SOIL AND AGRICULTURAL POTENTIAL SURVEY FOR PORTION 15 OF THE FARM SCHIETFONTEIN 437 JQ NEAR BRITS, NORTH WEST PROVINCE

28 September 2011

Compiled by:

P.S. Rossouw (MSc. Agric. Soil Science)

Member of:
Soil Science Society of South Africa (SSSSA)
South African Soil Surveyors Organisation (SASSO)

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

EXECUTIVE SUMMARY

Idada Environmental Consultants contracted Terra Soil Science cc to carry out a soil, agricultural potential, land type and land use study for portion 15 of the farm Schietfontein 437 JQ, near Brits, North West Province, comprising approximately 166 ha.

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 site earmarked for development is described as portion 15 of the farm Schietfontein 437 JQ, near Brits, North West Province. The site comprises a total of approximately 166 ha. The central site coordinates are: 25° 38' 3.85" S and 27° 56' 31.22" E. The R566 national road runs through the site with the N4 highway as one of the boundaries. Refer to Figure 1 for the locality map.

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).

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 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 that is described as hydromorphic or wetland soils (A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas, Department: Water Affairs and Forestry). Rainfall data for the area was obtained from the Department of Agriculture (AGIS).

The area lies in the Ae21 and Ea3 land types (Land Type Survey Staff, 1972 – 2006). The Ae land type is described as "red-yellow apedal, freely drained soils" and refers to yellow and red coloured soils where a free water table are not encountered. The Ea land type is described as "One or more of: Vertic, Melanic and red structured diagnostic horizons. Figure 2 is a land type map. The study area was found to fall into the latter land type (Ea) and exhibit high base status, dark and red coloured soils that are clayey. Land type Ea3 comprises 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 Rensburg soil form comprises a vertic A-horizon that overlies a G-horizon. The G-horizon, in some cases, develop when water saturation for long periods gives rise to gleying with the reduction of ferric oxides and hydrated oxides. The G-horizon is dominated by grey, low chroma colours, usually with marked clay illuviation. These soils occur in the seasonal to permanent zone of wetlands.
- The Shortlands soil form comprises an orthic A-horizon that overlies a red structured B-horizon. The red structured B-horizon exhibits well develop structure owing to the presence of 2:1 smectite type clays. The red colouration is ascribed to hematite dominating the Fe oxide fraction of the soil material.
- The Glenrosa soil form comprises an orthic A-horizon that overlies a lithocutanic B-horizon. The lithocutanic B-horizon is indicative of minimal pedogeneses and grades into hard rock.
- The Mispah soil form comprises an orthic A-horizon that overlies hard rock

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 area is rather homogenous in terms of variation in soil form. The Rensburg soil form dominates the stream channel while the Shortlands soil form dominates the rest of the site. The Arcadia soil form is encountered at localised areas in the stream channel. Soil depth varies immensely in the area, ranging from a depth of a few centimetres to deeper than 1.2 m. The soils are underlain by saprolitic material or hard rock. Generally speaking, the southern and south eastern sections of the study area exhibit deeper soil. Rock outcrops dominate the area, however, and the deeper soils are interspersed with shallow soils of the Shortlands soil form, the Mispah soil form and the Glenrosa soil form.

In the transition zone between the water course (dominated by the Rensburg soil form) and the arable land (dominated by the Shortlands soil form) soils that exhibit pedocutanic characteristics can be found. These soils exhibit signs of clay movement and indicate a transition from the Shortlands soil form to the Rensburg/Arcadia soil forms.
Although the area is dominated by the Shortlands soil form, the variation in depth impedes the use of this site for agricultural purposes. The Shortlands soil form is usually a soil of high agricultural potential. The area exhibits shallow 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. 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 the study area. The area can be deemed of **low agricultural potential**.

The Rensburg/Arcadia soil forms 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 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. The north western section is currently being used as a dumping yard. Excavation of soil and rock has also taken place in this area of the site on a devastating scale.

Development pertaining to the construction of a solar farm can, broadly speaking, be summarised as: 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.

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.

The study area mainly comprises soils of the Shortland soil form and the Rensburg soil form. Deeper soils (60 cm to deeper than 1.2 m) are interspaced by shallow soils and rocky outcrops. For this reason the area is deemed to be of low agricultural potential. 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. Mitigation measures must be put in place to combat the latter.

