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EIA LEVEL REPORT:

SOIL AND LAND CAPABILITY ASSESSMENT FOR

THE PROPOSED 150 MW METSIMATALA CSP FACILITY,

POSTMASBURG, NORTHERN CAPE PROVINCE

February 2016

1. Table of Contents

1. Terms of Reference

Digital soils Africa (Pty) Ltd was commissioned by Enviroworks (Pty) Ltd to undertake a full scoping and environmental impact assessment (EIA) for the proposed development of the 150 MW Metsimatala Concentrated Solar Power Facility, near Postmasburg, Northern Cape, as well as a basic assessment for two proposed 132kV powerlines from the Metsimatala CSP facility to Mananore, Postmasburg, Northern Cape Province.

2. Introduction

The proposed 150 MW Metsimatala CSP facility will encompass an area of approximately 420 ha near Postmasburg in the Northern Cape. This study aims to determine the impact of the proposed development on soil and agricultural resources through quantifying the land potential and land capability of the area. Specific objectives of this study were:

- To describe the site in terms of topography, geology, vegetation, soils and current agricultural practices using existing information.
- To identify and classify the soils of the study area according to the South African Classification System (Soil Classification Working Group, 1991);
- To create a soil map of the study area using Digital Soil Mapping (DSM) methods, which includes specifically positioned field observations;
- To determine the most probable soil distribution along the proposed powerlines, using Land Type disaggregation methods;
- To determine the agricultural potential of map units based on interpretations of the soil potential, climate, and current land use; and
- Discussion of the potential and actual impacts of the proposed development on soil and agricultural resources.

3. Site description

3.1. Location

Metsimatala is located in the Northern Cape Province approximately 30 km east of Postmasburg along the R385 (Figures 1 and 2). An area of approximately 420 ha located on Portion 4 and the remainder of the farm Groenwater No. 453 was dedicated for the proposed development. Two power line alternatives are presented, both of which run from the Metsimatala CSP facility to Mananore, Postmasburg (Figure 1), while a third powerline option is necessary to divert an existing powerline around the proposed CSP facility.

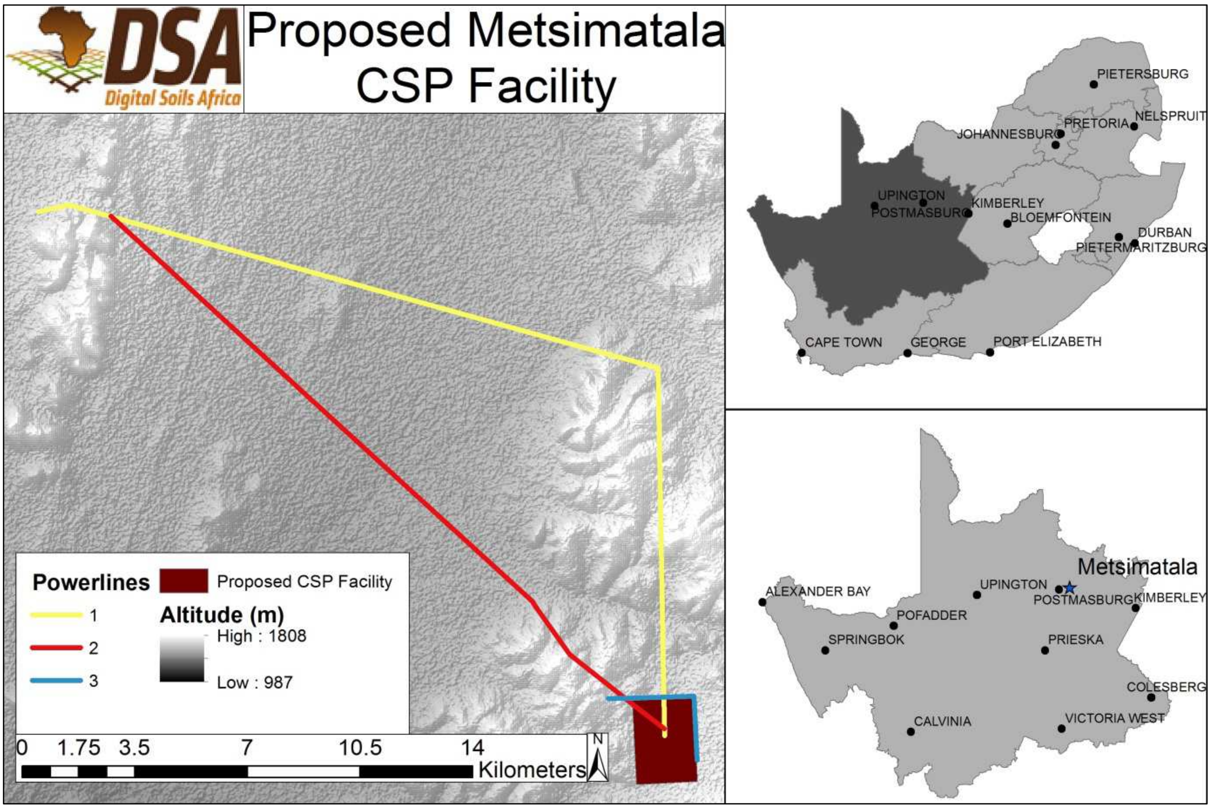


Figure 1. Location of the proposed Metsimatala CSP facility and the infrastructure associated with the development.

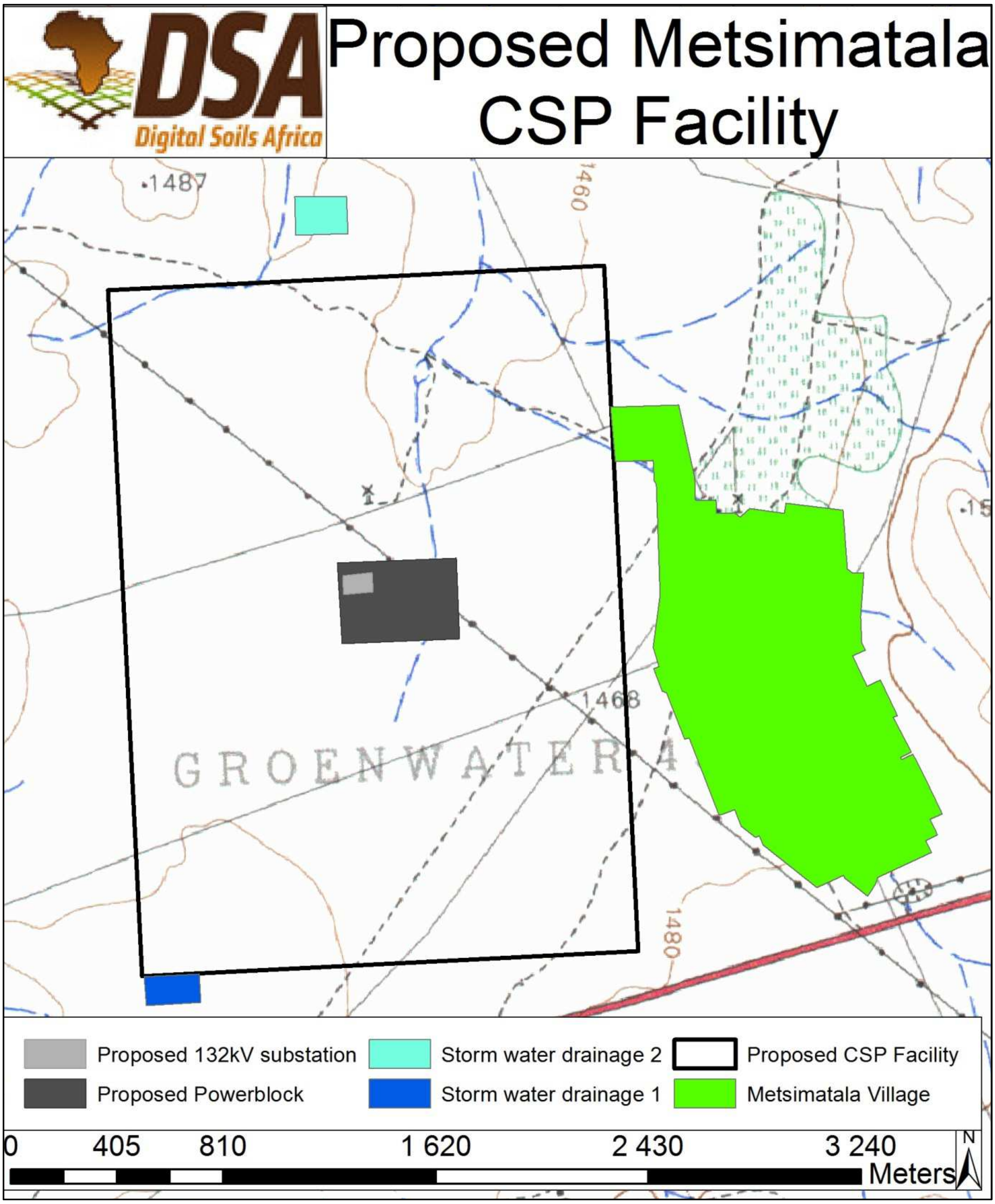


Figure 2. The proposed Metsimatala CSP facility on a 1: 50 000 topographical map background.

3.2 Climatic Information

Climatic information for the site was obtained from the South African Atlas of Climatology and Agrohydrology (Schulze, 2007). Selected climatic parameters are presented in Table 1.

