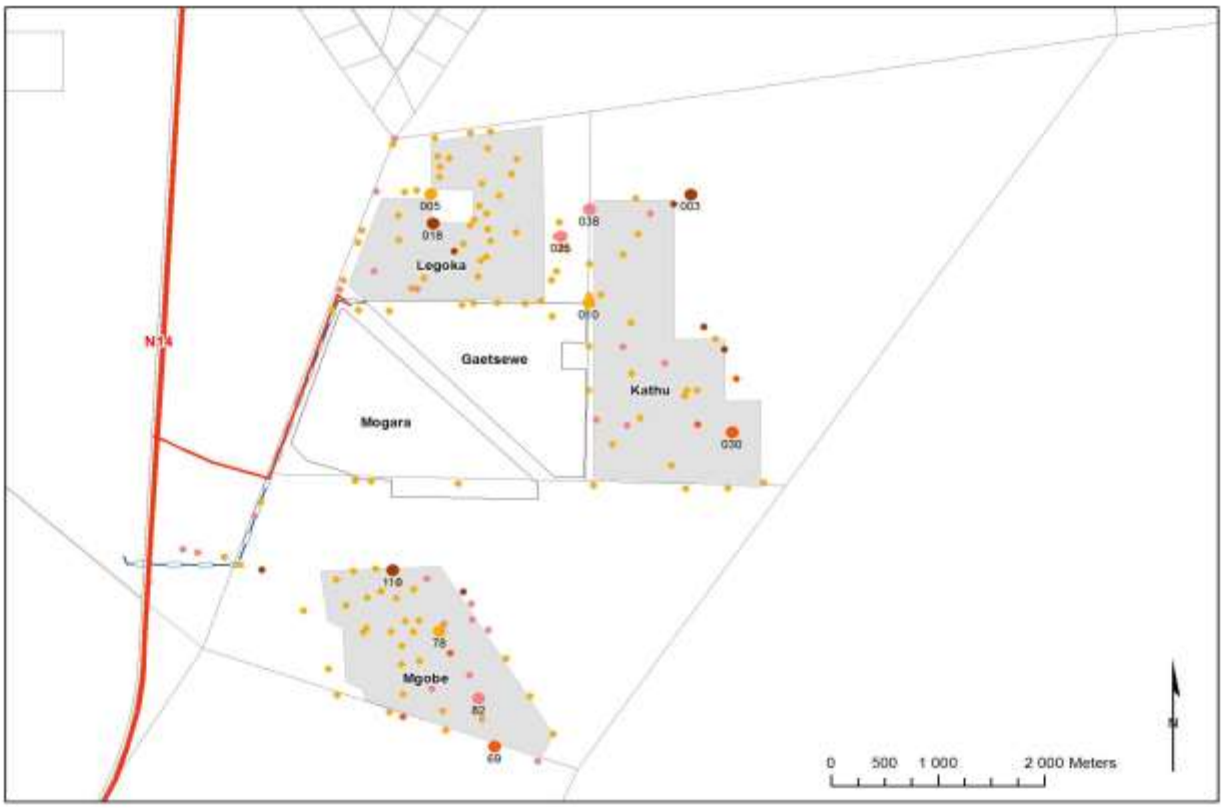


Figure 14: Compilation of footprints

The technology considered for the facility consist of photovoltaic (PV) modules, either mounted on fixed tilt or tracking structures. The associated infrastructure will include inverter stations, internal electrical reticulation, internal roads, an on-site switching station / substation, a 132 kV overhead transmission line, auxiliary buildings, construction laydown areas and perimeter fencing.

Auxiliary buildings will include a control building, offices, warehouses, a canteen, visitors centre, staff lockers and ablution facilities, a gatehouse and security offices.

