ENVIRONMENTAL IMPACT ASSESSMENT: PROPOSED CONSTRUCTION AND IMPLEMENTATION OF HUMANSRUS SOLAR 3 (PTY) LTD PROJECT NEAR COPPERTON IN THE NORTHERN CAPE

APPLICANT: HUMANSRUS SOLAR 3 (PTY) LTD

AGRICULTURAL IMPACT REPORT
APRIL 2016

STUDY CONDUCTED AND

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1. INTRODUCTION

Cape Environmental Assessment Practitioners (Pty) Ltd is conducting an EIA for Humansrus Solar 3 (Pty) Ltd to construct a solar power plant. The development site is on the Farm Humansrus 147, located 50 kilometres southwest of the town Prieska in the Northern Cape.

The EIA is conducted for environmental authorisation under the National Environmental Management Act (Act 107 of 1998), as amended. As part of this EIA, an agricultural impact study has been commissioned.

The agricultural study was undertaken by CR Lubbe, who has 42 years of experience in planning and managing natural resources to ensure optimal utilisation, without exploiting such resources to the detriment of future generations. His CV is attached as Appendix A.

2. OBJECTIVES

The objectives of the study were:

- To reconsider the possible impacts on agricultural production identified during the Scoping Phase
- To identify potentially significant impacts, assess them against the prescribed methodology and recommend mitigation measures where necessary.

It should be noted that this study addresses both preferred and alternative sites.

3. APPROACH AND METHODOLOGY

3.1 Desktop Study

A desktop study was conducted to review existing data and literature sources. The desktop review provided a baseline agricultural and land use profile, focusing on the specific geographical area potentially impacted by the proposed project.

3.2 Field Investigation

A field study, including a soil survey, was conducted during July 2014 for Humansrus Solar 1 (Pty) Ltd and Humansrus Solar 2 (Pty) Ltd, which also covered the area for Humansrus Solar 3 (Pty) Ltd. That field survey also included a study of drainage patterns on site that may be altered during and after the construction process.

4. DESCRIPTION OF THE PROPOSED PROJECT

Humansrus Solar 3 (Pty) Ltd, proposes to construct a 75 MW photovoltaic plant on the Farm Humansrus 147. A preliminary study area of 852ha was assessed of the total farm area of 4769ha. See Figure 1.

The net generating capacity (AC) of the plant will be 75 MWp, with an installed capacity (DC) of ± 90 MWp with fixed, single or double axis tracking technology.

Further technical details of the proposed development appear in Table 1. A simulation of the power plant is shown in Figure 2.

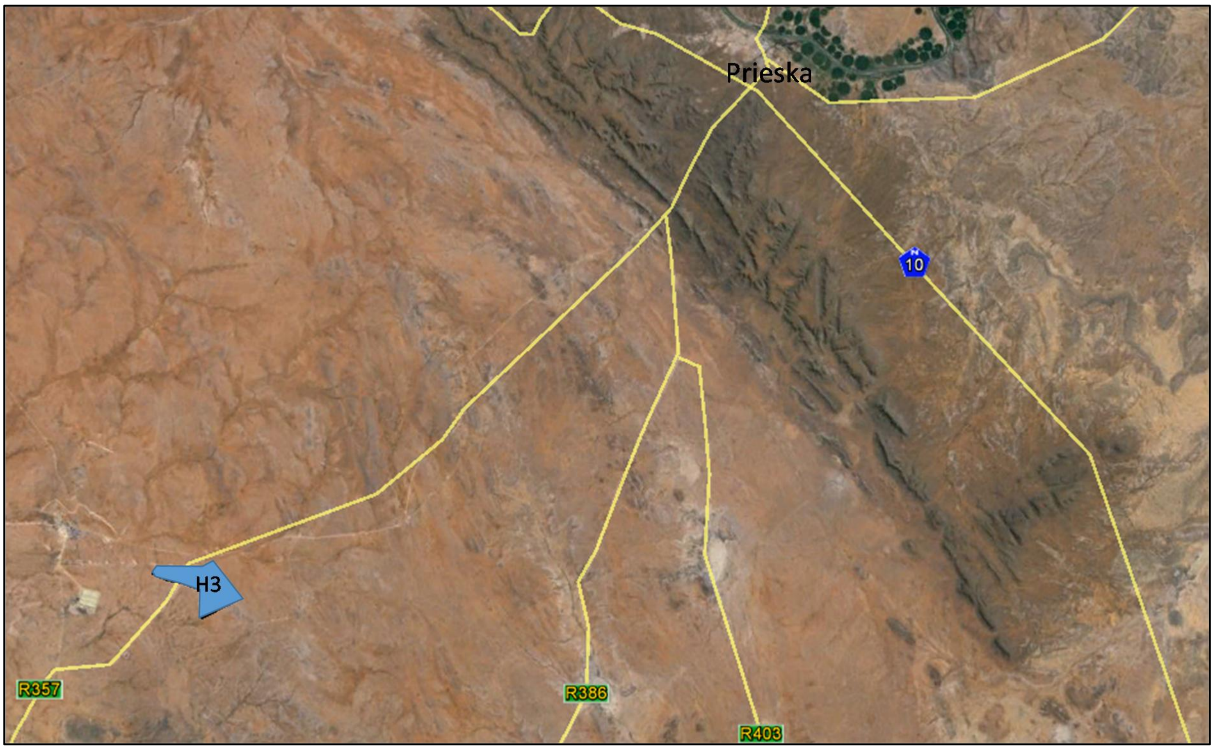

Figure 1: Locality sketch

Table 1: Technical details of proposed development

Development Footprint	Preliminary study area 852ha. Estimated site layout 220ha
Capacity of the facility	Net generating capacity (AC)of 75MWp with installed capacity (DC) of±90MW
Solar Technology	PV and concentrated PV with fixed single or double axis tracking technology. Footprint not more than 220ha and laydown area not exceeding 5ha
Water usage	6000m³/annum for construction period 18-24months 3000m³/annum for operation period 25 years
Grid connection	Connect to Kronos substation via self- build 132kV line
Power lines	1x132kV from onsite grid substation
Alternatives	Preferred and alternative layout

Construction methodology:

- Site clearance
- Layout determination and pegging.
- Trenching where necessary for cabling.
- Ground screws, hammered piled foundations or (unlikely) concrete foundations
- Erection of structures
- Erection of PV modules
- Connection of modules to string box.
- Erection of inverters,
- Medium voltage infrastructure connection.
- Substation erection