Table 1: Selected climatological attributes for the study site, from Schulze (2007)

Month	Median Rainfall	Pot. Evaporation	AI*	Max. Temp	Min. Temp	Mean Temp
	(mm)				(C˚)	
Jan	39	347	0.1	30.0	16.1	23.0
Feb	60	249	0.2	28.2	15.3	21.7
Mar	61	214	0.3	27.3	13.8	20.5
Apr	27	159	0.2	23.9	9.9	16.9
May	8	130	0.1	21.1	5.4	13.3
Jun	1	97	0.0	17.2	1.7	9.4
July	0	113	0.0	18.0	1.3	9.6
Aug	0	157	0.0	20.7	3.6	12.2
Sep	1	222	0.0	24.6	7.6	16.1
Oct	12	291	0.0	26.5	10.9	18.7
Nov	23	344	0.1	28.5	13.8	21.1
Dec	30	359	0.1	29.7	15.5	22.6
Total/Average	262	2682	0.1	24.6	9.6	17.1

*AI: Aridity Index = Median Rainfall/Potential Evaporation.

From Table 1 it is clear that the site is subject to harsh climatic conditions. The rainfall is low (median of 262 mm annum^{-1}), with a large degree of variability in the monthly rainfall. Potential evaporation is extremely high and the area can be classified as arid (AI = 0.1). High maximum and very low minimum temperatures are typical of this environment (Note: the maximum and minimum temperatures presented in Table 1 are the monthly average maximum and minimum temperatures).

3.3 Land Types, Geology and Topography

The total area (proposed CSP facility and infrastructure) covers several different Land Types (Land Type Survey Staff, 1972-2006). Land Types are units which comprise generally homogeneous climate, geology and topography. The Land Type inventories, which accompany each Land Type, shows an estimate of the percentages of different soil types covering different terrain morphological units within that land type. The Land Type inventories for the Land Types occurring on the total site are shown in the Appendix. Figures 3 shows the Land Types of the proposed CSP facility, while Figures 4, 5 6 and 7 show the Land Types for the entire area superimposed over various topographical layers, to give an indication of the topography. A brief summary of the geology, topography and soils of each Land Type follows.

3.3.1. Ae214

Land Type Ae214 occurs on the potential CSP facility site. The underlying geology is amygdaloidal andesitic lava with interbedded tuff, agglomerate, chert and red jasper from the Ongeluk Formation, Cox Group. The topography is mostly relatively flat, with slopes below 5 degrees, but there are a few hills where the slopes reach up to 10 degrees. The soil forms present are Hutton, Oakleaf and Valsrivier, with Hutton being the dominant soil form. Some areas are also covered with bare rock. Thirty-eight percent of the area could be overlain with potentially irrigable soils, being deeper than 1.2 m.

3.3.2. Ib237

Land Type Ib237 covers a small part of the potential CSP facility site, as well as both powerline options. The underlying geology is Yellow-brown banded or massive jaspilite with crocidolite; banded ironstone with subordinate amphibolite, crocidolite and ferruginized brecciated banded ironstone (blinkklip breccia) at base at places; brown jaspilite and chert at top. It forms part of the Asbestos Hills Formation. It has a hilly topography, with slopes reaching 20 degrees. Although Hutton soils are the most prominent soil form most of the area is covered with bare rock. There are no irrigable soils present on this Land Type.

3.3.3. Ae215

Land Type Ae215 occurs across a very small part of Powerline Option 1. The underlying geology is mainly red to flesh-coloured wind-blown sand of Tertiary to Recent age. Occasional outcrops of banded ironstone with bands of amphibolite also occur. It forms part of the Asbestos Hills Formation, Griquatown Group. The topography is alike to Land Type Ae214, being mostly flat, but with slopes up to 10 degrees in some areas. The soil forms present are Hutton, Clovelly, Kroonstad and Valsrivier, with Hutton being the dominant soil form. Some areas are covered with bare rock. Soils deeper than 1.2 m, which is potentially irrigable cover 92% of this land type, while the Kroonstad soil form, which is a wetland soil from cover 1.5% of this land type.

3.3.4. Ag110

Land Type Ag110 occurs across parts of Powerline Option 2. The underlying geology is Surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava. It forms part of the Ongeluk Formation. Topographically this is a very flat area, with slopes above 5 degrees only on very few occasions. The soil forms present are Mispah and Hutton, with Hutton being the dominant soil form. There are no soils deeper than 1.2 m, thus irrigation is not possible within this land type.

3.3.5. Ag111

Land Type Ag111 occurs across parts of both Powerline Options. The underlying geology is fine and coarse-grained dolomite, chert and dolomitic limestone with prominent interbedded chert, limestone and banded ironstone from the Ghaap Plateau Formation. This Land Types topography is alike to that of Land Type Ag110, with barely any slopes reaching above 5 degrees. The soil forms present are bare rock, Mispah and Hutton, with Hutton being the dominant soil form. There are no soils deeper than 1.2 m, thus irrigation is not possible within this land type.

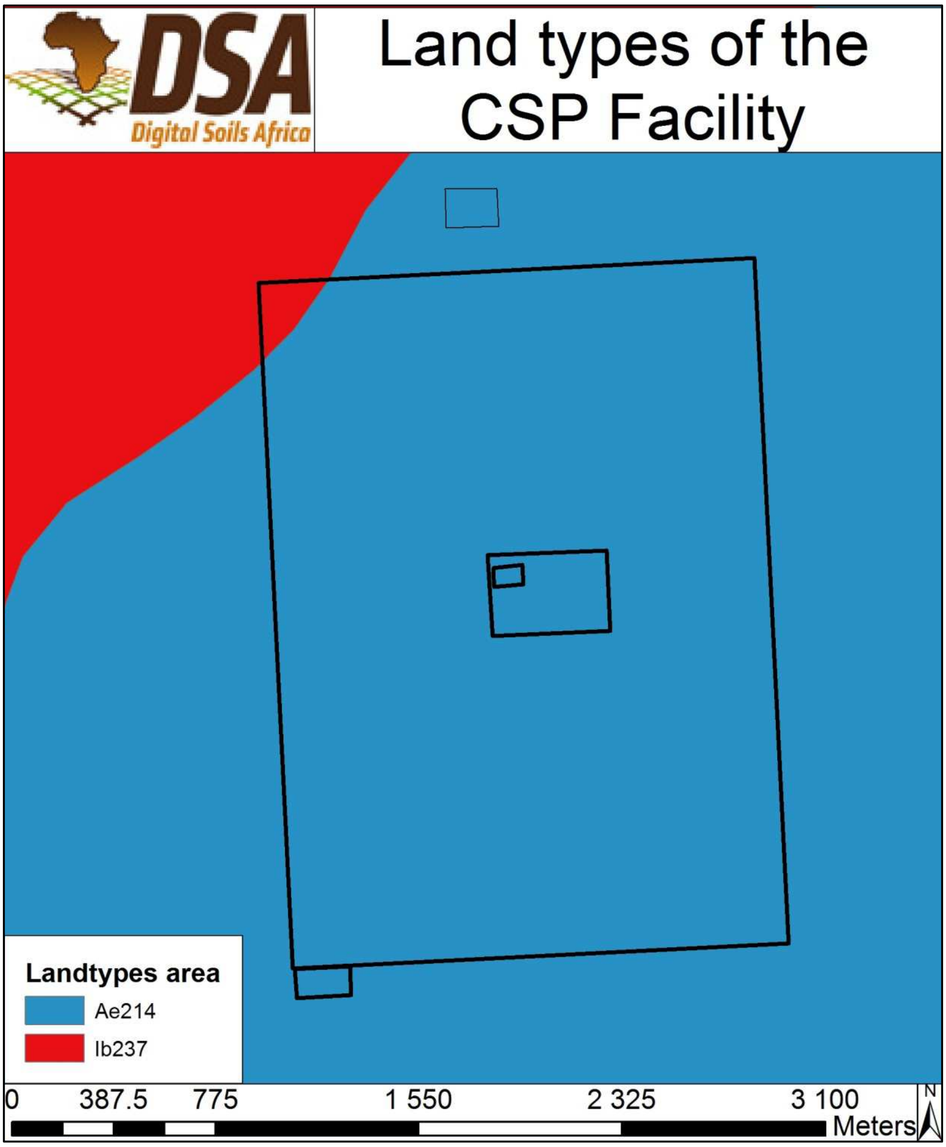


Figure 3: Land Types covering the potential Metsimatala CSP facility.