9. PREDICTED IMPACTS

9.1 Sensitivity of environment

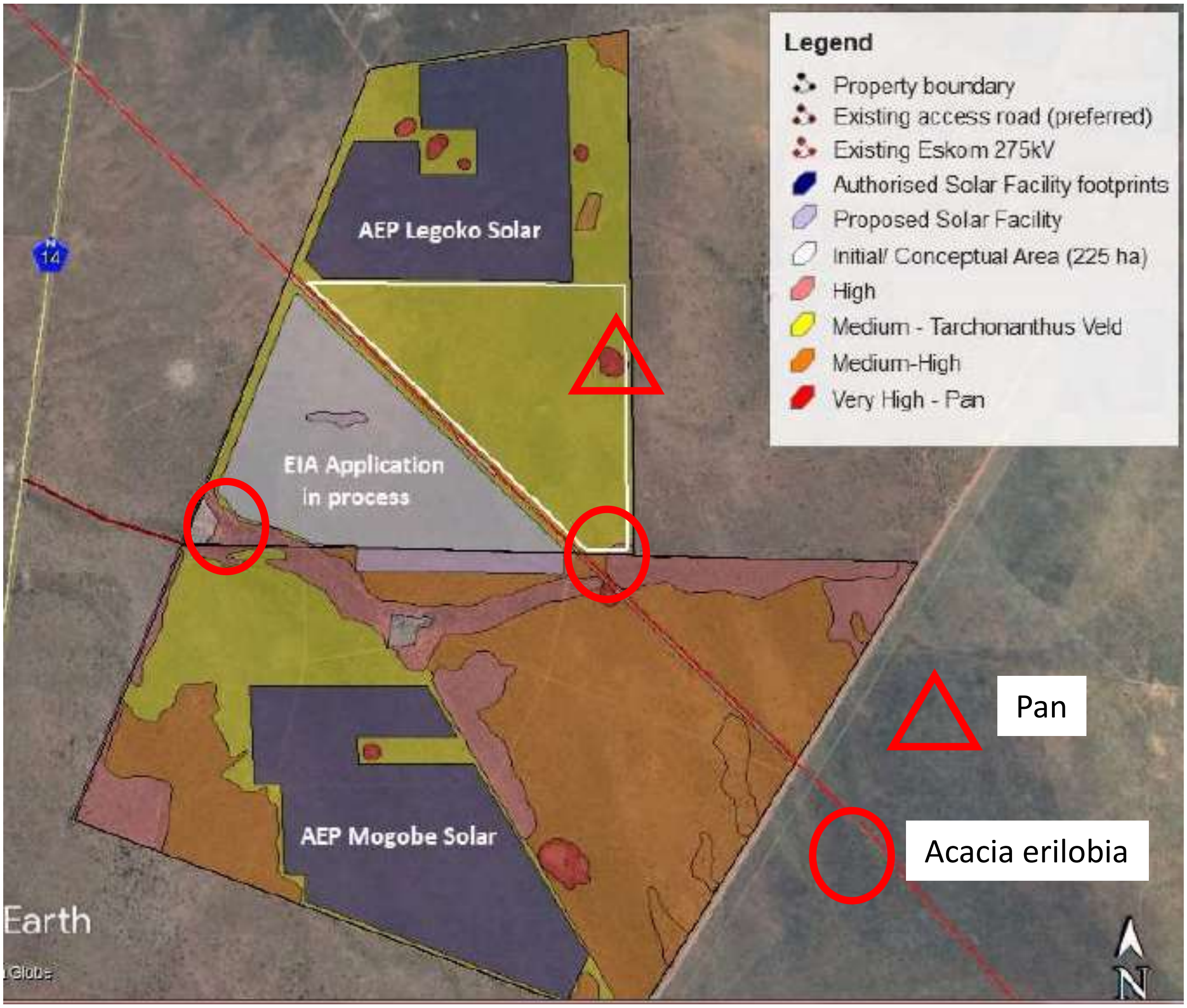


Figure 15: Sensitivity map

A sensitive screening was executed by an ecological expert and areas to avoid, identified.

The pan on the eastern side was labelled as very highly sensitive and excluded from the footprint.

On the southern corners the areas were marked “medium high sensitivity” due to the presence of *Acacia erioloba* and they are excluded from the footprint area.

On the alignment of the overhead transmission line where the kraal and homestead feature, the presence of *Acacia eriloba* is noted and must be respected with the construction process.

Some of these impacts further contribute towards the cumulative effect of the increasing number of renewable energy farms on the regional agricultural community with special effect on this farm, where the farm as a whole could be lost for agricultural use.

9.2 Loss of agricultural land

The loss of agricultural land firstly affects the owner of the farm, depriving him of potential income from agricultural production. Secondly, there could be a loss to the surrounding farming community, through the loss or alteration of natural resources. Finally, the loss could be to the non-farming community, who depended on the past produce from the land in question.

Potential income that could be earned from farming

With the survey, it was established that the land has a capability rating of VI. This rating indicates its best use is for natural grazing. The 1993 carrying capacity recommendation applicable to this site is 11 ha/LSU. Hypothetically, farming under these conditions, the following is possible:

The life cycle of beef cattle production can be categorized in three stages for marketing:

1. Life cycle of cow and bull (Start) Sell calves as weaners (7 months) 200 kg

2A. Life cycle of Grass finished beef (middle) Weaners prepare for feedlot (6mths)200 kg – 400 kg

2B. Life cycle of grain finished beef (middle) Weaners prepare for feedlot (6mths)200 kg –400 kg

3. Life cycle of grain finished beef (final) in a feedlot 400 kg – 600kg

To evaluate the potential loss due to the construction on the grazing land, a possible marketing plan for cattle farming can be structured as follows:

<u>Herd composition:</u> 80% (Cows bulls and calves), 10% one year heifers and 10% two year heifers.

<u>Marketing:</u> Sell at end of season 20% of cows (replacement) and 50% (bull) calves.

On Farm 460 Legoko, with an area of 856 ha and carrying capacity of 11 ha/LSU, it is possible to graze 80 LSU. The composition of such a herd would be 50 cows, 40 calves, 2 bulls, 8 one-year old heifers, 8 two-year old heifers.

The potential income that could be earned annually from this marketing practice would be the selling of 10 cows and 20 bull calves before the winter.

The potential loss of income for the farmer is calculated as follows:

10 @ R6600 = R66 000

20@ R3900 = R78 000

Total R144 000

The general acceptance of a sustainable herd size is 300 LSU.

Composition of the herd would then be:

190 cows, 150 calves 6 bulls 30 one year heifers and 30 two year heifers

Marketing: sell 20% cull and 50% bull calves

38 cows @R6600 =R250 800

75 calves @ R3900 = R296 400

Total = R547 200

To be able to achieve this an area of 3 300 ha is required with an 11 ha/LSU grazing capacity restriction.

9.2.2 The potential loss to the farming community

The opportunity to buy 10 cows to breed, 20 male calves to prepare for feedlot and 20 female weaners to be used as replacement heifers is lost to the community.

9.2.3 Potential loss to non-farming community

A potential meat produce of 9000 kg will be lost:

10 @ 500 kg = 5000kg

20 @ 200kg = 4000 kg.

If only the average footprint of ± 212 ha is used for the PV facility, the potential loss will be 25% of the above, namely, R36 000 in cash or 2 250 kg in meat products:

9.2.4 Mitigation proposed

Option 1

In the fire management plan the use of livestock is the preferred method of managing the plant biomass growing under the PV arrays. With the appropriate camping system and livestock selection, it would be possible to neutralize the loss of agricultural land (not taking into account any income that could be earned from it)

However, it has to be stated that these measures will have to be considered by the applying company for practicality.

The PV panels' ground clearance limit the height of livestock. Sheep would be better suited for the grazing under the panels, or calves between 3 and 7 months. With a conversion ratio of 4½ sheep to 1 LSU, 100 sheep are the equivalent of the 20 LSU presumably lost.

The 52 sheep under the shelter in Figure 16 gives an indication of the space needed for half the herd recommended above.

Figure 16: Ground clearance under PV panels in comparison with shelter provided to sheep.

During the operational phase, the re-vegetated trench lines and regrowth under the panels must be managed.

To manage the grass, the primary "tool" is an efficiently controlled camping system. If the livestock is left free ranging in their grazing habit, the veld condition will deteriorate. The reason for this is that they are allowed to graze selectively and stay too long in the same area with the result that they start grazing on the regrowth.

The footprint of the PV facility forms the skeleton of a camping system, as indicated in Figure 17. With the use of electrified fencing, the partitioning of any number and size of camps required, can be carried out by one labourer herding the stock. Watering would be portable troughs.

