



**RUSTMO2 PV PLANT: SOIL AND AGRICULTURAL
POTENTIAL SURVEY FOR THE REMAINDER OF PORTION
24 OF THE FARM SPRUITFONTEIN 341 NEAR
BUFFELSPOORT, NORTH WEST PROVINCE**

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DECLARATIONS

I, Petrus Stephanus Rossouw, declare that I –

- act as an independent specialist consultant in the fields of Soil Science and the Assessment of the Agricultural Potential, Land Use and Land Capability of soil;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report; and
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

P.S. ROSSOUW

I, Johan Hilgard van der Waals, declare that I –

- act as an independent specialist consultant in the fields of Soil Science and the Assessment of the Agricultural Potential, Land Use and Land Capability of soil;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report; and
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

J.H. VAN DER WAALS

EXECUTIVE SUMMARY

Savannah Environmental (Pty) Ltd., on behalf of Momentous Energy (Pty) Ltd, contracted Terra Soil Science cc to carry out a soil, agricultural potential, land type and land use study for the remaining extent of portion 24 of the farm Spruitfontein 341, near Buffelspoort, North West Province. The area is approximately 18 ha in extent.

The mentioned area has been proposed to serve as a locality for the construction of a photovoltaic (PV) plant and associated infrastructure for power generation purposes. This study aims to determine the possible impact that this development could have on the soil environment, with emphasis on land use, land capability and agricultural potential.

The area lies in the Bc and Ib land types (Land Type Survey Staff, 1972 – 2006). The Bc land type is described as a plinthic catena: upland duplex and marginalitic soils rare. A perfect catena is represented by (from higher to lower lying areas) Hutton, Bainsvlei, Avalon and Longlands soil forms. Gleyed soils, such as Rensburg, Willowbrook, Katspruit and Champagne soil forms, can occur in the valley bottom. Soils with hard plinthite are common in areas where sandstone underlies the area. Where water tables have not extended far beyond the valley bottom, red soils may dominate. In these cases plinthic soils are restricted to valley bottoms and pans.

The Ib land type refers to Miscellaneous land classes. This refers to land types with a soil pattern difficult to accommodate elsewhere. The Ib land type is dominated by exposed rock and shallow soils.

The soils of the survey area fall into Class II and V. These are defined as:

- Class II: Land subject to certain limitations or hazards. It is suitable for cropping with adequate protection measures, which may sometimes include special management practices and regular ley rotations. Limitations may include one or more of the following: moderately shallow soil-depth, slightly unfavourable surface physical characteristics, inadequate permeability in the lower root zone or moderate wetness existing as a permanent land character. Such land needs conservation practices which will depend on the limiting characteristics, but will include both moderate mechanical and biological conservation methods in varying combinations.
- Class V: Watercourses and land subject to wetness limitations. These limitations include temporary, periodic and semi-permanent wetness. Cultivation is only permitted with very special practices and measures. Vleis and watercourses subject to severe wetness are best left under permanent vegetation.

The soils of the area that were encountered during the survey can be categorised into the following soil forms:

- The Arcadia soil form comprises a Vertic A-horizon that overlies unspecified material. The vertic A-horizon is characterised by 2:1 swelling and shrinking clays of the smectite group. These horizons exhibit at least 55 percent clay content. Lime concretions are often encountered on the soils surface and in the soil profile itself.

- The Tukulu soil form comprises an orthic A-horizon that overlies a neocutanic B-horizon and a horizon that exhibits signs of wetness. The neocutanic B-horizon is characterised by colour variation due to clay movement and accumulation and an apedal or weakly developed structure. Unspecified material with signs of wetness is a lower profile horizon that has suffered the effects of intermittent or prolonged saturation with water. Signs of wetness are ascribed to conditions of reduction that leads to iron movement. Iron mobilises, moving from areas of reduction to precipitate in pockets that exhibit a higher state of oxidation. This leads to a bleached colouration in the soil matrix which is referred to as signs of wetness. Mottling may or may not be present.
- The Glenrosa soil form comprises an orthic A-horizon that overlies a lithocutanic B-horizon. The lithocutanic B-horizon is indicative of minimal pedogenesis and grades into hard rock.
- The Mispah soil form comprises an orthic A-horizon that overlies hard rock.

The soils of the Arcadia soil form are encountered in the transition zone between the water course and the arable land. These soils range in depth from a few centimetres to 1200 mm. The soils of the Tukulu soil form were found to be shallow in many cases due to rockiness. This impedes augering. Soils of 1200 mm and deeper were encountered, especially in the north and eastern sections of the area. The southern section of the site is dominated by shallow soils of the Mispah and Glenrosa soil form.