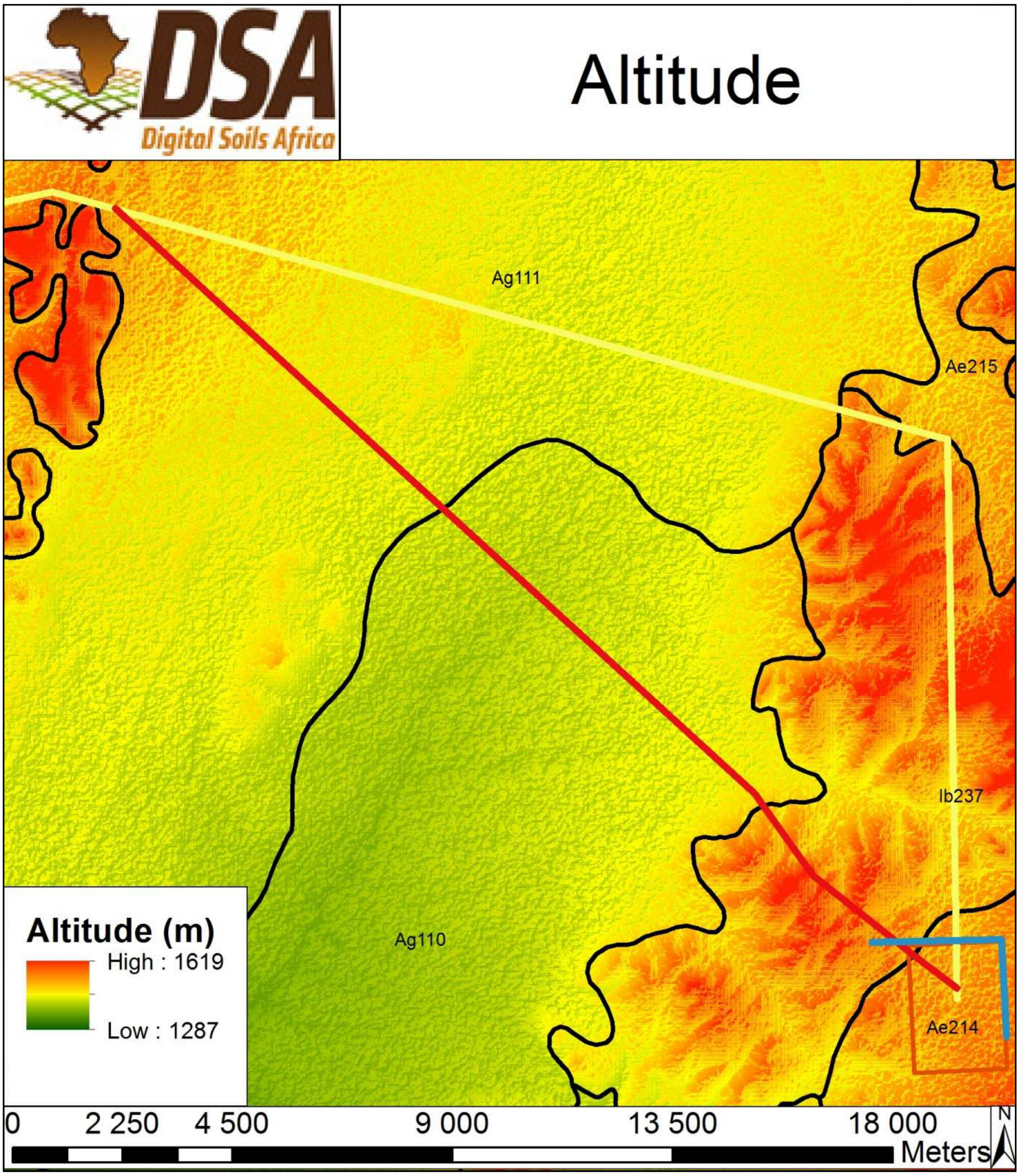


Figure 4: Altitude of the area, also showing the land types.

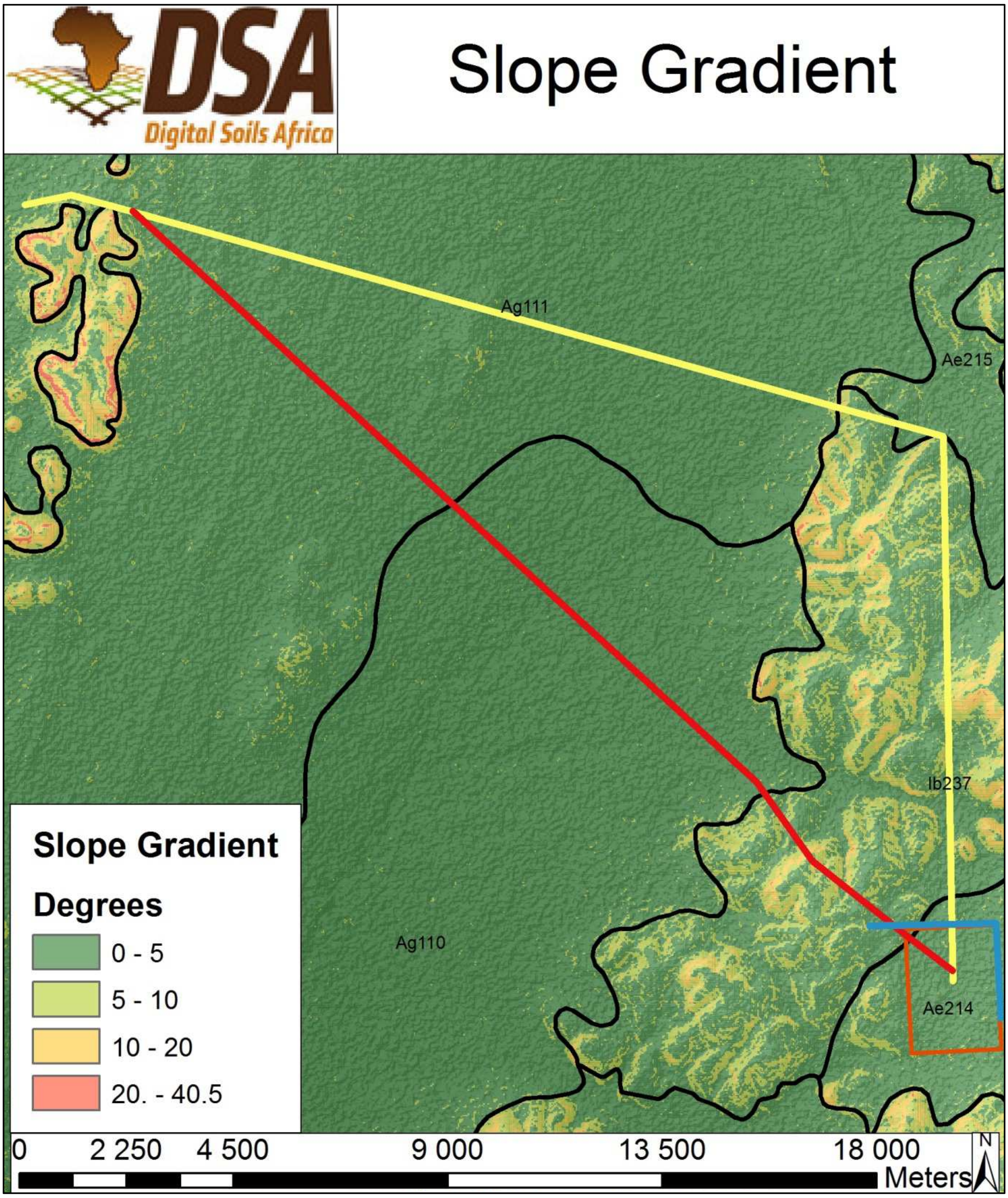


Figure 5: Slope Gradient of the area

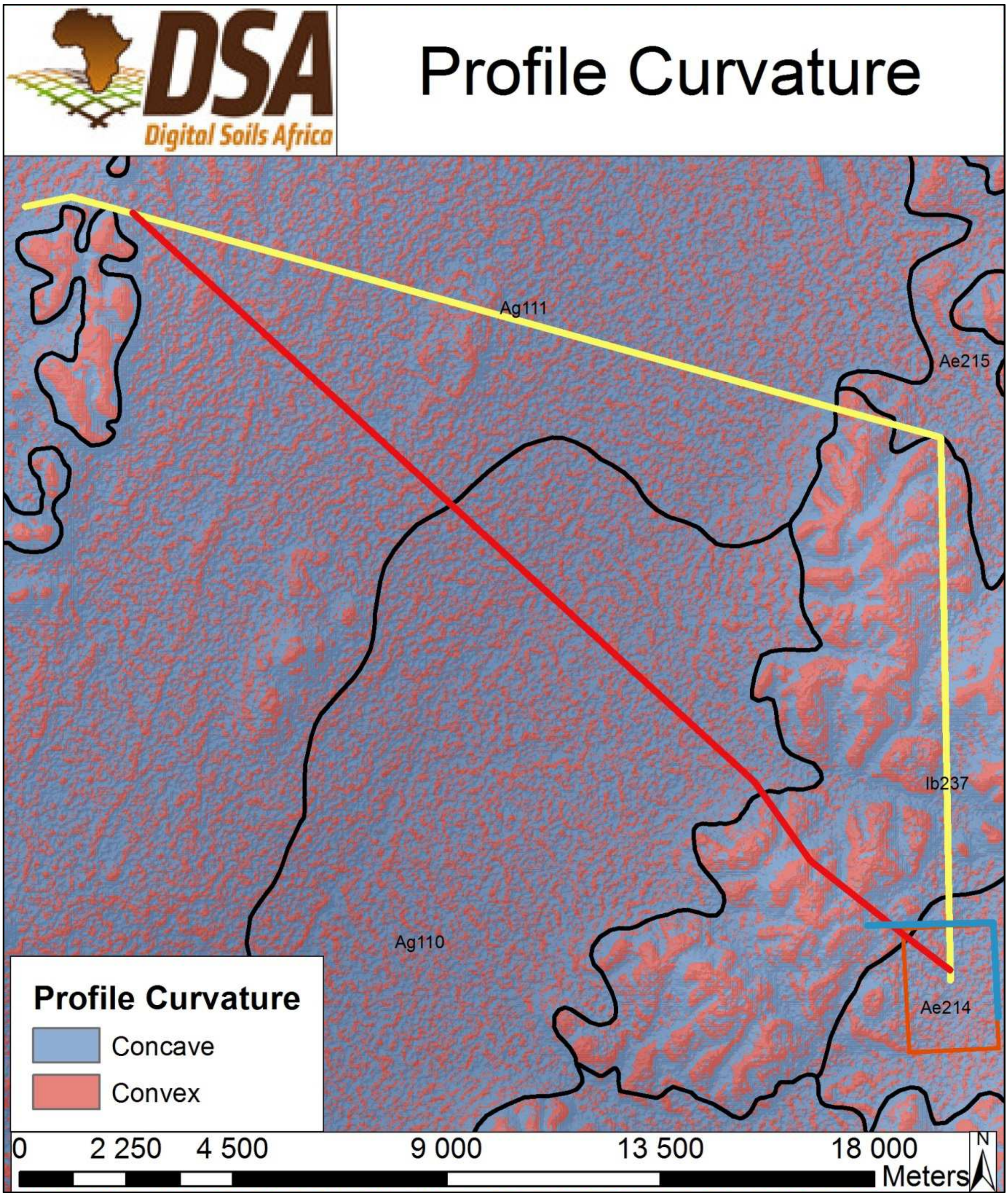


Figure 6: Profile curvature of the area.

