REPORT

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SOIL AND AGRICULTURAL POTENTIAL INFORMATION FOR THE PROPOSED PAULPUTS CSP PROJECT, NEAR POFADDER, NORTHERN CAPE

By

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DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
April 2016

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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Savannah Environmental to undertake soil and agricultural potential investigation near Pofadder, in the Northern Cape Province. The purpose of the investigation is to contribute to the Environmental Impact assessment (EIA) process for a proposed solar thermal energy facility and associated infrastructure. The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area as well as

- To assess broad agricultural potential.

2. SITE CHARACTERISTICS

2.1 Location

A broader study area of approximately 3 500 ha was investigated, within which the development footprint for the Project of approximately 900 ha in extent would be appropriately located. The area lies approximately 40 km to the north-east of the town of Pofadder. The area comprises Portion 4 of the farm Scuitklip 92 (where the CSP infrastructure will be located), along with two access road alternatives to the east (connecting with the R64 Pofadder-Upington road) and west (connecting with the R358 Pofadder-Onseepkans road). The area lies between 28° 50′ and 28° 54′ S and between 19° 32′ and 19° 37′ E. The position of the site is shown on the map in Figure 1, with the site area shown in black and the roads in green and pink.

2.2 Terrain

The site is generally flat to gently undulating and lies at a height of approximately 800-850 metres above sea level although there is an area of steeply undulating topography of the Ysterberg range of hills, with slopes of up to 100% (45°), in the north-eastern corner of the study area (although no infrastructure is proposed for this area).

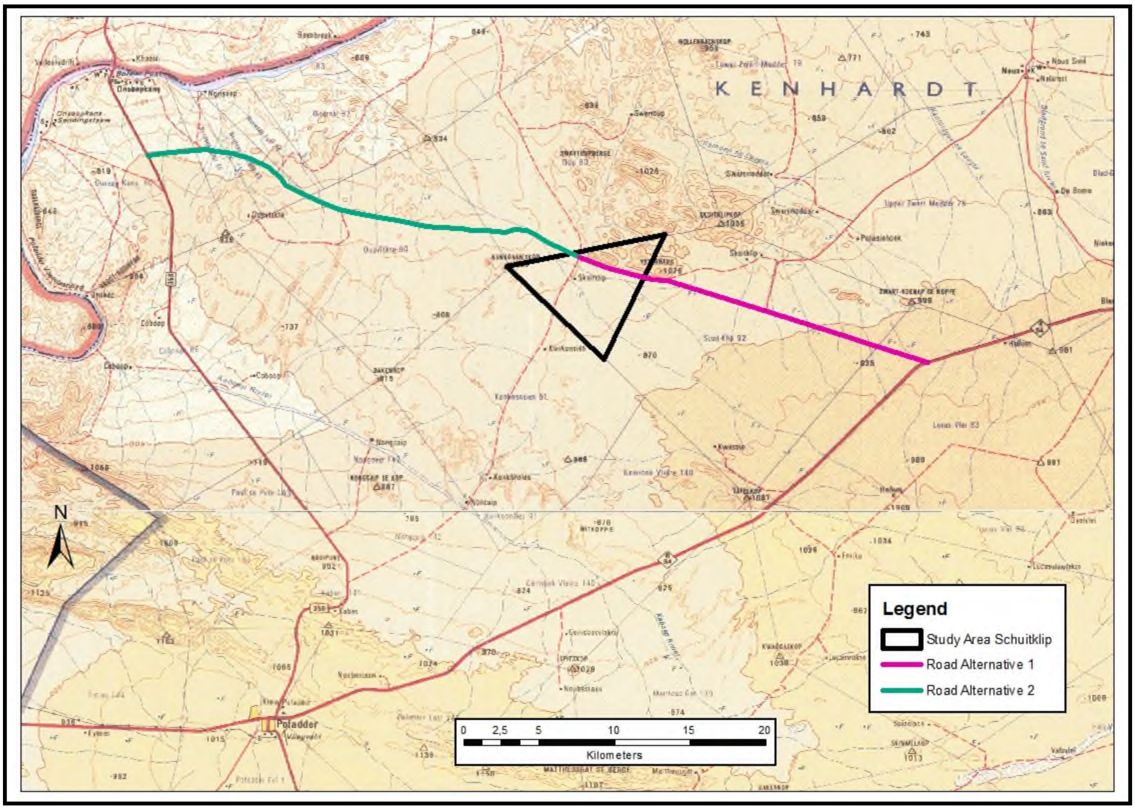

Figure 1 Locality map

2.3 Climate

The climate of the area (ARC-ISCW, 2008) was derived from the closest station, namely Pofadder. The climate can be regarded as typical of the Karoo interior, with a low, generally all-year round rainfall distribution, warm summers and cold to very cold winters. The main climatic indicators are given in Table 1 below.

