EIA LEVEL REPORT

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

PROPOSED ILANGA LETHEMBA PHOTOVOLTAIC SOLAR ENERGY FACILITY: DE AAR, NORTHERN CAPE

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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

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SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY – PROPOSED ILANGA LETHEMBA PHOTOVOLTAIC SOLAR ENERGY FACILITY: DE AAR, NORTHERN CAPE

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 Ilanga Lethemba Photovoltaic Solar Energy Facility on Portion 3 of the Farm Paarde Valley 145, in the Northern Cape Province.

2. INTRODUCTION

2.1 Study Aim and Objectives

The study area has been proposed to serve as a locality for the construction of a photovoltaic solar 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 solar panels and infrastructure.

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 lies between 30° 34’ 03’’ and 30° 37’ 45’’ south and 24° 02’ 10’’ and 24° 06’ 58’’ east 8 km north-northeast of the town of De Aar in the Northern Cape Province (**Figure 1**).

2.4 Survey Area Physical Features

The survey area lies predominantly on relatively flat terrain between 1220 and 1260 m above mean sea level with a distinct hill in the east up to 1380 m above mean sea level. The geology of the area is dominated by dolerite with aeolian sands in the western side (the bulk of the site) and by shale with sandstone and dolerite outcrops (with aeolian sands) in the east.

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).

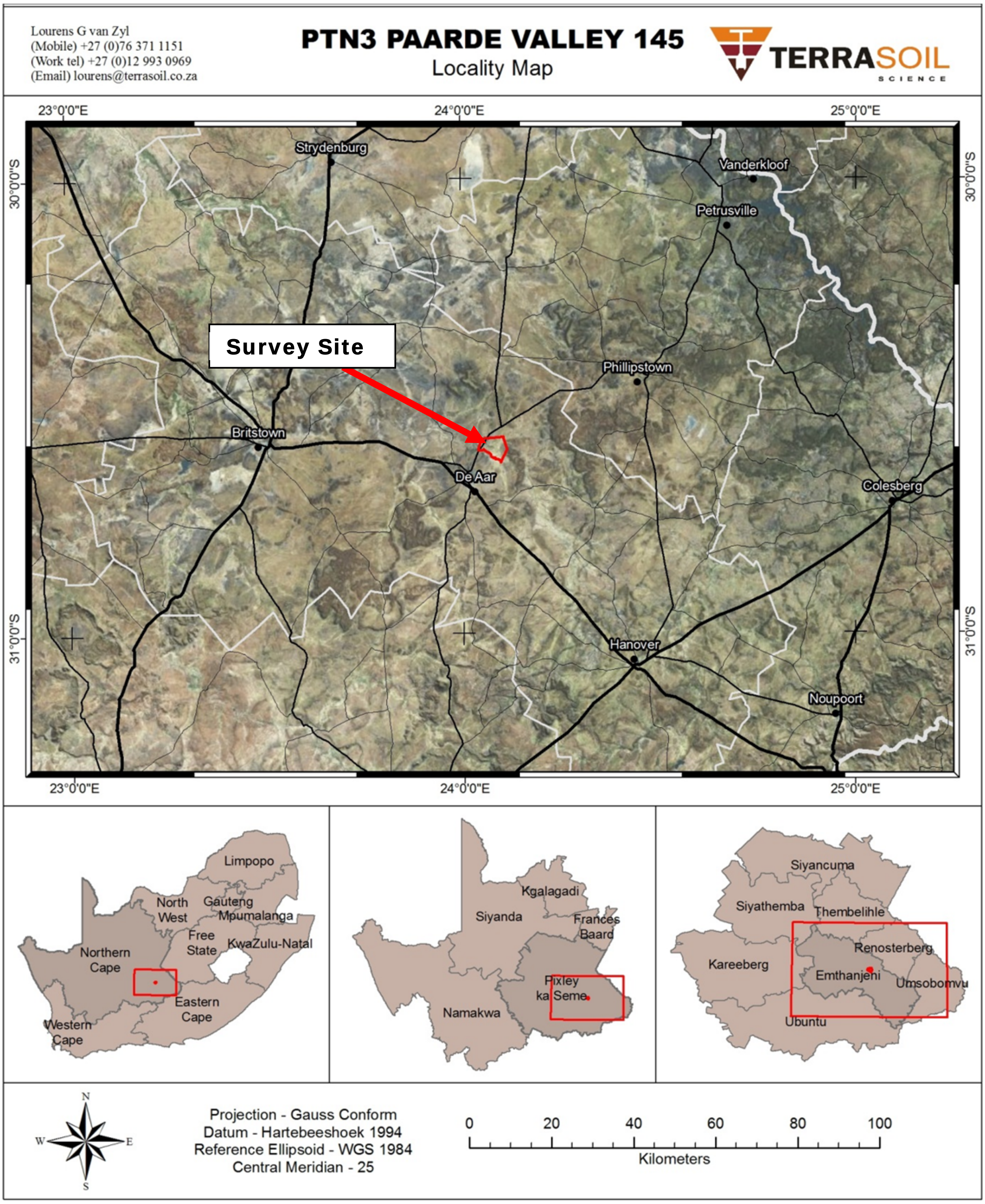

Figure 1 Locality of the survey site

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 11th of May, 2011, during which a reconnaissance soil survey was conducted. The site was traversed in a vehicle and on foot with the aim of ascertaining as much of the soil variability as possible within a limited timeframe and site accessibility constraints. Soils were described and photographs were taken of pertinent soil, landscape and land use characteristics. Seven soil samples were collected from three locations in order to determine soil chemical and physical parameters that could influence the long-term viability of irrigation practices on the site. The soil samples were submitted for analysis to the soil laboratory of the Department of Plant Production and Soil Science of the University of Pretoria. In addition, a water sample was collected to determine aspects such as water quality and Na levels. This sample was submitted to the laboratory of Clean Stream Scientific Services (CSSS) in Pretoria.