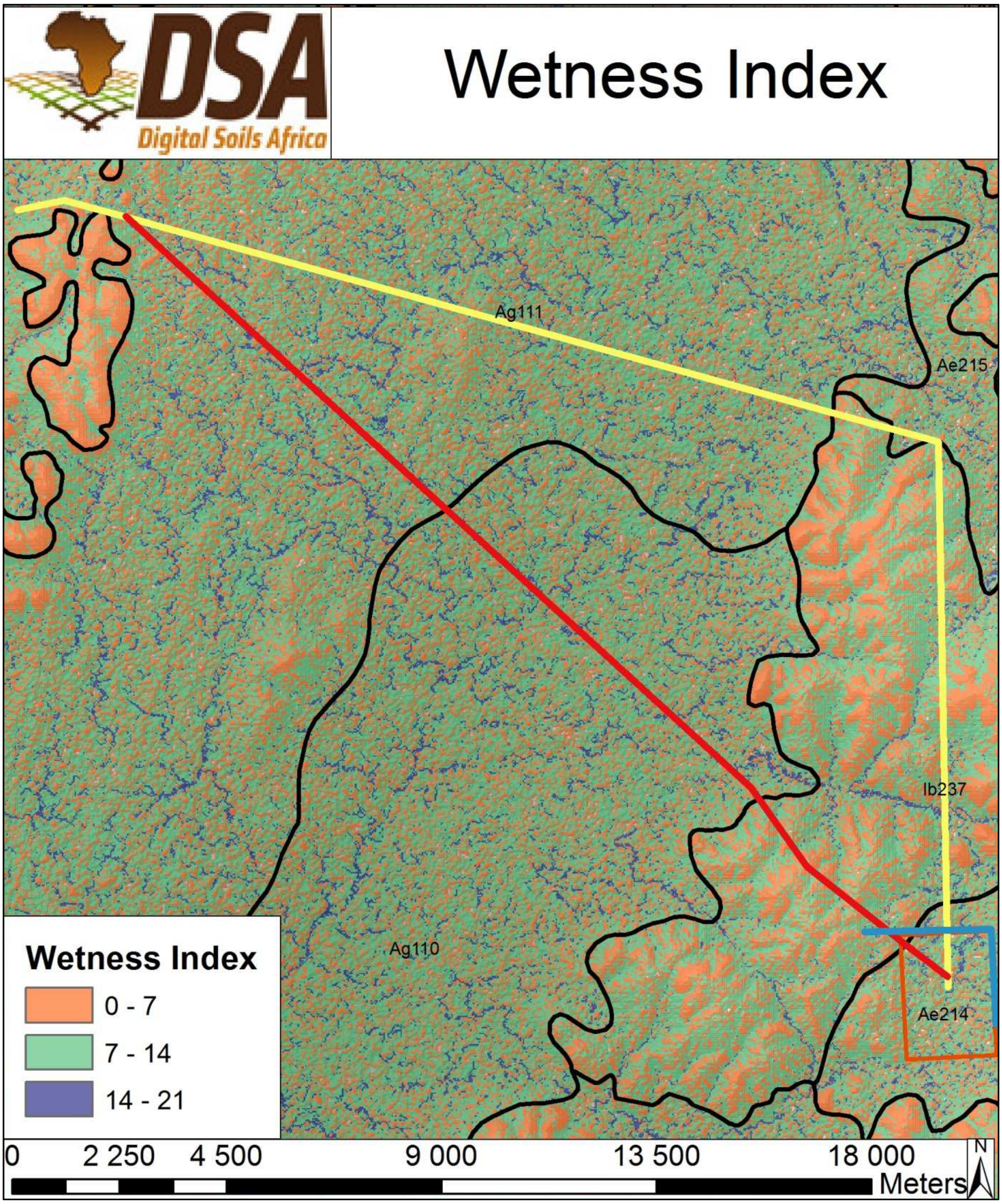


Figure 7: Topographical wetness index of the area.

3.4 Vegetation, current land use and agricultural activities.

The proposed CSP facility is mostly covered by Olifantshoek Plains Thornveld, with a small part in the north western corner being covered by Kuruman Mountain Bushveld (Mucina and Rutherford, 2006). The potential powerlines are additionally covered by the Kuruman Thornveld and Postmasburg Thornveld vegetation types (Mucina and Rutherford, 2006) (Figure 8). The current land-use is restricted to low intensity grazing. The low rainfall, high potential evaporation, high maximum and low minimum temperatures (Table 1), coupled with shallow soils (see section 4) covering most of the site, limits any additional land-use activities. If a water source could be found, there is a possibility for some irrigation, but the chances are slim. A number of non-perennial streams are present, but the dominant source of water for agricultural purposes is groundwater.

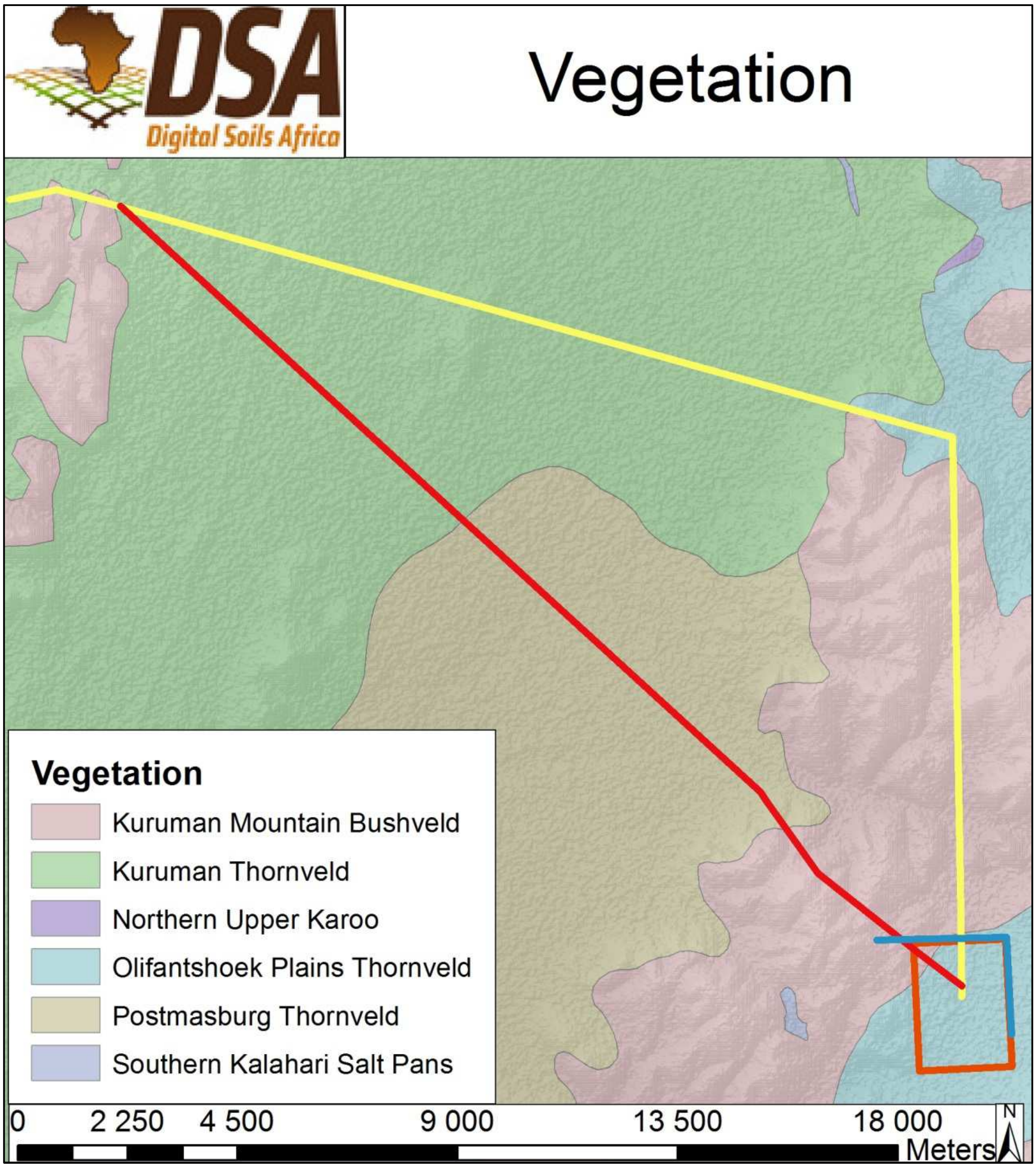


Figure 8: Vegetation map of the area

4. Soil and Agricultural potential

4.1 Methodology to quantify soil and agricultural potential

4.1.1. Potential CSP facility

The soil map for the potential CSP facility was created using a digital soil mapping (DSM) (McBratney et al., 2003) approach. The theory behind the DSM approach is that soils form due to five factors:

$$S(f) = P, Cl, R, O, T \ldots \text{ (Jenny, 1941).}$$

Were *S* is soil (soil formation), *P* is parent material (geology/lithology), *Cl* is the climate, *R* is the relief or topography, *O* is organism (including anthropological effects) and *T* is time.