The site is dominated by shallow, rocky soils and rock outcrops and can therefore not be deemed of high agricultural potential. The soils of the Glenrosa and Mispah soil forms serve as evidence. The site, furthermore, comprises an area of approximately 18 ha and is surrounded by mining and related infrastructure. Intensive agriculture, such as citrus production, may be viable on an area of this size if the soils are deep and of high agricultural potential. This is not the case for portion 108 (a portion of 23) of the farm Spruitfontein. The area can therefore be deemed of **low agricultural potential**.

The nature of the impact on soils includes the compaction and possibly the stripping and stockpiling of soil for construction purposes. Heavy machinery traffic on the soil surface could constitute further impacts on soil.

Compaction, stripping and stockpiling of soil usually result in:

- Loss of the original spatial distribution of natural soil forms and horizon sequences.
- Loss of natural topography and drainage pattern.
- Loss of original soil depth and soil volume.
- Loss of original fertility and organic carbon content.
- Soil compaction will adversely affect root development, effective soil depth and general soil fertility (in certain instances extensive surface crusting can occur that has a negative impact on re-vegetation efforts).

The impact on soils (agricultural potential and land capability) will be limited to the immediate area or site of development (local) but soil erosion, owing to increased surface water runoff and construction related impacts, can have an impact on the surrounding area.

Soil erosion may become a significant hazard in the area as many of the soils show signs of swelling and shrinking. This is a factor to be considered during construction and in the case of stockpiling of stripped soil. Hardsetting of the stockpiled material may also occur. This can be mitigated by:

- Ensuring that the slope of the stockpiled material is such that surface runoff is minimal;
- Additions of stabilising agents such as organic material or vegetative cover.

The latter point will also inhibit hardsetting. Soils must furthermore be stockpiled for the minimum period prior to re-use.

Surface runoff will be increased if concrete foundations are used and/or soil is compacted during construction. Storm water runoff must be controlled, especially if water is to be fed into the water course on site. If this is not done, soil erosion will be severe. Mitigation measures can include the building of attenuation ponds that ensure slow release of water into the water course. Surface structures such as swales and burms can also be used.

Tables summarise the impact of the proposed development on agricultural potential and land capability, as well as the impact that soil erosion, sprouting from the development, might have on the environment. These are included on separate pages following the executive summary.

Nature of Impact: <u>Loss of agricultural potential and land capability owing to the development</u>		
	Without mitigation	With mitigation
Extent	Low (1) – Local	Low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance*	21 (Low)	21 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
<p>Mitigation:</p> <p>The loss of agricultural land is a long term loss and there are no mitigation measures that can be put in place to combat this loss. This loss extends to the post-construction phase. The area is, however, of low agricultural potential.</p> <p>During construction, stripped soil should be stockpiled. Soil erosion and hardsetting of the stockpiled material may occur. This can be mitigated by:</p> <ul style="list-style-type: none"> • Ensuring that the slope of the stockpiled material is such that surface runoff is minimal; • Additions of stabilising agents such as organic material or vegetative cover. <p>Stockpiling of soil must be for a minimum period. Stockpiled soil can be used in the construction of berms, swales etc. to ensure that soil erosion does not cause major degradation of the surrounding land.</p>		
<p>Cumulative impacts:</p> <p>Soil erosion may arise owing to increased surface water runoff. The area surrounding the proposed site has been developed for mining purposes. This has led to higher surface water runoff volumes and velocities. Sediment load in the surface water is higher and soil erosion is a concern. This will be compounded by the proposed development. Surrounding developments, (mining etc.), have already impacted the agricultural potential of the area.</p>		
<p>Residual Impacts:</p> <p>The loss of agricultural land is a long term loss. This loss extends to the post-construction phase.</p>		

*Calculated using the formula $S = (E+D+M)P$, where S is significance, D is duration, M is Magnitude and P is probability

Nature of Impact: Soil erosion arising from increased surface water runoff owing to the disturbance and soil compaction during construction and the possible use of concrete foundations.

	Without mitigation	With mitigation
Extent	High (4)	Low (1)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (2)
Probability	Very Probable (5)	Improbable (2)
Significance*	80 (Very High)	14 (Low)
Status (positive or negative)	Negative	-
Reversibility	Low	-
Irreplaceable loss of resources?	Yes	-
Can impacts be mitigated?	Yes	
Mitigation: Mitigation Measures		
Building of swales and berms to decrease water runoff speed.		
Building of attenuation ponds to ensure slow release of water into the water course.		
Cumulative impacts:		
Soil erosion might extend to areas outside the area of development. Especially along the water course. This will influence biodiversity adversely and lead to higher sediment and solute content of water leaving the area, thus lowering water quality and possibly influencing agricultural practices in the area and posing a threat to human health. This is especially the case for subsistence farmers and informal settlements downstream.		
Residual Impacts:		
Impact can influence surrounding areas post the construction phase.		

