EIA LEVEL REPORT

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY:

PROPOSED TSITSIKAMMA COMMUNITY WIND ENERGY FACILITY: TSITSIKAMMA, EASTERN CAPE PROVINCE

September 6th, 2011

Compiled by:
J.H. van der Waals
(PhD Soil Science, Pr.Sci.Nat)
Member of:
Soil Science Society of South Africa (SSSSA)
Soil Science Society of America (SSSA)

Accredited member of:
South African Soil Surveyors Organisation (SASSO)

Registered with:
The South African Council for Natural Scientific Professions
Registration number: 400106/08

DECLARATION

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

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

J.H. VAN DER WAALS
TERRA SOIL SCIENCE

Table of Contents

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY – TSITSIKAMMA COMMUNITY WIND ENERGY FACILITY: TSITSIKAMMA, EASTERN CAPE PROVINCE

1. TERMS OF REFERENCE

Terra Soil Science (TSS) was commissioned by Savannah Environmental (Pty) Ltd to undertake an EIA level soil, land use, land capability, and agricultural potential survey for the proposed Tsitsikamma Community Wind Energy Facility in the Eastern Cape Province. The survey includes the site for the erection of the turbines as well as the potential routes for power lines.

2. INTRODUCTION

2.1 Study Aim and Objectives

The study area has been proposed to serve as a locality for the construction of a wind energy facility and associated infrastructure for power generation purposes. This study aims to determine the possible impact that this development could have on the soils, land use, land capability and agricultural potential as well as to identify areas of high sensitivity regarding turbine placement.

The study has as objectives the identification and estimation of:

» Soil form (SA taxonomic system) and soil depth for the area;
» Soil potential linked to current land use and other possible uses and options;
» Discussion of the agricultural potential in terms of the soils, water availability, surrounding developments and current status of land; and
» Discussion of impacts (potential and actual) as a result of the development.

2.2 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.

2.3 Survey Area Boundary

The survey area (proposed turbine placement) lies between 34° 03′ 03″ and 34° 06′ 45″ south and 24° 27′ 16″ and 24° 31′ 24″ east 25 km west of the town of Humansdorp in the Eastern Cape Province (**Figure 1**). The area including the power line optional routes lies between 33° 59′ 09″ and 34° 07′ 28″ south and 24° 28′ 21″ and 24° 48′ 15″ east in a south-western direction from Humansdorp.

2.4 Survey Area Physical Features

The survey area stretches from Humansdorp in the northeast across undulating and hilly terrain towards the southwest where sandy deposits in the form of old dunes occur. The altitude above mean sea level varies from 80 m in the southeast to 240 m in the north. The geology of the area is dominated by sandstone and shale leading to the occurrence of sandy soils with occasional high clay content soils.

3. SOIL, LAND CAPABILITY, LAND USE SURVEY AND AGRICULTURAL POTENTIAL SURVEY

3.1 Method of Survey

The EIA level soil, land capability, land use and agricultural potential surveys were conducted in three phases.

3.1.1 Phase 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). 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).

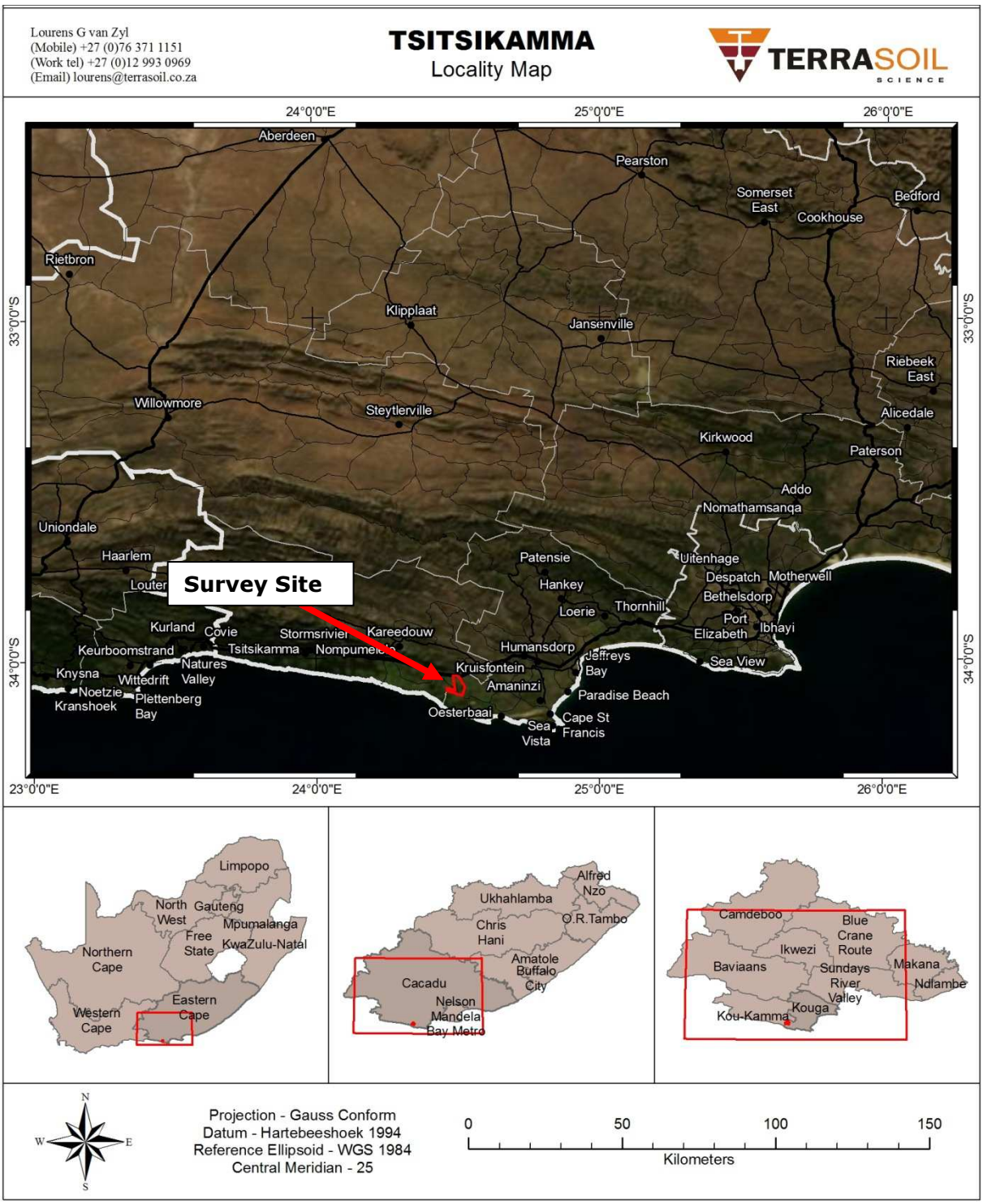

Figure 1 Locality of the survey site

3.1.2 Phase 2: Aerial Photograph Interpretation and Land Use Mapping

The most up to date aerial photographs of the site were obtained from Google Earth. The image was used to interpret aspects such as land use and land cover.