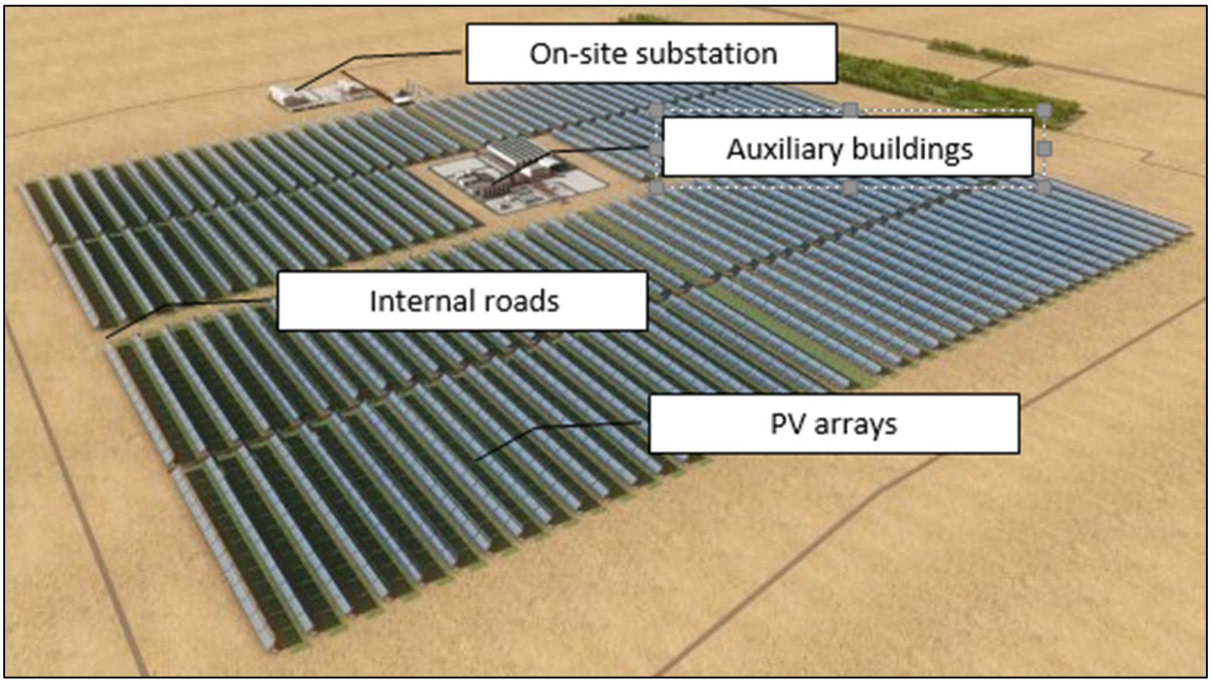

Figure 2: Simulation of proposed development

5. DESCRIPTION OF THE AGRICULTURAL ENVIRONMENT

5.1 Climate

The area in which the development site is situated is subject to harsh climatic conditions. The rainfall is low (163mm/annum), with a large degree of variability in the monthly rainfall. Potential evaporation is extremely high and the area can be classified as arid (AI = 0.1). High maximum and very low minimum temperatures are typical of this environment. Selected climatic parameters are presented in *Table 2*.

Table 2: Climatic data

Month	**Precipitation**	**Evaporation**	**Temperature**	**Range**
January	16 mm	8.4mm/day	Max Sum	33 - 35°C
February	30 mm	7.4mm/day	Min Sum	13.4-15.2°C
March	40 mm	5.7mm/day	Max Win	21.9 - 24°C
April	18 mm	4.1mm/day	Min Win	4 - min5.5°C
May	10 mm	2.8mm/day	Start frost	01 – 10 May
June	5 mm	2.1 mm/day	End Frost	11 - 20 Sept
July	4 mm	2.4mm/day		
August	4 mm	3.4mm/day		
September	4 mm	4.6mm/day		
October	9 mm	6.2mmday		
November	11 mm	7.5mm/day		
December	15 mm	8.2mm/day		
Annual	163 mm	1911mm		

The maximum and minimum temperatures are extremes and not the monthly average maximum and minimum temperatures.

Climatic information was obtained from the South African Atlas of Climatology and Agrohydrology (Schulze, 2007).

5.2 Geology

Two geological groups are identified on the development site. Dwyka group on the southwestern side; and Waterberg Soutpansberg, Orange River on the eastern side. Refer to Figure 3.

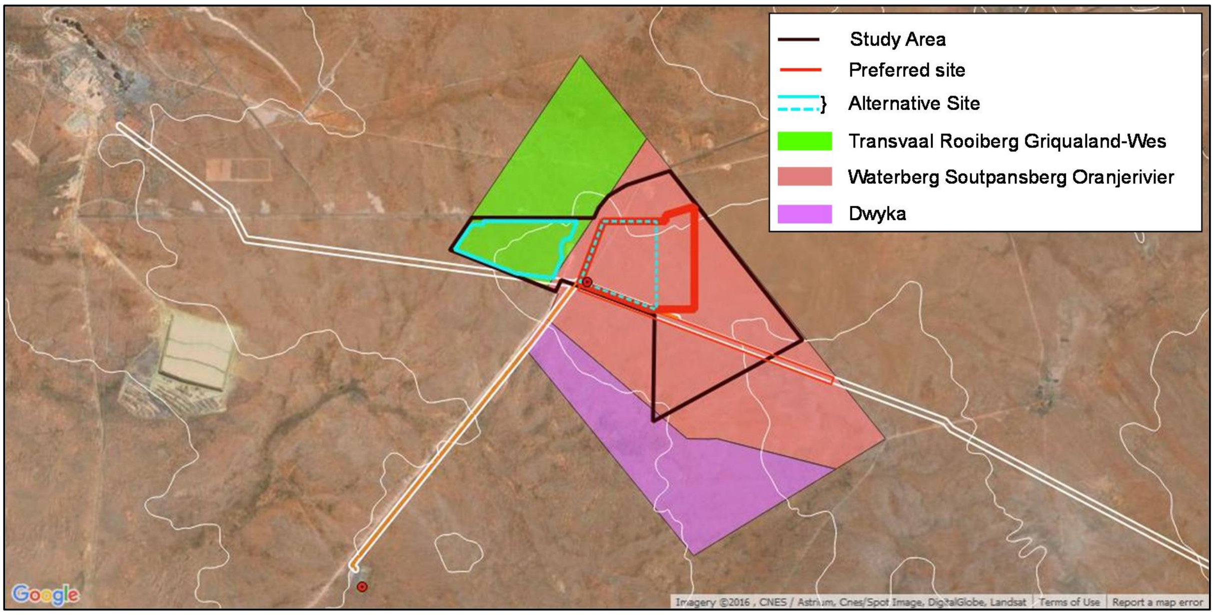

Figure 3: Geology

Sedimentary and Volcanic rocks of these groups are Tillite, Mudstone and Schale.