Table 1 Climate Data

Month	Rainfall (mm)	Min. Temp (ºC)	Max. Temp (ºC)
Jan	8.2	16.6	33.0
Feb	19.1	16.7	31.3
Mar	22.8	15.5	29.9
Apr	19.1	12.1	24.6
May	5.9	8.2	20.6
Jun	6.9	5.4	17.3
Jul	5.5	5.2	18.0
Aug	2.6	6.1	19.7
Sep	4.5	8.7	23.7
Oct	4.6	11.1	26.6
Nov	4.1	14.1	30.1
Dec	9.2	15.6	32.0
Year	**112.6 mm**	**18.4ºC (Average)**	

Very warm temperatures (>40ºC) may be experienced in summer, while frost in winter is not common, but may occur occasionally. In addition, extremely high evaporation rates will be found in the area, meaning that there will be an extreme moisture deficit throughout the year.

2.4 Parent Material

The geology of the area comprises recent alluvial and Aeolian deposits, with the mountainous areas in the north-east comprising kinzigite of the Namaqualand Sequence and granite of the Witwater Formation, Keimoes Suite (Geological Survey, 1984).

3. METHODOLOGY

Existing information was obtained from the map sheet 2818 Warmbad (Ellis, Schloms & Dietrichsen, 1986) from the national Land Type Survey, published at 1:250 000 scale. A land type is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

Within a broad 20 km buffer area, the area under investigation (namely the Scuitklip study area and the two access road alternatives) is covered by only five land types, as shown on the map in the Appendix, namely:

- **Ae67** (Red, freely-drained soils, high base status)
- **Ag2, Ag37** (Shallow, red, freely-drained soils, high base status)
- **Fb142** (Shallow lithosols and rock, mostly calcareous)
- **Ic136** (Mostly rock, little soil)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur.

The site was not visited during the course of this study, and so the detailed composition of the specific land types has not been ground-truthed. However, due to the very low prevailing agricultural potential, a site visit was not deemed necessary.

A summary of the dominant soil characteristics of each land type is given in Table 2 below (the colours correspond to those used in the map in the Appendix).

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in **bold type**.

4. SOILS

A summary of the dominant soil characteristics is given in **Table 2** below.

Table 2 Land types occurring (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Ae67	Hutton 32/25/42/45 Hutton 32/25/42/45 Rock	500-1000 200-300 -	49% 30% 13%	Red, sandy soils on hard rock and calcrete Red, sandy topsoils on hard rock and calcrete -	High: 0.0 Mod: 49.0 **Low: 51.0**
Ag2	Hutton 34/44/45/46 Mispah 10/12/14/22 Rock	100-300 50-150 -	48% 29% 7%	Red, sandy topsoils on hard rock and calcrete Grey-brown, sandy/loamy topsoils on hard rock/calcrete –	High: 0.0 Mod: 12.0 **Low: 88.0**
Ag37	Hutton 32/35/42/45 Rock Dundee 10 + Oakleaf 24	200-300 - 500-1000	48% 20% 15%	Red, sandy topsoils on hard rock and calcrete - Red-brown, alluvial soils on calcrete	High: 0.0 Mod: 23.0 **Low: 77.0**
Fb142	Rock Mispah + Glenrosa Hutton 32/35	- 100-350 100-300	54% 25% 13%	 Grey-brown, sandy/loamy topsoils on hard rock/calcrete Red, sandy topsoils on hard rock and calcrete	High: 0.0 Mod: 8.0 **Low: 92.0**
Ic136	Rock Mispah 10/20	- 50-150	89% 7%	 Grey-brown, sandy/loamy topsoils on hard rock/calcrete	High: 0.0 Mod: 3.5 **Low: 96.5**

5. AGRICULTURAL POTENTIAL

Much of the area comprises either shallow to very shallow soils or surface rock outcrops, and as can be seen from the information contained in Table 2, only a very small portion of deep soils. The very low rainfall in the area (Table 1) means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site.

Figure 2 Natural vegetation in study area

The photo above shows clearly the sparse nature of the vegetation present in the vicinity of the proposed project. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit.