TABLE OF CONTENT

DECLARATIONS ii

EXECUTIVE SUMMARY iii

LIST OF FIGURES viii

LIST OF TABLES ix

1 TERMS OF REFERENCE 1

2 INTRODUCTION 1

2.1 Study Aim and Objectives 1

2.2 Survey Area and Boundary 1

2.3 Agricultural Potential Background 2

3 MATERIALS AND METHODS 3

3.1 Land Type Data 3

3.2 Soil Survey 3

3.3 Rainfall data 4

4 RESULTS AND DISCUSSION 4

4.1 Land Type Data 4

4.2 Land Capability 6

4.3 Soil Survey 7

4.4 Rainfall Data 13

5 AGRICULTURAL POTENTIAL 14

5.1 Agricultural Potential Linked to Soil Form and Land Capability 14

5.2 Water Availability, Source and Quantity 15

5.3 Access Routes and Conditions Thereof 15

5.4 Current Status of Land 15

6 ASSESEMENT OF IMPACT 16

6.1 Impact on Agricultural Potential and Land Capability 16

7 CONCLUSION 18

8 REFERENCES 19

LIST OF FIGURES

Figure 1 The site earmarked for development is 15 of the farm Schietfontein 437 JQ, near Brits, North West Province. 2
Figure 2 The survey area lies in the Ae and Ea land types 5
Figure 3 Figure that indicates the position of the terrain units in the landscape 6
Figure 4 Map indicating the observation points 7
Figure 5 A map of the dominant soil forms encountered on the survey area 8
Figure 6 Soils of the Rensburg and Arcadia soil form exhibit cracks on the surface owing to the shrinking and swelling characteristics of 2:1 smectite type clays. 9
Figure 7 Cracks found on the surface of the Vertic A-horizon 9
Figure 8 The Shortlands soil form is underlain by saprolitic material (shown in the photo) or hard rock 10
Figure 9 The red structured B-horizon exhibits well defined structure and a red colouration hat is ascribed to the presence of hematite 10
Figure 10 Rock outcrops dominate the area and the deeper soils are interspersed with shallow soils of the Shortlands soil form, the Mispah soil form and the Glenrosa soil form. 11
Figure 11 Soil depth varies considerably in the area owing to the rock outcrops 11
Figure 12 Abrupt changes in soil depth are noted in the area: The auger indicates a point where the soil is 90 cm deep while rock outcrops can be seen less than two meters away. 12
Figure 13 DEM image of the area that indicates elevation 13
Figure 14 Rainfall of the area 14
Figure 15 The north western section of the study area is used as a dumping site 15
Figure 16 Excavation of soil and rock have taken place in the north western section of the study area 16

LIST OF TABLES

Table 1 Land capability classes and intensity of use 6
Table 2 Summary of the impact of the development on agricultural potential and land capability 17
Table 3 Summary of the impact that soil erosion might have on the environment.......... 18

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1 TERMS OF REFERENCE

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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 portion 15 of the farm Schietfontein 437 JQ, near Brits, North West Province. The site comprises a total of approximately 166 ha. The central site coordinates are: 25° 38’ 3.85” S and 27° 56’ 31.22” E. The R566 national road runs through the site with the N4 highway as one of the boundaries. Refer to Figure 1 for the locality map.