3.1.3 Phase 3: Site Visit and Soil Survey

A site visit was conducted on the 25th of August, 2011, during which a reconnaissance soil survey was conducted. The site was traversed in a vehicle and on foot and as many turbine points assessed as was possible within the limited timeframe and site accessibility constraints. Soils were described and photographs were taken of pertinent soil, landscape and land use characteristics.

3.2 Survey Results

3.2.1 Phase 1: Land Type Data

The following land types (Land Type Survey Staff, 1972 - 2006) occur in the areas as follows (**Figure 2**):

- Turbine development: **Bb75**, **Ca79**, **Ca80**, **Ha47, Ha50**
- Power lines – Option A: **Bb75**, **Ca80**, **Ca81**, **Ca83**, **Ca86**, **Ib56**, **Ib57**
- Power lines – Option B: **Bb75**, **Bb78**, **Bb80**, **Ca80**, **Ca81**, **Ca83**, **Ca85**, **Ca86**
- Power lines – Option C: **Bb75**, **Ca80**, **Ca81**, **Ca84**, **Ca85**, **Ca86**

Below follows a brief description of the land types in terms of soils, land capability, land use and agricultural potential.

Land Type Bb75

Soils: Predominantly deep, bleached (and leached) sandy soils with white to light yellow-brown colours. Podzols occur occasionally throughout the landscape. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

Land Types Bb78 and Bb80

Soils: Almost exclusively shallow, bleached (and leached) sandy soils with white grey colours. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to low carrying capacity and dominant vegetation.

Agricultural potential: Low in the natural state but medium if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and

fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

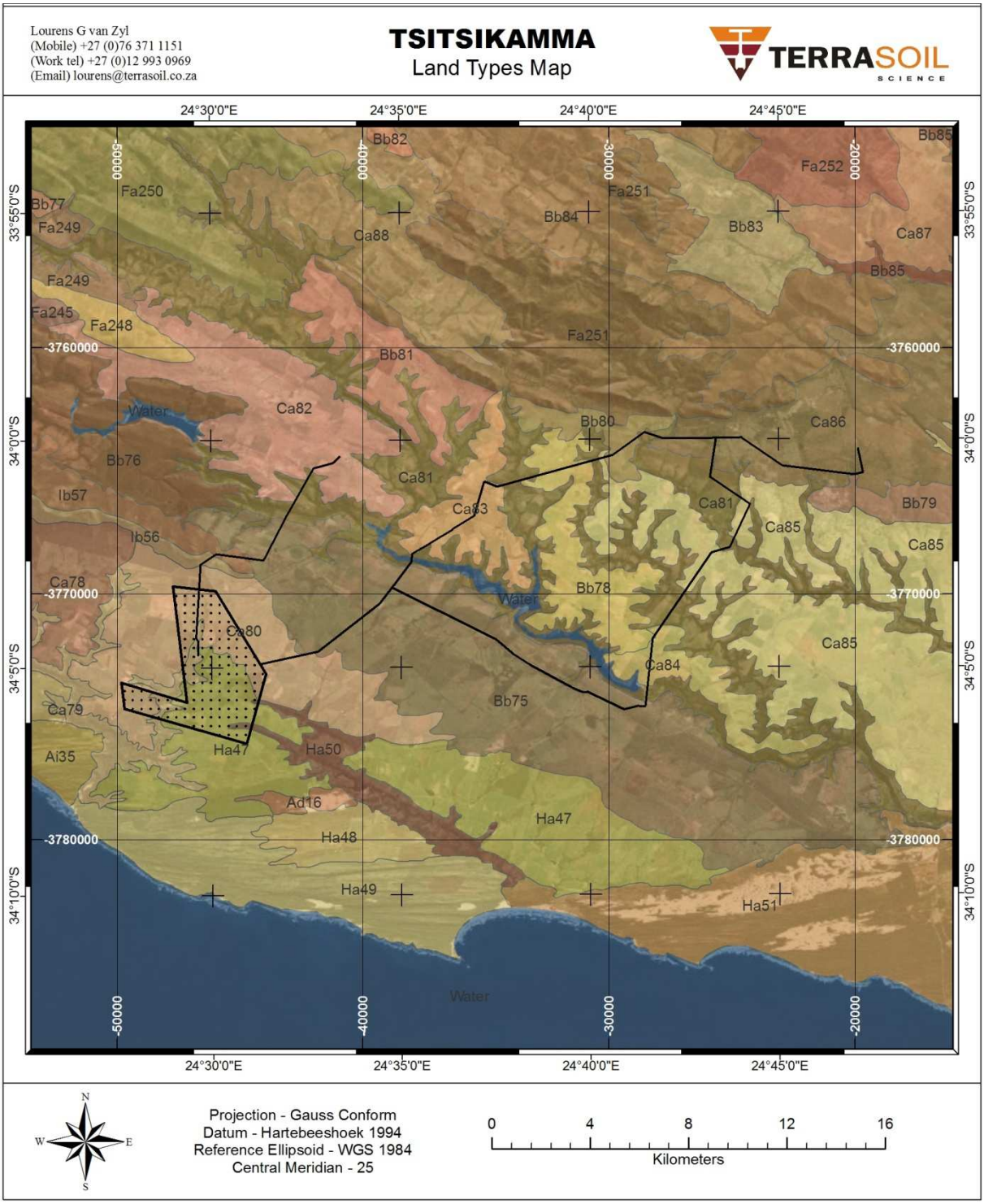

Figure 2 Land type map of the survey site

Land Types Ca79, Ca80, Ca81, Ca83, Ca84, Ca85 and Ca86

Soils: Predominantly shallow, bleached (and leached) sandy soils with white to light yellow-brown colour with a limited occurrence of duplex structured soils of varying degrees of wetness (as expressed in morphological "signs of wetness"). Podzols occur scattered to a limited degree in the landscape. Wetland character is expressed in the form of organic matter darkened A-horizons in the sandy soil profiles or morphological "signs of wetness" in high clay content subsoils.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure where soils allow for free drainage.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present (on suitable soils). Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

Land Type Ha47 and Ha50

Soils: Predominantly deep, bleached (and leached) sandy soils with white to light yellow-brown colours. Podzols occur occasionally throughout the landscape. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

Land Type Ib56and Ib57

Soils: Rocky and shallow, bleached (and leached) sandy soils with white to light yellow-brown colours. Podzols occur occasionally throughout the landscape. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: Predominantly extensive grazing with areas of forestry.