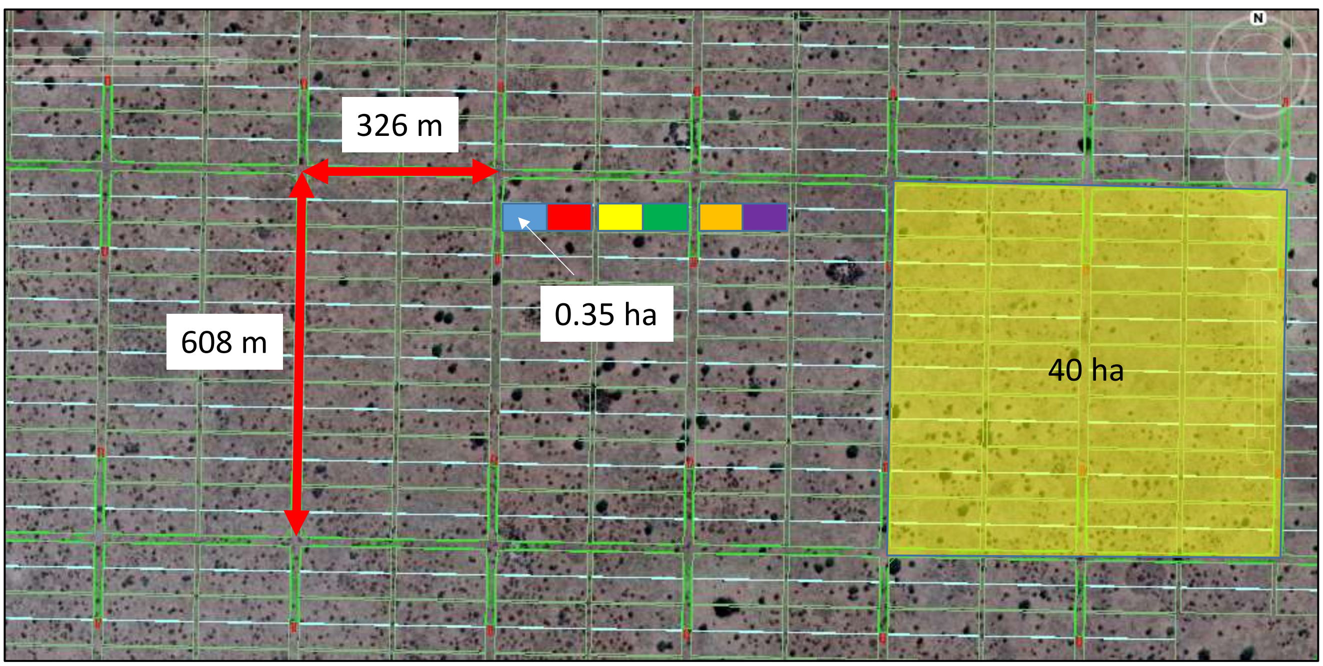


Figure 17 PV footprint as skeleton for camp outlay

The camps will be confined to the borders of the service roads, which ensure no interference with the service traffic.

The two camp sizes (0.35 ha and 40 ha) refer to different management systems. The 0.35 ha camps are used for ultra high density grazing. These camps are used for 1½ hour for six grazing sessions a day. The 40 ha is high density grazing camps where livestock stay 7 days before rotated.

A detailed rotation system with suitable camp size can be formulated to ensure the best results in animal gain and veld composition.

Option 2

There will be a time lapse after construction before grazing will be available, in which fodder will have to be provided for feeding.

The loss of area can also be calculated as loss of grazing for 20 LSU. It is assumed that an animal eats the equivalent of 3% of its body mass per day. The mass of an LSU is estimated as 450 kg; therefore, one LSU requires 13.5 kg roughage/day. The loss due to the footprint size is then 20 x 13.5 kg, which is 270 kg /day.

It is possible to produce 500 kg of fresh fodder in seven days from 50 kg cereal grain seed in a container measuring 8m x 4m x 2m. Once in production, 500 kg fodder can be harvested daily. The requirement for such production is to control the temperature between 20°C and 28°C and artificial (fluorescent) lighting. The seed is sprayed with a hydroponic nutrient three times a day.

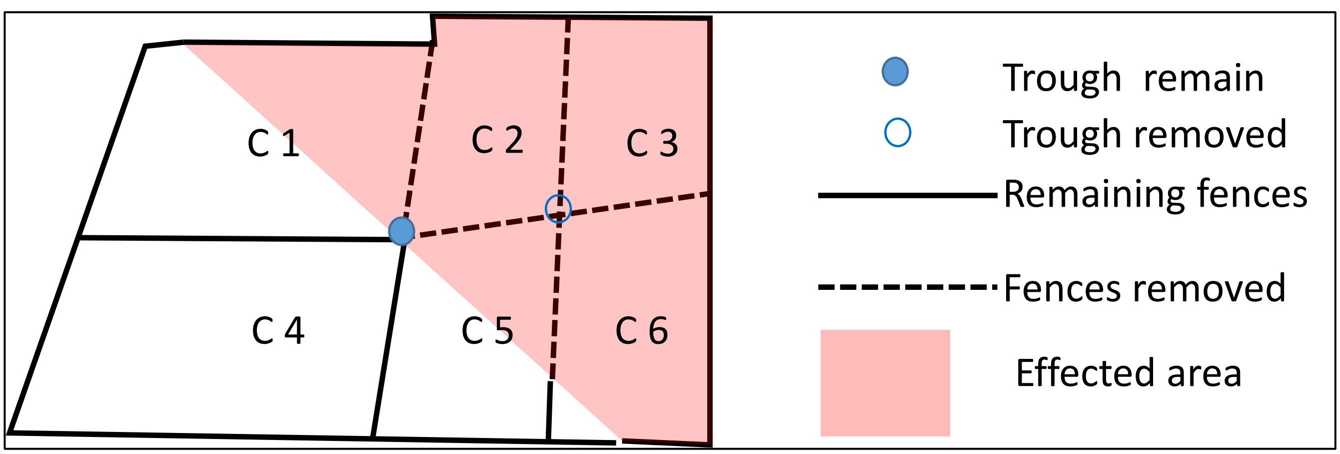
The fodder is fed directly to the animals: tray, roots and all.

This is only possible if electricity is affordable.

