BASIC ASSESSMENT SPECIALIST REPORT

On contract research for

Rosenthal Environmental

AGRICULTURAL POTENTIAL ASSESSMENT FOR PROPOSED MULILO PHOTOVOLTAIC SOLAR POWER PROJECT, AUGRABIES, NORTHERN CAPE

By

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DECLARATION

This report was prepared by me, DG Paterson of ARC-Institute for Soil Climate. I have an MSc degree in Soil Science from University of Pretoria and have considerable experience in soil studies and agricultural assessments since 1981. I have compiled more than 200 such surveys for a variety of purposes.

This specialist report was compiled on behalf of Rosenthal Environmental for their use in undertaking a basic assessment process for the proposed Mulilo Photovoltaic Power Project in the Northern Cape Province.

I hereby declare that I am qualified to compile this report as a registered Natural Scientist (Reg. No. 400463/04), 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
January 2012

Executive Summary

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted to undertake a soil investigation near Augrabies, in the Northern Cape Province. The purpose of the investigation is to contribute to the basic assessment process for the proposed *Mulilo Photovoltaic Solar Power Project* and associated infrastructure.

An area was investigated to the south of the Augrabies Falls National Park and within the larger study area, two alternative sites for the power plant are proposed. The site is flat to gently undulating, with slopes of approximately 2% and no permanently wet drainageways. The climate of the study area is warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 142 mm, and is erratic, both locally and seasonally. The average evaporation is over 2 580 mm per year, peaking at 11.5 mm per day in January.

The area comprises shallow to very shallow, red and red-brown sandy or sandy loam topsoils, often calcareous, with rock in the west. The very low rainfall means that the only means of cultivation would be by irrigation and there is no sign of any agricultural infrastructure and certainly none of irrigation. However, the very shallow soils in the study area mean that, even if a source of water for irrigation was available, the potential of these soils for irrigation would be almost non-existent.

The major impact would be the loss of potentially arable land due to the construction of infrastructure. However, due to the dry and hot climate, this impact would in all probability be of limited significance and would be local in extent. In addition, the nature of the infrastructure would mean that grazing between the solar panels would be possible, so that the actual area lost even to this form of agriculture would be small. 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 following rehabilitation, with little impact.

Based on soil information and prevailing agricultural potential, there is no preference for either alternative. Due mainly to the prevailing unfavourable climatic conditions for arable agriculture, as well as the prevalence of soils with limited depth, it is not envisaged that any more detailed soil investigation will be required.

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1. INTRODUCTION AND TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Rosenthal Environmental to undertake an agricultural assessment near Augrabies, in the Northern Cape Province. The purpose of the investigation is to contribute to the basic assessment process for the proposed *Mulilo Photovoltaic Solar Power Project* and associated infrastructure.

The soil and agricultural potential assessment must include:
» a description of the environment that may be affected by the proposed activity and the manner in which the environment may be affected by the proposed project

» the identification, description and evaluation of environmental issues and potential impacts (including direct, indirect and cumulative impacts)

» Direct, indirect and cumulative impacts of the identified issues must be evaluated 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), regional, national or international

» a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts

» identification of potentially significant impacts to be assessed and details of the methodology to be adopted in assessing these impacts.

The objectives of the study are;

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

- To assess broad agricultural potential and the significance of potential impacts.

2. SITE CHARACTERISTICS

2.1 Location

An area was investigated lying approximately 15 km to the west of the town of Augrabies. The area lies to the south of the Augrabies Falls National Park, between 28° 35' and 28° 35' S and between 20° 11' and 20° 18' E. The position of the site is shown on the map in Figure 1.