Agricultural potential: Very low due to the dominance of shallow rocky soils.

3.2.2 Phase 2: Aerial Photograph Interpretation and Land Use/Capability Mapping

The aerial photograph interpretation of the site yielded a number of land uses and potential wetland areas. The land uses include extensive grazing on untransformed land, grazing of improved pastures, irrigation of improved pastures and wattle plantations (**Figure 3**). The wetlands occur throughout the site within the grazing areas and sometimes on the edge of or within irrigated fields. **Table 1** provides the areas covered by each of these land uses on the site.

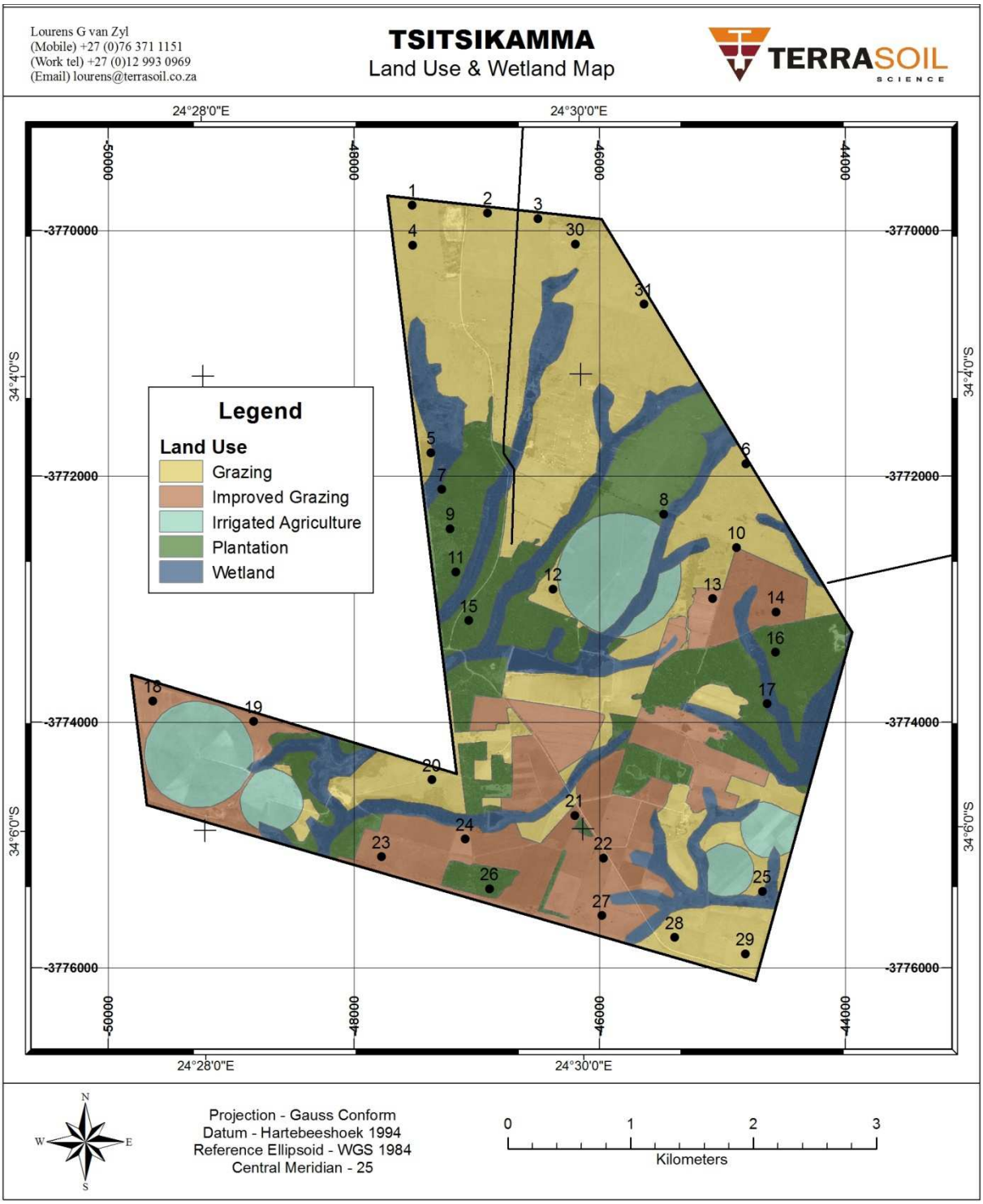

Figure 3 Land use map of the survey area

Table 1 Land use areas and percentage for the survey site

Land Use	**Area (ha)**	**Percentage**
Grazing	656	35.5
Improved Pastures	350	18.9
Irrigated Agriculture	175	9.5
Plantation	351	19.0
Wetland / Potential Wetland	317	17.1
Total	**1849**	

3.2.3 Phase 3: Site Visit and Soil Survey

The land uses as identified during the previous phase were confirmed during the site visit and survey. The reconnaissance soil survey confirmed the land type data. A generalised soil map of the areas is provided in **Figure 4**. The soils on the site can be divided into three main groups namely 1) shallow and rocky soils, 2) variable depth sandy soils and 3) deep sandy soils with podzols. The areal extent of the soils is provided in **Table 2**. The soils on the site were very wet (**Photographs 5** to **7**) and it was difficult (if not impossible in many cases) to extract the lower soil cores due to saturated subsoils and subsequent solifluction (soils becoming liquid under saturated conditions).