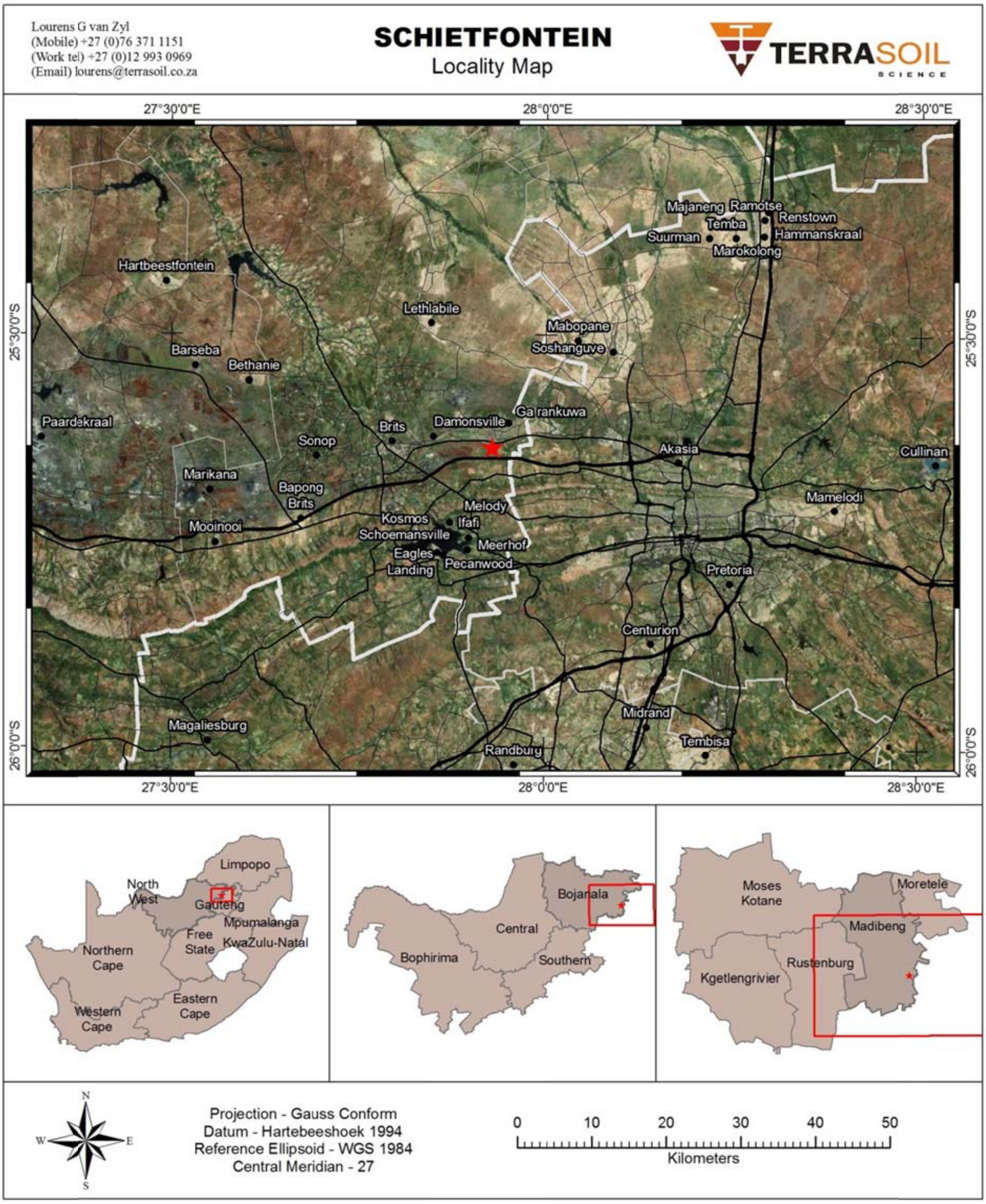

Figure 1 The site earmarked for development is 15 of the farm Schietfontein 437 JQ, near Brits, North West Province.

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 agriculture 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 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.

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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 Ae21 and Ea3 land types (Land Type Survey Staff, 1972 – 2006). The Ae land type is described as "red-yellow apedal, freely drained soils" and refers to yellow and red coloured soils where a free water table are not encountered. The Ea land type is described as "One or more of: Vertic, Melanic and red structured diagnostic horizons. Figure 2 is a land type map. The study area was found to fall into the latter land type (Ea) and exhibit high base status, dark and red coloured soils that are clayey. Land type Ea3 comprises the following soil forms:

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- The Shortlands soil form comprises an orthic A-horizon that overlies a red structured B-horizon. The red structured B-horizon exhibits well develop structure owing to the presence of 2:1 smectite type clays. The red colouration is ascribed to hematite dominating the Fe oxide fraction of the soil material.
- The Glenrosa soil form comprises an orthic A-horizon that overlies a lithocutanic B-horizon. The lithocutanic B-horizon is indicative of minimal pedogeneses and grades into hard rock.
- The Mispah soil form comprises an orthic A-horizon that overlies hard rock

The Arcadia and Rensburg soil forms are encountered in terrain unit 4 and 5 while the Shortlands, Glenrosa and Mispah soils are encountered in terrain units 1 and 3. Figure 3 illustrates the position of the terrain units in the landscape.