*Calculated using the formula $S = (E+D+M)P$, where S is significance, D is duration, M is Magnitude and P is probability

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RUSTMO 2 PV: SOIL AND AGRICULTURAL POTENTIAL SURVEY FOR PORTION 108 (A PORTION OF 23) OF THE FARM SPRUITFONTEIN NEAR BUFFELSPOORT, NORTH WEST PROVINCE

1 TERMS OF REFERENCE

Savannah Environmental (Pty) Ltd on behalf of Momentous Energy (Pty) Ltd, contracted Terra Soil Science cc to carry out a soil, agricultural potential, land type and land use study for the remaining extent of portion 24 of the farm Spruitfontein 341, near Buffelspoort, North West Province, comprising approximately 18 ha.

2 INTRODUCTION

2.1 Study Aim and Objectives

The mentioned area has been proposed to serve as a locality for the construction of a photovoltaic (PV) plant and associated infrastructure for power generation purposes. This study aims to determine the possible impact that this development could have on the soil environment, with emphasis on land use, land capability and agricultural potential.

The study has as objectives the identification and estimation of:

- Diagnostic soil horizons, soil form (SA taxonomic system) and soil depth at auguring point localities that were designed to adequately cover the area;
- Soil colour, texture, structure;
- Presence and intensity/frequency of mottles, concretions, and rocks;
- Soil potential linked to current land use and other possible uses and options;
- Discussion of the aspects:
 - Agricultural potential
 - Water availability, source and quantity
 - Access routes and condition thereof
 - Surrounding developments and activities
 - Current status of land

2.2 Survey Area and Boundary

The site earmarked for development is described as the remaining extent of portion 24 of the farm Spruitfontein 341, North West Province. The site comprises a total of approximately 18 ha and is situated alongside the Marikana Platinum Mine with the N4 highway as one of the boundaries. Refer to Figure 1 for the locality map.



Figure 1 The site earmarked for development is the remaining extent of portion 24 of the farm Spruitfontein 341

2.3 Agricultural Potential Background

The assessment of agricultural potential rests primarily on the identification of soils that are suited to crop production. In order to qualify as high potential soils they must have the following properties:

- Deep profile (more than 600 mm) for adequate root development,
- Deep profile and adequate clay content for the storing of sufficient water so that plants can weather short dry spells,
- Adequate structure (loose enough and not dense) that allows for good root development,
- Sufficient clay or organic matter to ensure retention and supply of plant nutrients,
- Limited quantities of rock in the matrix that would otherwise limit tilling options and water holding capacity,
- Adequate distribution of soils and size of high potential soil area to constitute a viable economic management unit, and
- Good enough internal and external (out of profile) drainage if irrigation practices are considered. Drainage is imperative for the removal (leaching) of salts that accumulate in profiles during irrigation and fertilization.

In addition to soil characteristics climatic characteristics need to be assessed to determine the agricultural potential of a site. The rainfall characteristics are of primary importance and in order to provide an adequate baseline for the viable production of crops rainfall quantities and distribution need to be sufficient and optimal. The combination of the above mentioned factors will be used to assess the agricultural potential of the soils on the site.

3 MATERIALS AND METHODS

3.1 Land Type Data

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (MacVicar, C.N. et al. 1991).

3.2 Soil Survey

The study area was traversed and observations regarding the landscape and occurrence of soils were made continuously. Specific soil characteristics were noted and logged. Augering was done to a maximum of 1200 mm. In some cases the occurrence of hard plinthite, rocks and gleyed material hampered deep augering. Soil form (Soil Classification, A Taxonomic System for South Africa, Soil Classification Working Group) and soil depth were recorded.

Soils that display morphological indicators of temporary or seasonal wetness within 500 mm of the soil surface, together with those subject to prolonged and permanent saturation, make up the area delineated as hydromorphic or wetland soils (A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas, Department: Water Affairs and Forestry).

3.3 Rainfall data

Rainfall data for the area was obtained from the Department of Agriculture (AGIS).

4 RESULTS AND DISCUSSION

4.1 Land Type Data

The area lies in the Bc and Ib land types (Land Type Survey Staff, 1972 – 2006). The Bc land type is described as a plinthic catena: upland duplex and marginal soils rare. A perfect catena is represented by (from higher to lower lying areas) Hutton, Bainsvlei, Avalon and Longlands soil forms. Gleyed soils, such as Rensburg, Willowbrook, Katspruit and Champagne soil forms, can occur in the valley bottom. Soils with hard plinthite are common in areas where sandstone underlies the area. Where water tables have not extended far

beyond the valley bottom, red soils may dominate. In these cases plinthic soils are restricted to valley bottoms and pans.