3.2 Survey Results

3.2.1 Phase 1: Land Type Data

Portion 3 of the Farm Paarde Valley 145 lies predominantly in the **Ae138** land type with the eastern sections lying in the **Ae139** and **Fb72** land types (Land Type Survey Staff, 1972 - 2006). (Refer to **Figure 2** for the land type map of the area.) Below follows a brief description of the land type in terms of soils, land capability, land use and agricultural potential.

Land Type Ae138

Soils: Shallow apedal (structureless) to structured soils in higher lying and midslope landscape positions. Rocky outcrops occur throughout. Duplex and variably structured soils with signs of incipient soil formation occur in footslope to valley bottom positions. Soils derived mainly from weathering of dolerite under arid conditions as well as wind-derived sands (aeolian deposits).

Land capability and land use: Mainly extensive grazing due to climatic constraints. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses are limited due to the lack of large volumes of water.

Agricultural potential: Low potential due to shallow soils and low and erratic rainfall (in the region of 300 mm per year – **Figure 3**). Dryland crop production is not viable in areas with rainfall lower than 500 mm unless significant shallow groundwater is available (not the case for the specific survey site).

Land Type Ae139

Soils: Shallow to moderately deep apedal (structureless) to structured soils in higher lying and midslope landscape positions. Soils often exhibit lime accumulation in the matrix. Rocky outcrops occur throughout. Duplex and variably structured soils with signs of incipient soil formation occur in footslope to valley bottom positions. Soils derived mainly from weathering of dolerite and shale under arid conditions as well as wind derived sands (aeolian deposits).

Land capability and land use: Mainly extensive grazing due to climatic constraints. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses are limited due to the lack of large volumes of water.

Agricultural potential: Low potential due to shallow soils and low and erratic rainfall (in the region of 300 mm per year – **Figure 3**). Dryland crop production is not viable in areas with rainfall lower than 500 mm unless significant shallow groundwater is available (not the case for the specific survey site).

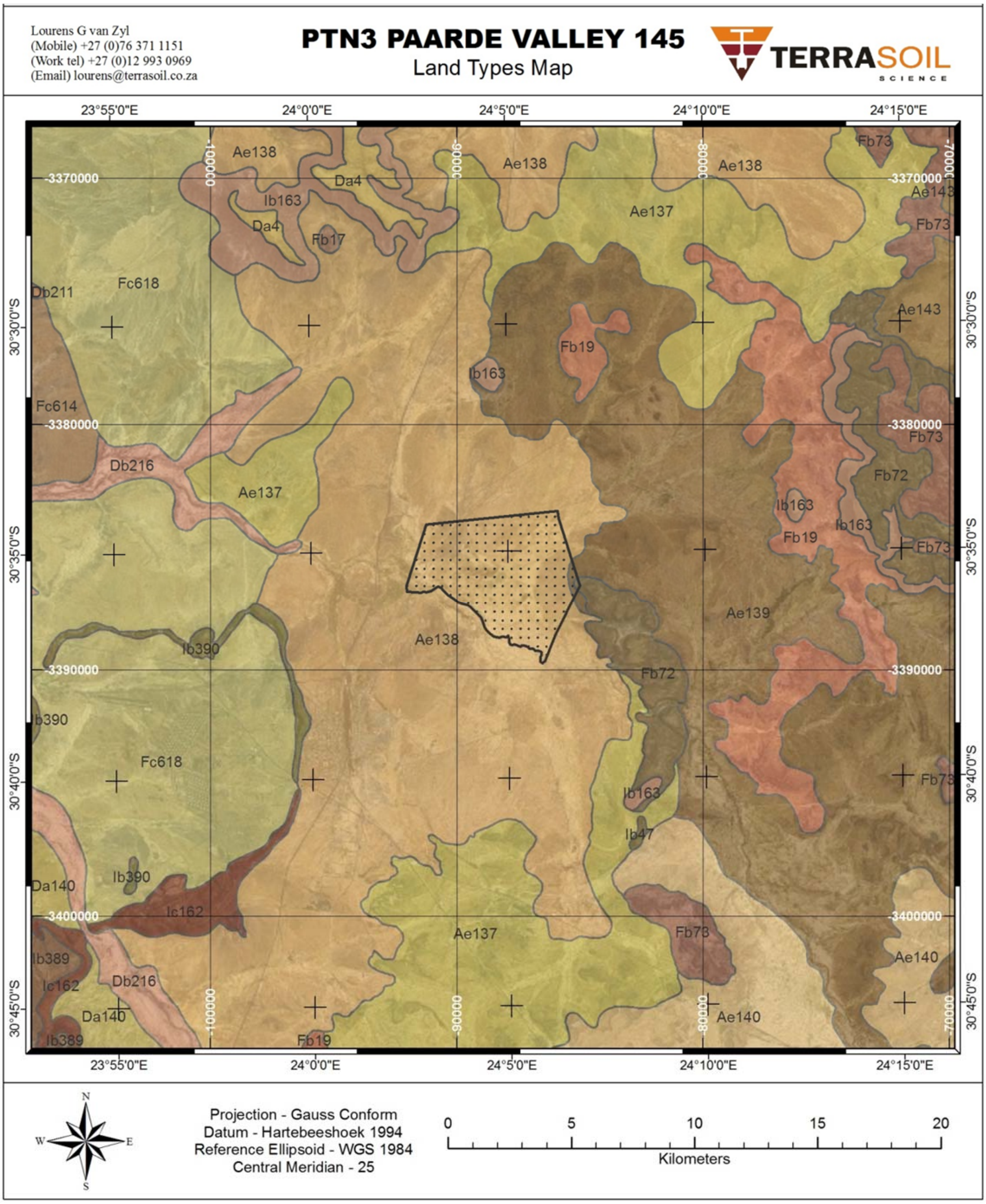

Figure 2 Land type map of the survey site

Land Type Fb72

Soils: Very shallow apedal (structureless) to structured soils in higher lying and midslope landscape positions with numerous rock outcrops. Duplex and variably structured soils with signs of incipient soil formation occur in footslope to valley bottom positions. Soils derived mainly from weathering of sandstone and shale, with the occasional dolerite outcrop, under arid conditions as well as wind derived sands (aeolian deposits).

