EIA LEVEL REPORT

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

PROPOSED RAMPHELE PHOTOVOLTAIC SOLAR ENERGY FACILITY: RITCHIE, NORTHERN CAPE PROVINCE

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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

Table of Contents

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY – PROPOSED RAMPHELE PHOTOVOLTAIC SOLAR ENERGY FACILITY: RITCHIE, NORTHERN 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 Ramphele Photovoltaic Solar Energy Facility on Portion 10 of the Farm Klipdrift and on the Farm Kookfontein 109 near Ritchie 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 29° 02' 52'' and 29° 07' 43'' south and 24° 33' 42'' and 24° 36' 30'' east 38 km south south-west of the town of Kimberley in the Northern Cape Province (**Figure 1**).

2.4 Survey Area Physical Features

The survey area lies on relatively flat terrain with a general north north-easterly aspect between 1110 and 1160 m above mean sea level. The site has a number of wetland features (depressions and indistinct water courses) scattered throughout. The northern section of the site has an indistinct water course draining towards the Riet Rivier. The geology of the site consists of aeolian sands and alluvium with occasional dolerite outcrops.

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).

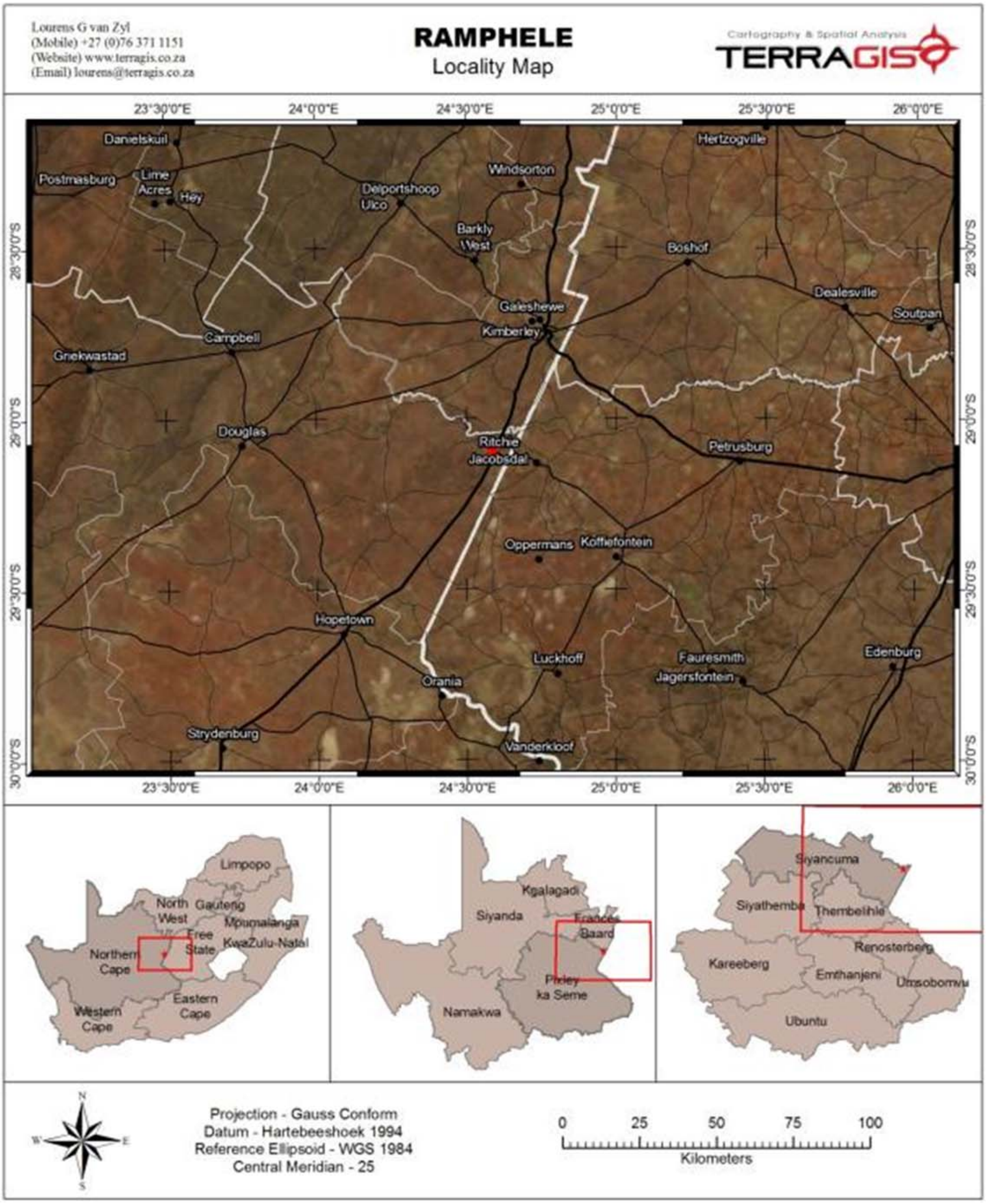

Figure 1 Locality of the survey site

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 as well as historic land uses such as cultivation.