The Ib land type refers to Miscellaneous land classes. This is land types with a soil pattern difficult to accommodate elsewhere. The Ib land type is dominated by exposed rock and shallow soils.

Figure 2 is a land type map.

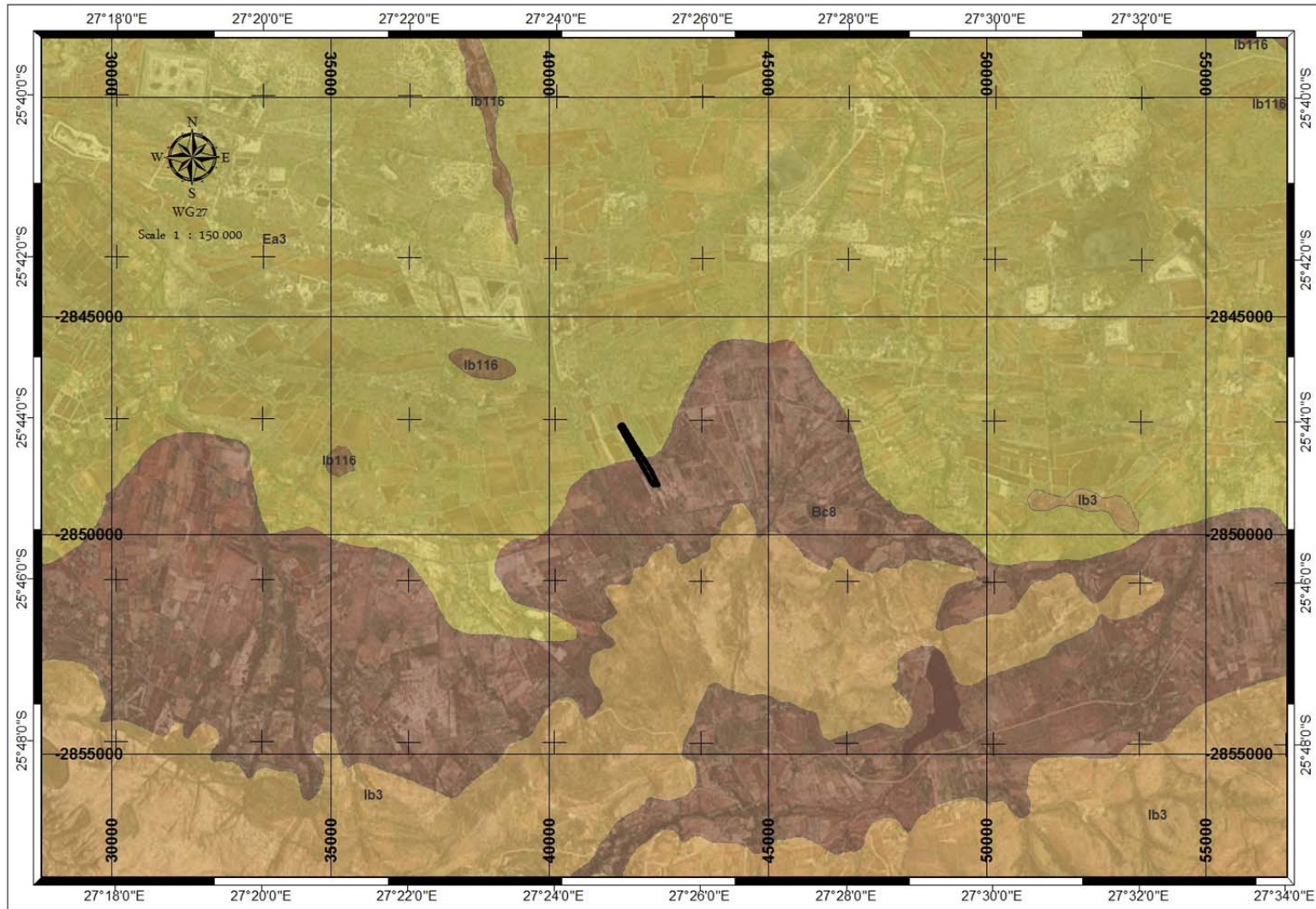


Figure 2 The survey area (indicated by the black rectangle) lies in the Bc and Ib land types

4.2 Land Capability

Eight land capability classes are recognised and these are divided into three land capability groups. Table 1 summarises this division.