9.3 Impairment of land capability due to construction

During the construction phase, interference with the agricultural activities takes place because of the following actions:

9.3.1 Removal of infrastructure



The farm is used for extensive grazing with cattle (refer to figure 4) showing six camps used to manage the cattle on 480 ha. With the construction of a solar facility, only 260 ha remain with one camp un-effected and two half-sized camps left for grazing. The stock watering system will however still be operational.

9.3.2 Removal of vegetation

The development of the proposed facility will take place in three phases, namely construction, operation and decommissioning. During each of these phases, vegetation will be exposed to specific impacts caused by the stripping of vegetation and mechanical disturbance of the soil profile:

Construction phase

During this phase, vegetation is stripped, topsoil is removed and stockpiled, access roads are constructed, structures are erected and vegetation resettled. Where soil conditions allow, topsoil should be left in situ as far as possible.

The construction of the transmission line is a good example where only a brush cutter is used to clear camphor bush.

The resettlement of vegetation forms the basis on which the last two phases shall perform. Therefore, this is the starting point of the rehabilitation process.

When veld is re-established after construction, the seed of climax grasses adapted for the site should be used. Grass species recommended are:

- Tassel Three–awn (Aristida *congesta*), which has low grazing value but is important to cover bare patches, thus preventing erosion;
- Small Bushman Grass (*Stipagrostis obtusa)*, which has high grazing value and good binder of sand;
- Tall Bushman Grass (*Stipagrostis clliata*) a palatable grass with high grazing value and good binder of sand;
- Lehmann’s Love Grass (*Eragrostis lehmanniana*), which is moderately palatable and good for stabilizing eroded soil;
- Guinia Grass (*Panicum maximum*), a very palatable good cultivated pasture; and
- Wool Grass (*Anthephora pubescens*).

Operational phase

This is the longest phase (25-30 years). During this phase, the re-vegetated surface must be conserved and used for maintaining the livelihood of the owner and workers. Adaption to new methods of operating must be incorporated in the management plan.

Decommissioning phase

When the facility reaches the end of its economic lifespan, decommissioning will take place. The area must then be restored to its natural stage.

9.4 Accumulation of spoil material

Excavation of trenches for cabling and building foundations will lead to accumulation of spoil material (hard carbonate). Where possible, this should be incorporated as filling material. Spoil material should not be allowed to accumulate in unmanageable piles, obstructing the workability on the terrain.

9.5 Altering of drainage patterns with construction of roads support buildings and PV panels

The facility is designed to be built on a foot slope with a regular shape and slope gradient of < 1% and no defined waterway.

The alignment of the panels is on the contour, supported by posts and with the panel not reaching soil surface. There will be very low obstruction of run-off. The run-off water will flow in a lateral way without concentration into furrows or depressions. When re-vegetation starts, these strips will slow down the flow speed on surface and enhance the infiltration rate.

A very low affect on the drainage pattern will be exercised by the facility.

10. POTENTIAL IMPACTS ON THE AGRICULTURAL ENVIRONMENT

10.1 Methodology to assess impacts

Potential impacts of the proposed project on agriculture were identified and evaluated. Impacts identified through the study were rated in terms of the following criteria:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be 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 will be assigned as appropriate (with 1 being low and 5 being high):
- The duration, wherein it will be 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 a score is assigned:
  - 0 is small and will have no affect 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)
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  - Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  - Assigned a score of 2 is improbable (some possibility, but low likelihood)
  - Assigned a score of 3 is probable (distinct possibility)

- Assigned a score of 4 is highly probable (most likely)
- Assigned a score of 5 is definite (impact will occur regardless of any
- prevention measures)

- the significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the status, which will be 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

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).

10.2 Possible impacts during construction

Soil pollution with contaminants during the construction phase may take place, including spillages of hydrocarbon (fuel oil) and cement. This is possible during the construction of all facets of the facility: laydown area, concrete foundations of the auxiliary buildings, inverter stations subterranean cabling, main access and internal service roads.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium Term (2)	Very short (1)
Magnitude	Low (4)	Minor(2)
Probability	Probable (3)	Probable(3)
Significance	**Low(21)**	**Low (12)**
Status (Positive or negative)	Negative	Negative
Reversibility	Partly reversible	Fully reversible
Irreplaceable loss of Resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes

Mitigation: Refuelling normally takes place in the laydown area. Proactive measures must be taken which include constructing a designated area where refuelling can take place. This area must have an impervious floor with low wall that will keep the spillage inside. This area should be cleaned with absorbent material on a regular basis. The use of cut-off drains must be incorporated to divert upslope clean storm water around the site into a natural drainage system. On the down slope, polluted water must be collected via a cut-off drain into a leachate collection and recovery system. When spillage accidently takes place, it should be removed and replaced with unpolluted soil. The clean soil can be sourced from excavations nearby. The polluted soil must be piled at a temporary storage facility with a firm waterproof base and is protected from inflow of storm water. It must have an effective drainage system to a waterproof spillage collection area. Contaminated soil must be disposed of at a hazardous waste storage facility.

The following is handy to have available


Ultra-Drain Guard


“Oil Dri” Bucket Spill Kit

Cumulative impacts: No, site-bound

Residual Risks: Yes, it is impossible to clear the effected area completely.

The establishment of the PV Solar facility will be done at the expense of agricultural land. Area to be lost for agricultural development would be 212 ha in size. This includes the area under PV panels, internal service roads and temporary laydown area.

	Without mitigation	**With mitigation**
Extent	Local – Regional (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (39)**	**Low (20)**
Status (Positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

The general objective is to position the PV facilities on the lowest potential soil and not in places that may have impact on agricultural activities, drainage lines and places with a sensitive nature.

Existing road alignments are followed and roads upgraded for use during the lifespan of facility. With the appropriate planning, the same lifestyle can be achieved during the lease period of the facility from the land so occupied by the facility.
Cumulative impacts: Impact is low due to agricultural potential of the site locally. With adding facilities, the impact will become more significant if not mitigated.
Residual Risks: No, after decommissioning this impact will be reversed when rehabilitation has been completed.

The construction of a PV Solar facility will cause impairment of the land capability with the potential risk of erosion and generation of spoil material on unwanted areas.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium(30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Brush cut only to clear Camphor bush leaving topsoil un-disturbed. Use mechanised machinery when installing posts to eliminate need for foundations. Construct on alternate strips to combat possible erosion.		
Cumulative impacts: No cumulative impacts are expected to occur, as all impacts will be site bounded.		
Residual Risks: No. Effected areas will be rehabilitated, as the impact will only be applicable during the construction phase.		