Land capability and land use: Mainly extensive grazing due to climatic constraints and steeper slopes. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses are limited due to the lack of large volumes of water.

Agricultural potential: Low potential due to shallow soils, steeper slopes and low and erratic rainfall (in the region of 300 mm per year – **Figure 3**). Dryland crop production is not viable in areas with rainfall lower than 500 mm unless significant shallow groundwater is available (not the case for the specific survey site).

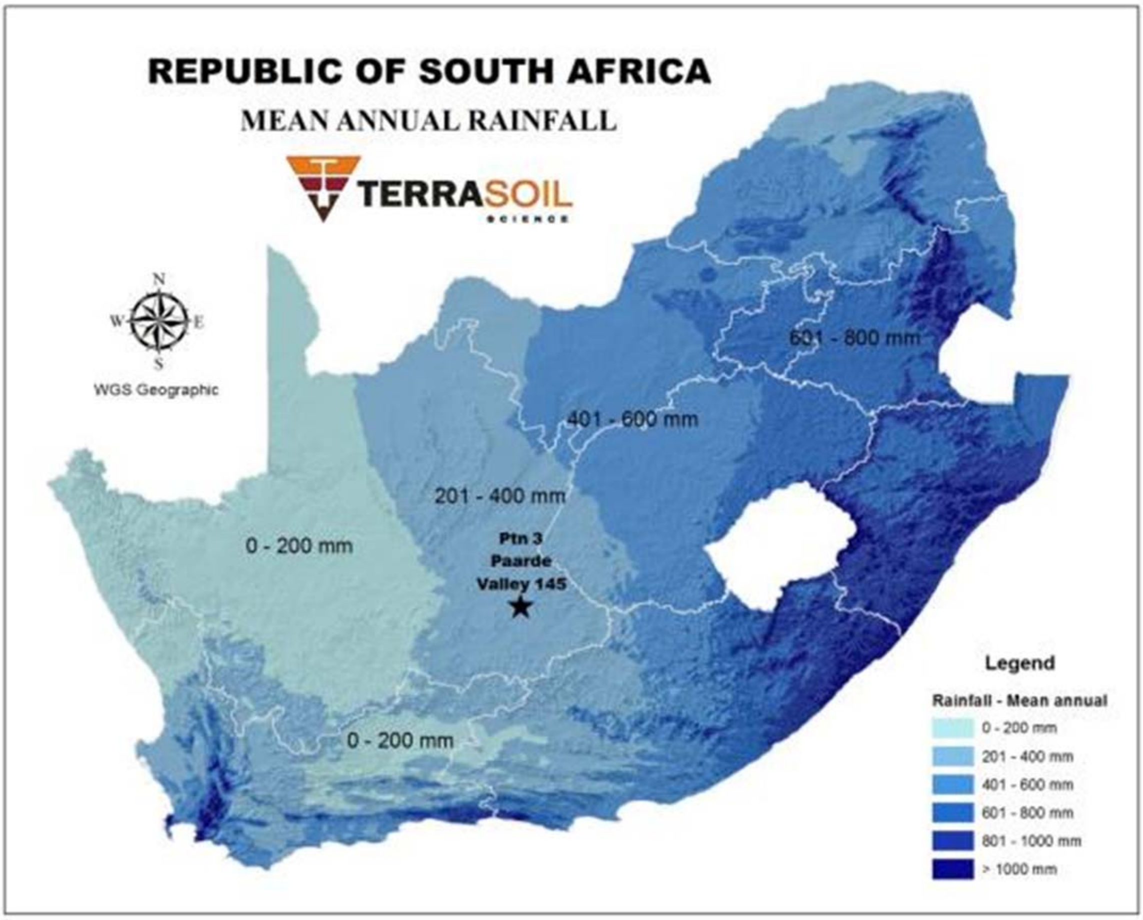

Figure 3 Rainfall map of South Africa indicating the survey site

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

The interpretation of aerial photographs yielded one dominant land use with one other secondary land use. The dominant land use is extensive grazing and the secondary one is irrigated agriculture (**Table 1**). The irrigation area covers 26 ha (1 %) of the entire site.

Table 1 Land use area and percentage for the survey site

Land Use	Area (ha)	Percentage
Grazing	2631	99.0
Irrigated agriculture	26	1.0
Total	**2657**	