5.1 Degradation/Cultivation

According to the latest version of the national Land Cover (GTI, 2015), while the vegetation class in the vicinity of the project is largely confined to either "Bare, non-vegetated" or "Low shrubland" (Figure 3). No areas identified as degraded, such as dongas or other erosion features, were identified. In addition, no areas of cultivation were identified except for the strip of cultivated orchards and pivots along the Gariep River to the north.

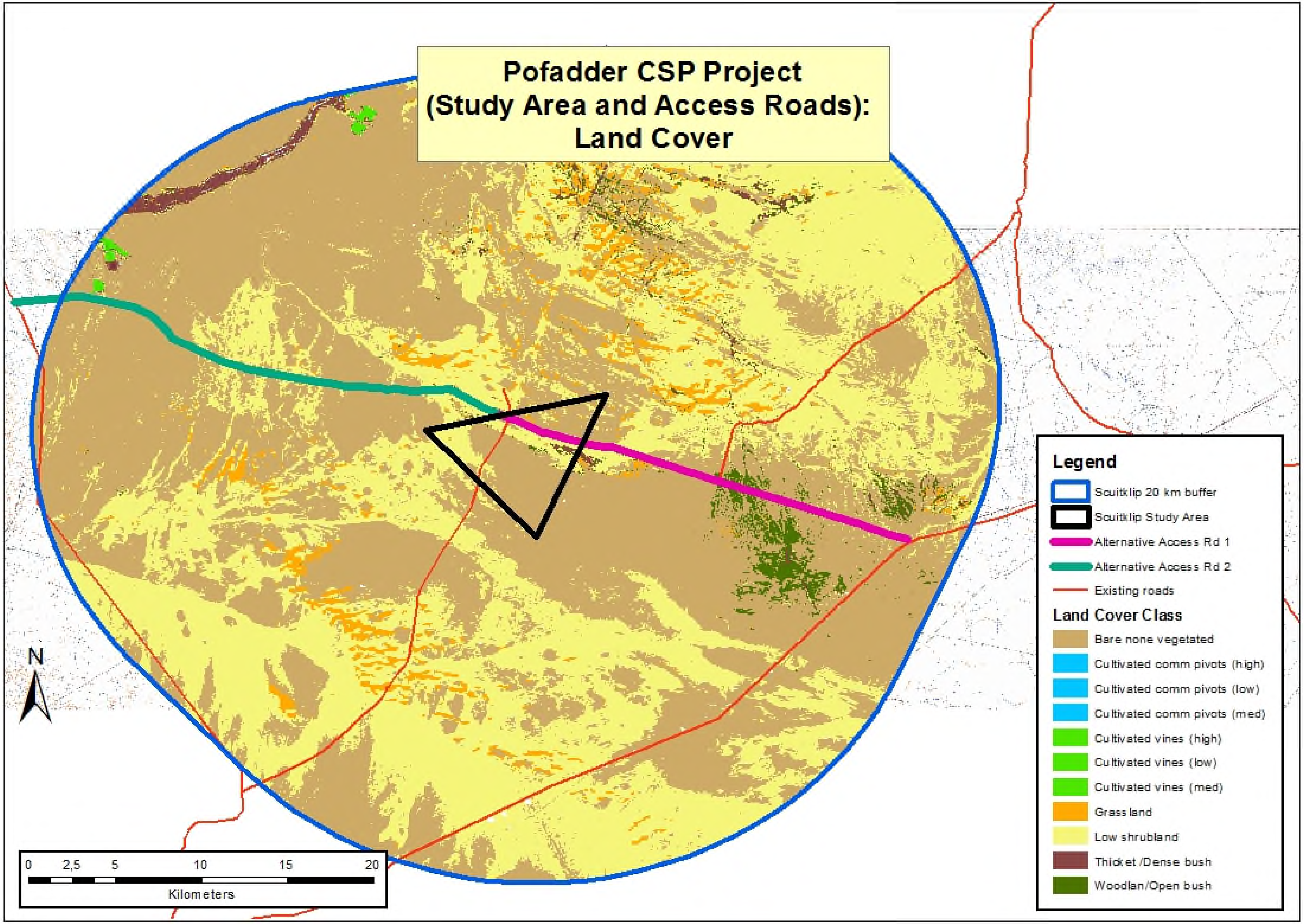

Figure 3. Land Cover Map.

6. IMPACTS

Two major impacts are assessed. The first impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The second impact would be the possibility of increased soil erosion due to the removal of vegetation in the construction process. This would probably be due to wind action on the relatively sandy topsoils.