Table 2 Soil zone area and percentage for the survey site

Land Use	**Area (ha)**	**Percentage**
Deep sandy soils / Podzols	790	42.7
Shallow rocky soils	493	26.7
Variable depth sandy soils	566	30.6
Total	**1849**	

3.2.3.1 Shallow Rocky Soils

The total area within the survey site covered by the shallow and rocky soils is 493 ha. The dominant soils occurring within this area are of the Mispah (Orthic A-horizon / Hard Rock) and Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) forms as well as numerous rock outcrops. **Figures 8** to **11** provide an indication of the areas covered in these soils as well as the profiles as identified on the site.

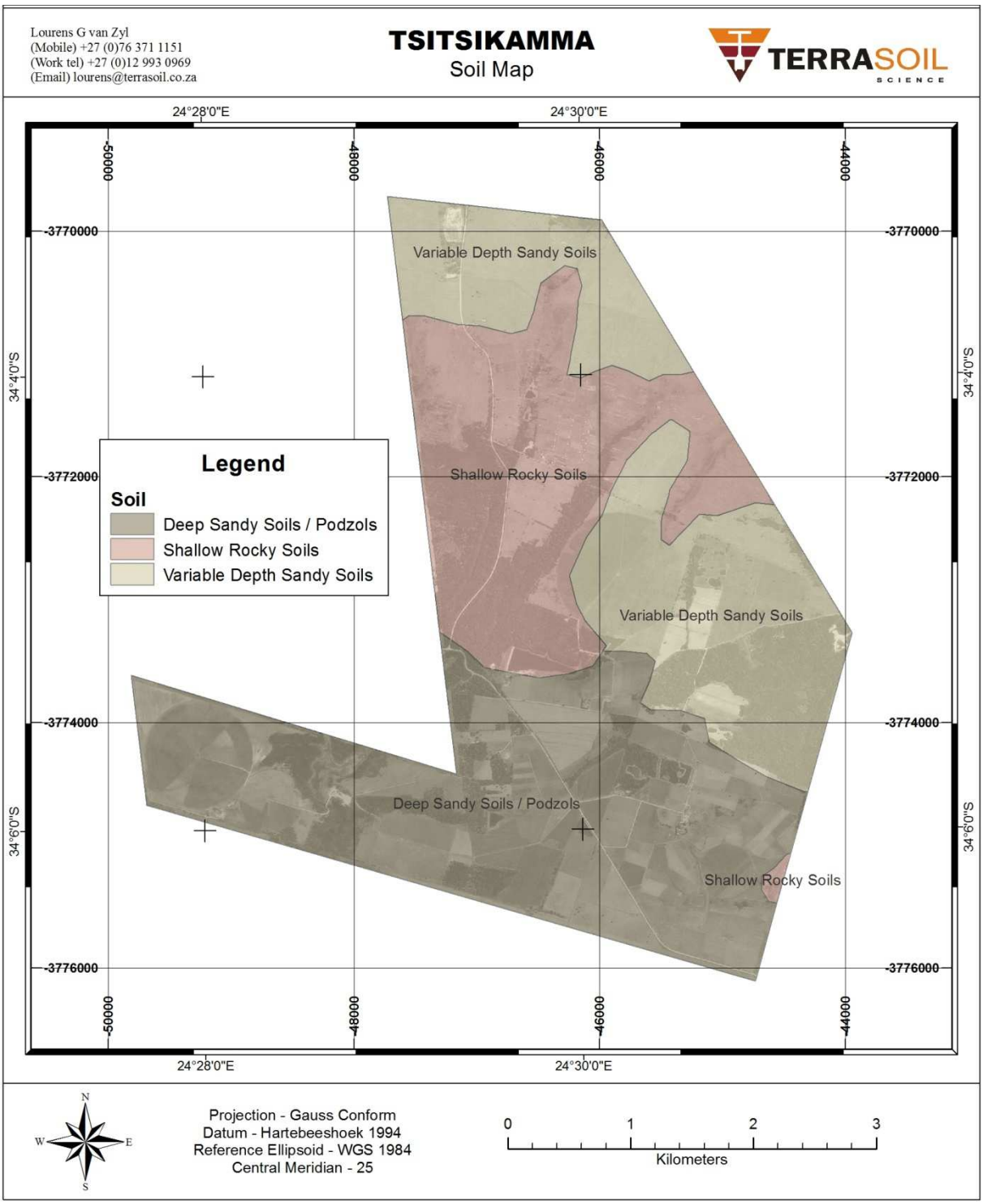

Figure 4 Generalised soil map of the survey site

Figure 5 Wet surface soil horizon in soil auger

Figure 6 Streaking of soil on soil auger – no soil could be extracted from the sample pit

Figure 7 Free water in the auger pit

Figure 8 Rock outcrops with Mispah soils in between

Figure 9 Rock outcrops with Mispah soils in between

Figure 10 Rock outcrops with Mispah soils in between

Figure 11 Shallow and rocky soil of the Glenrosa form

3.2.3.2 Deep Sandy Soils

The areas dominated by deep bleached sandy soils (790 ha) exhibit a relatively large degree of variation in soil form. The main soils forms that occur within this landscape include: Fernwood (Orthic A-horizon / E-horizon / Unspecified), Longlands (Orthic A-horizon / E-horizon / Soft Plinthic B-horizon), Wasbank (Orthic A-horizon / E-horizon / Hard Plinthic B-horizon), Kroonstad (Orthic A-horizon / E-horizon / G-horizon), Cartref (Orthic A-horizon / E-horizon / Lithocutanic B-horizon), Constantia (Orthic A-horizon / E-horizon / Yellow-brown Apedal B-horizon), Lamotte (Orthic A-horizon / E-horizon / Podzol B-horizon / Unconsolidated material with signs of wetness), Houwhoek (Orthic A-horizon / E-horizon / Podzol B-horizon / Saprolite), Westleigh (Orthic A-horizon / Soft Plinthic B-horizon) and Katspruit (Orthic A-horizon / G-horizon).

Good examples of Constantia / Lamotte soil forms were encountered and photographed in a fresh road cutting on the western edge of the survey site (**Figure 12**) as well as in an erosion donga in the central part of the site (**Figure 13**). One of the few sites where the soil was dry enough to be augured, described and classified a similar soil was found (**Figures 14** to **17**).