Table 1 Land capability classes and intensity of use

Land capability class	Increased intensity of use									Land capability groups
	W	F	LG	MG	IG	LC	MC	IC	VIC	
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				Grazing land
V	W		LG	MG						
VI	W	F	LG	MG						
VII	W	F	LG							Wildlife
VIII	W									

W - wildlife

F - forestry

LG - light grazing

MG - moderate grazing

IG - intensive grazing

LC - light cultivation

MC - moderate cultivation

IC - intensive cultivation

VIC - very intensive cultivation

The soils of the survey area fall into Class II and V. These are defined as:

- Class II: Land subject to certain limitations or hazards. It is suitable for cropping with adequate protection measures, which may sometimes include special management practices and regular ley rotations. Limitations may include one or more of the following: moderately shallow soil-depth, slightly unfavourable surface physical characteristics, inadequate permeability in the lower root zone or moderate wetness existing as a permanent land character. Such land needs conservation practices which will depend on the limiting characteristics, but will include both moderate mechanical and biological conservation methods in varying combinations.
- Class V: Watercourses and land subject to wetness limitations. These limitations include temporary, periodic and semi-permanent wetness. Cultivation is only permitted with very special practices and measures. Vleis and watercourses subject to severe wetness are best left under permanent vegetation.

4.3 Soil Survey

Figure 3 indicates the dominant soil forms found in the survey area. The area is rather homogenous in terms of variation in soil form.



Figure 3 A map of the dominant soil forms encountered on the survey area

The following soil forms were identified in the area:

- The Arcadia soil form comprises a Vertic A-horizon that overlies unspecified material. The vertic A-horizon is characterised by 2:1 swelling and shrinking clays of the smectite group. Figure 4 is a photograph that shows surface cracking which is ascribed to the shrinking of smectite type clays under conditions of drying. These horizons exhibit at least 55 percent clay content. Lime concretions are often encountered on the soils surface and in the soil profile itself as shown by Figure 5.
- The Tukulú soil form comprises an orthic A-horizon (Figure 6) that overlies a neocutanic B-horizon and a horizon that exhibits signs of wetness. The neocutanic B-horizon is characterised by colour variation (Figure 7) due to clay movement and accumulation and an apedal or weakly developed structure (Figure 8). Unspecified material with signs of wetness is a lower profile horizon that has suffered the effects of intermittent or prolonged saturation with water. Signs of wetness are ascribed to conditions of reduction that leads to iron movement. Iron mobilises, moving from areas of reduction to precipitate in pockets that exhibit a higher state of oxidation. This leads to a bleached colouration in the soil matrix which is referred to as signs of wetness. Mottling may or may not be present. Figure 9 is a photograph that exhibits a classical example of signs of wetness.
- The Glenrosa soil form comprises an orthic A-horizon that overlies a lithocutanic B-horizon. The lithocutanic B-horizon is indicative of minimal pedogenesis and grades into hard rock.
- The Mispah soil form comprises an orthic A-horizon that overlies hard rock.



Figure 4 Soils of the Arcadia soil form exhibit cracks on the surface owing to the shrinking and swelling characteristics of 2:1 smectite type clays



Figure 5 Lime concretions are often found on the surface of the Vertic A-horizon



Figure 6 The orthic A-horizon that overlies the subsoil horizons of the Tukulu soil form is bleached in colour and exhibit a sand clay loam texture



Figure 7 The neocutanic B-horizon is characterised by colour variation owing to clay movement



Figure 8 The neocutanic B-horizon exhibits weakly developed structure



Figure 9 Signs of wetness is ascribed to conditions of reduction that leads to iron movement and the occurrence of red, yellow and black mottles and/or bleached colouration

The soils of the Arcadia soil form are encountered in the transition zone between the water course and the arable land. These soils range in depth from a few centimetres to 1200 mm. The soils of the Tukulú soil form were found to be shallow in many cases due to rockiness. This impedes augering. Soils of 1200 mm and deeper were encountered, especially in the north and eastern sections of the area. The southern section of the site is dominated by shallow soils of the Mispah and Glenrosa soil form.

4.4 Rainfall Data

The rainfall for the area varies from 600 to 800 mm per year with the summer months receiving the bulk of the rain.

5 AGRICULTURAL POTENTIAL

5.1 Agricultural Potential Linked to Soil Form and Land Capability

The deeper of the soils of the Tukulu soil form can be used for agricultural development, but will have to be managed carefully. The poorly permeable layer that underlies the soils of the Tukulu soil form will impede drainage and water flow out of the profile. The Tukulu soil form may be an excellent dry-land production soil in years where rainfall is low. Carefully managed irrigation may lead to productive yields but in years of excessive rainfall drowning may occur. This is especially the case for soils of less than 600 mm depth.