The tables for these impacts can be summarized as follows:

Table 3 Impact significance

Nature of impact	**Loss of agricultural land**	**Land that is no longer able to be utilized due to construction of infrastructure**
Extent (E) of impact	Low, site only (1)	Confined to areas within the site where infrastructure will be located
Duration (D) of impact	Long-term (4)	Will cease if operation of activity ceases
Probability (P) of impact	Highly probable (4)	
Magnitude (M) of impact	Minor (2)	
Significance (S) of impact	S = (E+D+M) x P **28 (Low)**	Mainly due to low potential of area, as well as nature of infrastructure
Mitigation factors	The main mitigation would be to ensure that as little pollution or other non-physical disturbance occurs.	

Nature of impact	**Increased wind erosion**	**Loss of topsoil due to vegetation removal**
Extent (E) of impact	Low to medium, project vicinity (2)	Wind can blow soil over project boundary for a distance
Duration (D) of impact	Short-term (2)	Will cease if operation of activity ceases
Probability (P) of impact	Probable (3)	
Magnitude (M) of impact	Low (4)	
Significance	S = (E+D+M) x P	Should be low if proper mitigation measures

(S) of impact	**24 (Low)**	are implemented
Mitigation factors	• Project footprint kept as small as possible, with minimal vegetation removal • Keep soil moist if possible during construction activities • Soil conservation measures (windbreaks, geotextiles etc) if required to protect bare areas • Re-vegetation as soon as possible, using irrigation as required • Regular monitoring (at least every 6 months) until vegetation cover re-established	

6.1 Cumulative Impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The major potential cumulative impact would be the possibility of wind erosion caused by construction activities at the Paulputs CSP site that would cause topsoil to be blown and deposited elsewhere, for example at any nearby facilities, where dust accumulation would be a problem.

Table 4 Cumulative impacts

Nature of impact	**Increased wind erosion**	**Loss of topsoil due to vegetation removal**
	Overall Impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent (E) of impact	Low to medium, project vicinity (2)	Medium (3)
Duration (D) of impact	Short-term (2)	Long-term (4)
Probability (P) of impact	Probable (3)	Highly Probable (4)
Magnitude (M) of impact	Low (4)	Moderate (6)
Significance (S) of impact	S = (E+D+M) x P **24 (Low)**	S = (E+D+M) x P **52 (Medium)**
Status (+/-)	Neg	Neg
Reversibility	Medium	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Confidence in findings: High		

Mitigation factors	As specified for the impact in isolation, namely: • Project footprint kept as small as possible, with minimal vegetation removal • Keep soil moist if possible during construction activities • Soil conservation measures (windbreaks, geotextiles etc) if required to protect bare areas • Re-vegetation as soon as possible, using irrigation as required • Regular monitoring (at least every 6 months) until vegetation cover re-established

Nature of impact	**Loss of agricultural land**	**Land that is no longer able to be utilized due to construction of infrastructure**
	Overall Impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent (E) of impact	Low, site only (1)	Low, site only (1)
Duration (D) of impact	Long-term (4)	Long-term (4)
Probability (P) of impact	Highly probable (4)	Highly probable (4)
Magnitude (M) of impact	Minor (2)	Minor (2)
Significance (S) of impact	S = (E+D+M) x P **28 (Low)**	S = (E+D+M) x P **28 (Low)**
Status (+/-)	Neg	Neg
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Confidence in findings: High		
Mitigation factors	Ensure minimum extent of construction footprint. However, low prevailing agricultural potential means impact will not be significant within wider area.	

Cumulative impact statement

From a soil and agricultural potential perspective the potential cumulative impacts would be the possibility of wind erosion caused by construction activities at the Paulputs CSP site that would cause topsoil to be blown and deposited elsewhere, for example at any nearby facilities, where dust accumulation would be a problem and; loss of potential agricultural land. Both impacts, post-mitigation are found to be of low significance.

Motivation regarding site visit requirement by DEA

Regarding the standard requirement that a detailed soil investigation be undertaken, the following can be stated.

The majority of solar power applications in this area of the Northern Cape comprise some of the lowest agricultural potential that one will find anywhere in South Africa, with **very hot, dry conditions** A site visit would only confirm this situation. There might well be a soil erosion hazard regarding wind erosion, but that is mentioned in the report (see Table 3 and Table 4) with a range of mitigation measures specified, and a site visit would also not add significant value to that assessment.

Where a specialist soil investigation for an environmental impact assessment is concerned, if there is any possibility of medium or high potential agricultural soils, or if there is any other specific situation that justifies a site visit, that would definitely be recommended in the report, but this is not the case for the Paulputs area.