Although the site has a large degree of variation in soil form the soils tend to act similarly in terms of their land use and agricultural characteristics (within limits). The essence is that the soils have a very low nutrient storage and holding capacity as well as low water holding capacity in the sandy layers. This has a major impact on the management of the soils in that fertilizer applications have to be such that the minimum is allowed to leach through the profile into the groundwater. In order to do this the land user has to apply small quantities frequently.

Figure 12 Exposed profile (road cutting) of a Constantia/Lamotte soil form

Figure 13 Exposed profile (erosion donga) of a Constantia/Lamotte soil form

Figure 14 Augured profile (Constantia/Lamotte soil form) in the southern section of the site

Figure 15 Bleached A-horizon and E-horizon of the Constantia/Lamotte soil form

Figure 16 Podzol/Yellow Brown Apedal B-horizon (distinction can only be confirmed through chemical analysis) in the Constantia/Lamotte soil form

Figure 17 "Signs of wetness" at the bottom of the profile in the Constantia/Lamotte soil form

3.2.3.3 Variable Depth Sandy Soils

The total area within the survey site covered by the variable depth sandy soils is 566 ha. The dominant soils occurring within this area are of the Glenrosa (Orthic A-horizon / Lithocutanic B-horizon), Cartref (Orthic A-horizon / E-horizon / Lithocutanic B-horizon) and Houwhoek

(Orthic A-horizon / E-horizon / Podzol B-horizon / Saprolite) forms with varying depth profiles. A number of exposed profiles were found and photographed (**Figures 18** to **21**).

Figure 18 Exposed profile of variable depth sandy soils of different soil forms (Glenrosa, Cartref and Houwhoek).

Figure 19 Exposed profile of Cartref soil form

Figure 20 Exposed profile of Cartref soil form

Figure 21 Exposed profile of Glenrosa soil form

4. INTERPRETATION OF SOIL, LAND CAPABILITY AND LAND USE SURVEY RESULTS

The interpretation of the land use and land capability results yielded a number of aspects that are of importance to the project.

4.1 Agricultural Potential

The agricultural potential of the site is directly linked to the soils. The shallow and rocky soils are predominantly of **low** potential and the deeper sandy soils are of **medium** potential. The potential of the sandy soils is limited due to their sandy nature leading to low nutrient and water holding capacity. This is especially relevant in an area with variable rainfall (**Figure 15**). In the cases where irrigation infrastructure has been established the potential of the soils increases to **high**. The high potential comes at a price in the form of distinct risks of nutrient leaching leading to losses in agriculture and to eutrophication of water sources (groundwater and surface water – **Figures 23** to **26**). The agricultural use is limited to grazing with improved pastures under irrigation as well as plantations (**Figures 27** and **28**).

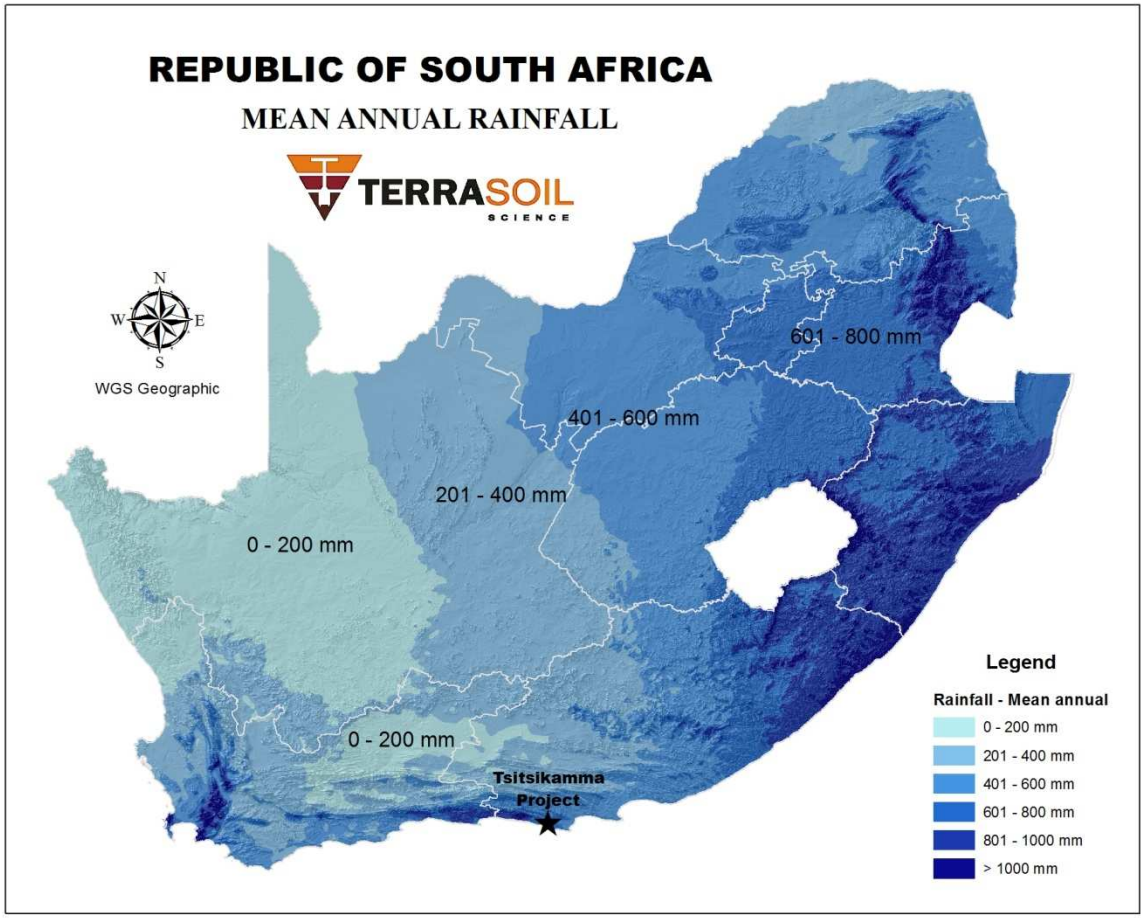

Figure 22 Rainfall map of South Africa indicating the survey site

Figure 23 Sedimentation on the survey site

Figure 24 Surface water impacts on the survey site

Figure 25 Surface water impacts on the survey site

Figure 26 Surface water impacts and eutrophication (algal growth) on the survey site

Figure 2 Wattle plantation on the survey site

Figure 28 Irrigation practices on the survey site

4.2 Wetland Distribution

The wetland distribution is linked to the topography of the site and its associated drainage features (**Figure 29**). The wetlands identified during the aerial photograph interpretation (**Figure 3**) are more extensive than the drainage features indicated on the contour map. The explanation is straight forward in the sense that sandy soil areas often exhibit extensive seepage wetland zones that are also reflected in vegetation distribution. Most of the wetlands within the agricultural areas have been impacted severely but a few areas still appear relatively intact (**Figures 30** and **31**).