The establishment of the PV Solar facility may alter drainage patterns with construction and cause erosion		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (2)	Long term (2)
Magnitude	Low (2)	Low (2)
Probability	Probable (2)	Probable (2)
Significance	**Low(12)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Yes	Yes
Mitigation: Establish structures on the contour. Use grass strips to regulate flow speed		
Cumulative impacts: No, all impacts will be site bounded.		
Residual Risks: No. Effected areas will be rehabilitated when operation has ceased.		

10.3 Possible impacts during operational phase

Soil pollution with contaminants during the operational phase may take place, including spillages of hydrocarbon (fuel oil) and cement. This is possible during the maintenance of the facility:		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Low (2)	Minor(2)
Probability	Probable (2)	Probable(2)
Significance	**Low(14)**	**Low (14)**
Status (Positive or negative)	Negative	Negative
Reversibility	Partly reversible	Fully reversible
Irreplaceable loss of Resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Refuelling normally takes place in the workshop of the control building. A designated area for refuelling must be constructed with an impervious floor and low wall that will keep the spillage inside. Any spillage must be cleaned with absorbent material as soon as possible and disposed into clearly marked containers. Where spillage takes place, contaminated soil must be excavated and replaced with unpolluted soil. The contaminated soil should be collected by a licenced landfill contractor.		
Cumulative impacts: No, site-bound.		
Residual Risks: Yes, It is impossible to clear the effected area completely.		

The establishment of the PV Solar facility will be done at the expense of agricultural land. Area to be lost for agricultural development would be 212 ha. This includes the area under PV panels, internal service roads and temporary laydown area.		
	Without mitigation	**With mitigation**
Extent	Local – Regional (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	improbable (2)
Significance	**Medium (39)**	**Low (20)**
Status (Positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation: The general objective is to position the PV facilities on the lowest potential soil and not in places that may have impact on agricultural activities, drainage lines and places with a sensitive nature. Existing road alignments are followed and roads upgraded for use during the live span of facility. With the appropriate planning, the same live style can be achieved during the lease period of the facility from the land so occupied by the facility.
Cumulative impacts: Impact is low due to agricultural potential of the locally. With increasingly adding of facilities, the impact will become more of significance if not mitigated. .
Residual Risks: No, after decommissioning this impact will be reversed when rehabilitation has been completed.

10.4 Possible impacts during decommissioning phase

All components of the facility should be dissembled and roads demolished. Rehabilitation should focus on:

- Demolish and removal of structures
- Demolish related roads
- Establish cultivation environment
- Stabilisation of erosion
- Reinstall camp fences and stock watering

Soil pollution with contaminants during the decommissioning phase may take place, including spillages of hydrocarbon (fuel oil) and cement. This is possible during the decommissioning of all facets of the facility: laydown area, demolished concrete foundations of the auxiliary buildings, inverter stations subterranean cabling, main access and internal service roads.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium Term (2)	Very short (1)
Magnitude	Low (4)	Minor(2)
Probability	Probable (3)	Probable(3)
Significance	**Low(21)**	**Low (12)**
Status (Positive or negative)	Negative	Negative
Reversibility	Partly reversible	Fully reversible
Irreplaceable loss of Resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Refuelling normally takes place in the workshop of the control building. A designated area for refuelling must be constructed with an impervious floor and low wall that will keep the spillage inside. Any spillage must be cleaned with absorbent material as soon as possible and disposed into clearly marked containers. Where spillage takes place, contaminated soil must be excavated and replaced with unpolluted soil. The contaminated soil should be collected by a licenced landfill contractor.		
Cumulative impacts: No, site-bound.		
Residual Risks: Yes, It is impossible to clear the effected area completely.		

11. CUMULATIVE IMPACT ASSESSMENT

To assess the cumulative impacts, an overview map showing the land capability, drainage and grazing capacity is used to identify possible impacts that may accumulate as similar developments are developed in a 30 km radius from this facility – see Figure 18.

Table 6: PV power facility locations within in a 30km radius, including Gaetsewe Solar

Reference	Name	Status
1	No Name	Authorisation lapsed 2012
2	Sishen Solar	Approved 2011
	San Solar	Approved 2016
	Boitshoko	Approved 2016
3	Kalahari	Approved 2015
4	Mogobe	Approved 2016
	Legoko	Approved 2016
	Kathu	Approved 2017
	Bestwood	Approved 2011
	Gaetsewe	Application in process
	Mogara	Application in process

When investigating the cumulative impact of similar developments in close range, their individual agricultural potential has to be established. The parameters used were land capability, drainage and carrying capacity.

