REPORT

On contract research for

SAVANNAH ENVIRONMENTAL

DETAILED SOIL SURVEY FOR THE PROPOSED WATERBERG PHOTOVOLTAIC PLANT, LIMPOPO PROVINCE

EIA Study

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.

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July 2010

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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 a soil investigation for Thupela Energy in the Waterberg area of Limpopo Province. The purpose of the investigation is to look at the soils and associated agricultural potential occurring on a site earmarked for the proposed establishment of a photovoltaic (PV) facility.

The first stage of the investigation involved a scoping study, based on the national Land Type Survey at 1:250 000 scale (Paterson, 2010). However, due to the probable occurrence of high potential soils on the site (as confirmed by the reconnaissance study), it was necessary to visit the site and carry out a more detailed soil survey. This report deals with the detailed soil investigation.

2. SITE CHARACTERISTICS

2.1 Location

The study area covers an area of approximately 49 ha and lies on Portion 2 of the farm Goedgevonden 104KR. It is located next to the Melk River, to the east, approximately 25 km north-east of the town of Vaalwater, as shown in Figure 1.

The area has been used for irrigation in the past, as two existing centre-pivot lands which are currently used for the production of planted pasture (*Eragrostis*) can be seen, although the irrigation equipment has been removed.

The more detailed map of the area is given in the Appendix.

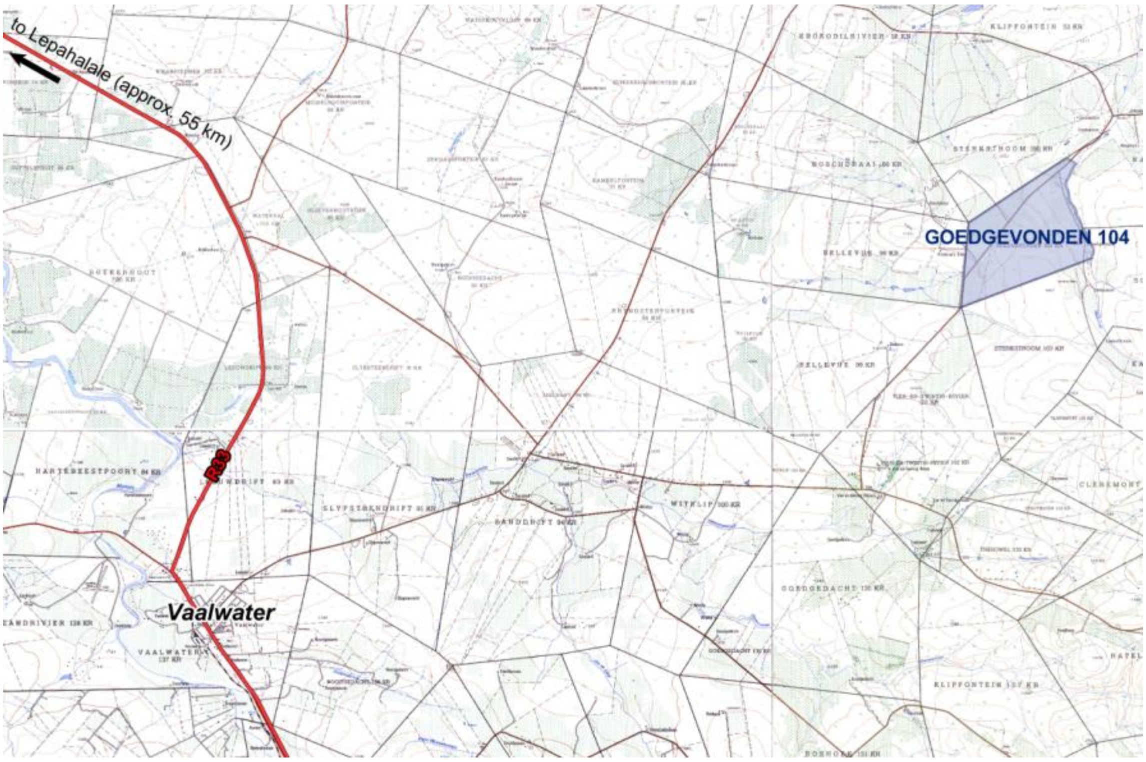

Figure 1 Locality map

2.2 Terrain

The study area lies within the broad plateau of the Waterberg mountain range. The area consists of almost flat to gently undulating terrain (2-3% slopes), at an altitude of around 1 360 m.

The study area lies on the west bank of the Melk River, a perennial river which flows northward out of the Waterberg towards the Limpopo River.

2.3 Climate

The climate of the area can be regarded as typical of the Bushveld, with mild to cool, dry winters and warm to hot, moist summers (Koch, 1988).

The prevailing climatic parameters are given in Table 1.