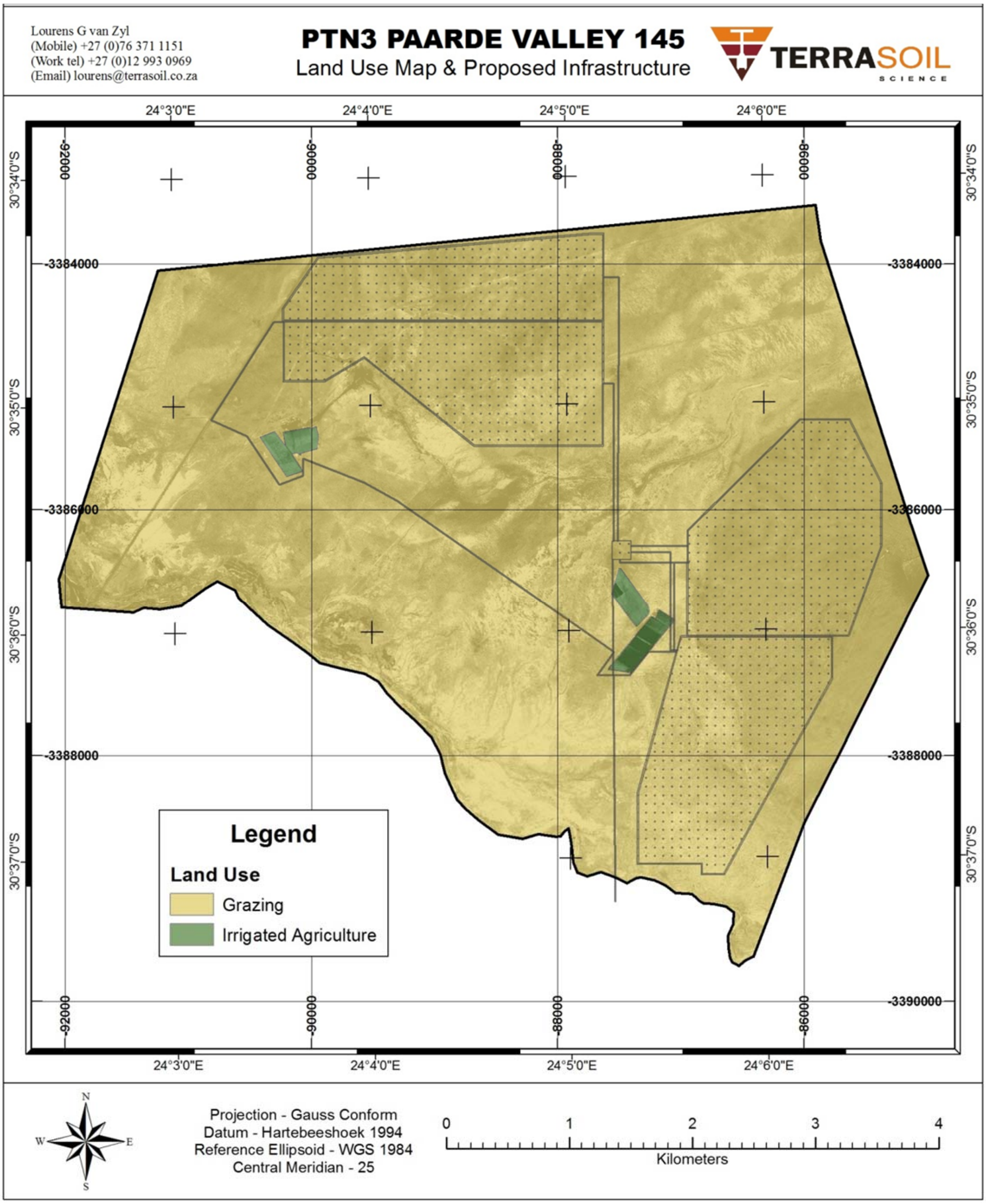

Figure 4 Land use map of the survey area

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 5**. The soils on the site can be divided into four main groups namely 1) variable depth floodplain soils, 2) shallow rocky soils, 3) exposed lime containing soils and 4) freely drained rocky soils. The areal extent of the soils is provided in **Table 2**. A description of each soil group is provided below.

Table 2 Soil zone area and percentage for the survey site

Soil groups	**Area (ha)**	**Percentage**
Variable depth floodplain soils	1452	54.6
Shallow rocky soils	295	11.1
Exposed, lime containing soils	503	19.0
Freely drained rocky soils	408	15.3
Total	**2657**	

3.2.3.1 Variable Depth Floodplain Soils

The total area within the survey site covered by the variable depth floodplain soils is 1452 ha. The process having lead to the formation of these soils appears to be the fact that it lies on relatively level terrain between other topographic features such as hills and elevated areas. In between these elevated areas finer (silty and clayey) soil materials have accumulated over long periods of time to form relatively homogenous soil profiles overlying rock or lime pans. The soils also contain varying levels of lime in the lower parts of the profiles. The dominant soils occurring within this area are of the Mispah (Orthic A-horizon / Hard Rock), Glenrosa (Orthic A-horizon / Lithocutanic B-horizon), Oakleaf (Orthic A-horizon / Neocutanic B-horizon / Unspecified material) and Augrabies (Orthic A-horizon / Neocarbonate B-horizon / Unspecified material) forms. In certain areas soils of the Valsrivier (Orthic A-horizon / Pedocutanic B-horizon / Unconsolidated material without signs of wetness) form also occur. The soil samples collected for analysis were collected as indicated in **Figure 6**. **Figures 7** to **9** indicate the surface conditions of the irrigation sites.

The results of the soil and water analysis are presented in **Tables 3** to **5**. The values indicate that the soils used for irrigation have undergone some accumulation of salts at lower depths. These salts are predominantly of the SO_4 and Cl forms associated with Ca and Mg. From the data it appears that long term irrigation with the water (Table 5) could lead to an increase in salt content and therefore a gradual degradation of the soils. Proper irrigation scheduling is therefore critical to prolong the usable lifetime of the irrigation areas. Leaching appears to be problematic as there is a clear increase in clay content (determined in the field) with depth.