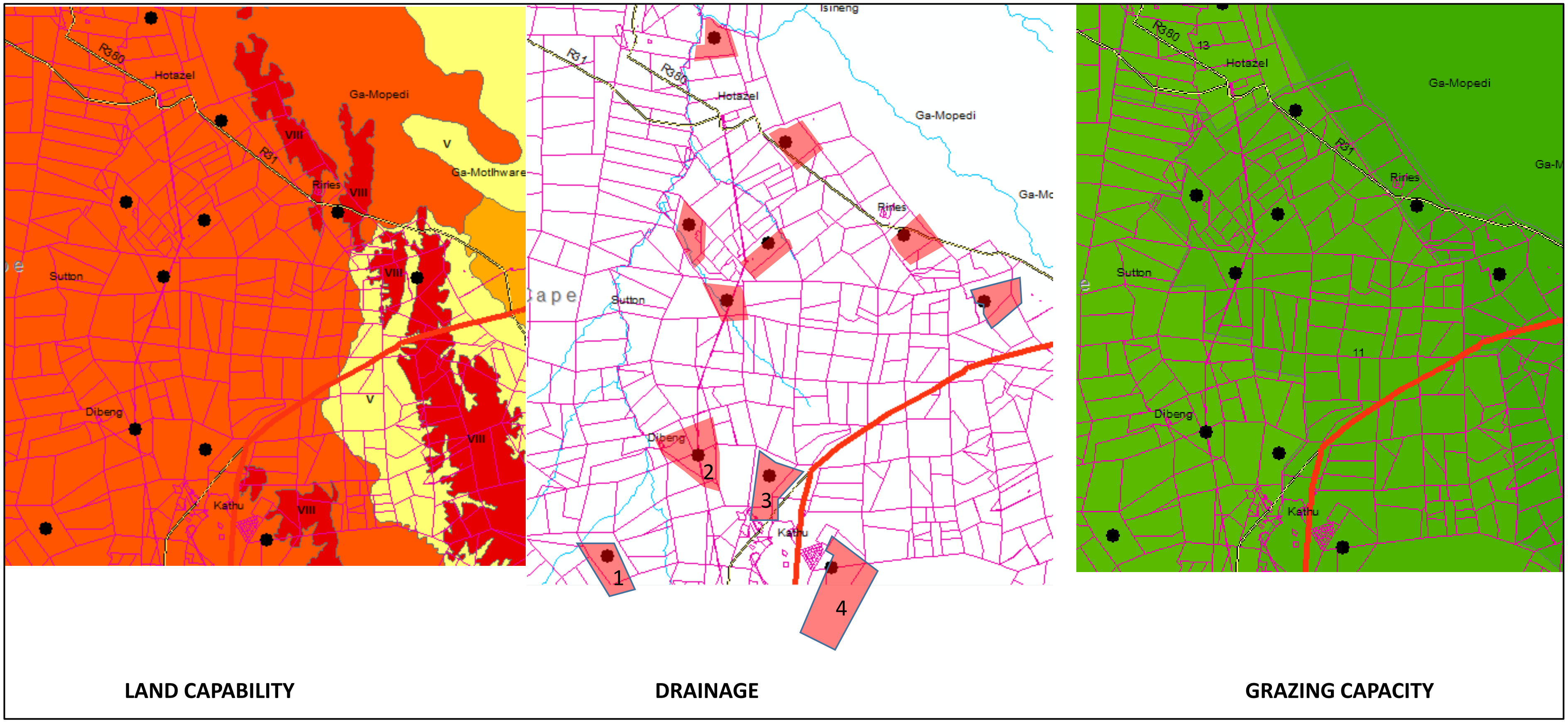


Figure 18: Proposed similar developments in the region

The quantity of available soil for agricultural production decreases as a result of the footprints of these facilities. The quality of soil decreases in the way the construction of these structures alters the workability of the soil. This includes the physical deformation in the soil profile.		
	Overall impact of proposed project considered in isolation	**Cumulative impact of the projects in the area**
Extent	Local – Regional (1)	Regional(2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Low(4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (36)**
Status (Positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Ensure that most infrastructure features are erected on transformed or non-arable land. Implement stormwater management as an integral part of planning and as a guideline for the positioning of structures. Use existing roads and conservation structures to the maximum in the planning and operation phases. Rehabilitate disturbed areas as soon as possible after construction. Incorporate livestock in the fire management plan or as an production unit on its own		

Clearing of vegetation increases flow speed and a lower infiltration tempo increases silt transport.		
	Overall impact of proposed project considered in isolation	**Cumulative impact of the projects in the area**
Extent	Local (1)	Regional(2)
Duration	Long Term (4)	Long Term (4)
Magnitude	low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (18)**	**Medium (30)**
Status (Positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Erosion and sediment control with proper water run-off control planning.		

Chemicals, hazardous substances and waste used or generated during the lifespan of the facility accumulates and soil may become contaminated		
	Overall impact of proposed project considered in isolation	**Cumulative impact of the projects in the area**
Extent	Local (1)	Regional(2)
Duration	Long Term (4)	Long Term (4)
Magnitude	low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (18)**	**Medium (30)**
Status (Positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Appropriate handling and storage of chemicals and hazardous substances and waste should be done.		

12. ENVIRONMENTAL MANAGEMENT PROGRAMME

The following should be included in the Environmental Management Programme:

12.1 Objective: Placement of spoil material generated from construction related excavations.		
Project components	Construction: Foundations and trenching for cabling	
Potential impact	Placement of spoil material accumulated during construction can have logistic problems in the rehabilitation phase.	
Activity/risk source	Spoil material will end up in inappropriate places.	
Mitigation: Target/Objective	When preparing cabling trenches and foundations cuts should be used for fill with little or no wastages. The wastages can then be used in building of roads.	
Mitigation: Action/control	**Responsibility** Construction manager Environmental officer	**Timeframe** 24 months
Performance Indicator	No stockpiling of spoil material.	
Monitoring	During and after construction	

12.2 Objective: Prevent and clean up soil pollution		
Project components	• PV energy facility • Substation; • Access roads; • Power line; • All other infrastructure (site camp, batching plant etc.).	
Potential impact	Pollution of soil by fuel, cement and other toxic materials	
Activity/risk source	Soil will become contaminated	
Mitigation: Target/Objective	All solid waste must be collected at a central location at each construction site and stored temporary until it can be removed to an appropriate landfill site in the vicinity. The target should be to minimise spillages and soil contamination.	
Mitigation: Action/control	**Responsibility** Construction manager Maintenance team	**Timeframe** Lifespan of facility
Performance Indicator	No spillages	
Monitoring	Regular inspections of terrain and various infrastructure units.	

12.3 Objective: Conservation of soil		
Project components	• PV energy facility • Substation; • Access roads; • Power line; • All other infrastructure (site camp, batching plant etc.).	
Potential impact	Erosion of cultivated land	
Activity/risk source	Soil get unusable and unproductive	
Mitigation: Target/Objective	Apply conservation measures.	
Mitigation: Action/control	**Responsibility** Construction Manager Maintenance team Environmental manager	**Timeframe** Lifespan of facility
Performance Indicator	No water run-off problems / erosion	
Monitoring	Regular inspections of terrain	

13. CONCLUSION AND RECOMMENDATION

In general, there are various opinions about the impact of the facility on the farm or its impact on similar facilities in the area.

13.1 Potential loss of land affects the livelihoods of farmers, families and workers.

Cattle farming are predominately practised on farms in the area. Farming with cattle is actually farming with the pasture growing on the land. The livelihood is based on marketing the offspring at the end of the production season. The core group (farmer’s family and workers) depend on the income from the land in revenue or products.

When part of or an entire farming land is no longer available, new means of earning have to be found. As mentioned in this report, there are possibilities to continue farming, but also possible employment of farm workers by the solar facility.