Table 1 Climate Data

Month	Rainfall (mm)	Min. Temp (°C)	Max. Temp (°C)	Average frost dates
Jan	119.2	16.5	30.0	Start date:
Feb	92.6	16.3	29.8	End date:
Mar	75.9	14.5	28.5	Days with frost:
Apr	37.2	10.4	26.4	
May	15.6	6.5	24.2	
Jun	4.5	3.1	21.4	
Jul	5.0	3.6	21.0	**Heat units (hrs > 10°C)**
Aug	3.3	5.7	23.8	Summer
Sep	13.8	9.4	27.1	(Oct-Mar): 2203
Oct	40.3	12.9	28.1	
Nov	78.3	14.9	28.8	Winter
Dec	96.8	15.8	29.5	(Apr-Sept): 957
Year	**582.5 mm**	**18.7°C (Average)**		

The extreme high temperature that has been recorded is 39.2°C and the extreme low –4.0ºC. Frost will occur at times in the winter, but usually not severely.

2.4 Parent Material

The study area is underlain by coarse-grained sandstone of the Cleremont Formation of Waterberg Group (Geological Survey, 1978).

3. METHODOLOGY

Based on information that was obtained from the national Land Type Survey, published at 1:250 000 scale, the dominant soils in the area were recorded under land type **Bb87** (non-red, low to medium base status soils with plinthic subsoils, usually deep), which indicated that almost two-thirds of the area might contain high potential soils.

Therefore, a soil survey was carried out, using a hand-held soil auger. Soil observations, which were controlled by position on a GPS, were made on a grid of 150 x 150 m, to a maximum depth of 1.2 m (or shallower, if a restricting layer such as rock was encountered).

The soils were classified using the latest version of the South African soil classification system (Soil Classification Working Group, 1991) and similar soils were grouped into mapping units, the distribution of which are shown on the map in the Appendix.

4. SOILS

A summary of the various classes of agricultural potential, based on the soils and/or rock occurring in each land type, is given in **Table 2** below.

Table 2 Soil legend

Map Unit	Dominant Soil Form & Family	Depth (mm)	Soil Characteristics	Area (ha)
dCv	Clovelly 3100	>1200	Brown, structureless, sandy loam topsoil on yellow, structureless, freely-drained, sandy loam subsoil	32.52
mGc	Glencoe 3100	700-900	Brown, structureless, sandy loam topsoil on yellow, structureless, sandy loam subsoil on cemented ferricrete	16.88
			Total	49.40

From the soil map in the Appendix, it can be seen that the deeper soils (map unit **dCv**) occur closer to the Melk River in a downslope position, while the somewhat shallower soils (map unit **mGc**) occur slightly higher up the slope, further from the river.

The soils are friable, with little clay increase from the topsoil to the subsoil and have an extremely homogeneous colour, with little mottling.

5. AGRICULTURAL POTENTIAL

The prevailing dryland agricultural potential of each map unit is shown in Table 3 below.

Table 3 Agricultural potential

Map Unit	Soil characteristics	Agricultural Potential
dCv	Deep soil, favourable texture, no structural restriction	High
mGc	Moderately deep soil, favourable texture, depth restriction due to ferricrete layer at depth	Moderate to high

The prevailing climate of the area is reasonably well suited to dryland, or rain-fed agriculture, although the rainfall (long-term average of 582 mm) is slightly on the low side and may prove somewhat risky for profitable enterprises. However, the soils are generally very suitable for cultivation and have a favourable depth and texture. Another advantage of the site is that it lies immediately adjacent to the Melk River, so that supplementary irrigation should be available.

The **mGc** map unit has a somewhat shallower depth than the **dCv** unit, and the soils are underlain by cemented ferricrete (hard plinthite or "ouklip"), which provides a barrier to water and/or root penetration. However, this layer occurs at a depth from the soil surface of between 700 and 900 mm, so that the soil limitation is generally slight, and good yields may be still expected for most crops.

The properties of the soils occurring, in addition to the adjacent source of irrigation water, means that the soils on the site, especially in the areas closest to the river, have a high potential for cultivation and should be reserved for agriculture

5.1 Impacts

The proposed solar energy project consists of photovoltaic units (solar panels) and associated infrastructure which is planned to occupy around 20 ha (but not more than 30 ha) of the study area of 50 ha. The infrastructure will not involve any significant earth-moving processes or large-scale topsoil removal. Nevertheless, the loss of agricultural land will be total for the life of the project, although the site should be able to be returned to its natural state at a future stage without significant problems.

An impact table summarising the significance of impacts (with and without mitigation) is shown below.

Table 4 Impact assessment

Nature of impact: Loss of agricultural land		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (2)
Duration	Medium-term (4)	Medium-term (4)
Magnitude	Moderate (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**33 (Medium)**	**30 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: It is recommended that construction of infrastructure be confined, as far as possible, to the higher parts of the study area (map unit **mGc** on the soil map), where soils of slightly lower agricultural potential are located.		