The site is, however, dominated by shallow, rocky soils and rock outcrops and can therefore not be deemed of high agricultural potential. The soils of the Glenrosa and Mispah soil forms serve as evidence. The site, furthermore, comprises an area of 18 ha and is surrounded by mining and related infrastructure. Intensive agriculture, such as citrus production, may be viable on an area of this size if the soils are deep and of high agricultural potential. This is not the case for portion 108 (a portion of 23) of the farm Spruitfontein. The area can be deemed of **low agricultural potential**.

The Arcadia soil form is indicative of a transition area to a wetland/water course and should, from a land type perspective, only be used for carefully managed grazing. The area is, however, too small to be stocked with livestock on an economic viable scale.

5.2 Water Availability, Source and Quantity

The volumes of water available for the site are not known but from the survey it appears that there is not enough water for irrigation purposes on an economic scale. At present there is no crop production under either dry-land production systems or irrigation. The quality of the water on the site was not assessed.

5.3 Access Routes and Conditions Thereof

The bulk of the site is adequately serviced by road.

5.4 Surrounding Developments and Activities

The site is bordered, in the north, east and south, by mining and related infrastructure as indicated by Figure 10. Citrus production is common in the area as indicated by Figure 11.

5.5 Current Status of Land

The area is currently not being used for agricultural purposes. It would seem that certain areas were previously used for grazing purposes. It is unsure if this is still the case.



Figure 10 The study area is mainly bordered by mining and related infrastructure



Figure 11 Citrus production is common in the area but deemed not viable for the study area owing to shallow, rocky soils dominating the site

6 ASSESMENT OF IMPACT

6.1 Impact on Agricultural Potential and Land Capability

Momentous Energy (Pty) Ltd summarises the proposed development as follows:

- “The construction would consist of mainly solar panels buried into the ground. The usual method of fixing these panels are through galvanised steel tubing of about 30mm dia (A), rammed into the ground to about 1500mm. A 1000mm high aluminium tube of about 20mm outside dia (B) is fixed to the grounded stake A. The PV panel is fixed onto B. The weight of B + one panel amounts to under 3kg.”

In some areas ramming deeper than 1500mm into the ground may be necessary. Mere ram piling may not be sufficient in these cases and concrete foundations for each mounting structure may have to be used.

The nature of the impact on soils includes the compaction and possibly the stripping and stockpiling of soil for construction purposes. Heavy machinery traffic on the soil surface could constitute further impacts on soil.

Compaction, stripping and stockpiling of soil usually result in:

- Loss of the original spatial distribution of natural soil forms and horizon sequences.
- Loss of natural topography and drainage pattern.
- Loss of original soil depth and soil volume.
- Loss of original fertility and organic carbon content.
- Soil compaction will adversely affect root development, effective soil depth and general soil fertility (in certain instances extensive surface crusting can occur that has a negative impact on re-vegetation efforts).

The impact on soils (agricultural potential and land capability) will be limited to the immediate area or site of development (local) but soil erosion, owing to increased surface water runoff and construction related impacts, can have an impact on the surrounding area.

Soil erosion may become a significant hazard in the area as many of the soils show signs of swelling and shrinking. This is a factor to be considered during construction and in the case of stockpiling of stripped soil. Hardsetting of the stockpiled material may also occur. This can be mitigated by:

- Ensuring that the slope of the stockpiled material is such that surface runoff is minimal;
- Additions of stabilising agents such as organic material or vegetative cover.

The latter point will also inhibit hardsetting. Soils must furthermore be stockpiled for the minimum period prior to re-use.

Surface runoff will be increased if concrete foundations are used and/or soil is compacted during construction. Storm water runoff must be controlled, especially if water is to be fed into the water course on site. If this is not done, soil erosion will be severe. Mitigation measures can include the building of attenuation ponds that ensure slow release of water into the water course. Surface structures such as swales and berms can also be used.

Table 2 summarises the impact of the proposed development on agricultural potential and land capability. Table 3 summarises the impact that soil erosion, sprouting from the development, might have on the environment.

Table 2 Summary of the impact of the development on agricultural potential and land capability

<i>Nature of Impact: Loss of agricultural potential and land capability owing to the development</i>		
	Without mitigation	With mitigation
<i>Extent</i>	Low (1) – Local	Low (1)
<i>Duration</i>	Long term (4)	Long term (4)
<i>Magnitude</i>	Low (2)	Low (2)
<i>Probability</i>	Probable (3)	Probable (3)
<i>Significance*</i>	21 (Low)	21 (Low)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Medium	Medium
<i>Irreplaceable loss of resources?</i>	Yes	Yes
<i>Can impacts be mitigated?</i>	No	

Mitigation:

The loss of agricultural land is a long term loss and there are no mitigation measures that can be put in place to combat this loss. This loss extends to the post-construction phase. The area is, however, of low agricultural potential.