Understanding the impacts of these five factors on soil formation, enable trained pedologists to predict the occurrence of soils within a given area. Twenty pre-determined observations points was set out, using the conditioned Latin Hypercube method of Minasny and McBratney (2006). In this method, points are set out to reflect the entire attribute space of the area. The attributes used in the instance was Slope degree and Profile Curvature. Field work carried out on the 11th of December 2015 included auger observations to bedrock at these specific positions, as well as noting interesting occurrences while moving in the field. In all 24 field observations were made (Figure 10). All the auger observations were Mispah soil forms, which is a very shallow soil (> 300 mm). The four surface observations included two rock outcrops, one observation of hard lime lying on the soil surface, which indicates a shallow soil, and a shallow Tukulu soil form (< 400 mm) on soft lime, within a perennial stream. Thus it was concluded that the potential CSP facility was covered by shallow Mispah soils with occasional rock outcrops and lime deposits. Within perennial streams Tukulu soils on soft lime could be found. Thus the whole area is only suited to rangeland agriculture, with a low grazing capacity. Also, at all observation points the vegetation was degraded and clear signs of sheet erosion was noted (Figure 9). To create the final soil map (Figure 10), the following soil terrain rules were created.

1. R/Ms – Altitude Above Channel Network > 0.065 m; Topographical Wetness Index < 12.7
2. Tukulu – Altitude Above Channel Network < 0.065 m; Topographical Wetness Index > 12.7

Table 2 summarises the agricultural potential of the soil map units, based on Table 1 and Figure 10. Overall the area has soil with very low agricultural potential, and very low potential for irrigation. Furthermore, there is a risk of soil erosion, as one can see from the signs of erosion already present on the site.

a)

b)

c)

Figure 9: Examples of degraded vegetation (a and b) and sheet and rill erosion (c).

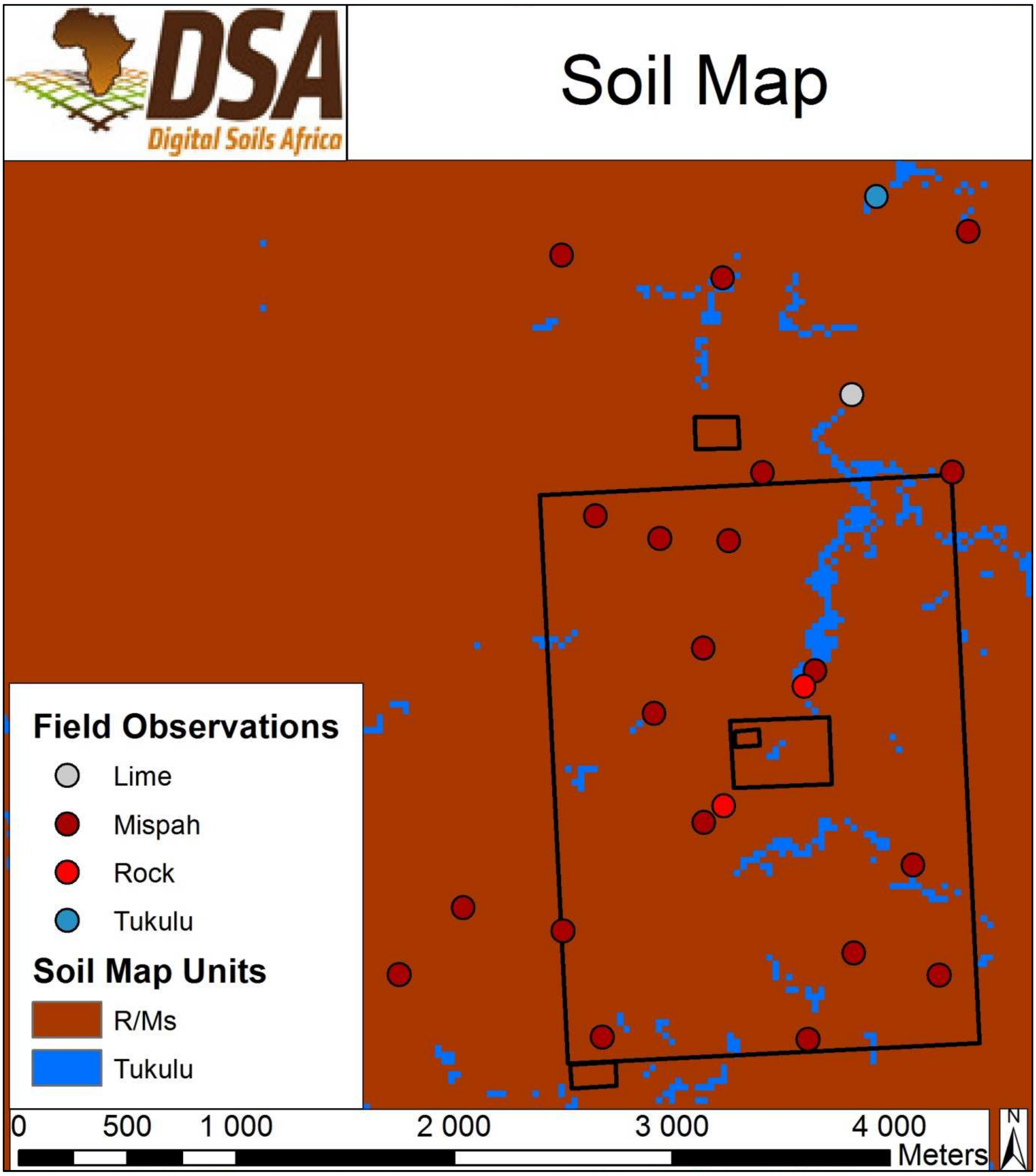


Figure 10: Soil map of the CSP facility showing soil observation points

Table 2: Soil map units on the proposed CSP facility

Soil Map Unit	Soil forms	Current Potential	Limitations	Irrigation Potential	Erosion sensitivity
R / Ms	Rock Mispah	Very low	Arid climate, Shallow soils	Very Low	High
Tukulu	Tukulu	Very low	Arid climate, Shallow soils	Very Low	Moderate

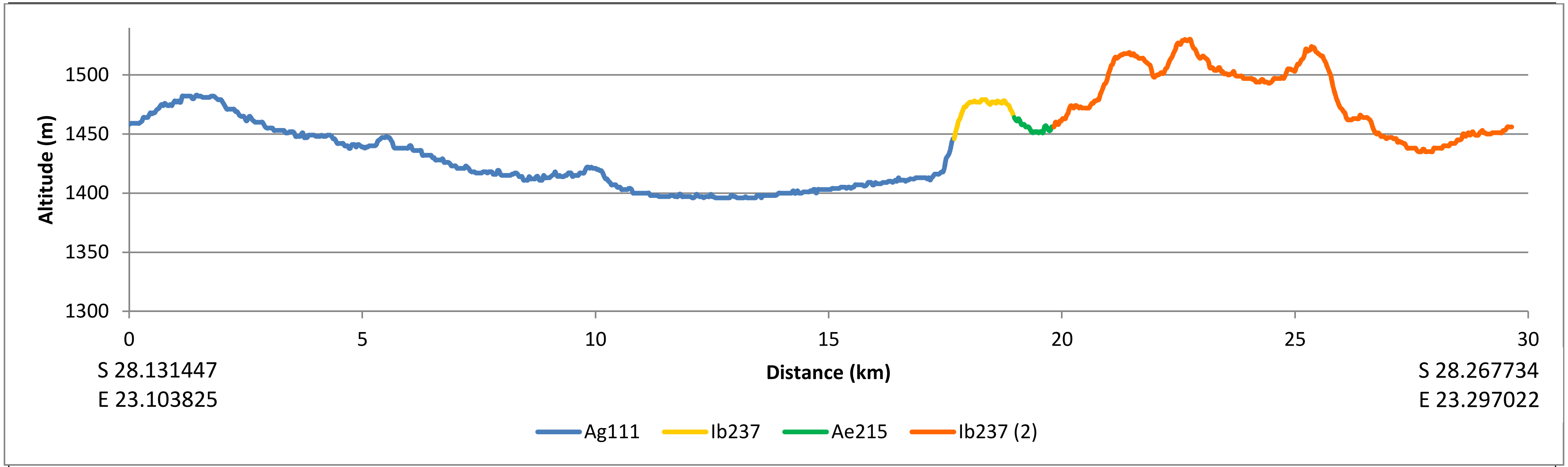
4.1.2. Powerline Options

To assess the soils of the different powerline options, a land type disaggregation (Van Zijl et al., 2013; Van Tol et al., 2014) approach was followed. In this approach 2-dimensional topographical transects were drawn from the 30 m SRTM digital elevation model, along the routes of the potential powerline options. The dominant soil forms from the Land Type inventories were allocated to the different terrain morphological positions (TMU's) contained within the Land Type inventories of the specific Land Types. The 2-dimensional transects of Powerline Options 1 & 2 are shown in Figures 11 and 12. The area of Powerline Option 3 is covered in the soil map (Figure 10). The agricultural potential of the soil map units are assessed in Table 3.