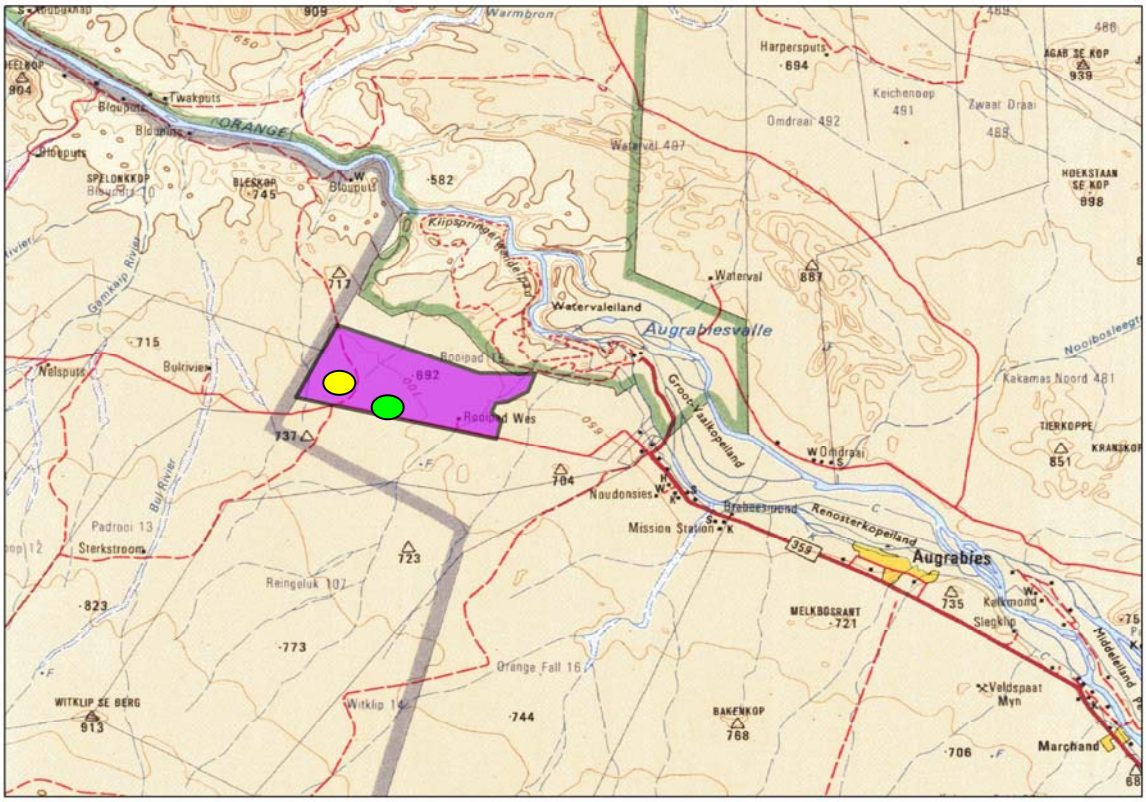


Figure 1 Locality map

Within the larger study area, two alternative sites for the power plant are proposed, as shown above. Alternative 1 is shown in yellow and Alternative 2 in green. For the more detailed location, see Figure 2.

2.2 Terrain

The site lies at a height of approximately 700 metres above sea level, and is flat to gently undulating, with slopes of approximately 2%. No permanently wet drainageways are present in the area, although a few extremely non-perennial channels occur, especially in the west.

2.3 Climate

The climate of the study area (Koch & Kotze, 1986) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 142 mm, of which 99 mm, or 70%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 580 mm per year, peaking at 11.5 mm per day in January.

Temperatures vary from an average monthly maximum and minimum of 35.7ºC and 19.1ºC for January to 20.3ºC and 3.3ºC for July respectively. The extreme high temperature that has been recorded is 43.4ºC and the extreme low –7.2ºC. Frost occurs most years on around 14 days on average between early June and mid August.

2.4 Parent Material

The geology of the area comprises granite and gneiss of the Riemvasmaak Gneiss (in the west) and Augrabies Gneiss (in the east) (Geological Survey, 1988).

3. METHODOLOGY

Existing soil information was obtained from the map sheet 2820 Upington (Eloff *et al.*, 1983) 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).

The area under investigation is covered by only one land type, as shown on the map in the Appendix, namely:

- **Ag2** (Shallow, red, freely-drained soils, high base status)
- **Fb142** (Shallow mixed soils, often calcareous)

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.**

4. SOILS

A summary of the dominant soil characteristics is given in **Table 1** below.