During construction, stripped soil should be stockpiled. Soil erosion and hardsetting of the stockpiled material may occur. This can be mitigated by:

- Ensuring that the slope of the stockpiled material is such that surface runoff is minimal;
- Additions of stabilising agents such as organic material or vegetative cover.

Stockpiling of soil must be for a minimum period. Stockpiled soil can be used in the construction of berms, swales etc. to ensure that soil erosion does not cause major degradation of the surrounding land.

Cumulative impacts:

Soil erosion may arise owing to increased surface water runoff. The area surrounding the proposed site has been developed for mining purposes. This has led to higher surface water runoff volumes and velocities. Sediment load in the surface water is higher and soil erosion is a concern. This will be compounded by the proposed development. The surrounding developments have already had an impact on the agricultural potential of the area.

Residual Impacts:

The loss of agricultural land is a long term loss. This loss extends to the post-construction phase.

*Calculated using the formula $S = (E+D+M)P$, where S is significance, D is duration, M is Magnitude and P is probability

Table 3 Summary of the impact that soil erosion might have on the environment

<i>Nature of Impact: Soil erosion arising from increased surface water runoff owing to the disturbance and soil compaction during construction and the possible use of concrete foundations.</i>		
	Without mitigation	With mitigation
<i>Extent</i>	High (4)	Low (1)
<i>Duration</i>	Long term (4)	Long term (4)
<i>Magnitude</i>	High (8)	Low (2)
<i>Probability</i>	Very Probable (5)	Improbable (2)
<i>Significance*</i>	80 (Very High)	14 (Low)
<i>Status (positive or negative)</i>	Negative	-
<i>Reversibility</i>	Low	-
<i>Irreplaceable loss of resources?</i>	Yes	-
<i>Can impacts be mitigated?</i>	Yes	-
<i>Mitigation: Mitigation Measures</i>		
Building of swales and berms to decrease water runoff speed.		
Building of attenuation ponds to ensure slow release of water into the water course.		
<i>Cumulative impacts: Cumulative Impacts</i>		
Soil erosion might extend to areas outside the area of development. Especially along the water course. This will influence biodiversity adversely and lead to higher sediment and solute content of water leaving the area, thus lowering water quality and possibly influencing agricultural practices in the area and posing a threat to human health. This is especially the case for subsistence farmers and informal settlements downstream.		
<i>Residual Impacts: Residual Impacts</i>		
Impact can influence surrounding areas post the construction phase.		

*Calculated using the formula $S = (E+D+M)P$, where S is significance, D is duration, M is Magnitude and P is probability

7 SUMMARY AND CONCLUSION

Savannah Environmental (Pty) Ltd., on behalf of Momentous Energy (Pty) Ltd, contracted Terra Soil Science cc to carry out a soil, agricultural potential, land type and land use study for the remaining extent of portion 24 of the farm Spruitfontein 341, near Buffelspoort, North West Province. The area is approximately 18 ha in extent.

The mentioned area has been proposed to serve as a locality for the construction of a photovoltaic plant and associated infrastructure for power generation purposes. This study aims to determine the possible impact that this development could have on the soil environment, with emphasis on land use, land capability and agricultural potential.

The area lies in the Bc and Ib land types (Land Type Survey Staff, 1972 – 2006). The Bc land type is described as a plinthic catena: upland duplex and marginal soils rare. A perfect catena is represented by (from higher to lower lying areas) Hutton, Bainsvlei, Avalon and Longlands soil forms. Gleyed soils, such as Rensburg, Willowbrook, Katspruit and Champagne soil forms, can occur in the valley bottom. Soils with hard plinthite are common in areas where sandstone underlies the area. Where water tables have not extended far beyond the valley bottom, red soils may dominate. In these cases plinthic soils are restricted to valley bottoms and pans.

The Ib land type refers to Miscellaneous land classes. This is land types with a soil pattern difficult to accommodate elsewhere. The Ib land type is dominated by exposed rock and shallow soils.