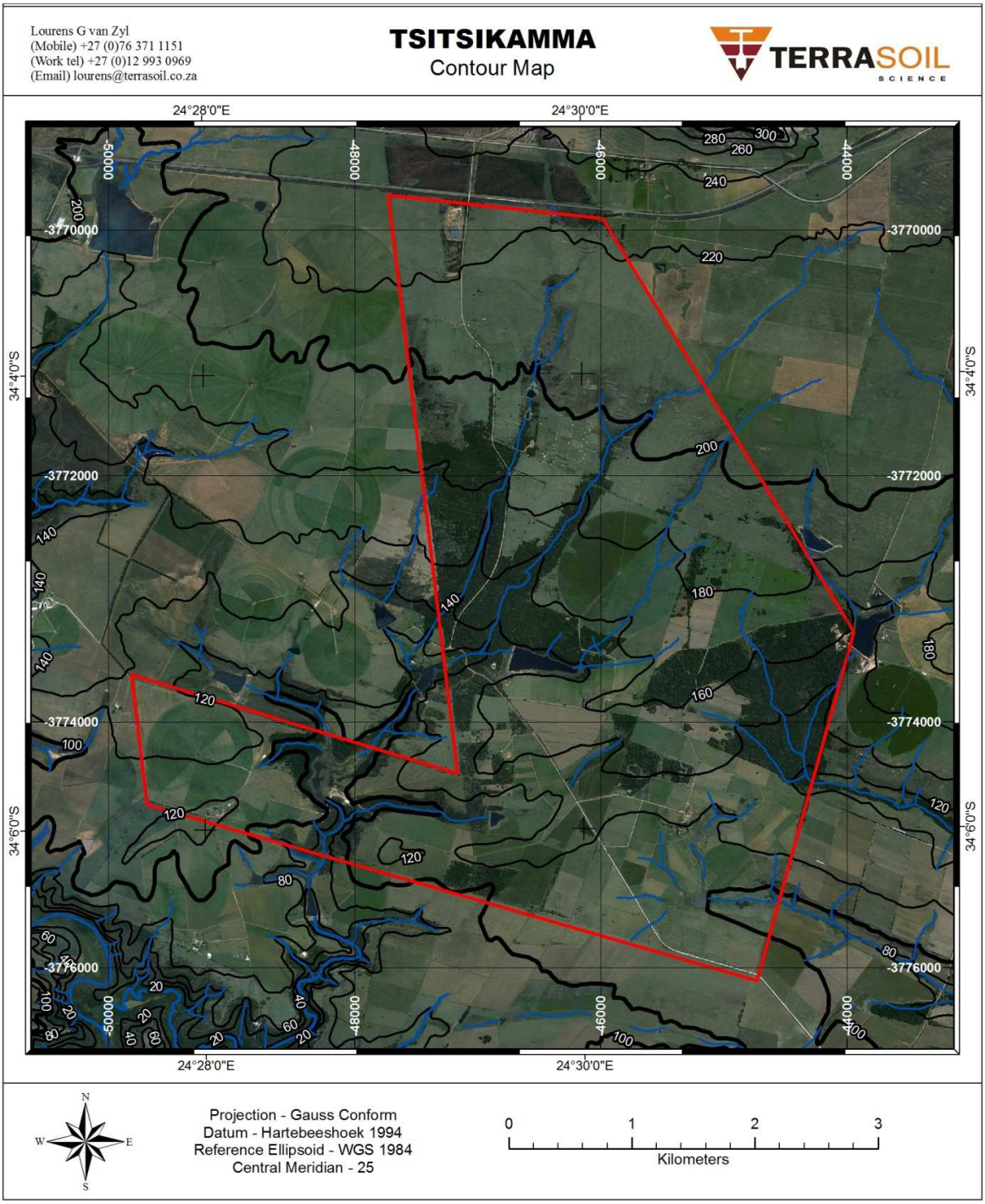

Figure 29 Topography of the site indicating drainage features

Figure 30 Relatively intact wetland vegetation on the south eastern edge of the site

Figure 31 Relatively intact wetland vegetation on the south eastern edge of the site

4.3 Overall Soil Impacts

The presence of pastures and cattle production has already lead to significant impact on the site relating to erosion and sediment generation (**Figures 32** to **34**) as well as eutrophication (discussed earlier). For the development of the turbines the overall soil impacts are expected to be relatively low for the shallow soil zones but will be very high for areas with established irrigation infrastructure. Impacts are generally restricted to small areas around the turbine foundation as well as the transmission and road infrastructure. Erosion control measures will have to be implemented to prevent and contain erosion associated with soil surface disturbance due to construction activities.

The impacts of the wind turbines on cattle production are not addressed in this report as they will have to be addressed by a dedicated specialist on cattle.

Figure 32 Sedimentation on the site due to erosion in other parts

Figure 33 Erosion due to erodible materials and human activities

Figure 34 Erosion due to erodible materials and human activities

4.4 Overall Land Impacts

The landscape on the site has been divided into areas of different sensitivity (low, medium and high) as a function of land use, agricultural use and wetland zones (**Figure 35**). From this map it is evident that a number of turbines fall within areas of high and medium sensitivity (**Table 3**). Some of the turbines are situated on the edge of potential wetland zones and could be excluded once a dedicated wetland delineation study has been conducted.