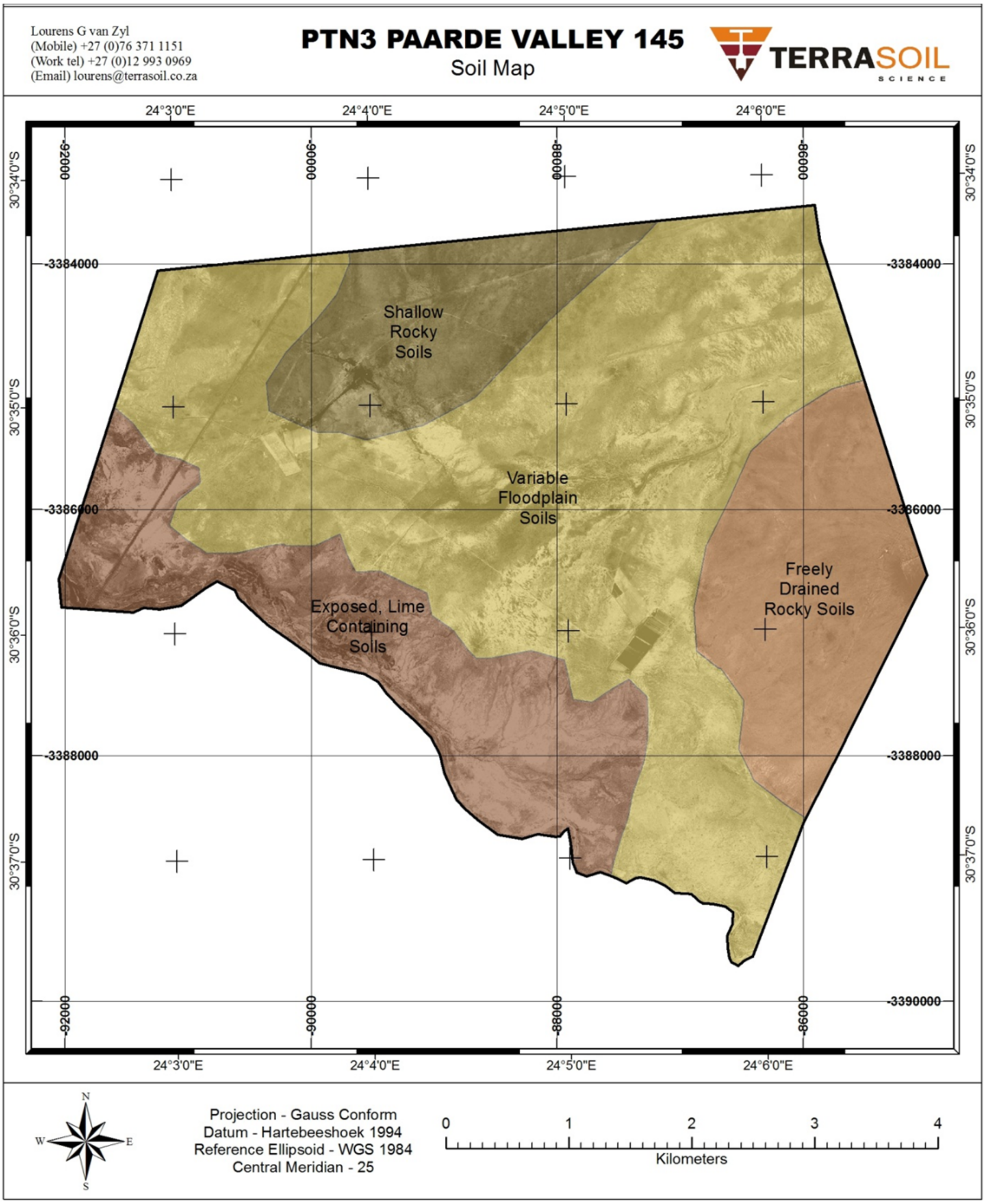

Figure 5 Generalised soil map of the survey site

Figure 6 Irrigated areas and soil sample (for analysis) positions

Table 3 Selected soil chemical properties of the soil samples collected on the site

Sample Point	Depth	pH	P (Bray 1)	Saturated Paste Extract (mg.kg^{-1})				
			mg.kg^{-1}	SO_4	Ca	Mg	K	Na
P2	0-15	8.6	24.5	18.3	16.9	7.6	23.6	14.9
P2	15-40	8.4	0.3	66.6	21.9	15.5	8.7	29.5
P3	0-15	8.1	4.2	17.4	24.3	17.4	6.5	7.9
P3	15-45	8.1	3.2	111	34.2	28.9	4.8	17.8
P3	45-60	8.1	6.5	154.5	51.5	47	6	36.6
P3	60+	8.2	7.1	194.4	42.2	29.7	8.5	53.2
P4	0-30	8	20.5	25.2	14.3	6.6	3.5	17.5

Table 4 Transformed cation concentrations and SAR

Sample Point	Depth	Ca	Mg	K	Na	Ca:Mg	SAR
		cmol(+).kg^{-1}	cmol(+).kg^{-1}	cmol(+).kg^{-1}	cmol(+).kg^{-1}		
P2	0-15	0.08	0.06	0.06	0.06	1.35	0.24
P2	15-40	0.11	0.13	0.02	0.13	0.86	0.37
P3	0-15	0.12	0.14	0.02	0.03	0.85	0.09
P3	15-45	0.17	0.24	0.01	0.08	0.72	0.17
P3	45-60	0.26	0.39	0.02	0.16	0.67	0.28
P3	60+	0.21	0.24	0.02	0.23	0.86	0.48
P4	0-30	0.07	0.05	0.01	0.08	1.32	0.30

Table 5 Water quality of sample collected at borehole at point P3

Parameter	Unit	Value
Electrical Conductivity	$mS.m^{-1}$	112.8
pH		7.85
Total Dissolved Solids	$mg.l^{-1}$	5810
Cl	mg.l	92.5
SO_4	mg.l	79.7
NO_3 (as N)	mg.l	5.8
NH_4 (as N)	mg.l	0
PO_4 (as P)	mg.l	0
F	mg.l	0.24
Ca	mg.l	76.6
Mg	mg.l	67.7
K	mg.l	1.8
Na	mg.l	61.5
Al	mg.l	0
Fe	mg.l	0
Mn	mg.l	0
Total hardness	$mg.l^{-}$	470
SAR		0.39

Figure 7 Irrigated pastures with sheep grazing

Figure 8 Irrigated pastures

Figure 9 Ploughed irrigation fields

3.2.3.2 Shallow Rocky Soils

The area covered by shallow and rocky soils comprises 295 ha on the survey site. This area seems to be underlain by hard rock and lime outcrops and the soils are therefore limited mainly to Mispah (Orthic A-horizon / Hard Rock), Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) and Couga (Orthic A-horizon / Hard Pan Carbonate) and 4) soil forms with the frequent occurrence of rock outcrops.