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

Table 1 Land type occurring (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Ag2	Hutton 44/45	100-300	30%	Red, sandy to sandy loam, calcareous topsoils on hard rock	High:0.0
	Mispah 10	50-150	18%	Red-brown, sandy topsoils on rock	Mod: 13.3
	Glenrosa 22/24/25	100-300	10%	Red-brown, sandy/loamy, calcareous topsoils on weathering rock	**Low: 86.7**
Fb142	Rock	-	54%	Exposed rock outcrops	High:0.0
	Mispah 10/20	100-300	24%	Red-brown, occasionally calcareous topsoils on rock/calcrete	Mod: 8.0
	Hutton 32/35/42/45	100-300	13%	Red-brown, sandy/loamy, often calcareous topsoils on rock	**Low: 92.0**

5. AGRICULTURAL POTENTIAL

The area comprises shallow to very shallow, red and red-brown sandy or sandy loam topsoils, often calcareous as can be seen from the information contained in Table 1. Rock occurs more often in the west (land type **Fb142**). The very low rainfall in the area (Section 2.3) means that the only means of cultivation would be by irrigation and the Google Earth image of the area (Figure 2) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation, although there is an area of irrigated grapes to the east of the study area. However, the very shallow soils in the study area mean that, even if a source of water for irrigation was available, the potential of these soils for irrigation would be almost non-existent.

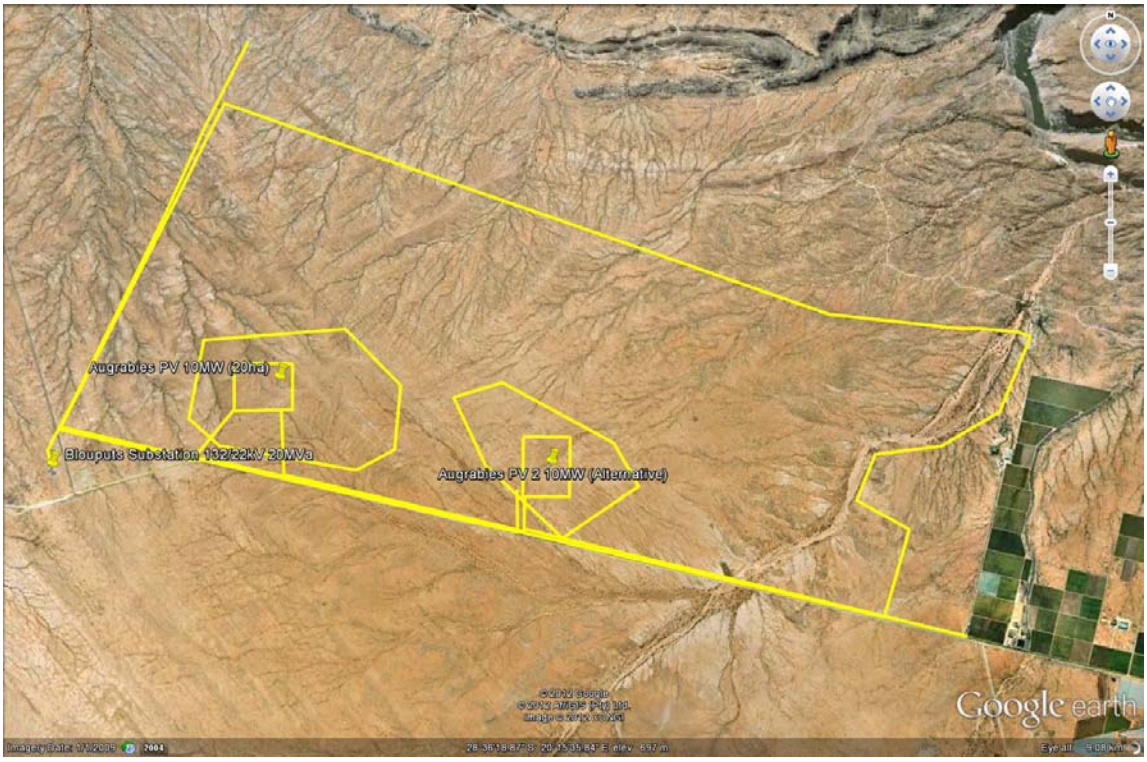


Figure 2 Google Earth image of study area

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is extremely low, >40 ha/large stock unit (ARC-ISCW, 2004).