The lithology is unconsolidated sand overlaying gravel, overlaying calcrete, overlaying sand and siltstone.

Calcic soils can usually be found on this geology and under arid climatic conditions.

5.3 Vegetation

The Acocks classification of the area is Karoo and Karroid veld types with Shrubland and low Fynbos .Two biomes are present on site: Bushmanland basin shrubland on the western side and Bushmanland arid grassland on the eastern side (see Figure 4). The influence of the geology shows in the vegetation, as they share the same dividing line.

There is a small difference in the potential carrying capacity of the site (36-40 ha/LSU for the western side and 31-35 ha/LSU for the eastern side).

The agricultural utilization of the veld is sheep farming. In fact, 82% of agriculture in the Northern Cape consist of sheep farming. Hardly any cultivation takes place in this region, which indicates that no high potential soils are involved in the proposed development. Table 3 contains more detail on the vegetation of the area.

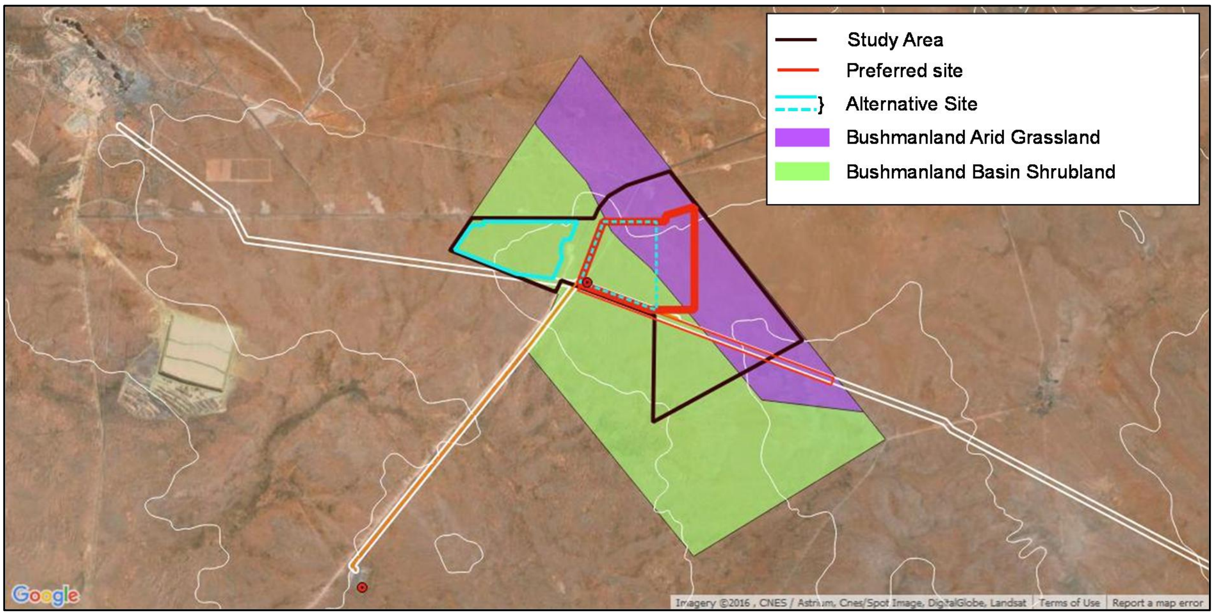

Figure 4: Vegetation types

Table 3: Vegetation

Attribute	Western side	Eastern side
Acocks veld types	Karoo and Karroid types	Karoo and Karroid types
Vegetation Biome	Bushmanland Basin shrubland	Bushmanland Arid grassland
Tree density	<5%	<5%
NDVI	Low	Low
Land cover	Shrub land and low Fynbos	Shrub land and low Fynbos
Potential grazing capacity	36 – 40 ha / LSU	31 – 35 ha / LSU
Agricultural region	Sheep farming	Sheep farming

The field investigation indicated that the site is indeed situated in the Nama Karoo Bushmanland region and in general, the vegetation is an open shrub land, dominated by small woody shrubs and white Bushman Gras, *Stipagrostis* species. Succulents occur in some areas.

Trees and bigger shrubs are mostly confined to rocky areas, but there are some woody plants on the plains, especially where the soils are shallow, along drainage lines or seasonal watercourses. On the flats, the *Rhigozum* species and *Rhus* species tend to be more common.

The grazing capacity is low at 36 to 40 hectares per large stock unit (LSU). The Normalised Difference Vegetation Index (NDVI) is low.[1] The photos in Figure 5 shows the sparse landcover.

[1] *NDVI refers to a mathematical formula applied to satellite imagery to provide information on plant activity or vigour. It is an indicator of active vegetation cover.*

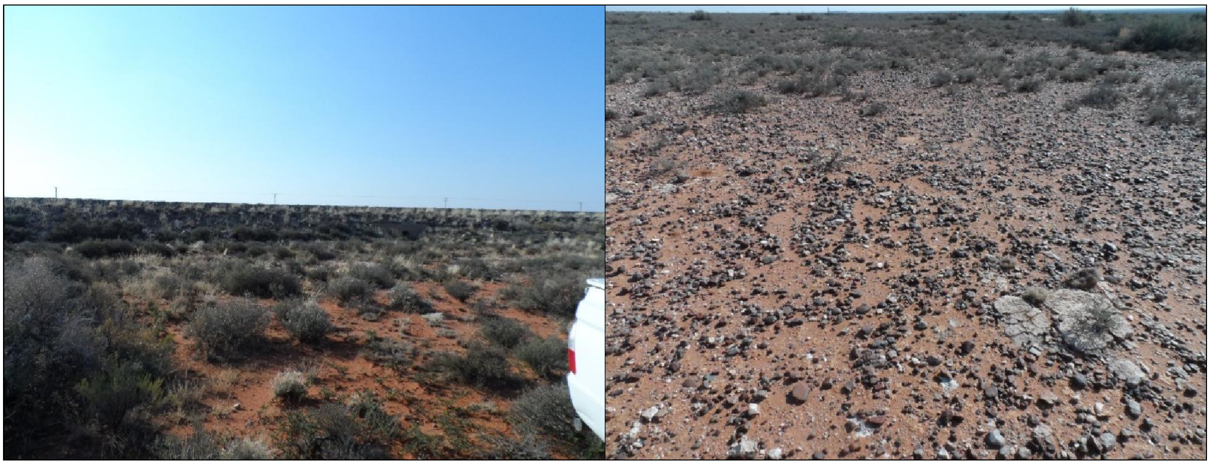

Figure 5: Sparse landcover

5.4 Soil

The occurrence of soil units in South Africa were systematically mapped by the Soil and Irrigation Institute, which compiled an inventory for each land type in terms of terrain, soil and climate parameters.