3.2.3.3 Exposed Lime Containing Soils

This zone covers 503 ha of the survey site and is characterised by soils that are associated with old floodplain soils in the lower lying parts of the landscape. These soils show significant lime accumulation within the profile and this is a result of prolonged seepage and accumulation of base rich water that flowed surface and subsurface wise to this lower part of the landscape. In many cases these soils show signs of surface erosion due to a poor surface cover and high intensity rainstorms in an arid environment.

3.2.3.4 Freely Drained Rocky Soils

This area to the east of the survey site lies slightly higher and covers 408 ha (on the site). It is characterised by hills and rock outcrops with areas showing distinct signs of alluvial and colluvial transport of coarser material in the form of pebbles and rocks (**Figures 10** to **12**). This leads to the formation of relatively deep soils with a rocky matrix in depressions and shallow rocky soils on localised crests. Water drains off this area freely but human impacts in the form of roads and tracks along power lines lead to significant erosion (**Figures 13** to **15**)

Figure 10 Hilly terrain with variable depth soils

Figure 11 Rocks and pebbles on the soil surface with a variable depth rocky subsoil

Figure 12 Rocks and pebbles on the soil surface with a variable depth rocky subsoil

Figure 13 Eskom power lines running across the site

Figure 14 Erosion along power line service tracks

Figure 15 Erosion along power line service tracks

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 determined mainly by the climate in that the rainfall effectively excludes any form of crop production. The site is therefore suited to extensive grazing with a long-term carrying capacity of approximately 6 ha per small stock unit. Where irrigation water is available the agricultural potential increases drastically and crop production as pasture production becomes possible. The area under irrigation is limited by the amount of water available for use at any one time or within a crop production unit (and therefore irrigation cycles). Most of the soils on the site can be used for irrigation but the limiting factor is the available water volume and long-term sustainable yield.

As discussed earlier the soils within the level terrain areas are suitable for irrigation but the long-term sustainability will depend on rotation of irrigation fields, application of a leaching requirement as well as adequate irrigation scheduling. Due to the finer texture of the subsoils within the level terrain area the long-term viability of irrigated agriculture is limited through the limited potential of irrigation induced salt leaching. It is therefore recommended that a large enough area be left open around the current irrigated fields to allow for rotation of fields as well as shift if salt build-up becomes problematic on the current fields.

4.2 Wetland Distribution

The distribution of drainage features on the site is provided in **Figure 16**. From a hydric soil perspective no signs of wetlands were found though. This is predominantly due to the low rainfall and dominance of Fe rich soils on the site. It is recommended though that development be excluded from the drainage features and that adequate storm water management measures be put in place across the site where development is to take place.

4.3 Overall Soil and Land Impacts

Due to the low agricultural potential of the site as well as the variable rainfall the impacts on soils and agriculture is expected to be low – provided that 1) adequate storm water management and erosion prevention measures are implemented and 2) that an adequately large area be left open around the current irrigated fields to allow for rotation and/or expansion. The development outside of the irrigated areas will not have a major impact on agricultural production and it is postulate that with improved irrigation development and scheduling the productivity of the farm can increase.

The sensitivity of the site is indicated in Figure 17. From this map it is clear that the developments will take place outside of the sensitive areas.