Table 3 Turbines occurring in areas of low, medium and high sensitivity

Sensitivity	Turbine Numbers
Low	T1, T2, T3, T4, T5, T6, T10, T12, T20, T28, T29, T30, T31
Medium	T7, T8, T9, T11, T13, T14, T15, T16, T18, T19, T21, T22, T23, T24, T26, T27
High	T17, T25

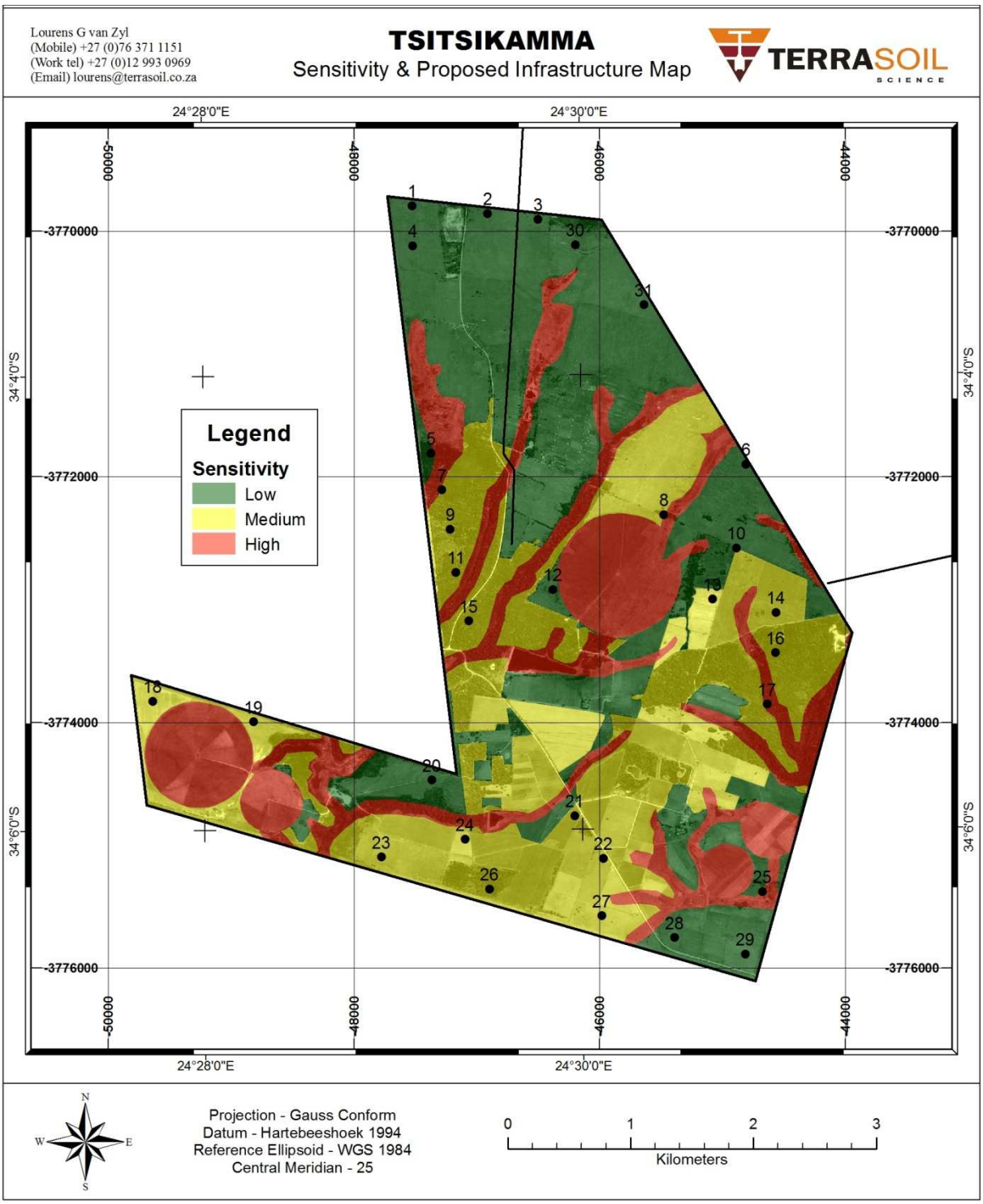

Figure 35 Sensitivity of the site with turbine positions

5. ASSESMENT OF IMPACT

5.1 Assessment Criteria

The following assessment criteria (**Table 4**) will be used for the impact assessment.

Table 4 Impact Assessment Criteria

CATEGORY	DESCRIPTION OF DEFINITION
Direct, indirect and cumulative impacts	In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Nature	A description of the cause of the effect, what will be affected and how it will be affected.
Extent (Scale) • 1 • 2 • 3 • 4 • 5	The area over which the impact will be expressed – ranging from local (1) to regional (5).
Duration • 1 • 2 • 3 • 4 • 5	Indicates what the lifetime of the impact will be. • Very short term: 0 – 1 years • Short-term: 2 – 5 years • Medium-term: 5 – 15 years • Long-term: > 15 years • Permanent
Magnitude • 2 • 4 • 6 • 8 • 10	This is quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
Probability • 1 • 2 • 3 • 4 • 5	Describes the likelihood of an impact actually occurring. • Very Improbable • Improbable • Probable • Highly probable • Definite
Significance	The significance of an impact is determined through a synthesis of <u>all</u> of the above aspects.

CATEGORY	DESCRIPTION OF DEFINITION
	S = (E + D + M)*P S = Significance weighting E = Extent D = Duration M = Magnitude
Status • Positive • Negative • Neutral	Described as either positive, negative or neutral
Other	• Degree to which the impact can be reversed • Degree to which the impact may cause irreplaceable loss of resources • Degree to which the impact can be mitigated

5.2 List of Activities for the Site

Table 5 lists the anticipated activities for the site. The centre two columns in the table list the anticipated forms of soil degradation and geographical distribution of the impacts.

Table 5 List of activities and their associated forms of soil degradation

Activity	Form of Degradation	Geographical Extent	Comment (Section described)
Construction Phase			
Construction of turbines (foundations)	Physical degradation (compound)	Two dimensional	Impact small im low sensitivity areas due to localised nature (Section 5.4.1)
Construction of buildings and other infrastructure	Physical degradation (compound)	Two dimensional	(Section 5.4.2)
Construction of roads	Physical degradation (compound)	Two dimensional	(Section 5.4.3)
Construction of power lines	Physical degradation (compound)	Two dimensional	(Section 5.4.4)
Construction and Operational Phase Related Effects			
Vehicle operation on site	Physical and chemical degradation (hydrocarbon spills)	Mainly point and one dimensional	(Section 5.4.5)
Dust generation	Physical degradation	Two dimensional	(Section 5.4.6)

5.3 Assessment of the Impacts of Activities

Many of the impacts are generic and their impacts will remain similar for most areas on the site. The generic activity will therefore be assessed. The impacts associated with the different activities have been assessed below for each activity. These impacts have been summarized in **Table 12**.