A land type is an area with similar climate, topography and soil distribution patterns -which can be demarcated on a scale of 1:250 000. Two land types dominate the study area, namely Ah93 and Ag154 (Figure 6).

A-land types refer to regions where freely drained yellow and red soils occupy more than 40% of the land area. The soils of *A*-land types are generally considered to be good for crop production and suitable for irrigation. Since these soils are freely drained, saturation seldom occurs, thereby reducing the chances of erosion. *Ah* land types (Ah93 in Figure 6) refers to an area where more than 40% of the soils are red, high base status soils deeper than 300 mm, but shallower than 750mm. Ag154 (see eastern side of Figure 6) refers to soils shallower than 300mm. The agricultural potential of these two land types are low and land-use restricted to low intensity grazing, due to climatic constraints.

Table 4 reflects the specific soil properties that can be expected.

- Soils have minimal development, are usually shallow, on hard or weathering rock, with or without intermittent diverse soils.
- Lime is generally present in part or most of the landscape.
- Red and yellow well drained sandy soil with high base status may occur.
- Freely drained, structure less soils may occur.
- Soils may have favourable physical properties.
- Soils may also have restricted depth, excessive drainage, high erodibility and low natural fertility and low water holding capacity.

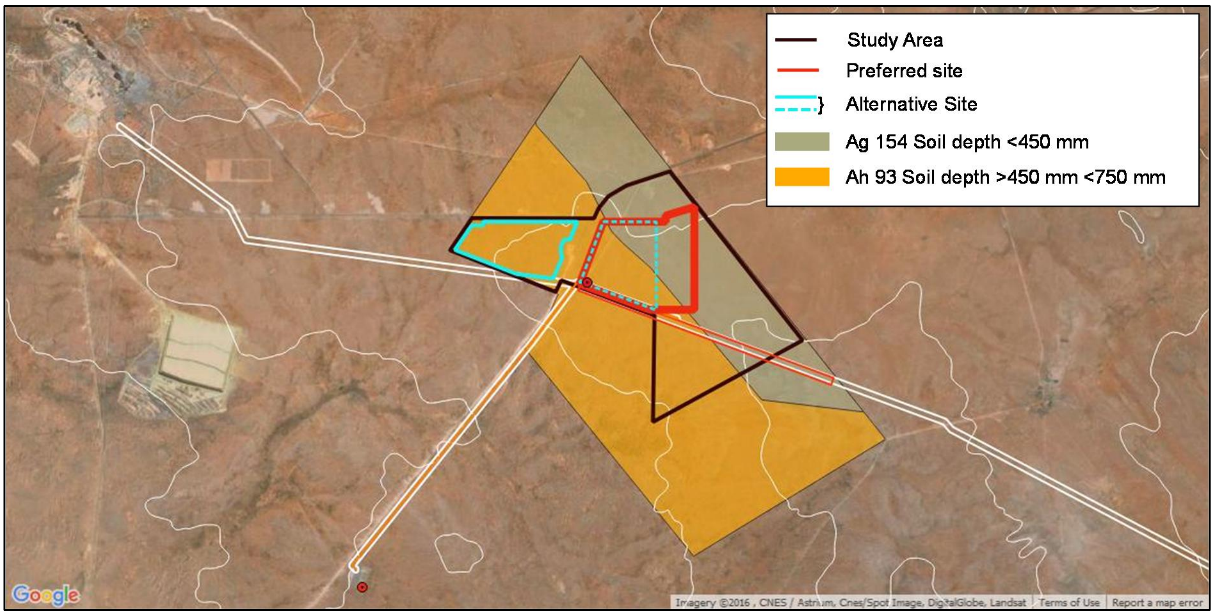

Figure 6: Land type and effective depth

Table 4: Soil Properties

Property	**Western side**	**Eastern side**
Classification	Red/Yellow freely drained High base status	Red/Yellow freely drained High base status
Water holding capacity	<20mm/m	21-40mm/m
Texture	<15%	<15%
Effective depth	>450mm <750mm	<450mm
Textural contrast	Clear transitions present	Abrupt transitions present
Swelling clays	Very low	Very low
Natural organic carbon content	<0.5	<0.5
Natural pH	7.5 – 8.4	7.5 – 8.4
Leaching status	Calcareous	Eutrophic
Cation exchange capacity	6.1 -10	6.1 – 10

The field study was done by augering the site and connection line route, describing the soil properties and veld condition. Figure 7 contains the augering points and soil map.

Extracts from the field observation book are printed in *Table 5* followed by photos of the specific observation points and a further description of the soil properties. These extracts represent the soil properties of the whole site. The photos in Figure 8 show the soil profiles.