6. IMPACTS

The major impact on the natural resources of the study area would be the loss of potentially arable land due to the construction of the various types of infrastructure. However, due to the dry and hot climate of the region (Section 2.3), this impact would in all probability be of limited significance and would be local in extent.

In addition, the nature of the planned infrastructure would mean that grazing of livestock or game species between the solar panels would be possible, so that the actual area lost even to this form of agriculture would be small. 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 following rehabilitation, with little impact, especially given the low prevailing agricultural potential.

The impact can be summarized as follows:

Table 3 Impact Assessment table: Soil loss

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long Term	Long Term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	Low	Low
Cumulative impact	Low	Low
Nature of Cumulative impact	Loss of agriculturally productive soils and land that is no longer able to be utilized due to construction of infrastructure	
Degree to which impact can be reversed	Removal of infrastructure at the end of the project should enable the site to be returned to close to its natural state.	
Degree to which impact may cause irreplaceable loss of resources	The low potential for arable agriculture, caused by a combination of shallow soils in many places and the hot, dry climate, means that the area has a low potential for cultivation and the resources are not irreplaceable.	
Degree to which impact can be mitigated	The main mitigation would be to ensure that as little pollution or other non-physical disturbance occurs.	

Table 4 Impact Assessment table: Soil erosion by wind

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long Term	Long Term
Intensity	Medium	Low
Probability	Probable	Unlikely
Confidence	High	High
Significance	Medium	Low
Cumulative impact	Low	Low
Nature of Cumulative impact	Loss of topsoil due to erosion by wind, caused by loss of vegetation	
Degree to which impact can be reversed	Difficult to reverse if it occurs, but proper mitigation should make the impact unlikely	
Degree to which impact may cause irreplaceable loss of resources	The low potential for arable agriculture, caused by a combination of shallow soils in many places and the hot, dry climate, means that the area has a low potential for cultivation and the resources are not irreplaceable.	
Degree to which impact can be mitigated	The main mitigation would be to put specific measures in place during both the construction and operational phases, which would include: absolute minimum removal of vegetation; possible construction of windbreaks. Also, ensure that as little pollution or other non-physical disturbance occurs.	

Alternatives

Based on soil information and prevailing agricultural potential, there is no preference for either Alternative 1 or Alternative 2.

7. CONCLUSION

The major impact on the natural resources of the study area would be the loss of potentially arable land due to the construction of the various types of infrastructure. However, due to the dry and hot climate of the region, this impact would in all probability be of limited significance and would be local in extent.

With fine-grained, sandy soils occurring, there is a potential hazard for topsoil removal by wind. The main mitigation would be to put specific measures in place during both the construction and operational phases, which would include: absolute minimum removal of vegetation; possible construction of windbreaks. Also, ensure that as little pollution or other non-physical disturbance occurs.

Due mainly to the prevailing unfavourable climatic conditions for arable agriculture, as well as the prevalence of soils with limited depth, it is not envisaged that any more detailed soil investigation will be required.

REFERENCES

ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria

Koch, F.G.L. & Kotze, A.V., 1986. Climate data. In: Land types of the maps SE27/20 Witdraai, 2720 Noenieput, 2722 Kuruman, 2724 Christiana, 2820 Upington and 2822 Postmasburg. *Mem. Nat. Agric. Res. S. Afr.* No. 3. ARC-Institute for Soil, Climate and Water, Pretoria.