5.3.1 Construction of Turbine Foundations

Table 6 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of turbine foundations.

Table 6 Construction of turbine foundations

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be relatively small as the turbines are spread out and have small footprints.
Nature	This activity entails the construction of turbines (with a foundation) with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed (3 – if construction takes place within a high sensitivity area)
Duration	5 – Permanent (unless removed)
Magnitude	4 (10 – if construction takes place in high sensitivity areas)
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 4)*4 = 40 (low and medium sensitivity areas) S = (3 + 5 + 10)*4 = 72 (high sensitivity areas)
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.2 Construction of Buildings and Other Infrastructure

Table 7 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of buildings and other infrastructure.

Table 7 Construction of buildings and other infrastructure

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small as it is limited in extent on land with variable agricultural potential.
Nature	This activity entails the construction of buildings and other infrastructure with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed (3 – if construction takes place within a high sensitivity area)
Duration	5 – Permanent (unless removed)
Magnitude	4 (10 – if construction takes place in high sensitivity areas)
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 4)*4 = 40 (low and medium sensitivity areas) S = (3 + 5 + 10)*4 = 72 (high sensitivity areas)
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.3 Construction of Roads

Table 8 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of roads.

Table 8 Construction of roads

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small as it is linear and limited in geographical extent.
Nature	This activity entails the construction of roads with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed along the road (3 – if construction takes place within a high sensitivity area)
Duration	5 – Permanent (unless removed)
Magnitude	4 (10 – if construction takes place in high sensitivity areas)
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 4)*4 = 40 (low and medium sensitivity areas) S = (3 + 5 + 10)*4 = 72 (high sensitivity areas)
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area and keep to existing roads as far as possible

5.3.4 Construction of Power Lines

Table 9 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of power lines.

Table 9 Construction of power lines

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small as it is linear and limited in geographical extent. Impacts are only associated with pylon foundations and not the line.
Nature	This activity entails the construction of power lines with the associated disturbance of soils and existing land use ate each pylon point.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area of the pylon footprint. (3 – if construction takes place within a high sensitivity area)
Duration	5 – Permanent (unless removed)
Magnitude	2 (10 – if construction takes place in high sensitivity areas)
Probability	2 (improbable due to localised impact) 4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*2 = 16 (low and medium sensitivity areas) S = (3 + 5 + 10)*4 = 72 (high sensitivity areas)
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area and keep to existing roads as far as possible for placement of power line.

5.3.5 Vehicle Operation on Site

It is assumed that vehicle movement will be restricted to the construction site and established roads. Vehicle impacts in this sense are restricted to spillages of lubricants and petroleum products. **Table 10** presents the impact criteria and a description with respect to soils, land capability and land use for the operation of vehicles on the site.

Table 10 Assessment of impact of vehicle operation on site

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small if managed.
Nature	This activity entails the operation of vehicles on site and their associated impacts in terms of spillages of lubricants and petroleum products
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	2 – Short-term
Magnitude	2
Probability	4 (2 with prevention and mitigation)
Significance of impact	S = (1 + 2 + 2)*4 = 20 (10 with prevention and mitigation)
Status	Negative
Mitigation	Maintain vehicles, prevent and address spillages

5.3.6 Dust Generation

Generated dust can impact large areas depending on environmental and climatic conditions. **Table 11** presents the impact criteria and a description with respect to soils, land capability and land use for dust generation on the site.

Table 11 Assessment of impact of dust generation on site

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small if managed but can have widespread impacts if ignored.
Nature	This activity entails the operation of vehicles on site and their associated dust generation
Extent	2 - Local: The impact is diffuse (depending on environmental and climatic conditions) and will probably be limited to within 3 – 5 km of the site
Duration	2 – Short-term
Magnitude	2
Probability	4 (2 with mitigation and adequate management)
Significance of impact	S = (2 + 2 + 2)*4 = 24 (12 with mitigation and adequate management)
Status	Negative
Mitigation	Limit vehicle movement to absolute minimum, construct proper roads for access

Table 12 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) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance*	16 (Low)	16 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but indirect impacts can be minimised and avoided through adequate planning of layout	
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. Mitigation is restricted to the limitation of the extent of the impact to the immediate area of impact and minimisation of off-site impacts		
Cumulative impacts: Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures should be implemented.		
Residual Impacts: The loss of agricultural land is a long term loss. This loss extends to the post-construction phase. The agricultural potential is variable though and negative impacts can be limited through adequate planning for the layout.		

6. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the proposed development of a wind energy facility on the site will have potentially large impacts in areas of high sensitivity and these areas are therefore considered no-go areas for development.

The current land use of cattle production on irrigated fields has impacted negatively on wetlands and has the potential to add to eutrophication of surface water sources. It is recommended that land users prevent cattle trampling of soil in drainage depressions and that natural wetland vegetation be re-established in these lines.

Regarding the construction of turbines and associated infrastructure the following recommendations are made:

1. Limit physical impacts to as small a footprint as possible;

2. Site management has to be implemented with the appointment of a suitable environmental control officer (ECO) to oversee the process, address problems and recommend and implement corrective measures;
3. Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads);
4. Plan the road and site layout in such a way as to make maximal use of existing roads and fence/border areas to minimise impacts and to keep grazing and natural units as intact as possible; and
5. Prevent dust generation and vehicle associated pollution an spillages.

The impacts on the site need to be viewed in relation to the opencast mining of coal in areas of high potential soils – such as the Eastern Highveld. With this comparison in mind the impact of a wind energy facility is negligible compared to the damaging impacts of coal mining – for a similar energy output. Therefore, in perspective, the impacts of the proposed facility can be motivated as necessary in decreasing the impacts in areas where agriculture potential plays a more significant role.

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.

MACVICAR, C.N. et al. 1977. *Soil Classification. A binomial system for South Africa.* Sci. Bull. 390. Dep. Agric. Tech. Serv., Repub. S. Afr., Pretoria.

MACVICAR, C.N. et al. 1991. *Soil Classification. A taxonomic system for South Africa. Mem. Agric. Nat. Resour. S.Afr.* No.15. Pretoria.