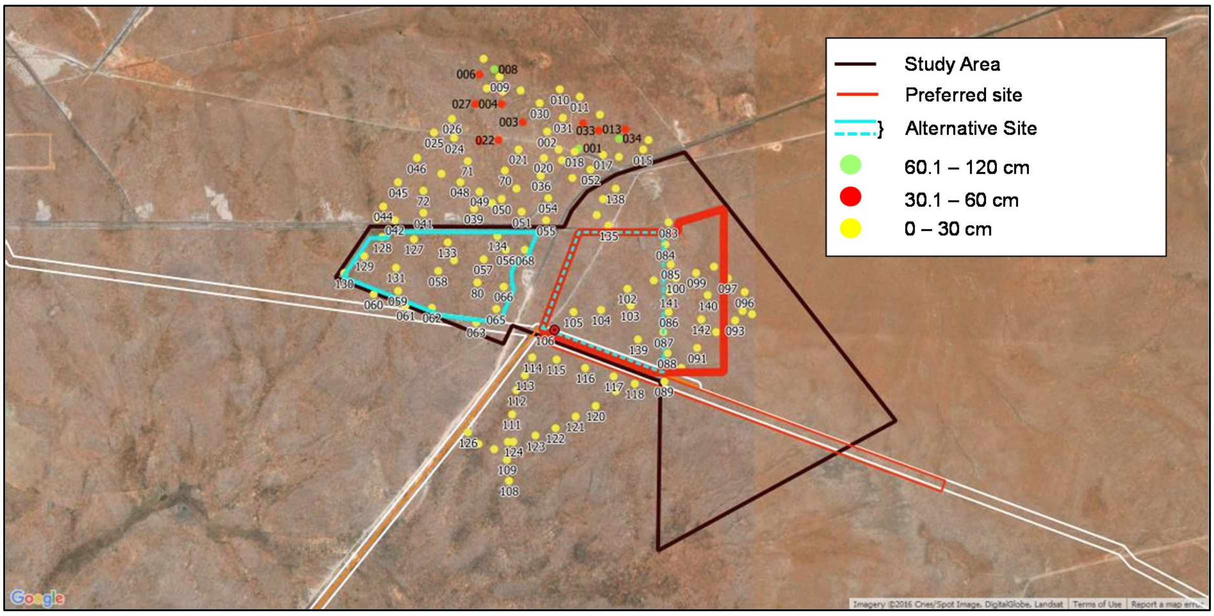

Figure 7: Augering points and soil map

Table 5: Soil description

OBS	140	COMMENT													
LAT	29 59 02.4	SLOPE GRAD			1		MOISTURE		L						
LONG	22 22 46.7	SLOPE SHAPE		R			EROSION		sl						
	FORM	Py	TSD	30	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	30	C	l	1	A	10	5YR56	10	vf	5	sg	0
	ROUGH	1	ASD		GEO	D1	2	B	30	5YR58	10	vf	5	a	0
	TERR_POS	3	LTN	h	PHOTO		3								
	L.COVER/USE:	small bush													
	VIS.VELD.COND	A		B		C		D		E		TOTAL			

Top soil:10cm yellowish red
Very fine grade sandy texture
Single grain structured
Loose consistency
Sub soil: 20cm yellowish red
Very fine grade sandy texture
Apedal structured
Loose consistency
Hard Carbonate limiting layer

OBS	58	COMMENT													
LAT	29 58 40.4	SLOPE GRAD			1		MOISTURE		L						
LONG	22 21 53.1	SLOPE SHAPE		R			EROSION		sl						
	FORM	Cg	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	l	1	A	20	7.5YR56	10	vf	5	sg	s1
	ROUGH	1	ASD		GEO	D1	2								
	TERR_POS	3	LTN	h	PHOTO		3								
	L.COVER/USE:	small bush													
	VIS.VELD.COND	A		B		C		D		E		TOTAL			

	Top soil:20cm Brown Very fine grade sandy texture Single grain structured Loose consistency with 10% stones Hard Carbonate limiting layer

	
Profile of Plooysburg soil form in railway cutting that form the northern border of the proposed PV field	Profile of Coega soil form in railway cutting that form the northern border of the proposed PV field

Figure 8: Soil profiles

SUMMARY OF SOIL PROPERTIES

The soils found with the field study correspond with the AGIS predictions. The soils are homogeneous in soil properties as well as terrain

Effective rooting depth

The site has an effective depth of less than 31cm. The restriction is rock and hard carbonates sub surface layers. The top surface is also rough with a high level of surface rock. Cultivation is not possible because of these mechanical restrictions.

The stony nature soils reduces available soil for root development and water retention. It is also a high mechanical risk for agricultural machinery.

The very shallow soil depth with its limited water holding capacity restrict root development.

Texture

The clay content top horizon is 10% and sub horizon is 10% with fine sand grade. Texture: class loam sand.

The very fine sand grade of top soil influences the stability and erodibility potential.

Low clay percentage results in low water holding capacity and low nutrient availability, which leads to low soil fertility.

Depth limiting layer
Hard setting layer (Hard carbonate horizon) and/or Carbonate rock. The effects of this include:

- mechanical limitations for cultivation (Stoniness)
- Prevent root development
- Limit water holding capacity

5.5 Topography and Terrain type

The topography has low relief. The slope gradient is between 0 and 2% with a concave shape. Some small pans occur (Figure 9).

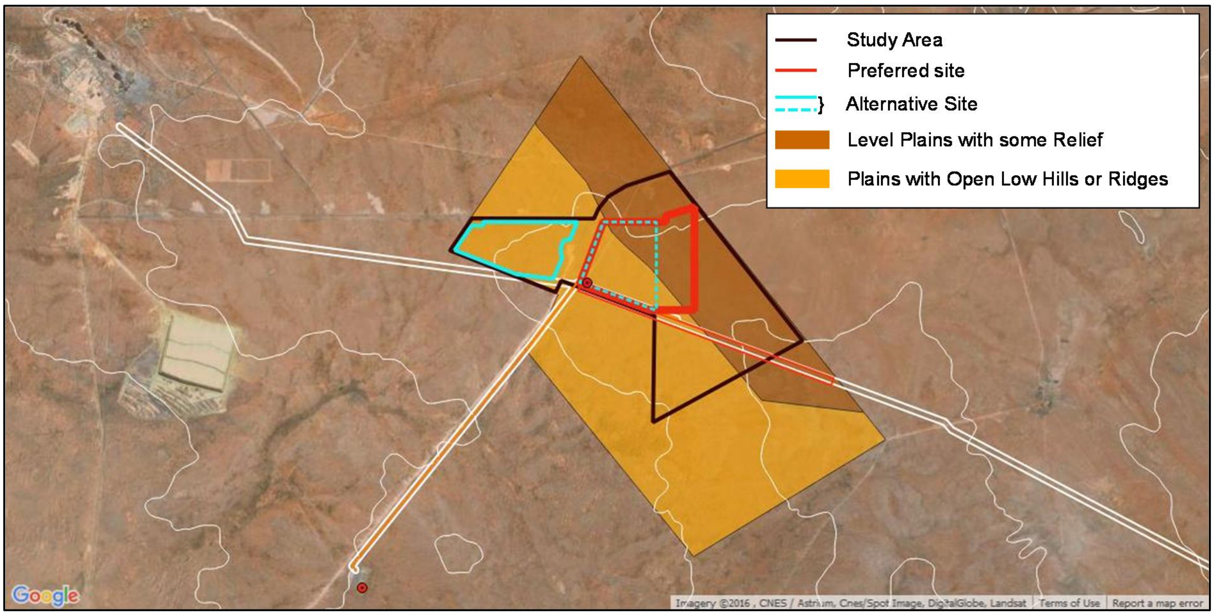

Figure 9: Topography

Terrain type shows the uniformity of the surface form, namely Plains with open hills or ridges for the western side and level plains with some relief on the eastern side (*Table 6*).