Table 3: Soil map units on the different powerline options

Soil unit	Soil forms	Powerline Option	Current Potential	Limitations	Irrigation Potential	Erosion sensitivity
R/Ms	Rock Mispah	1, 2	Very low	Arid climate, Shallow soils	Verly Low	High
Hu 1200	Hutton	1, 2	Very low	Arid climate	Moderate	Moderate
Hu 1200+	Hutton	1	Very low	Arid climate	High	Moderate

The overall agricultural potential is very low, due to the arid climate of the area. The R/Ms soil unit is comprised of rock outcrops and Mispah soils. It is very shallow, and has very low agricultural potential. The Hu 1200 soil unit is a Hutton soil which is up to 1200 mm deep. The agricultural potential of the soil is much higher, but in this area it is still very low due to the arid climate. Under the current guidelines for irrigation in the Northern Cape, this soil unit will be too shallow for irrigation. Could irrigation water be obtained, there is a possibility that the Hu 1200+ soil unit could be irrigated, as it is potentially deeper than 1200 mm. This unit is only present on a very small portion of Powerline Option 1, within the Land Type Ae215. However, due to the existing powerline already running along this route, the current situation does not allow for irrigation to occur within this area. Thus it is advised that based on the agricultural assessment, Powerline Option 1 is a viable option.



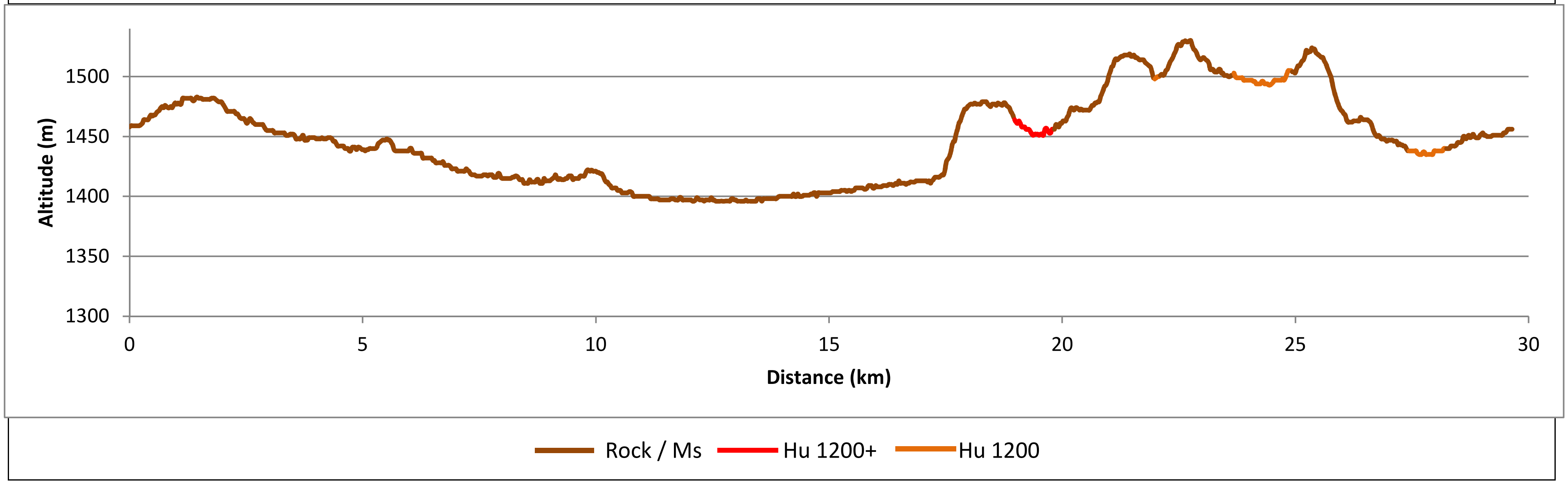
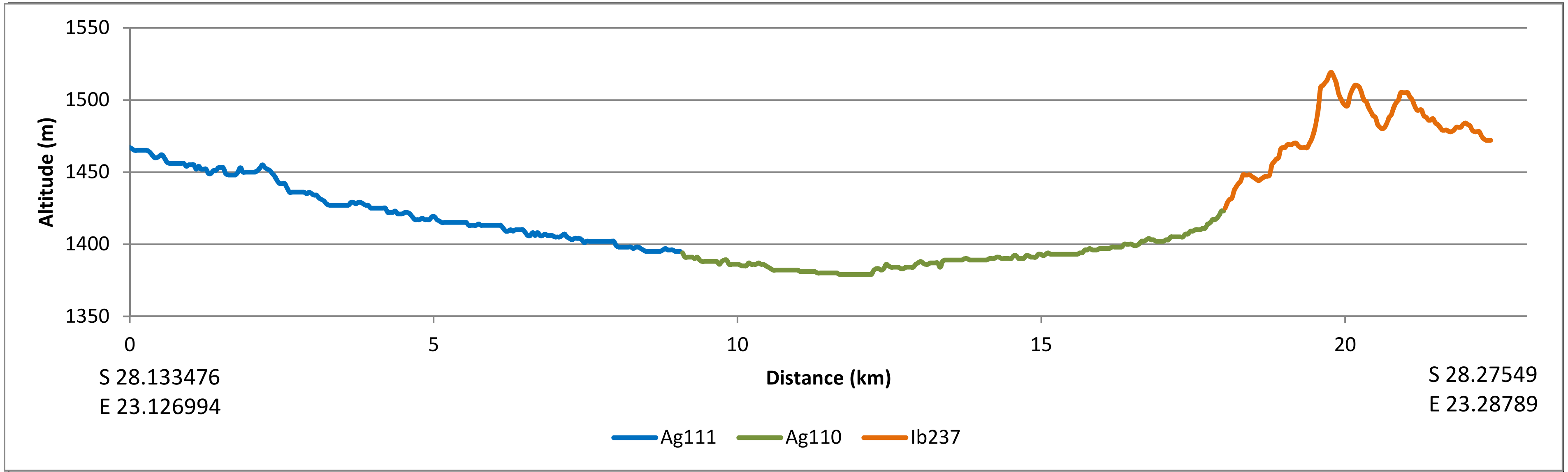


Figure 11: Land Type (a) and Soil Form (b) distribution across Powerline Option 1.



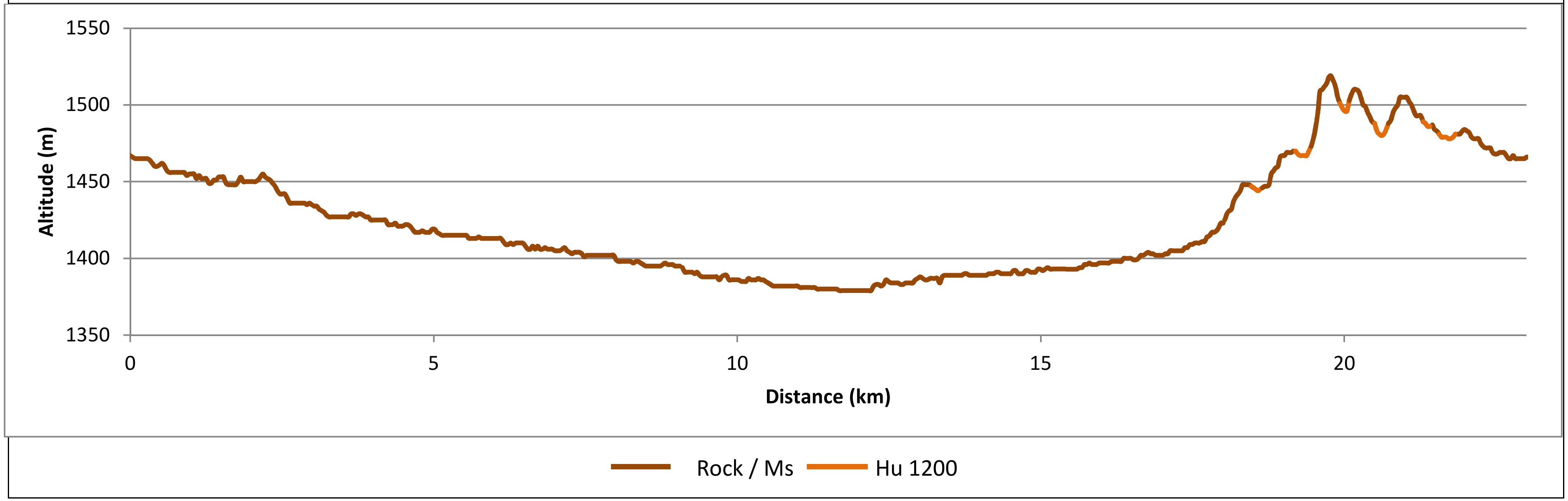


Figure 12: Land Type (a) and Soil Form (b) distribution across Powerline Option 2.

5. Assessment of impacts

5.1. Assessment criteria

The criteria used to assess the impact of the proposed development are presented in Table 4. This assessment is based on direct, indirect and cumulative impacts of the proposed development.

Table 4. Impact assessment criteria

Category	Description of category
Nature	Describes the cause of the effect, what will be affected and how will it be affected
Extent (E)	Indicate the area being affected i.e. geographical extent (**scale**: 1 = local *up to* 5 = regional)
Duration (D)	Indicate the lifespan of the impact (**scale**: 1 = short term *up to* 5 = permanent
Magnitude (M)	Indicate the impact of the effect on the environment (**scale**: 0=no significant impact; 2 = minor impact; 4 = low/slight impact; 6 = moderate; 8 = high i.e. natural processes significantly altered and 10 = very high i.e. complete destruction of biophysical environment
Probability (P)	Describes the likelihood of the impact actually occurring (**scale**: 1 = very improbable *up to* 5 = definite)
Significance (S)	Summarise the impact by combining the criteria in the following formula: $S = (E + D + M) \times P$
Status	Either positive, negative or neutral
Reversal and mitigation	Indicate the degree to which the impact might be reversed or mitigated

The following activities are likely to impact soil and agricultural resources in the study area:

- Construction of CSP facility and associated buildings (sub-stations, workshops etc.);
- Construction of access roads to site;
- Erection of overhead power line; and
- Vehicles operating on the site during the construction and implementation phase.