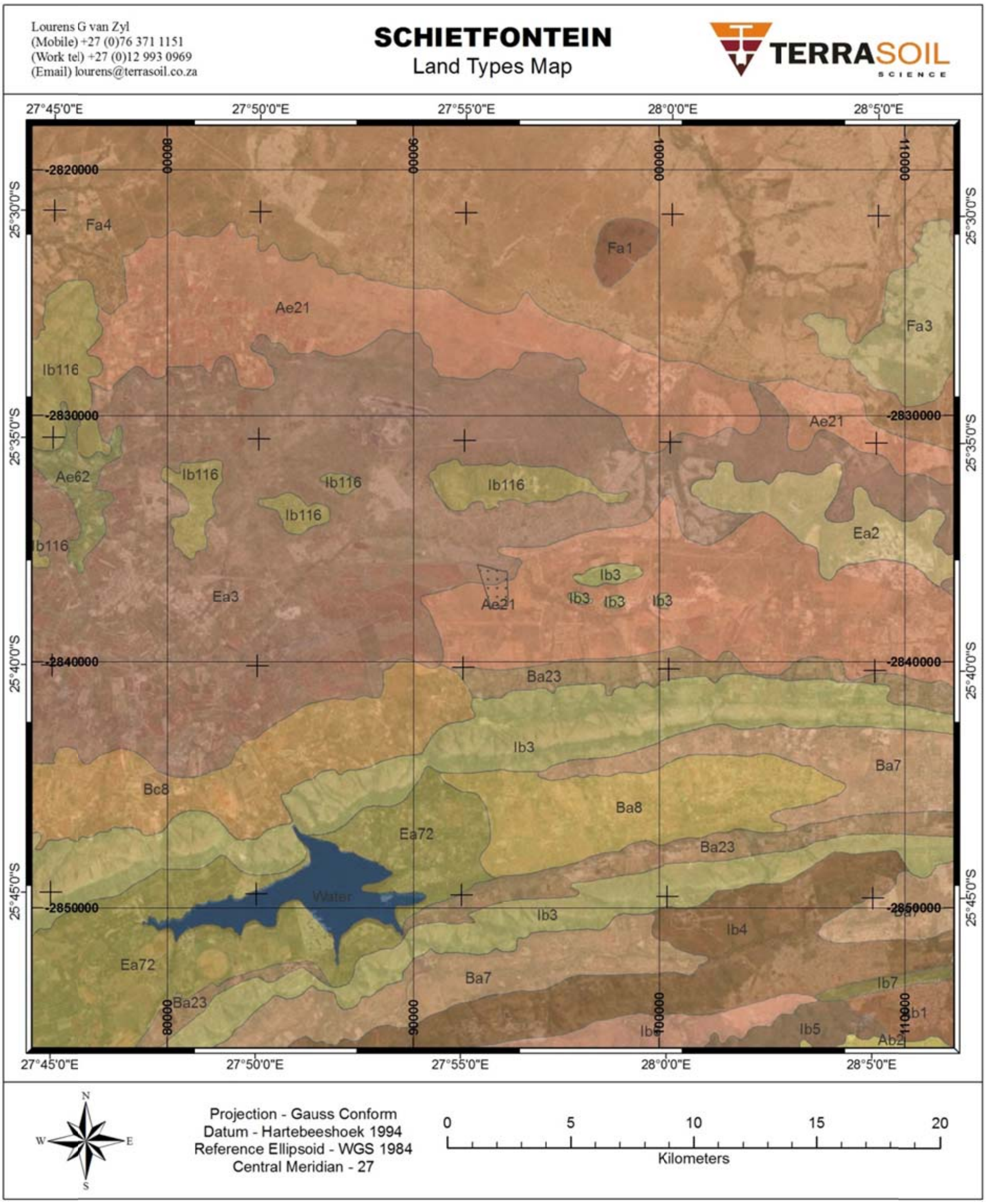

Figure 2 The survey area lies in the Ae and Ea land types

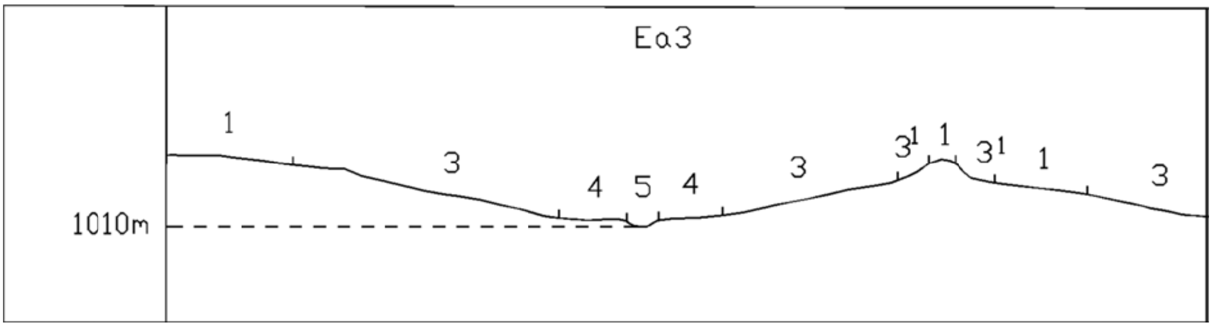

Figure 3 Figure that indicates the position of the terrain units in the landscape

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
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				
V	W		LG	MG						Grazing land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife

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 4 illustrates the points where observations were made during the field visit while Figure 5 indicates the dominant soil forms found in the survey area.