Table 6: Terrain type

Attribute	Western side	Eastern side
Terrain type	Plains with open hills or ridges	Level plains with some relief
Slope	< 2%	< 2%
Shape	Concave	Concave
Terrain type	A2*	A2*
*A: more than 80% of the area have a slope of less than 8% 2: local relief has a vertical difference of 30-90m between the highest and lowest point in the terrain unit		

5.6 Drainage

The drainage is limited to small intermittently active streams and pans. The nett flow is to the west. See Figure 10.

The proposed development will have a low interference in drainage because of terrain position.

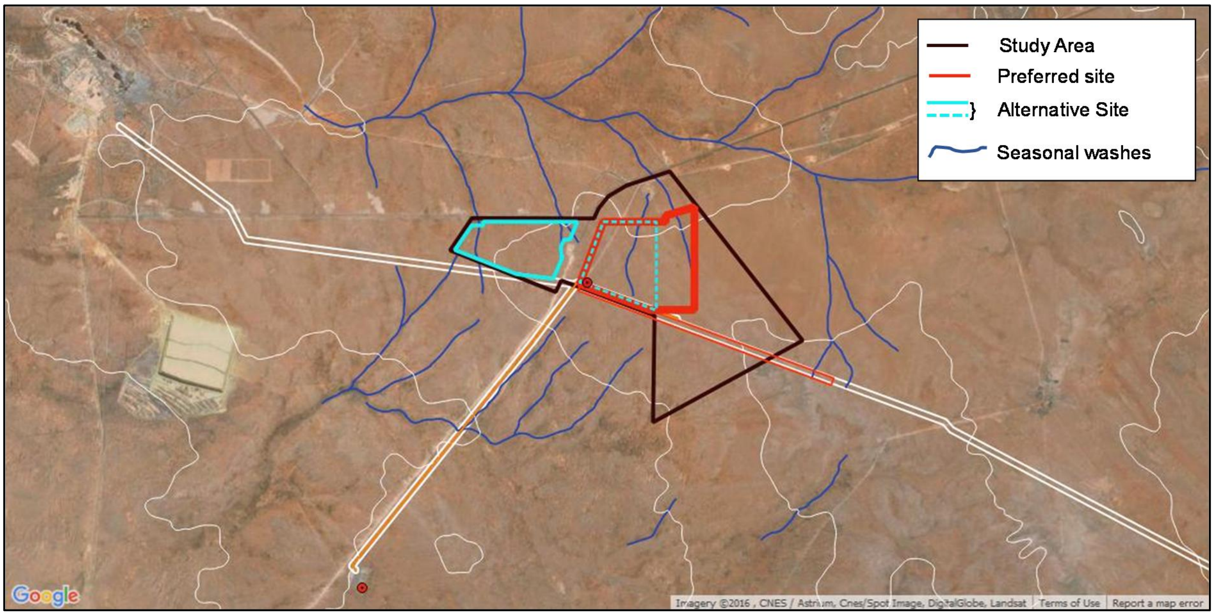

Figure 10: Drainage

The site falls in the Orange Water Management Area, catchment D54D. Further details about this Water Management Area appears in *Table 7*.

Table 7: Water management Area

Attribute	**Description**
Water Management Area	Orange
Catchment area	D54D
Terrain position	Plateau
Reference to waterbodies that may be effected	Rooidam:130km NW Van Wyksvlei dam:70km SW

6. CURRENT LAND-USE AND AGRICULTURAL ACTIVITIES

The current land-use is restricted to low intensity grazing. The natural grazing capacity of the site is approximately 35-40 hectares per large stock unit. The low rainfall, high potential evaporation, high maximum and low minimum temperatures (*Table 2*), coupled with shallow soils (see Section 5.4) covering most of the site, limits any additional land-use activities.

Figure 11 reflects the current land use. The small buffer around the Gariep 50 km away, is intensively cultivated and irrigated, while the rest of the area has no cultivation.

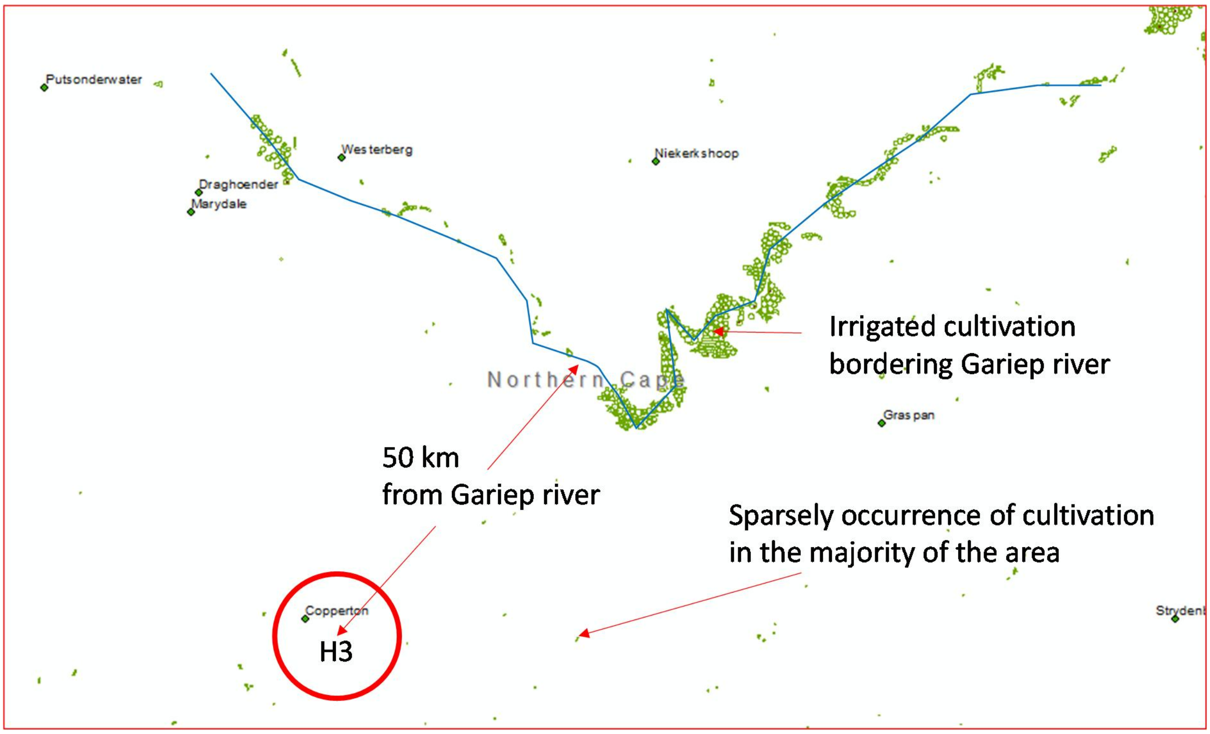

Figure 11: Land use

7. GRID CONNECTION ALIGNMENTS

The proposed powerline do not cross wetlands and waterbodies. The (existing) Kronos substation is situated on the edge of a water body (see Figure 12).