13.2 Decrease in quantity and quality of soils;

The criteria for high potential soil are:

- Land has few limitations that restrict its use;
- May be used safely and profitably for cultivated crops;
- Soils are nearly level and deep;
- Soil hold water well and are generally well drained;
- It is easily worked, and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizers;
- When used for crops, the soil needs ordinary management practices to maintain productivity; and
- The climate is favourable for growing many of the common field crops.

High potential soils are not expected in the region of this proposed facility, because of the low annual rainfall, high evaporation rate and extreme temperatures. Soils formed under these conditions have little movement of soluble nutrients and insoluble clay particles in the soil profile, restricting the adsorption of nutrients that would be available to plants. The soil is thus low in nutrient availability and has a low response to fertilizer input.

Calcium is another dissolved product of rock that will remain in the soil profile and form a cemented soil when water evaporates in the arid conditions. This soil layer limits water movement, root development and poses a mechanical restriction for cultivation.

The soils observed on this site concur to the above and is of low potential because of:

- Low annual rainfall, high evaporation and extreme temperatures restrict dry land cultivation;
- The very shallow soil depth with its limited water holding capacity restricts root development;
- The very fine sand grade of top soil influences the stability and increases the erosion potential;
- The hard setting layer hampers mechanical cultivation.

13.3 Industrial character of facilities replaces the known agricultural character

When consulting the geology map, ignoring the lithology and focusing on the minerology, the presence of mining activity is evident. With the infrastructure associated with mining the agricultural character is soon replaced to be industrial. Electricity is a vital requirement for development with the result that the national grid follow the path to these activities. The locality for most of the PV facilities are near an established town and or on route of the national grid.

The presence of the PV facility is rather seen as a by-product of the electricity provider than an invader of the agricultural character.

Figure 1 in this report shows how the proposed facility is boxed in by existing developments surrounding the farm, already destroying the agricultural character.

13.4 Establish more than one facility on a farm and/or zone as to industrial in total

In the case of locations 2 and 4 in (Figure 18: Proposed similar developments in the region The negative impact would be the total void in agricultural produce from this land. Agricultural loss does not only apply to the owner, but also to the broad community relying on agricultural produce. When traveling in this region, it is common to see an abnormal vehicle from this dry region, transporting hay to other regions. Farming is not isolated and has many tentacles sourcing commodities for its continued existence. Each farm may have one special component to contribute towards a final product.

With the availability of electricity, farming activities could shift from extensive to intensive practices such as ultra high strip grazing or feeding in feedlots with hydroponic cultured fodder.

With the distribution indicated on the drainage map, the facilities are well positioned as depots for fodder, if the demand may exist.

13.4 Establish more than one facility on a farm

To establish more than one facility on a single farm may be regarded as having only negative impacts. However, there are also positive effects that should be considered.

13.4.1 Negative

With a smaller area for grazing, cattle farming will become less viable and even not viable at all, affecting the livelihood of the farmer, his family and workers.

The more fragmented the farm gets, the more difficult it is to manage and infrastructure will have to be adjusted to comply with the new management.

As industrial facilities continue to take up lower potential land (previous agricultural land), the availability of low potential land diminishes.

13.4.2 Positive

Where more than one facility is established on a single piece of land, they share connections lines to the national grid, instead of having several connection lines constructed. The same applies to access and internal roads. Thus, less additional farms are cut into pieces for solar energy provision.

Where a movable electric fence is used to partition grazing camps, management of stock farming becomes easier and can be applied more uniformly on the farm.

From an environmental and land use perspective, no fatal flaws are associated with the project, if the mitigation measures recommended are applied.

From an agricultural perspective, the photovoltaic (PV) solar energy facility will have a low impact on its environment and could therefore be authorised.

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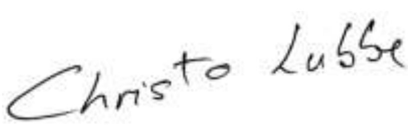

C R LUBBE **4 December 2018**
AGRICULTURAL SPECIALIST
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LIMITATIONS

This Document has been provided subject to the following limitations:

(i) This Document has been prepared for the particular purpose outlined in it. No responsibility is accepted for its use in other contexts or for other purpose.

(ii) CR Lubbe did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. Conditions may exist which were undetectable at the time of this study. Variations in conditions may occur from time to time.

(iii) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted for incomplete or inaccurate data supplied by others.

(iv) This Document is provided for sole use by the client and its professional advisers and is therefore confidential. No responsibility for the contents of this Document will be accepted to any person other than the Client.

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KEY QUALIFICATIONS:

National Higher Diploma in Agriculture (Irrigation), Technikon Pretoria, 1982
Certificate in Stereoscopic Interpretation, Geology and Resource Classification and Utilisation, Department of Agriculture, 1979
National Diploma in Agriculture, Technikon Pretoria, 1976

OTHER EDUCATION:

Certificate in Turf Grass Management, Technikon Pretoria, 1987
Certificate in Landscape Management, Technikon Pretoria, 1988
Cultivated pastures (Mod 320), University of Pretoria, 1995
FSC Auditors Course (Woodmark, UK), Sappi Ltd, 2003
NOSA Health and Safety Certificate, 1996
Certificate of Competence: Civil Designer - Design Centre and Survey and Design (Knowledge Base, August 2005)

EMPLOYMENT RECORD:

July 2006 to date	**CR LUBBE** Self employed Involved in various projects (see project related experience).	
June 2004- June 2006	**Gauteng Department of Agriculture Conservation and Environment** (Component: Technology Development and Support) **Acting Assistant Director: Resource Planning and Utilization**	**Johannesburg, SA**
Jan 1997 – May 2004	**CR LUBBE** **Self employed** Involved in various projects (See Project related experience below)	**Pretoria, SA**
1980 to 1996	**Technikon Pretoria** **Lecturer** Teaching Agricultural Engineering and Land Use Planning subjects. Teaching included practical courses, examination and moderation	**Pretoria, SA**
1974 - 1979	**Department of Agriculture (Transvaal Region)** **Senior Extension Technician** Farm Planning, Surveying, Design of soil conservation systems, Agricultural Extension.	**Carolina and Ermelo, SA**

SUMMARY OF EXPERIENCE

Has 42 years of experience in planning and managing natural resources to ensure optimal utilisation, without exploiting such resources to the detriment of future generations.