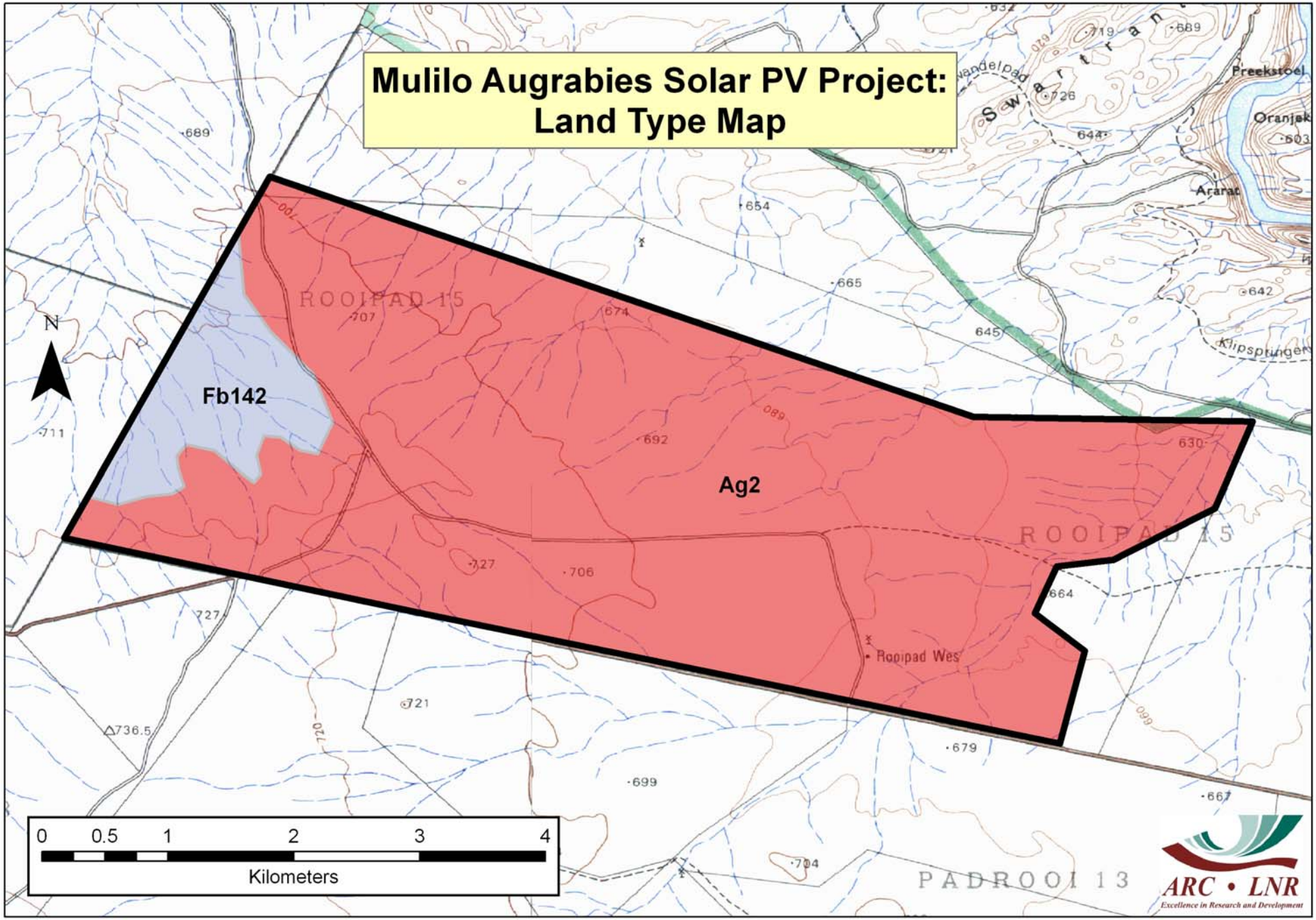
Eloff, J.F., Dietrichsen, J.A.V., Bennie, A.T.P. & Geers, B.C., 1983. 1:250 000 land type map 2820 Upington. ARC-Institute for Soil, Climate and Water, Pretoria.

Geological Survey, 1988. 1:250 000 scale geological map 2820 Upington. Department of Mineral and Energy Affairs, Pretoria.

MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

APPENDIX

MAP OF LAND TYPES


Mulilo Augrabies Solar PV Project:
Land Type Map
Fb142
Ag2
N
ROOIPAD 15
ROOIPAD 15
PADROOI 13
Roopad Wes
Preekstoel
Oranjak
Ararat
Klipspringer
Swartrand
0 0.5 1 2 3 4
Kilometers
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