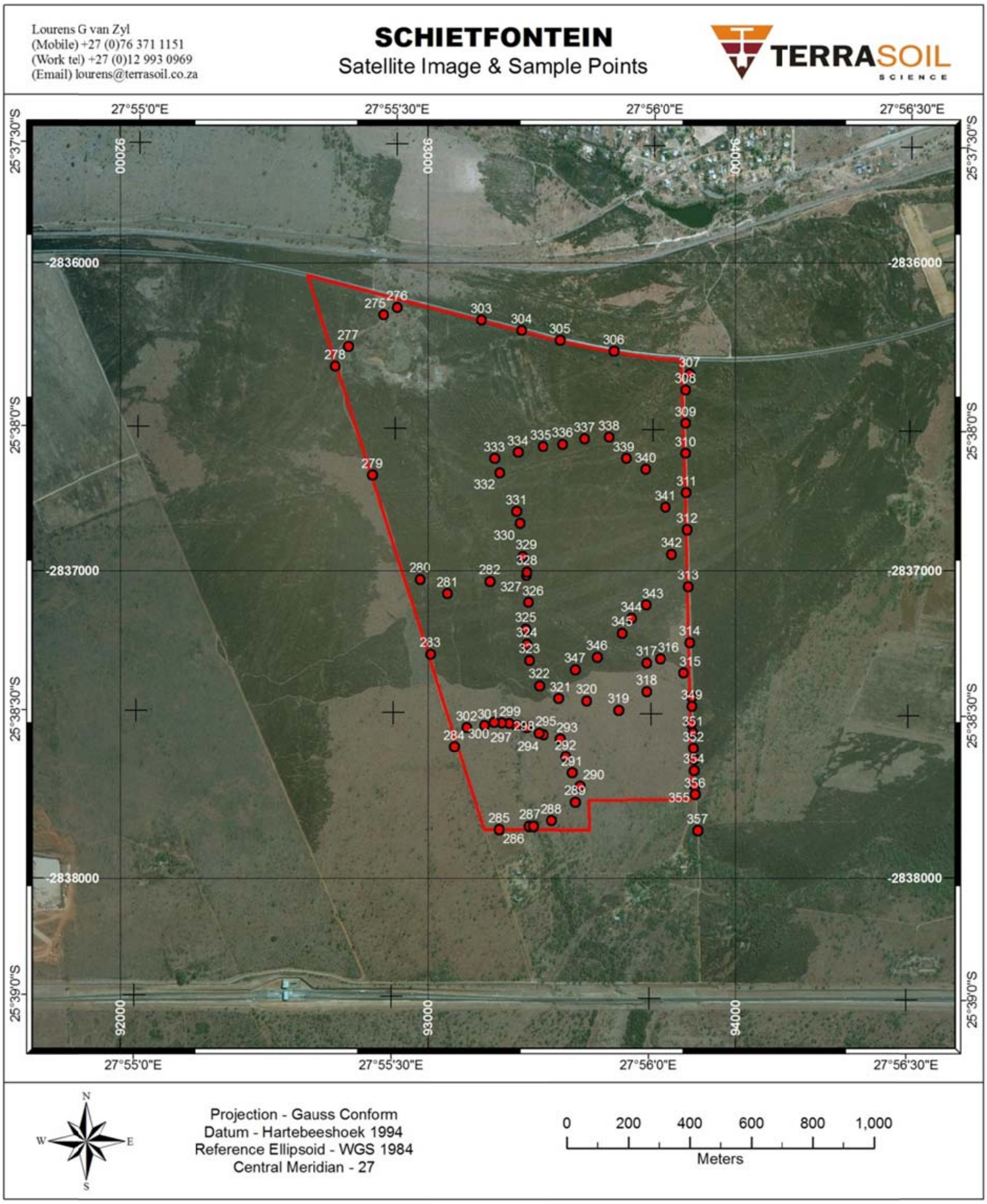

Figure 4 Map indicating the observation points

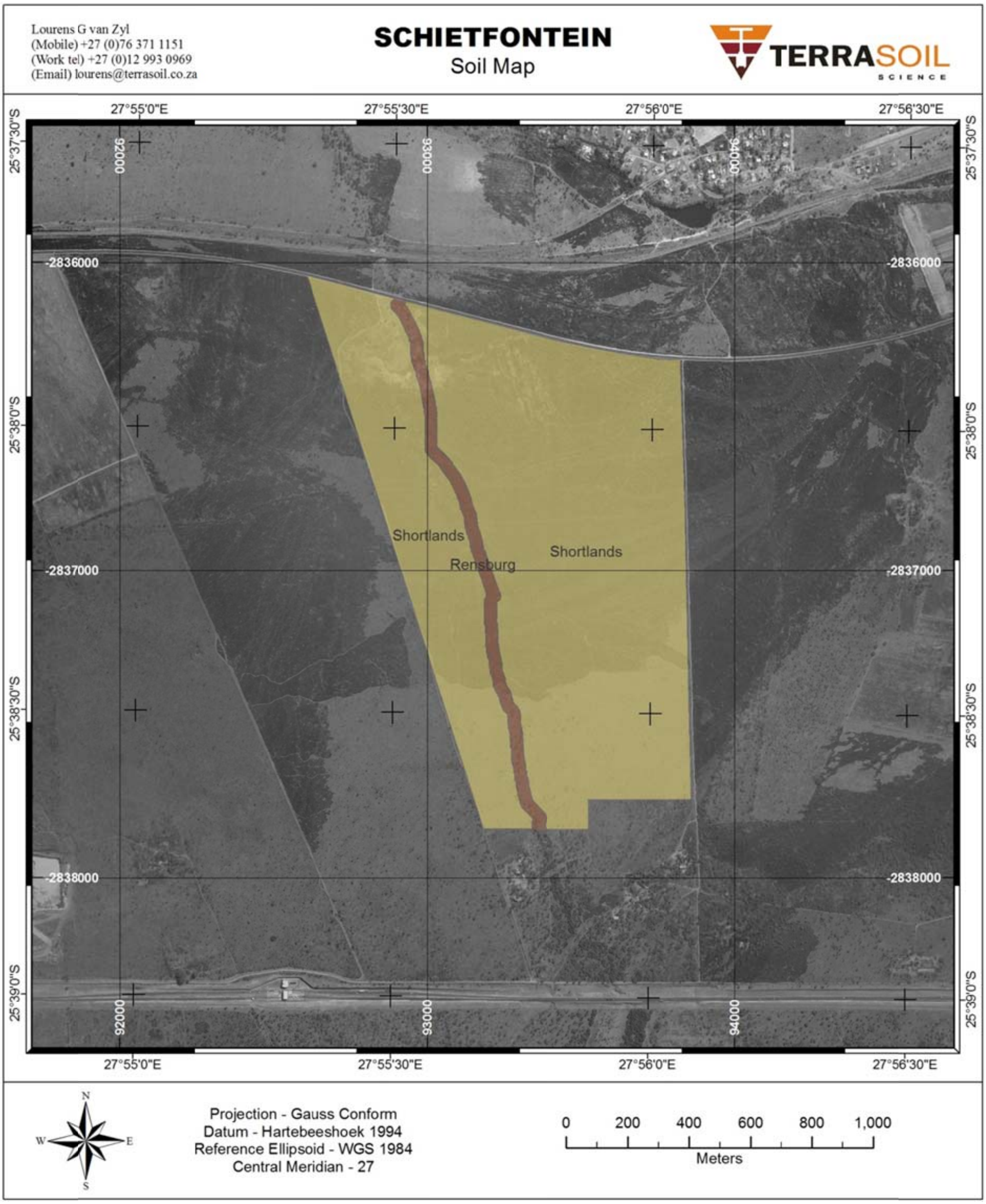

Figure 5 A map of the dominant soil forms encountered on the survey area

The area is rather homogenous in terms of variation in soil form. The Rensburg soil form dominates the stream channel while the Shortlands soil form dominates the rest of the site. Figure 6 and 7 illustrate the cracking of the soil surface owing to the shrinking and swelling characteristics of the vertic A-horizon that is found in the stream channel. The Arcadia soil form is encountered at localised areas in the stream channel. Figures 8 and 9 illustrate the blocky structure of the red structured B-horizon. Soil depth varies immensely in the area, ranging from a depth of a few centimetres to deeper than 1.2 m. The soils are underlain by saprolitic material or hard rock. Generally speaking, the southern and south eastern sections of the study area exhibit deeper soil. Rock outcrops (Figure 10 and 11) dominate the area, however, and the deeper soils are interspersed with shallow soils of the Shortlands soil form, the Mispah soil form and the Glenrosa soil form. Figure 12 illustrates the change in soil depth over a short distance. The auger indicates a point where the soil is 90 cm deep while rock outcrops can be seen less than two meters away from the point.

Figure 6 Soils of the Rensburg and Arcadia soil form exhibit cracks on the surface owing to the shrinking and swelling characteristics of 2:1 smectite type clays

Figure 7 Cracks found on the surface of the Vertic A-horizon

Figure 8 The Shortlands soil form is underlain by saprolitic material (shown in the photo) or hard rock

Figure 9 The red structured B-horizon exhibits well defined structure and a red colouration hat is ascribed to the presence of hematite

Figure 10 Rock outcrops dominate the area and the deeper soils are interspersed with shallow soils of the Shortlands soil form, the Mispah soil form and the Glenrosa soil form.

Figure 11 Soil depth varies considerably in the area owing to the rock outcrops

Figure 12 Abrupt changes in soil depth are noted in the area: The auger indicates a point where the soil is 90 cm deep while rock outcrops can be seen less than two meters away.