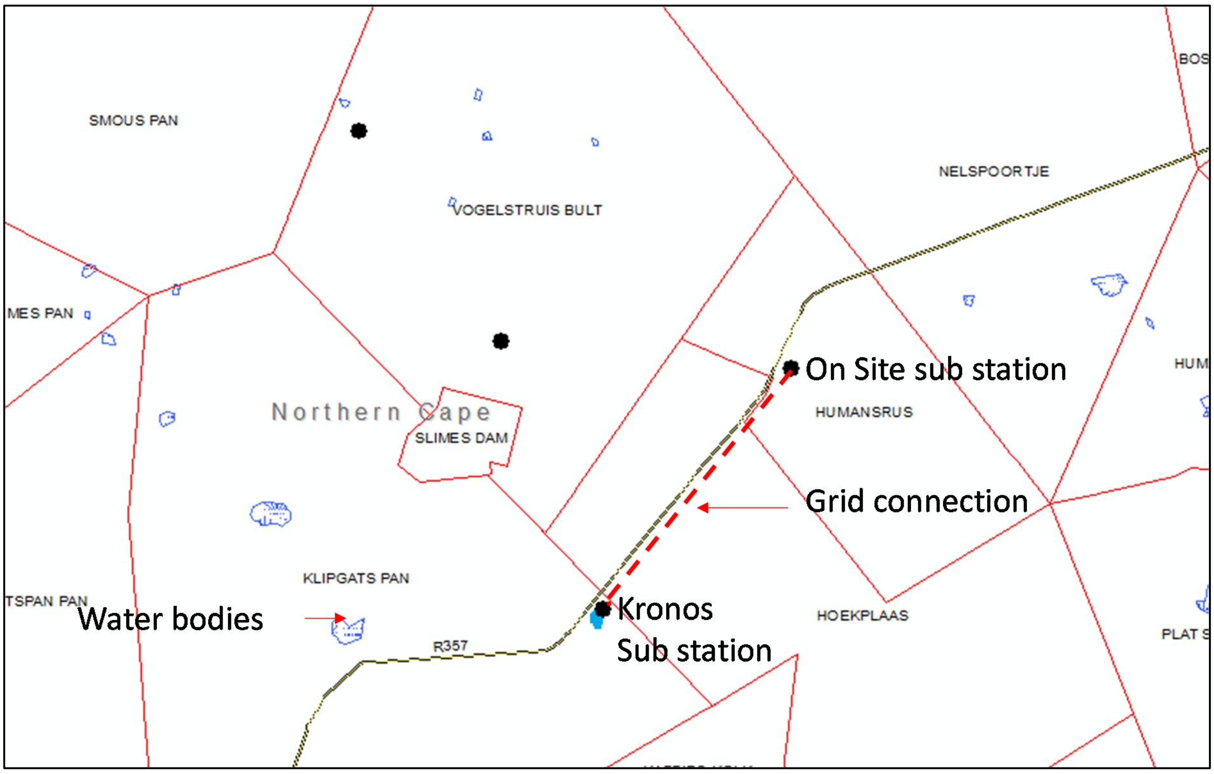

Figure 12: Wetlands and water bodies

Figure 13 shows the two land types Ah (west) and Ag (east) that occur along the grid connection alignment. These are described in more detail in *Table 8*.

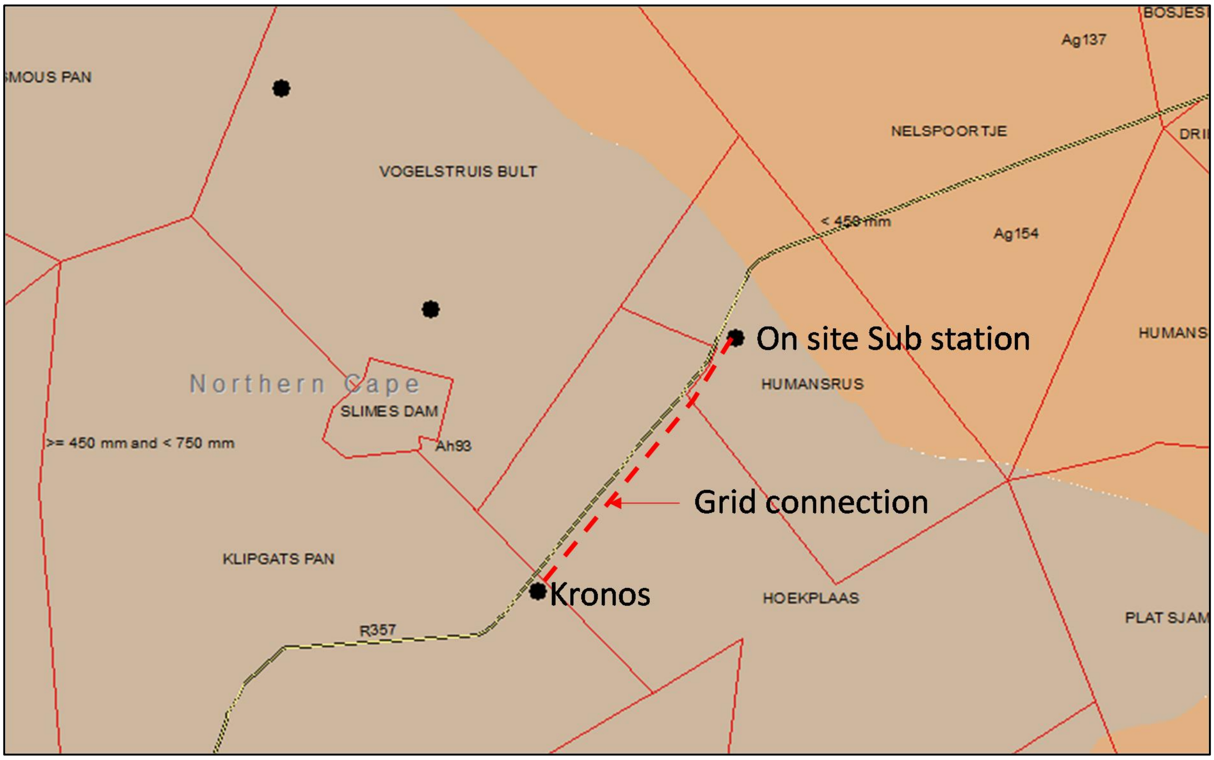

Figure 13: Land types and effective depth of grid connection alignment

Table 8: Soil properties of grid connection alignment

Property	**Finding**
Classification	Red/Yellow freely drained High base status
Water holding capacity	<20mm/m
Texture	<15%
Effective depth	>450mm <750mm
Textural contrast	Clear transitions present
Swelling clays	Very low
Natural organic carbon content	<0.5
Natural pH	7.5 – 8.4
Leaching status	Calcareous
Cation exchange capacity	6.1 -10

- Soils have minimal development, are usually shallow, on hard or weathering rock, with or without intermittent diverse soils.
- Lime is generally present in part or most of the landscape.
- Red and yellow well drained sandy soil with high base status may occur.
- Freely drained, structure less soils may occur.
- Soils may have favourable physical properties.