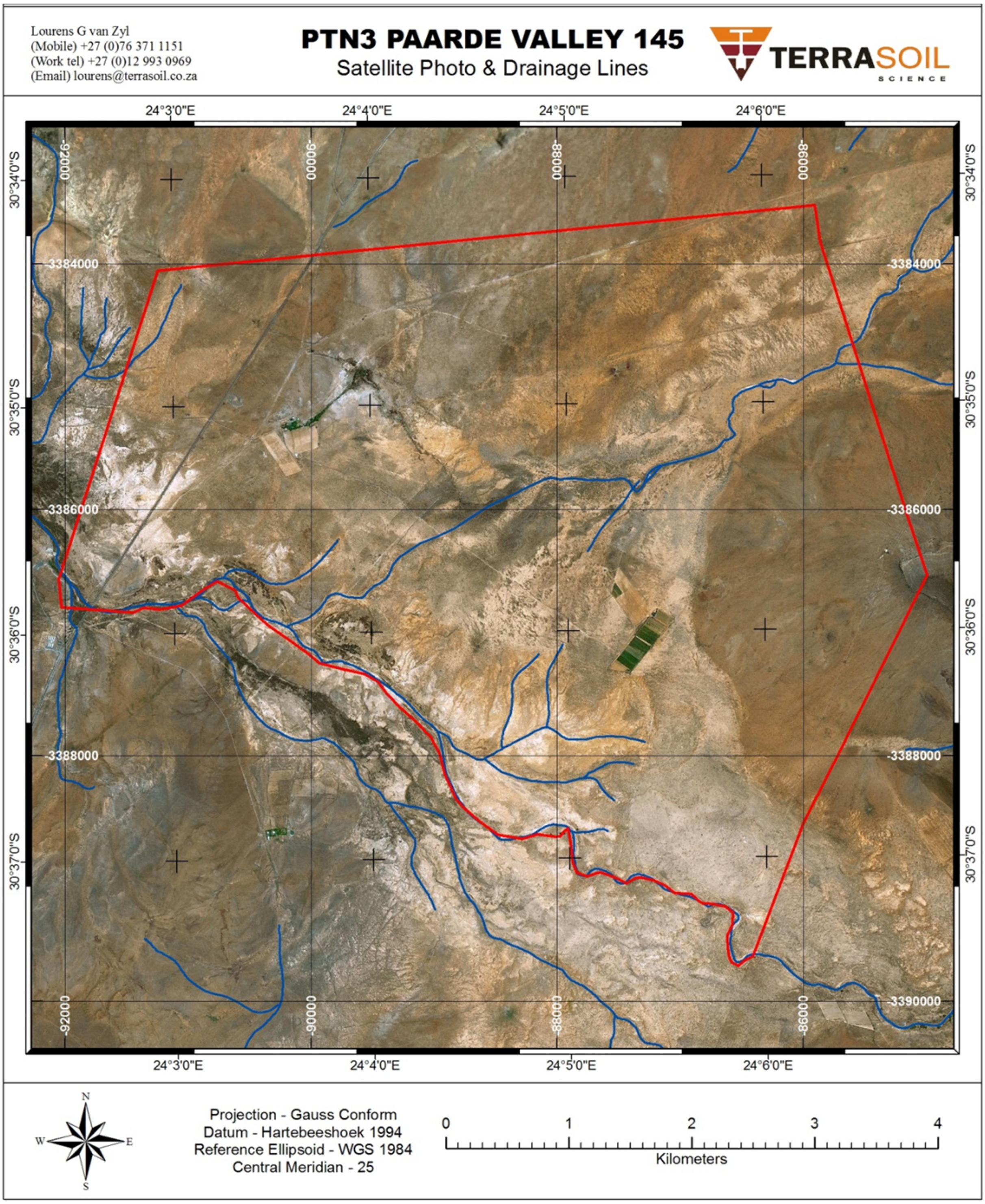

Figure 16 Topography of the site indicating drainage features

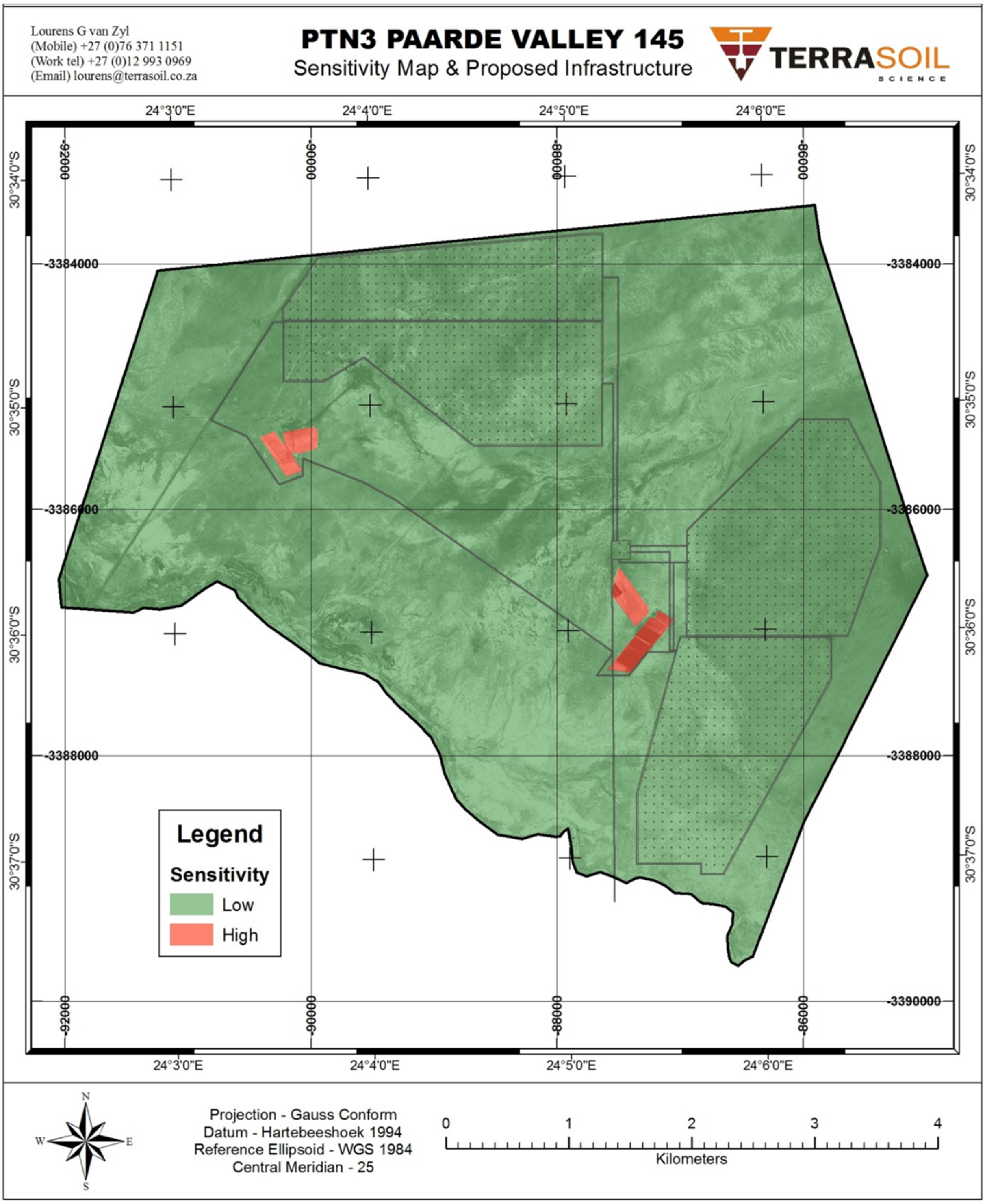

Figure 17 Sensitivity of the site with solar panel infrastructure footprints

5. ASSESMENT OF IMPACT

5.1 Assessment Criteria

The following assessment criteria (**Table 6**) will be used for the impact assessment.