5.2. Construction of buildings and other infrastructure

Table 5 summarise the impact of the construction of the CSP facility, including the power block, substation, and storm water drains on soil and agricultural resources. The cumulative impact of these constructions is expected to be small due to the low agricultural potential of the land.

Table 5. Impact of the construction of buildings

Category	Description of category
Nature	Constructing CSP facility, powerblock, reflectors, substation and stormwater drains leading to the loss of agricultural land and potential erosion
Extent (E)	1 – Site (2 dimensional)
Duration (D)	5 – Permanent
Magnitude (M)	2 (can be 6 if adequate erosion measures are not in place)
Probability (P)	4
Significance (S)	32
Status	Negative
Reversal and mitigation	None; limit footprint and ensure that adequate water erosion measures are in place, especially at reflector area, which will cause concentrated run off

5.3. Construction of access roads

Table 6 summarise the impact of the expansion of the road network in the study site on soil and agricultural resources. The cumulative impact of these constructions is expected to be small due to the low agricultural potential of the land.

Table 6. Impact of the expansion on the road network.

Category	Description of category
Nature	Constructing of access roads to the new buildings leading to the loss of agricultural land and potential erosion
Extent (E)	1 – Site (2 dimensional)
Duration (D)	5 - Permanent
Magnitude (M)	2 (can be 6 if adequate erosion measures are not in place)
Probability (P)	4
Significance (S)	32
Status	Negative
Reversal and mitigation	None; use existing roads as far as possible, adequate erosion measures are vital

5.4. Erection of overhead power line

Table 7 summarise the impact of the two power line options on existing soil and agricultural resources (see section 5). Almost identical soil associations exist between the two options and their impacts are considered to be identical, as with the current powerline running along Powerline Option 1 and the lack of available irrigation water, irrigation is not possible for the small area with irrigable soils The cumulative impact on soil and agricultural resources is expected to be low due low agricultural potential of the area.

Table 7. Impact of the erection of overhead power lines

Category	Description of category
Nature	Erection of power line to connect substation to national grid
Extent (E)	1 – Site (2 dimensional)
Duration (D)	5 - Permanent
Magnitude (M)	2
Probability (P)	4
Significance (S)	32
Status	Negative
Reversal and mitigation	None; ensure that adequate erosion measures are in place and limit direct footprint

5.5. Vehicles operating during construction and implementation

A concern for sheep farmers are dust generation associated with more traffic on the farms, resulting in lower quality wool. If managed correctly the cumulative impact of vehicles on dust creation can be limited. Table 8 summarise the anticipated impact of increased vehicle activity on soil and agricultural resources.

Table 8. Impact of increased vehicle activity

Category	Description of category
Nature	Increased vehicle activity and associated dust generation
Extent (E)	2 – Local
Duration (D)	2 – Short term, generally restricted to construction period
Magnitude (M)	2
Probability (P)	2 (if managed correctly)
Significance (S)	12
Status	Negative
Reversal and mitigation	None; limit vehicle movement and ensure that road surfaces are moist during maximum vehicle movement periods

5.6. Summary of the environmental impact

A summary of the impact of the proposed development on soil and agricultural resources is presented in Table 9. The cumulative impact of this development is expected to be low due to the low potential of the land.

Table 9. Summary of the impact of the development

Nature	**Loss of soil and agricultural resources due to development of the Metsimatala CSP facility.**	
	Without mitigation	With mitigation
Extent (E)	1 – Site	1 - Site
Duration (D)	5 – Permanent	5 - Permanent
Magnitude (M)	2 – Low inherent potential	2 – Low inherent potential
Probability (P)	4 – Very likely	4 – Very likely
Significance (S)	32 - Medium	32 - Medium
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No (not the loss of agricultural land)	No (not the loss of agricultural land)
Mitigation strategies	The loss of agricultural land will be permanent.	
Cumulative Impacts	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	
Residual Impacts	If concentrated runoff from the reflectors, buildings and access roads are not managed correctly it might lead to severe erosion,	

5.7. Environmental Management Plan

A draft management plan regarding two potential impacts, namely erosion and dust creation are presented in Table 10 and 11 respectively.

Table 10. EMP to restrict the impact of soil erosion

Objective	**Erosion control**	
Project components	Erosion control measures	
Potential impact	Severe soil water erosion, loss of topsoil, erosion gullies	
Activity risk/source	Concentration of overland flows from infrastructure, inadequate planning of road network	
Mitigation objectives	Prevent soil erosion	
Action/control	**Responsibility**	**Timeframe**
Contour walls in reflector area, adequate planning of roads, contour walls, and other erosion control measures such as gabion weirs in existing gullies	Civil engineers and construction team	Throughout the duration of the project
Performance indicator	Overland flow from infrastructure not concentrated to gullies	
Monitoring	Measure suspended sediments, visual observations of gully formation	

Table 11. EMP to restrict impact of dust generation

Objective	**Dust generation due to vehicle activity on the site**	
Project components	Limit the generation of dust associated with vehicle activity, especially during construction phase	
Potential impact	Dust generation, health risk and economical impact on sheep farmer (wool quality)	
Activity risk/source	Excessive traffic on dirt roads	
Mitigation objectives	Limit dust generation	
Action/control	**Responsibility**	**Timeframe**
Restrict vehicle movement to a minimum, ensure that dirt roads are moist using dust suppressants during peak construction periods	Civil engineers and construction team	Throughout the construction phase of the project
Performance indicator	Assessment of dust generated	
Monitoring	Visual observations and direct measurement of air quality	

6. Conclusions

This report describes the soil and agricultural resources of the proposed Metsimatala CSP Facility and the impact the development might have on these resources. The arid climate of the study area coupled with shallow soils limits the agricultural potential to low intensity grazing. The impact of the proposed development agricultural resources is therefore considered to be small. It is however important that the direct footprint of infrastructure be kept to a minimum and that adequate erosion measures and mitigation strategies are in place to ensure that the proposed project and current agricultural practices continue in sustainable symbioses.

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8. Appendix: Land Type inventories of the study site

8.1. Ae214

LAND TYPE / *LANDTIPE* .... : **Ae214**
CLIMATE ZONE / *KLIMAATSONE* .... : 556S
Area / *Oppervlakte* .... : 6760 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 190 ha

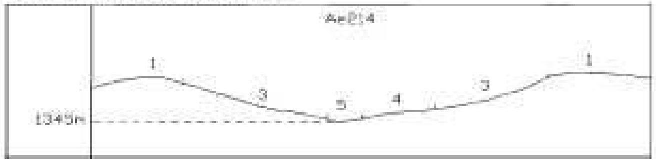
Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2822 Postmasburg (6760 ha)

Inventory by / *Inventaris deur* :
J F Eloff & S W J Idema
Modal Profiles / *Modale profiele* :
None / Geen

Terrain unit / *Terreineenheid*	:	1	3	4	5
% of land type / *% van landtipe*	:	10	50	28	12
Area / *Oppervlakte (ha)*	:	676	3380	1893	811
Slope / *Helling (%)*	:	1 - 7	3 - 12	0 - 2	0 - 2
Slope length / *Hellingslengte (m)*	:	100 - 500	500 - 2000	50 - 1000	50 - 200
Slope shape / *Hellingsvorm*	:	Y-Z	Z-X	Z	Z
MB0, MB1 (ha)	:	34	1690	1136	608
MB2 - MB4 (ha)	:	642	1690	757	203

Soil series or land classes / *Grondseries of landklasse*	Depth / *Diepte* (mm)	MB :	ha	%	ha	%	ha	%	ha	%	Total / *Totaal* ha	%	Clay content % / *Klei-inhoud %* A	E	B21	Hor	Texture / *Tekstuur* Class / *Klas*	Depth limiting material / *Diepte-beperkende materiaal*
Soil-rock complex		:																
Grond-rotskompleks:		:																
Rock/Rots		4 :	541	80	676	20					1217	18.0						
Shorrocks Hu36, Mangano Hu33	100-300	3 :	101	15	338	10					439	6.5	8-18		12-25	B	LmfiSa-SaClLm	R
Shorrocks Hu36, Mangano Hu33	300-750	1 :	34	5	169	5					203	3.0	8-18		12-25	B	srLmfiSa-SaClLm	R
Shorrocks Hu36	300-1200+	1 :			1521	45	473	25	122	15	2116	31.3	12-20		25-35	B	srfiSaClLm	R
Shorrocks Hu36	100-300+	3 :			676	20	757	40	122	15	1555	23.0	12-20		25-35	B	srfiSaClLm	R
Shorrocks Hu36	300-1200	0 :					379	20	122	15	500	7.4	10-15		15-25	B	fiSaLm-SaClLm	R
Mangano Hu33	600-1200+	0 :					189	10	284	35	473	7.0	6-12		6-15	B	fiSa-LmSa	R
Leeufontein Oa16, Waterval Va11	300-1000	0 :					95	5	81	10	176	2.6	8-20		15-25	B	fiSaLm-SaClLm	R
Stream beds/Stroombeddings		4 :							81	10	81	1.2						

Terrain type / *Terreintipe* : B2
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: Amygdaloidal andesitic lava with interbedded tuff, agglomerate, chert and red jasper (Ongeluk Formation, Cox Group).