Fourteen years experience as a soil consultant, doing mainly soil surveys, terrain classification and agricultural potential studies. Reports include a variety of maps and GIS aspects thus play a large role in these surveys and studies.

Seventeen years of lecturing agricultural engineering subjects: Soil Conservation Techniques I, II and III, which dealt with the surveying, design and drawing of soil conservation structures; Farm Planning, which dealt with optimal resource utilization and Agricultural Mechanization, which dealt with the implements and machinery used to mechanize farming.

Ten years experience in the survey, design and supervising the construction of soil conservation structures in the agricultural field, mainly for farm planning.

PROJECT RELATED EXPERIENCE

PROJECTS UNDERTAKEN IN INDIVIDUAL CAPACITY

Cape EA — **Apr 2015**
Agricultural Impact Assessment : EIA for the Construction and Operation of two Photovoltaic Power Stations at Kathu in the Northern Cape.

Savannah Environmental — **Mar 2015**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Wind Farm near Moorreesburg, Western Cape.

Department of Agriculture, Forestry and Fisheries — **Mar 2015**
Eastern Cape Land Capability Verification Survey

Department of Agriculture, Forestry and Fisheries — **Dec 2014**
Western Cape Land Capability Verification Survey

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington (RE Cap 5)in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Postmasburg (RE Cap 5)in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington (Joram) in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Copperton (RE Cap 5) in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Establishment of a Cemetery at Zoar, near Ladismith in the Western Cape. .

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Copperton (RE Cap 5) in the Northern Cape.

Macroplan **Jun 2014**
Agricultural Impact Assessment: Application for rezoning of Agricultural land at Upington (Sweet Sensation), Northern Cape

Macroplan **Mar 2014**
Agricultural Potential Study: Application for change of land use at Upington (McTaggarts), Northern Cape

Agricultural Development Corporation **Jan to March 2014**
Design of Feedlot infrastructure and stock watering systems for Kenana Sugar in Sudan.

Cape EA **Nov 2013**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station in the Richtersveld, Western Cape.

Cape EA **Jul 2013**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington in the Northern Cape.

Cape EA **Oct 2012**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station near Danielskuil in the Northern Cape.

Senter360 **Oct 2012**
Agricultural Potential Study for a Food Security Development Units in the Democratic Republic of the Congo.

Africa Livestock Project Development Consortium **Aug 2012**
Agricultural Impact Assessment for the Construction and Operation of a Beef Cattle Handlings Facility for a Sugar Company in Northern Sudan

Van Zyl Environmental Consultants **Mar 2012**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station in the Northern Cape.

Bushveld Eco Services **Nov 2011**
Design and cost estimate of a stock watering system in the Lephalale disctrict.

WSM Leshika **Sep 2011**
Soil suitability survey for two new upcoming farmers at Vhuawela & Tshoga in the Limpopo Province.

National Department of Agriculture **Aug 2011**
Soil survey investigating soil potential for change of land use at the Levendal Development in the Paarl district, Western Cape.

Van Zyl Environmental Consultants **Mar 2011**
Agricultural Impact Assessment : EIA for the Construction and Operation of four Photovoltaic Power Stations in the Northern Cape.

WSM Leshika **Nov 2010**
Potential assessments and land use plans for four new upcoming farmers in the Limpopo Province.

FP Botha **Apr 2010**
Potential assessments and land use plans for various new Limpopo agricultural development hubs

Golder Associates Africa (Pty) Ltd **May 2009 – Apr 2010**
Potential assessments and Landuse plans for the resettlement of land tenants at Mafube Coal Mine in the Belfast district of the Mpumalanga Province
Sappi **Vryheid, RSA**
Undertook reconnaissance soil surveys on various plantations and farms in the Vryheid and Piet Retief districts to establish forestation potential and evaluation for species choice (covering a total area of 5173 ha).

Environmentek, CSIR **Nelspruit, RSA**
Undertook soil and terrain classification surveys on the Jessievale (8313 ha) and New Agatha (1 700 ha) plantations.

Safcol (Komatieland) **Limpopo Province**
Undertook environmental, soil and terrain classification surveys on the Thatevondo (4 500 ha), Mafela (920 ha) and Mmamatola (1 263 ha) plantations.

Measured Farming **Gabon, Swaziland & RSA**
Undertook soil and terrain classification surveys on Ranch Lope and Ranch Suba in Gabon, Kubuta Farm in Swaziland and on the farms Madikwe in the Limpopo Province and Stoffelsrus in the Free State, South Africa.

Loxton Venn and Associates **Potgietersrus, RSA**
Assess comparative soils and area for relocating Village Ga-Sekhaolelo on Overysel 815LR to Rooibokfontein 812LR and Village Ga-Puka on Swartfontein 818 LR to Armoed on Potgietersrus Platinum Mine.

Department of Water Affairs and Forestry **Gauteng**
GPS survey and alien identification for mapping of Jukskei and Swartspruit areas, as part of the Working for Water Program.

Sustainable Forestry Management Ltd **Limpopo and Mpumalanga**
Participated in a due diligence audit on various SAFCOL plantations in the Limpopo and Mpumalanga Provinces as part of the preparation of a British company's tender to purchase these plantations.

Mustek Engineering **Ghana**
Survey to provide a detailed inventory of the forest resources in 17 specified Forest Reserves in Ghana to develop a practical and operationally sound methodology for monitoring the natural forest resources in Ghana, based on satellite imagery for the Ghana Forestry Commission.

Afrigis Environmental Solutions, Pretoria
Various Soil Surveys and Landuse Plannings – Domestic and Neighbouring Countries

Rural Integrated Engineering, Pretoria
Various Soil Surveys and Landuse Plannings

Africa Land-Use Training, Modimole
Lectures at Basic Farm Planning Course (Limpopo and Gauteng)

Appendix B

Declaration of Independence

CR Lubbe was appointed by Atlantic Renewable Energy Partners (Pty) Ltd via Cape Environmental Assessment Practitioners (Pty) Ltd, the EAP, to conduct an independent agricultural scoping study for the proposed Gaetsewe PV Power Plant in the Northern Cape.

He is not a subsidiary or in any way affiliated to Atlantic Renewable Energy Partners (Pty) Ltd.

CR Lubbe also does not have any interest in secondary developments that may arise from the authorisation of the proposed project.

Christo Lubbe

CR Lubbe

4 December 2018