Direct, indirect, and cumulative impacts are assessed in terms of the following criteria:

- The nature of the impact - what causes the impact, what will be impacted and how it will be impacted;
- The extent of the impact - whether it is local (limited to the immediate area or site of the development) or regional (on a scale of 1 to 5);
- The duration of the impact – whether it will be very short (less than 1 year), short (1-5 years), medium (5-15 years), long (>15 years) or permanent (on a scale of 1 to 5, respectively);
- The magnitude, quantified on a scale of 0-10, where 0 is small and will have no impact on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will have a slight impact on processes, 6 is moderate and will result in processes continuing, but in a modified way, 8 is high and processes are altered the extent that they temporarily cease, and 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 (on a scale of 1 to 5 – very improbable to definite);
- The significance, which is determined through a synthesis of the characteristics described above and is assessed as low, medium or high.
- The status, which is described as positive, negative or neutral;
- The degree to which the impact can be reversed;
- The degree to which the impact may cause the irreplaceable loss of resources;
- The degree to which the impact can be mitigated;
- The possibility of significant cumulative impacts of a number of individual areas of activity; and
- The possibility of residual impacts existing after mitigating measures have been put in place.

The significance is calculated by combining the criteria in the following formula:

$$S = (E+D+M)P$$

Where:
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: Moderate (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 will influence the decision to develop in the area).

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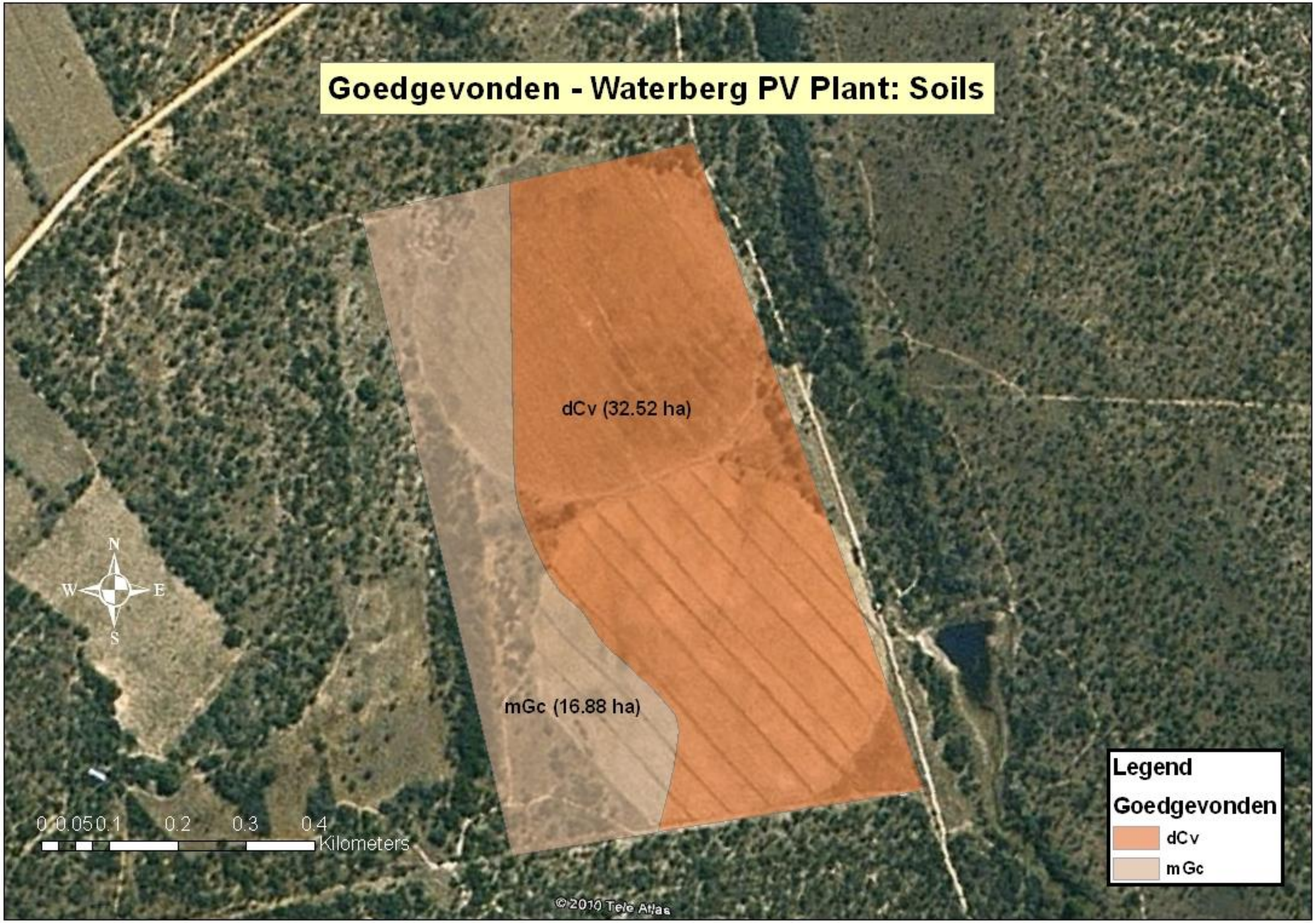
APPENDIX 1

SOIL MAP



Goedgevonden - Waterberg PV Plant: Soils
dCv (32.52 ha)
mGc (16.88 ha)
N
W
E
S
0 0.05 0.1 0.2 0.3 0.4
Kilometers
Legend
Goedgevonden
dCv
mGc
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