3.1.3 Phase 3: Site Visit and Soil Survey

A site visit was conducted on the 28th of June, 2011, during which a soil survey was conducted. The site was traversed on foot and in a vehicle with the aim of ascertaining as much of the soil variability as possible. Soils were described and photographs were taken of pertinent soil, landscape and land use characteristics. The drainage features on the site were specifically investigated for signs of wetness in the soils in order to determine wetland conditions according to the Wetland Delineation Guidelines (WDG) as published by DWAF (2005).

3.2 Survey Results

3.2.1 Phase 1: Land Type Data

The northern section of the site falls into the **Ag145** land type and the southern section falls into the **Ae15** land type (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 Ag145

Soils: Shallow red apedal (structureless) soils on hard pan carbonate horizons (calcrete) with occasional calcrete outcrops. Soils are derived mainly from aeolian and alluvial origin.

Land capability and land use: Mainly extensive grazing due to climatic and soil constraints. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses only present in areas with adequate water provision through irrigation infrastructure.

Agricultural potential: Low potential due to shallow soils and low and erratic rainfall (in the region of 300-400 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). Irrigation is practiced in certain sections where deeper soils occur and where irrigation infrastructure has been established.

Land Type Ae15

Soils: Variable depth soils dominated by sandy red soils with occasional occurrence of structured soils.

Land capability and land use: Mainly extensive grazing due to climatic and soil constraints. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses only present in areas with adequate water provision through irrigation infrastructure.

Agricultural potential: Refer to Land Type Ag145.