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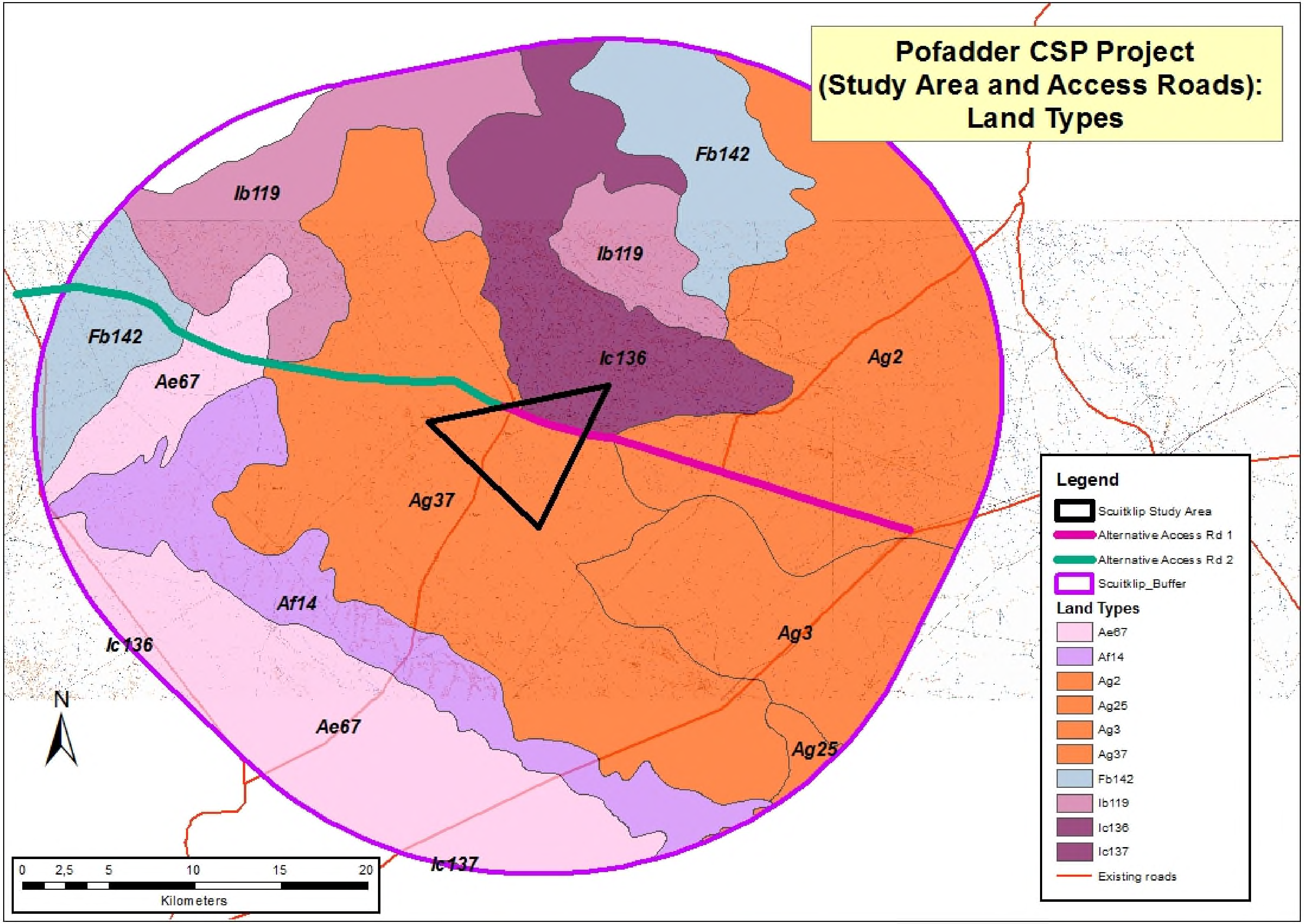
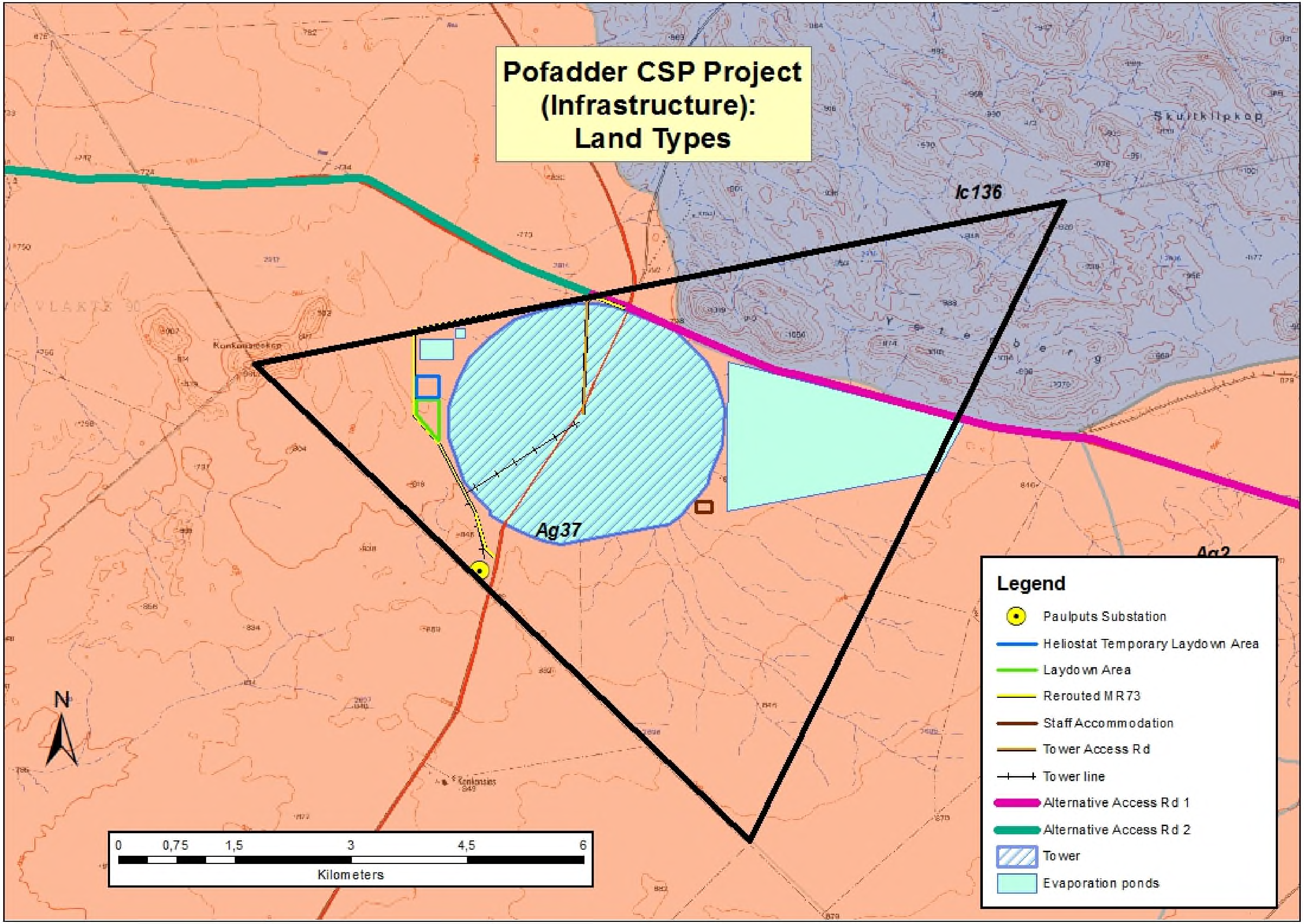
APPENDIX

MAPS OF LAND TYPES


Pofadder CSP Project
(Study Area and Access Roads):
Land Types
Ib119
Fb142
Ib119
Fb142
Ic136
Ag2
Ae67
Ag37
Af14
Ic136
Ag3
Ae67
Ag25
Ic137
N
0 2,5 5 10 15 20
Kilometers
Legend
Scuitklip Study Area
Alternative Access Rd 1
Alternative Access Rd 2
Scuitklip_Buffer
Land Types
Ae67
Af14
Ag2
Ag25
Ag3
Ag37
Fb142
Ib119
Ic136
Ic137
Existing roads


Pofadder CSP Project
(Infrastructure):
Land Types
Ic136
Ag37
Ag2
Skuitklipkop
Legend
Paulputs Substation
Heliostat Temporary Laydown Area
Laydown Area
Rerouted MR73
Staff Accommodation
Tower Access Rd
Tower line
Alternative Access Rd 1
Alternative Access Rd 2
Tower
Evaporation ponds
N
0
0,75
1,5
3
4,5
6
Kilometers