In the transition zone between the water course (dominated by the Rensburg soil form) and the arable land (dominated by the Shortlands soil form) soils that exhibit pedocutanic characteristics can be found. These soils exhibit signs of clay movement and indicate a transition from the Shortlands soil form to the Rensburg/Arcadia soil forms. Figure 13 is a DEM image of the area and fro this the position of the watercourse can be deduced, as well as the area of transition between terrain units 3 and 1.

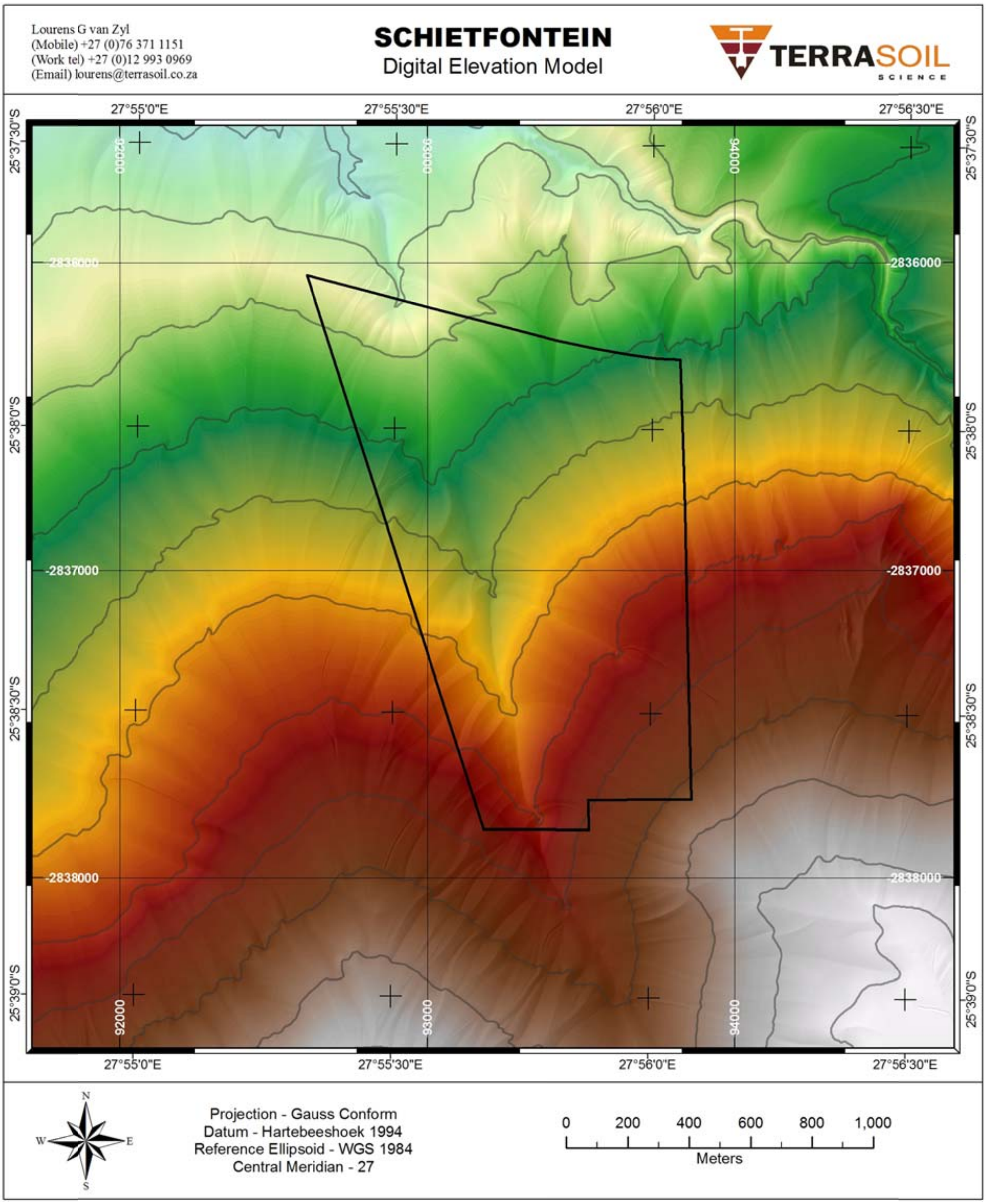

Figure 13 DEM image of the area that indicates elevation

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 as indicated by Figure 14.