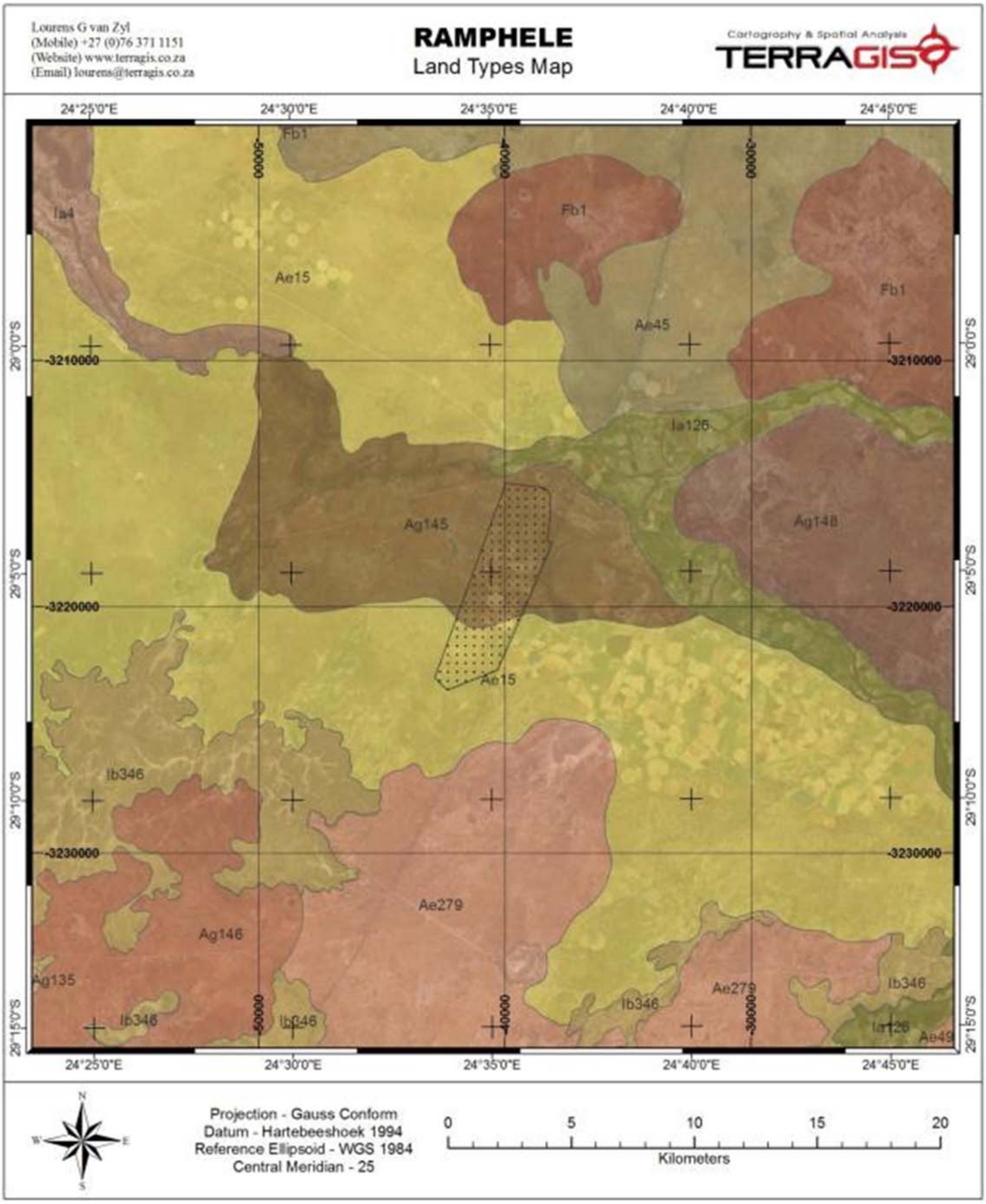

Figure 2 Land type map of the survey site

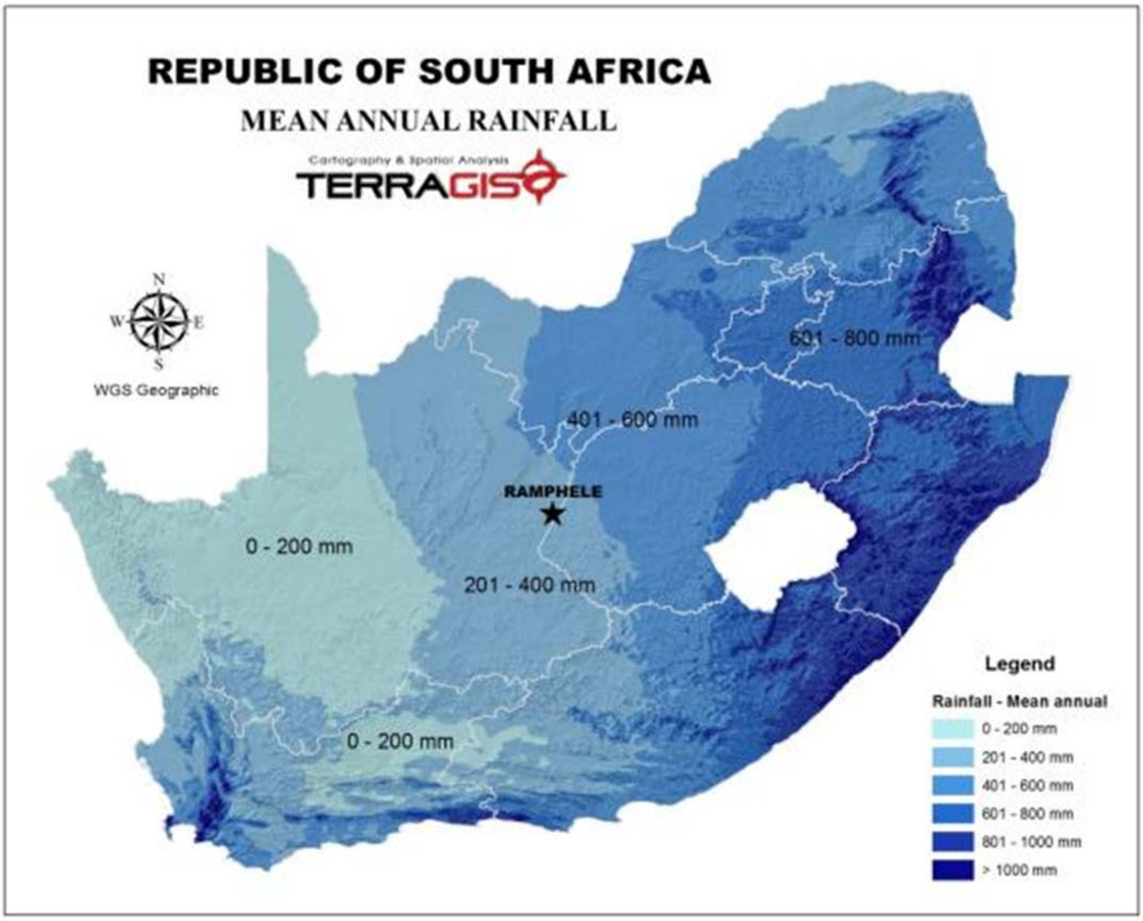

Figure 3 Rainfall map of South Africa indicating the survey site

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

The interpretation of aerial photographs yielded two dominant land uses, namely grazing and irrigated agriculture (**Figure 4**). The land uses correspond to the soils on the site (as discussed later in the report) in that the irrigation land uses occur on deep sandy soils and the extensive grazing on the shallower soils of low agricultural potential. In the area identified as extensive grazing a few wetland features were identified (**Figure 5**). Although these features correspond to topographic data for the site they are difficult to assess from aerial photographs and have been addressed in the soil section following below.

3.2.3 Phase 3: Site Visit and Soil Survey

The soil survey confirmed the land type data. A generalised soil map of the areas is provided in **Figure 6**. The soils on the site can be divided into four main groups namely 1) variable to deep well-drained soils, 2) shallow well-drained soils, 3) shallow rocky soils, and 4) shallow lime containing soils. These soil areas grade into each other and the lines demarcating the different areas are therefore only an indication of the approximate distribution.