Table 6 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 7 lists the anticipated activities for the site. The last two columns in the table list the anticipated forms of soil degradation and geographical distribution of the impacts.

Table 7 List of activities and their associated forms of soil degradation

Activity	Form of Degradation	Geographical Extent	Comment (Section described)
Construction Phase			
Construction of solar panels and stands	Physical degradation (surface)	Two dimensional	Impact small due to localised nature (Section 5.3.1)
Construction of buildings and other infrastructure	Physical degradation (compound)	Two dimensional	(Section 5.3.2)
Construction of roads	Physical degradation (compound)	Two dimensional	(Section 5.3.3)
Construction and Operational Phase Related Effects			
Vehicle operation on site	Physical and chemical degradation (hydrocarbon spills)	Mainly point and one dimensional	(Section 5.3.4)
Dust generation	Physical degradation	Two dimensional	(Section 5.3.5)

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 13**. **Note:** The impacts listed below indicate that no mitigation is possible. It is important to note that any soil impact in the form of drastic physical disturbance (as with construction activities) is a permanent one and no mitigation is possible. The mitigation that can be applied the restriction of off-site effects due to developments through adequate implementation of environmental management measures (discussed later in the report).

5.3.1 Construction of Solar Panels and Stands

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

Table 8 Construction of solar panels and stands

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small as it is constructed on land with low agricultural potential.
Nature	This activity entails the construction of solar panels and stands 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
Duration	5 – Permanent (unless removed)
Magnitude	2
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.2 Construction of Buildings and Other Infrastructure

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

Table 9 Construction of buildings and other infrastructure

Criteria	Description
Cumulative Impact	The cumulative impact of this activity will be small as it is constructed on land with low 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
Duration	5 – Permanent (unless removed)
Magnitude	2
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.3 Construction of Roads

Table 10 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of roads.

Table 10 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	2 (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 + 2)*4 = 32 (low 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 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 11** 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 11 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

5.3.5 Dust Generation

Generated dust can impact large areas depending on environmental and climatic conditions. **Table 12** presents the impact criteria and a description with respect to soils, land capability and land use for dust generation on the site.

Table 12 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 13 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 (2)	Low (2)
Probability	Highly probable (4)	Highly probable (4)
Significance*	32 (Low)	32 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	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.		
Cumulative impacts: Soil erosion may arise owing to increased 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 very low though.		

5.4 Environmental Management Plan

Tables 14 to **16** provide the critical aspects for inclusion in the EMP.

Table 14 Measures for erosion mitigation and control

Objective: Erosion control and mitigation		
Project components	Soil stabilisation, construction of impoundments and erosion mitigation structures	
Potential Impact	Large scale erosion and sediment generation	
Activity / risk source	Poor planning of rainfall surface runoff and storm water management	
Mitigation: Target / Objective	Prevention of eroded materials and silt rich water running off the site	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan and implement adequate erosion control measures	Construction team and engineer	Throughout project
Performance indicator	Assessment of storm water structures and erosion mitigation measures. Measurement of actual erosion and sediment generation.	
Monitoring	Monitor and measure sediment generation and erosion damage	

Table 15 Measures for limiting vehicle operation impacts on site (spillages)

Objective: Erosion control and mitigation		
Project components	Maintenance of vehicles and planning of vehicle service areas	
Potential Impact	Oil, fuel and other hydrocarbon pollution	
Activity / risk source	Poor maintenance of vehicles and poor control over service areas	
Mitigation: Target / Objective	Adequate maintenance and control over service areas	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Service vehicles adequately	Construction team and engineer	Throughout project
Maintenance of service areas, regular cleanup	Construction team and engineer	Throughout project
Performance indicator	Assessment number and extent of spillages on a regular basis.	
Monitoring	Monitor construction and service sites	

Table 16 Measures for limiting dust generation on site

Objective: Dust generation suppression			
Project components	Limit and address dust generation on site linked to construction activities		
Potential Impact	Large scale dust generation on site		
Activity / risk source	Inadequate dust control measures, excessive vehicle movement on unpaved roads		
Mitigation: Target / Objective	Minimise generation of dust		
Mitigation: Action/control		**Responsibility**	**Timeframe**
Implement dust control strategy including dust suppressants and tarring of roads		Construction team and engineer	Throughout project
Limit vehicle movement on unpaved areas to the absolute minimum		Construction team and engineer	Throughout project
Performance indicator	Assessment of dust generated on site		
Monitoring	Monitor construction site and surrounds		

6. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the proposed development of a photovoltaic facility on the site, outside of the current irrigation areas, will not have large impacts due to the low agricultural potential of the site. The long-term challenges regarding the management of salts in the irrigated soils are problematic and can be managed through adequate field rotation, irrigation scheduling and application of a leaching requirement. In this regard it is recommended that the land owner appoint an irrigation specialist to draw up a dedicated plan for irrigation scheduling and salt management. The proper management of the irrigated fields could improve the production on the site to beyond the current values.

There are three aspects that have to be managed on the site. These are:

1. Erosion must be controlled through adequate mitigation and control structures.
2. Impacts from vehicles, such as spillages of oil and hydrocarbons, should be prevented and mitigated.
3. Dust generation on site should be mitigated and minimised as the dust can negatively affect the quality of pastures as well as sheep production.

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 solar 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.

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