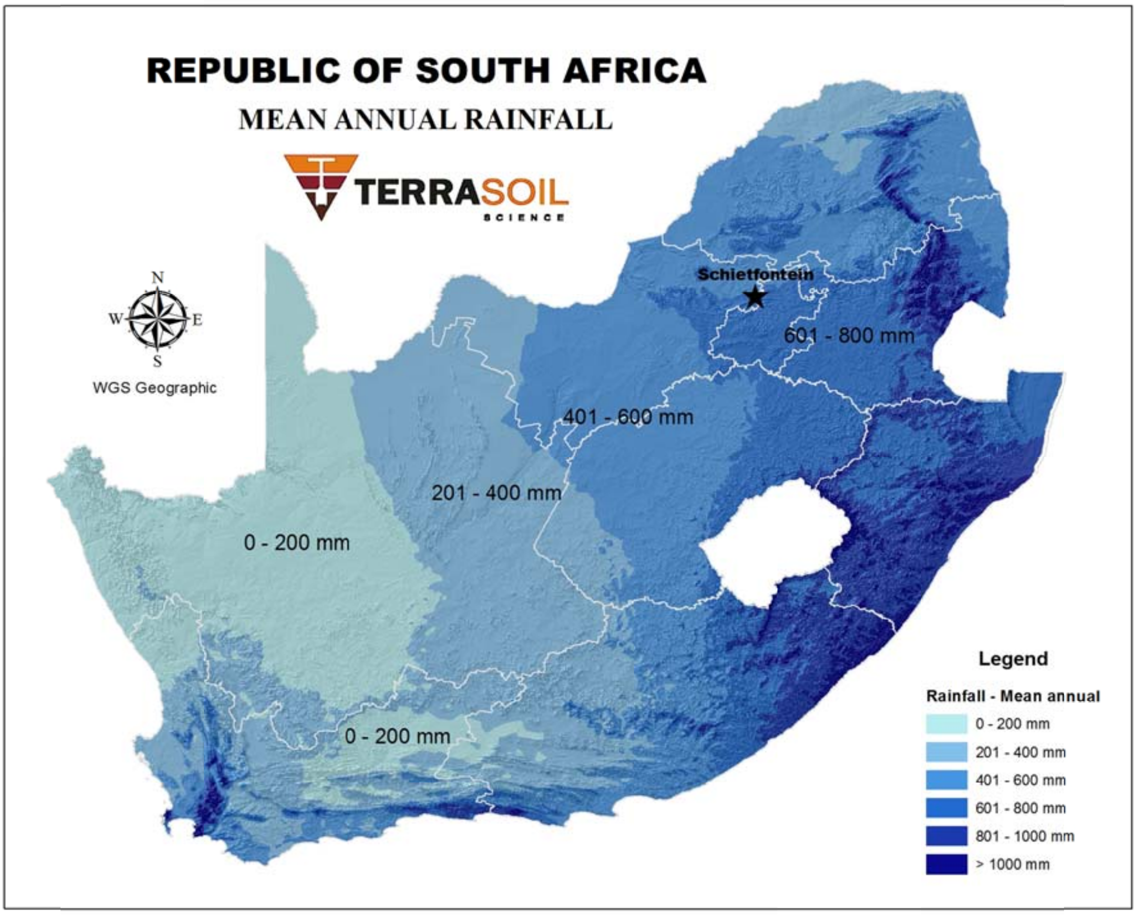

Figure 14 Rainfall of the area

5 AGRICULTURAL POTENTIAL

5.1 Agricultural Potential Linked to Soil Form and Land Capability

Although the area is dominated by the Shortlands soil form, the variation in depth impedes the use of this site for agricultural purposes. The Shortlands soil form is usually a soil of high agricultural potential. The area exhibits shallow 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. 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 the study area. The area can be deemed of **low agricultural potential**.

The Rensburg/Arcadia soil forms 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.

5.2 Water Availability, Source and Quantity

The volumes of water available for the site are not known. 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 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. The north western section is currently being used as a dumping yard as indicated by Figure 15. Excavation of soil and rock has also taken place in this area of the site on a devastating scale (Figure 16).

Figure 15 The north western section of the study area is used as a dumping site

Figure 16 Excavation of soil and rock have taken place in the north western section of the study area

6 ASSESMENT OF IMPACT

6.1 Impact on Agricultural Potential and Land Capability

Development pertaining to the construction of a solar farm can, broadly speaking, be summarised as: 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 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

Nature of Impact: *Loss of agricultural potential and land capability owing to the development*		
	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	
Mitigation: Mitigation Measures 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: Cumulative Impacts Soil erosion may arise owing to increased surface water runoff. Sediment load in the surface water may be high and soil erosion is a concern. This will be compounded by the proposed development.		
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

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: 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: 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

7 CONCLUSION

The study area mainly comprises soils of the Shortland soil form and the Rensburg soil form. Deeper soils (60 cm to deeper than 1.2 m) are interspaced by shallow soils and rocky outcrops. For this reason the area is deemed to be of low agricultural potential. 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. Mitigation measures must be put in place to combat the latter.

8 REFERENCES

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