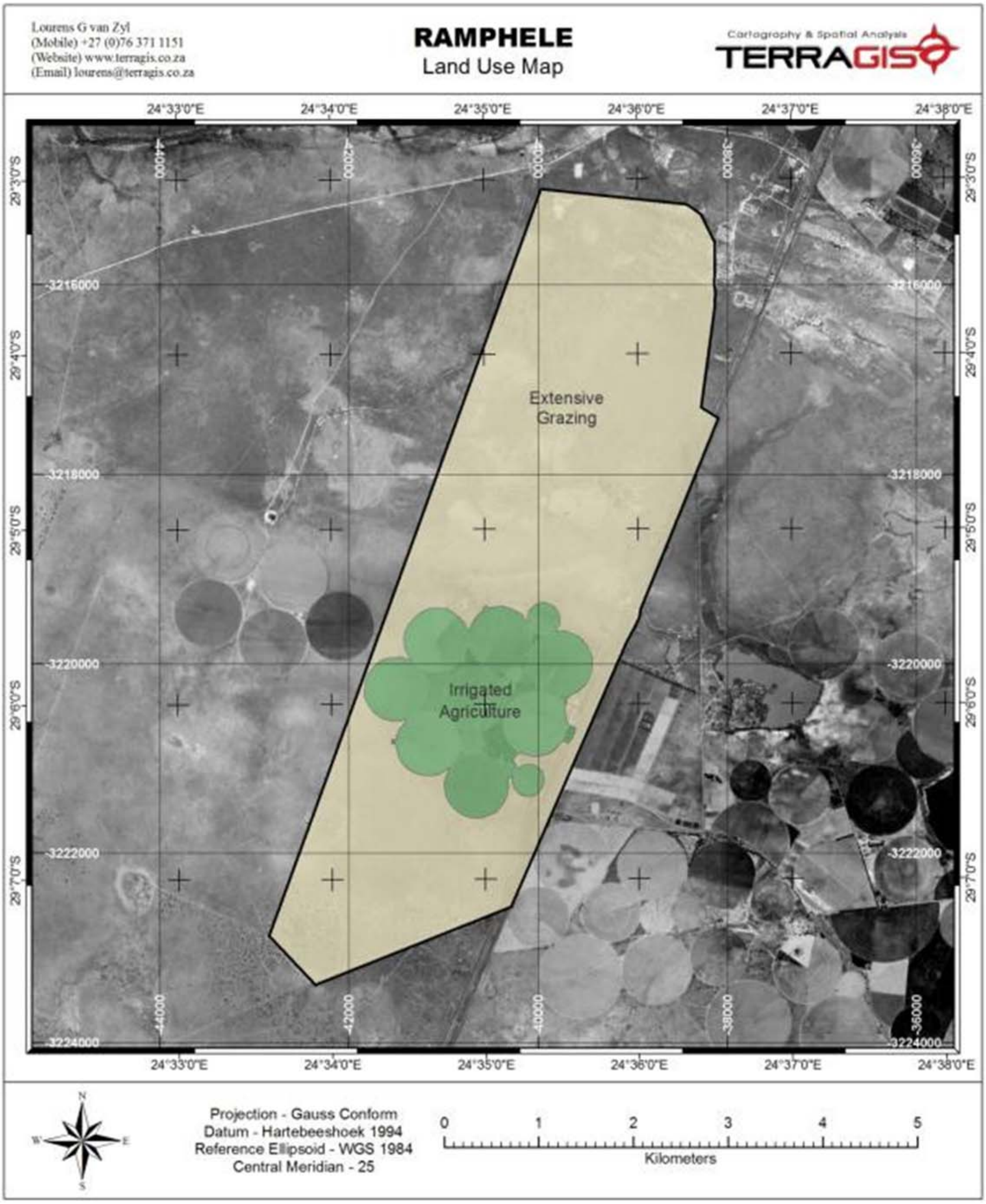

Figure 4 Land use map of the survey area

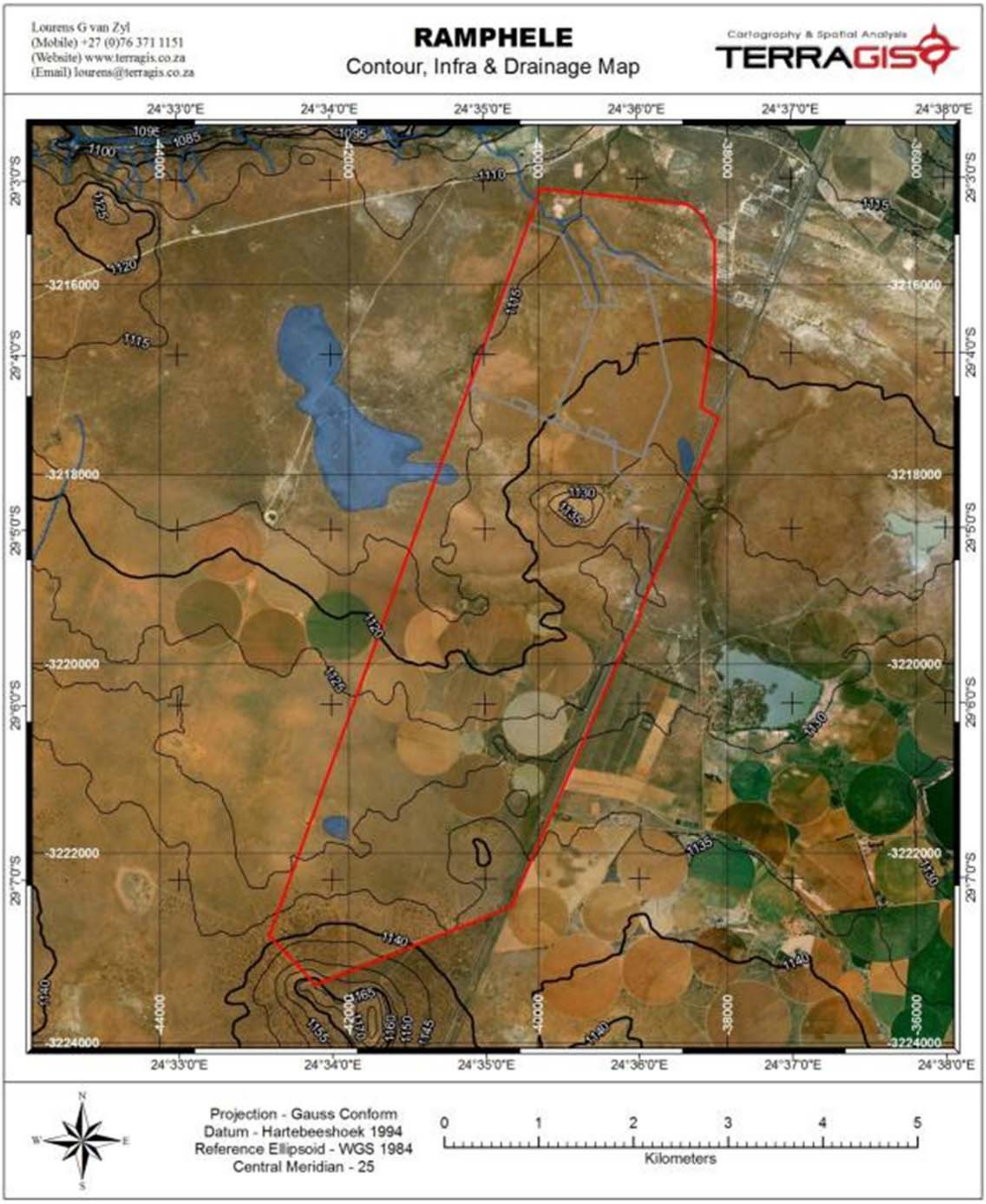

Figure 5 Topographic characteristics of the site indicating wetland and water features as well