The soils of the survey area fall into Class II and V. These are defined as:

- Class II: Land subject to certain limitations or hazards. It is suitable for cropping with adequate protection measures, which may sometimes include special management practices and regular ley rotations. Limitations may include one or more of the following: moderately shallow soil-depth, slightly unfavourable surface physical characteristics, inadequate permeability in the lower root zone or moderate wetness existing as a permanent land character. Such land needs conservation practices which will depend on the limiting characteristics, but will include both moderate mechanical and biological conservation methods in varying combinations.
- Class V: Watercourses and land subject to wetness limitations. These limitations include temporary, periodic and semi-permanent wetness. Cultivation is only permitted with very special practices and measures. vleis and watercourses subject to severe wetness are best left under permanent vegetation.

The soils of the area that were encountered during the survey can be categorised into the following soil forms:

- The Arcadia soil form comprises a Vertic A-horizon that overlies unspecified material. The vertic A-horizon is characterised by 2:1 swelling and shrinking clays of the smectite group. These horizons exhibit at least 55 percent clay content. Lime concretions are often encountered on the soils surface and in the soil profile itself.
- The Tukulú soil form comprises an orthic A-horizon that overlies a neocutanic B-horizon and a horizon that exhibits signs of wetness. The neocutanic B-horizon is characterised by colour variation due to clay movement and accumulation and an apedal or weakly developed structure. Unspecified material with signs of wetness is a lower profile horizon that has suffered the effects of intermittent or prolonged saturation with water. Signs of wetness are ascribed to conditions of reduction that leads to iron movement. Iron mobilises, moving from areas of reduction to precipitate in pockets that exhibit a higher state of oxidation. This leads to a bleached colouration in the soil matrix which is referred to as signs of wetness. Mottling may or may not be present.
- The Glenrosa soil form comprises an orthic A-horizon that overlies a lithocutanic B-horizon. The lithocutanic B-horizon is indicative of minimal pedogenesis and grades into hard rock.
- The Mispah soil form comprises an orthic A-horizon that overlies hard rock.

The soils of the Arcadia soil form are encountered in the transition zone between the water course and the arable land. These soils range in depth from a few centimetres to 1200 mm. The soils of the Tukulú soil form were found to be shallow in many cases due to rockiness. This impedes augering. Soils of 1200 mm and deeper were encountered, especially in the north and eastern sections of the area. The southern section of the site is dominated by shallow soils of the Mispah and Glenrosa soil form.

The site is dominated by shallow, rocky soils and rock outcrops and can therefore not be deemed of high agricultural potential. The soils of the Glenrosa and Mispah soil forms serve as evidence. The site, furthermore, comprises an area of ~18 ha and is surrounded by mining and related infrastructure. Intensive agriculture, such as citrus production, may be viable on an area of this size if the soils are deep and of high agricultural potential. This is

not the case for portion 108 (a portion of 23) of the farm Spruitfontein. The area can be deemed of **low agricultural potential**.

The nature of the impact on soils includes the compaction and possibly the stripping and stockpiling of soil for construction purposes. Heavy machinery traffic on the soil surface could constitute further impacts on soil.

Compaction, stripping and stockpiling of soil usually result in:

- Loss of the original spatial distribution of natural soil forms and horizon sequences.
- Loss of natural topography and drainage pattern.
- Loss of original soil depth and soil volume.
- Loss of original fertility and organic carbon content.
- Soil compaction will adversely affect root development, effective soil depth and general soil fertility (in certain instances extensive surface crusting can occur that has a negative impact on re-vegetation efforts).

The impact on soils (agricultural potential and land capability) will be limited to the immediate area or site of development (local) but soil erosion, owing to increased surface water runoff construction related impacts, can have an impact on the surrounding area.

Soil erosion may become a significant hazard in the area as many of the soils show signs of swelling and shrinking. This is a factor to be considered during construction and in the case of stockpiling of stripped soil. Hardsetting of the stockpiled material may also occur. This can be mitigated by:

- Ensuring that the slope of the stockpiled material is such that surface runoff is minimal;
- Additions of stabilising agents such as organic material or vegetative cover.

The latter point will also inhibit hardsetting. Soils must furthermore be stockpiled for the minimum period prior to re-use.

Surface runoff will be increased if concrete foundations are used and/or soil is compacted during construction. Storm water runoff must be controlled, especially if water is to be fed into the water course on site. If this is not done, soil erosion will be severe. Mitigation measures can include the building of attenuation ponds that ensure slow release of water into the water course. Surface structures such as swales and berms can also be used.

Tables summarise the impact of the proposed development on agricultural potential and land capability, as well as the impact that soil erosion, sprouting from the development, might have on the environment. These are included in the executive summary and Section 6 of the report.

8 REFERENCES

Land Type Survey Staff. 1972 – 2006. Land Types of South Africa: Digital map (1:250 000 scale) and soil inventory databases. ARC-Institute for Soil, Climate and Water, Pretoria.

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