Geologie: Amandelhoudende andesitiese lawa met tussenlae van tuf, agglomeraat, chert en rooi jaspis (Formasie Ongeluk, Groep Cox).

8.2 Ib237

LAND TYPE / *LANDTIPE* : **Ib237**

CLIMATE ZONE / *KLIMAATSONE* : 556S

Area / *Oppervlakte* : 56920 ha

Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 310 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2722 Kuruman (4270 ha) 2822 Postmasburg (52650 ha)

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

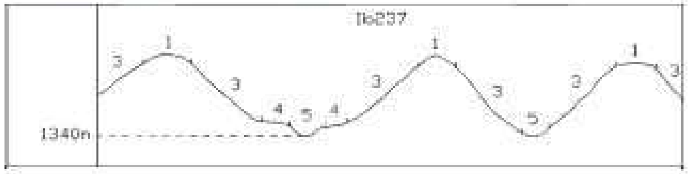
Modal Profiles / *Modale profiele* :
None / Geen

Terrain unit / *Terreineenheid*	1	3	4	5
% of land type / *% van landtipe*	23	60	5	12
Area / *Oppervlakte (ha)*	13092	34152	2846	6830
Slope / *Helling (%)*	1 - 7	6 - 45	0 - 2	1 - 3
Slope length / *Hellingslengte (m)*	100 - 800	200 - 2000	50 - 500	20 - 150
Slope shape / *Hellingsvorm*	Y	Y-Z	Z	X
MB0, MB1 (ha)	0	1708	2134	4098
MB2 - MB4 (ha)	13092	32444	711	2732

Soil series or land classes / *Grondseries of landklasse*	Depth / *Diepte* (mm)	MB	1 ha	%	3 ha	%	4 ha	%	5 ha	%	Total / *Totaal* ha	%	Clay content % / *Klei-inhoud %* A	E	B21	Hor	Texture / *Tekstuur* Class / *Klas*	Depth limiting material / *Diepte-beperkende materiaal*
Soil-rock complex / *Grond-rotskompleks:*																		
Rock/Rots		4	10474	80	22199	65	427	15	1366	20	34465	60.6						
Mangano Hu33, Roodepoort Hu30	50-300	3	2618	20	10246	30	285	10	888	13	14036	24.7	2-6		4-10	B	fiSa	R
Mangano Hu33, Zwartfontein Hu34, Roodepoort Hu30	300-1200	0			1708	5	2134	75	4098	60	7940	14.0	2-6		4-10	B	fi/meSa	R
Stream beds/Stroombeddings		4							478	7	478	0.8						

Terrain type / *Terreintipe* : C3

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: Yellow-brown banded or massive jaspilite with crocidolite; banded ironstone with subordinate amphibolite, crocidolite and ferruginized brecciated banded ironstone (blinkklip breccia) at base at places; brown jaspilite and chert at top (Asbestos Hills Formation).

Geologie: Geelbruin gestreepte of massiewe jaspiliet met krokidoliet; asook gestreepte ystersteen met ondergeskikte amfiboliet, krokidoliet en verysterde gebreksieerde gestreepte ystersteen (blinkklipbreksie) plek-plek aan basis; bruin jaspiliet en chert aan bokant (Formasie Asbesberge).

8.3. Ae215

LAND TYPE / *LANDTIPE* ....: **Ae215**

CLIMATE ZONE / *KLIMAATSONE* ....: 556S

Area / *Oppervlakte* ....: 25630 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 480 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2822 Postmasburg (25630 ha)

Inventory by / *Inventaris deur* :

J F Eloff & S W J Idema

Modal Profiles / *Modale profiele* :

None / Geen

Terrain unit / ***Terreineenheid*** ....:	4	5
% of land type / *% van landtipe* ....:	90	10
Area / *Oppervlakte (ha)* ....:	23067	2563
Slope / *Helling (%)* ....:	0 - 3	1 - 2
Slope length / *Hellingslengte (m)* ....:	300 - 2000	20 - 150
Slope shape / *Hellingsvorm* ....:	Z-X	X
MB0, MB1 (ha) ....:	21914	2435
MB2 - MB4 (ha) ....:	1153	128

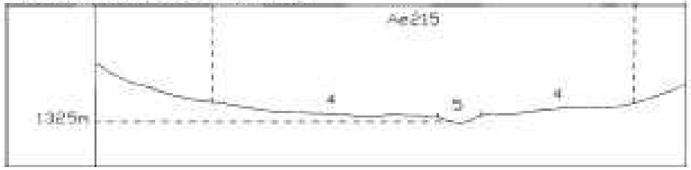
Soil series or land classes *Grondseries of landklasse*	Depth *Diepte* (mm)	MB:	ha	%	ha	%	Total *Totaal* ha	%	Clay content % *Klei-inhoud %* A	E	B21	Hor	Texture *Tekstuur* Class / *Klas*	Depth limiting material *Diepte-beperkende materiaal*
Rock / Rots		4 :	1153	5	128	5	1282	5.0						
Mangano Hu33	450-1200+	0 :	19607	85	1153	45	20760	81.0	4-8		6-10	B	fiSa	R,ka
Roodepoort Hu30	450-1200+	0 :	1615	7	128	5	1743	6.8	2-6		3-6	B	fiSa	R,ka
Annandale Cv33	450-1200+	0 :	692	3	513	20	1205	4.7	4-8		6-10	B	fiSa	R,ka
Rocklands Kd10, Kroonstad Kd13	400-600	0 :			384	15	384	1.5	4-8	4-8	15-25	E	fiSa	gc
Lindley Va41	300-600	0 :			256	10	256	1.0	5-12		35-40	B	fiSaCl	vp

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : A2

Terrain form sketch / *Terreinvormskets*



Geology: Mainly red to flesh-coloured wind-blown sand of Tertiary to Recent age. Occasional outcrops of banded ironstone with bands of amphibolite (Asbestos Hills Formation, Griquatown Group).

Geologie: Oorwegend rooi tot vleeskleurige waaisand van Tersiere tot Resente ouderdom. Enkele dagsome van gestreepte ystersteen met bande van amfiboliet (Formasie Asbesberge, Groep Griekwastad).

8.4. Ag111

LAND TYPE / *LANDTIPE* .... : **Ag111**
CLIMATE ZONE / *KLIMAATSONE* ....: 5S
Area / *Oppervlakte* .... : 99230 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 1810 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2722 Kuruman (16160 ha) 2822 Postmasburg (83070 ha)

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

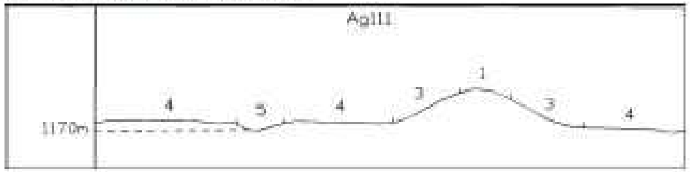
Modal Profiles / *Modale profiele* :
P36

Terrain unit / *Terreineenheid*	1	3	4	5
% of land type /*% van landtipe*	3	5	85	7
Area / *Oppervlakte (ha)*	2977	4962	84346	6946
Slope / *Helling (%)*	1 - 4	6 - 30	0 - 2	0 - 1
Slope length / *Hellingslengte (m)*	50 - 500	100 - 700	500 - 5000	50 - 500
Slope shape / *Hellingsvorm*	Z-Y	Z	Z	Z
MB0, MB1 (ha)	0	0	4217	139
MB2 - MB4 (ha)	2977	4962	80128	6807

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB	ha	%	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Soil-rock complex																		
Grond-rotskompleks:																		
Rock/Rots		4	1786	60	1985	40	8435	10			12205	12.3						
Mispah Ms10, Mangano Hu33, Shorrocks Hu36	20-250	3	1191	40	2977	60	4217	5			8385	8.5	6-15		10-25	A	fiSa-LmSa	R
Mangano Hu33, Shorrocks Hu36	20-300	3					42173	50	4862	70	47035	47.4	6-15		10-25	B	LmfiSa-SaLm	R,ka
Mispah Ms10	10-250	3					15182	18	695	10	15877	16.0	6-12			A	fiSa-LmSa	R
Kalkbank Ms22, Loskop Ms12	20-250	3					10122	12	972	14	11094	11.2	6-12			A	fiSa-LmSa	ka
Mangano Hu33, Shorrocks Hu36	300-750	0					4217	5	139	2	4356	4.4	6-15		10-25	B	LmfiSa-SaLm	R
Stream beds/Stroombeddings		4							278	4	278	0.3						

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

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



Geology: Fine and coarse-grained dolomite, chert and dolomitic limestone with prominent interbedded chert, limestone and banded ironstone (Ghaap Plateau Formation).

Geologie: Fyn- en grofkorrelrige dolomiet, chert en dolomitiese kalksteen met prominente tussengelaagde chert, kalksteen en gestreepte ystersteen (Formasie Ghaapplato).

8.5. Ag110

LAND TYPE / *LANDTIPE* .... : **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

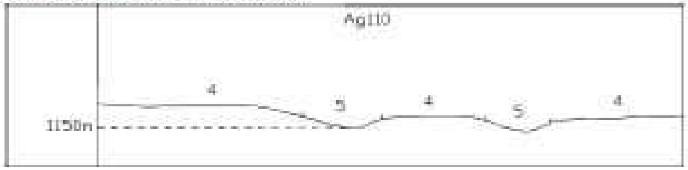
Modal Profiles / *Modale profiele :*
None / Geen

Terrain unit / *Terreineenheid* .... :	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	4 ha	4 %	5 ha	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	20-300	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						

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

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



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).