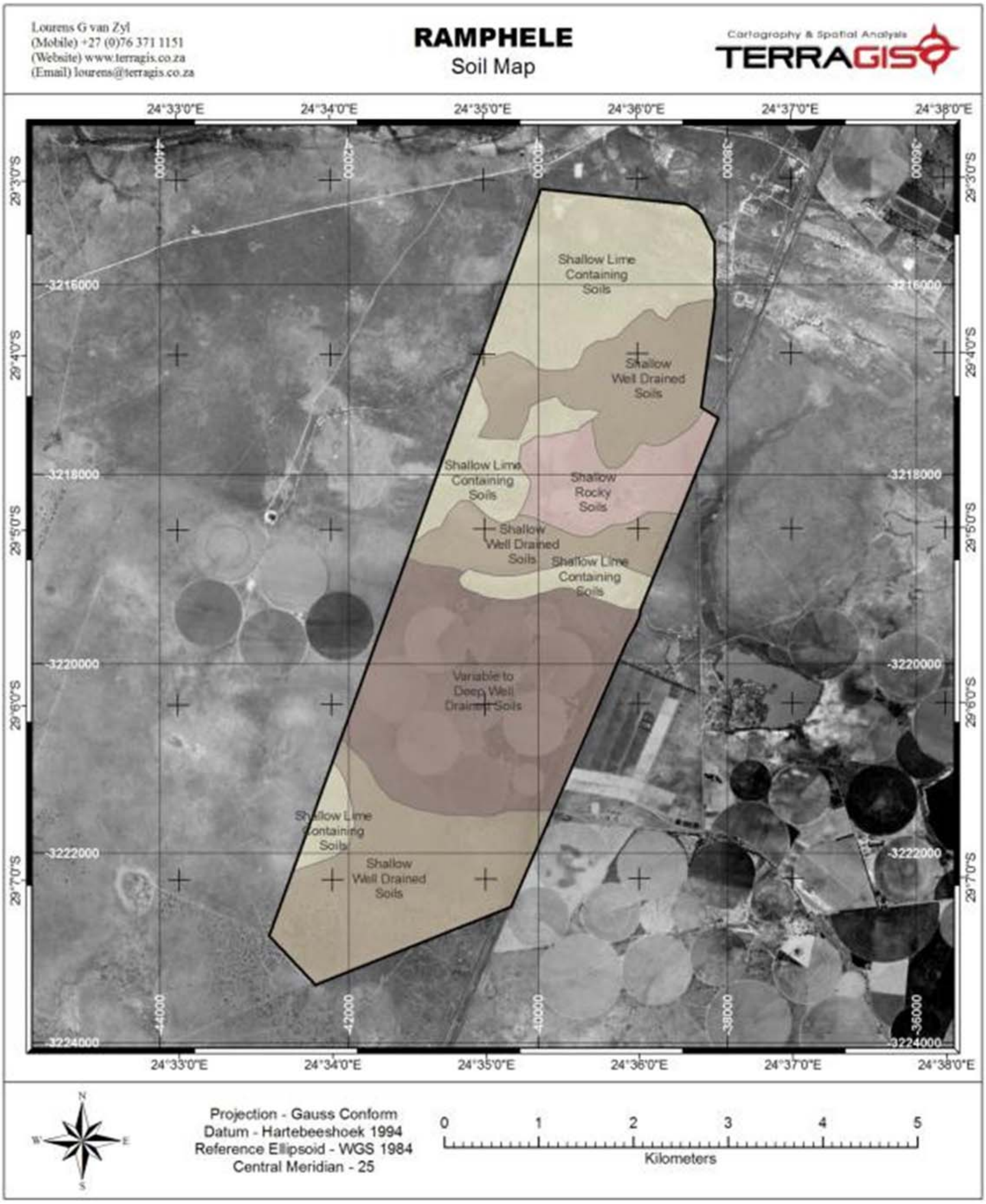

Figure 6 Generalised soil map of the survey site

3.2.3.1 *Variable to Deep Well-drained Soils*

This area is dominated by sandy loam eutrophic soils of variable depth (60 to 120+ cm) of the Hutton (Orthic A-horizon / Red Apedal B-horizon / Unspecified – usually weathering rock) and Clovelly (Orthic A-horizon / Yellow-brown Apedal B-horizon / Unspecified – usually weathering rock) forms. This area corresponds to the irrigated agriculture land uses as expected as the well-drained soils provide the opportunity of applying excessive water for the purpose of leaching salts (associated with irrigated agriculture) out of the root zone. Where these soils have more dense and restrictive subsoil horizons the potential for leaching is diminished.

3.2.3.2 *Shallow Well-drained Soils*

This area is dominated by sandy loam eutrophic soils of shallow depth (less than 60 cm) of the Hutton (Orthic A-horizon / Red Apedal B-horizon / Unspecified – usually weathering rock) and Clovelly (Orthic A-horizon / Yellow-brown Apedal B-horizon / Unspecified – usually weathering rock) forms. (**Figures 7** and **8** provide an indication of the landscape and soil characteristics.) Although the soils are well drained the profiles are generally thin and therefore not ideally suited to irrigated agriculture. Due to the low rainfall and poor water storage capacity these soils are only suited to extensive grazing and not dryland agriculture. Irrigation can be practised but land establishment costs are very high compared to the deeper soils – and these soils are therefore often excluded from irrigation if soils of higher potential occur.

Figure 7 Land cover in the shallow and well drained (red soil colour) area

Figure 8 Exposed soil excavated by an animal indicating a stony matrix and red colour

3.2.3.3 Shallow Rocky Soils

This area is dominated by sandy loam eutrophic soils of very shallow depth (less than 30 cm) of the Hutton (Orthic A-horizon / Red Apedal B-horizon / Unspecified – usually weathering rock), Clovelly (Orthic A-horizon / Yellow-brown Apedal B-horizon / Unspecified – usually weathering rock), Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) and Mispah (Orthic A-horizon / Hard Rock) forms. Due to the presence of large volumes of rock as well as shallow profiles these soils are not suited to irrigated or dryland crop production. (**Figures 9** to **12** provide an indication of the landscape and soil surface characteristics.) The dominant land use is extensive grazing.

3.2.3.4 Shallow Lime Containing Soils

This area is dominated by sandy loam lime containing soils of very shallow depth (less than 30 cm) of the Plooysburg (Orthic A-horizon / Red Apedal B-horizon / Hardpan Carbonate), Augrabies (Orthic A-horizon / Neocarbonate B-horizon / Unspecified – usually weathering rock), Prieska (Orthic A-horizon / Neocarbonate B-horizon / Hardpan Carbonate) and Couga (Orthic A-horizon / Hardpan Carbonate) forms. (**Figures 9** to **12** provide an indication of the landscape and soil surface characteristics.) Due to the presence of shallow lime pans these soils are not suited to irrigated or dryland crop production. The dominant land use is extensive grazing.

Figure 9 Land cover in the shallow and rocky soil area

Figure 10 Land cover in the shallow and rocky soil area

Figure 11 Exposed rock at the soil surface

Figure 12 Exposed rock at the soil surface

Figure 13 Lime pebbles on the soil surface in the lime dominated area

Figure 14 Exposed profile with lime pebbles in the matrix in the lime dominated area

Figure 15 Exposed profile with lime pebbles and lamellae in the matrix in the lime dominated area

Figure 16 Exposed profile with lime pebbles and boulders in the matrix in the lime dominated area

Figure 17 Undisturbed soil surface in the lime dominated area

Figure 18 Soil excavated by animals exhibiting significant lime nodule content in the matrix

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 dryland agricultural potential of the site is determined mainly by the climate in that the low rainfall effectively excludes most forms of rain-fed crop production. From a dryland perspective the site is therefore only suited to extensive grazing. The areas of deeper soil are suited to irrigated crop production, especially with the presence of water from the irrigation scheme. Due to the sandy nature of these soils as well as their depth individual fields can be leached on a regular basis to remove excessive salts from the profiles. The shallower soils and especially the area dominated by lime hardpans could prove problematic with regards to salt build-up and leaching of the salts due to restricting subsoil layers. The long-term prognosis for irrigation is good on the deeper soil but very poor on the shallower soils – especially if deep and intensive ripping and subsurface drainage is not done and constructed respectively.

The site earmarked for the development of the photovoltaic facility is situated on shallow soils (with and without lime in the subsoil) that are of low agricultural potential. This area is also, as discussed earlier, problematic with respect to the long-term management of salts in the profile and therefore not suited to intensive irrigated agriculture (unless subsoil drainage is installed).

The photovoltaic plant, with its associated storm water management measures, could serve as a water harvesting structure to yield additional (high quality) water for irrigation purposes. in this sense every 1 ha of development could potentially yield 2000 to 4000 m^3 of rainwater that could be used to irrigate up to 0.5 ha of land. This aspect has the potential to increase the agricultural potential of the soils on the site considerably as water availability, as stated previously, is the main constraint in crop production.

4.2 Wetland Distribution

The potential wetland features are indicated in **Figure 5**. The pans have been confirmed as such but the drainage feature in the north does not exhibit hydromorphic soils (**Figure 19**). The only indicator of soil wetness in the drainage feature is the presence of moss on the soil surface (**Figure 20**). The matrix of the soil is of a high chroma and hydromorphic soil properties could not be identified within the areas and it therefore does not qualify as a wetland from a soil form or soil wetness perspective. The drainage feature could be considered to be sensitive from a storm water perspective but could be used, with proper storm water management, to function as a water harvesting structure to harvest water for irrigation purposes (discussed above).

Figure 19 Red soils within the drainage feature on the site

Figure 20 Moss on the soil surface (with a red matrix underneath) indicating periodic wet surface conditions within the drainage feature on the site

4.3 Overall Soil and Land Impacts

Due to the low agricultural potential of the site as well as the low variable rainfall the impacts on soils and dryland agriculture is expected to be low – provided that adequate storm water management and erosion prevention measures are implemented. The development is outside of the area of variable depth to deep soils (used for irrigation) and impacts on these are therefore not expected. The solar panels will have an impact on the soils but it should be relatively simple to reverse impacts through adequate rehabilitation should the infrastructure be removed at some point in the future. This is especially so since the agricultural potential baseline for the soils in the development area is very low.

As solar panel infrastructure is mainly limited to the surface of the soil without drastic deep soil impacts the effect of the development will remain for the duration of the activities but could be rehabilitated afterwards (as stated earlier).

5. ASSESMENT OF IMPACT

5.1 Assessment Criteria

The following assessment criteria (**Table 1**) will be used for the impact assessment.

Table 1 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	This is quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor

CATEGORY	DESCRIPTION OF DEFINITION
• 4 • 6 • 8 • 10	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. 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 2 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 2 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 8**. **<u>Note</u>:** 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 is the restriction of off-site effects due to developments through adequate implementation of environmental management measures (discussed later in the report). Surface related impacts can be mitigated to a large degree if the infrastructure is removed and proper rehabilitation conducted in an area with a low agricultural potential baseline. Surface impacts on high potential agricultural land are more difficult to mitigate as these soils are more sensitive to degradation in the context of their suitability to crop production.

5.3.1 Construction of Solar Panels and Stands

Table 3 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 3 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. Rehabilitation possible after removal of infrastructure due to the low agricultural potential baseline of the development area.

5.3.2 Construction of Buildings and Other Infrastructure

Table 4 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 4 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 5 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of roads.

Table 5 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
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 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 6** 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 6 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 7** presents the impact criteria and a description with respect to soils, land capability and land use for dust generation on the site.

Table 7 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 8 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. In the case of low agriculture potential soils impacts can be rehabilitated afterwards if infrastructure is removed.		
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 9 to **11** provide the critical aspects for inclusion in the EMP.

Table 9 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 10 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 11 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 will not have large impacts due to the low agricultural potential of the site. The pans are outside of the development area and the drainage feature that occurs to the north of the development area does not have hydric soils. It is recommended though that this area be excluded from development as storm water could affect the intended structures as well as lead to increased soil erosion if not properly mitigated. The feature can be used though for storm water management and water harvesting purposes to increase irrigation activities on the site.

The area currently used for irrigation purposes (and also ideally suited for such purposes) on the site falls outside of the development area. With the proper planning of storm water management and water harvesting on the development footprint the area under irrigation can be expanded by an area roughly 0.5 times as big as the development footprint. This aspect will have to be planned in detail during the development but has the potential to lead to net positive agricultural impacts on the site.

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. Storm water mitigation should be put in place to prevent erosion within the drainage features.
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. The impacts are further limited through the judicious planning of storm water management and water harvesting for irrigation purposes – thereby increasing the agricultural production on such sites. 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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