- Soils may also have restricted depth, excessive drainage, high erodibility and low natural fertility.

8. AGRICULTURAL CAPABILITY OF THE DEVELOPMENT AREA

The agricultural capability of the site is low. The natural resources identified show that the area is largely unsuitable for cultivation, i.e.:

- Low annual rainfall, high evaporation and extreme temperatures restrict dry land cultivation.
- The very shallow soil depth with its limited water holding capacity restricts root development
- The very fine sand grade of top soil influences the stability and increases erodibility potential.
- Low clay percentage results in low water holding capacity and low nutrient availability, resulting in low soil fertility.
- The veld types are Karoo and Karroid veld types, while the vegetation biome is Bushmanland Basin shrub land on the western side with Bushmanland Arid grassland on the eastern side. Tree density is less than 5%.
- Grazing capacity is low at 31 to 40 hectares per large stock unit (LSU).
- The Normalised Difference Vegetation Index (NDVI) is low.

Potential impacts on agricultural resources and productivity is low.

9. CUMMULATIVE EFFECTS ASSESMENT

Figure 14 shows the compilation of farms surrounding the proposed Humansrus 4 facility which may have a cumulative effect on the environment.

To assess the effect that the cumulative developments will have on the environment the following situations are addressed:

- Decrease in quantity and quality of soils.
- The compilation of farms effected by possible change of land use form a core around the previously mining community of Copperton. A great portion of land changed to urban infrastructure, road and railway alignments and were lost for agriculture. The extensive farming still continued.
- With the concentration of renewable energy farms in one area, other areas remain undisturbed, leaving agricultural infrastructure as is. Furthermore, connection lines are combined, thus saving normal agricultural farms from sacrificing land for such purposes.
- The negative impact would be that farms may become uneconomical to farm on.
- Measured against the norms for sub-division of farms (Act 70 of 1970) the economic size must be 2400 ha (60 ha/LSU, minimum 60 head).

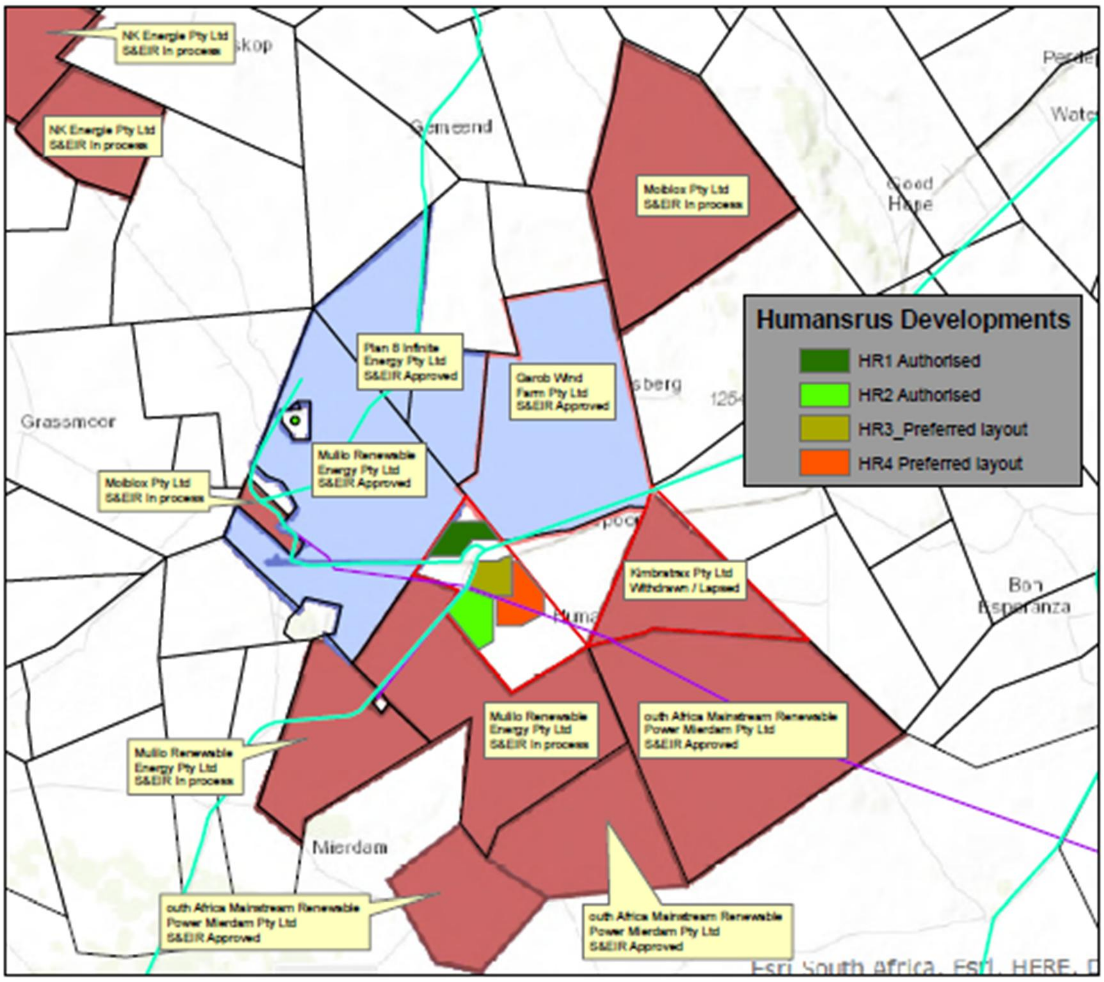

Figure 14: Renewable Energy Farms

(Source: Department of Environmental Affairs)

Loss of biological diversity

The biological diversity may be lost in the sense that the vegetation downstream from the PV field may is deprived of run-off water and thus influence the moisture regime of the vegetation. This is not the case because:

- The abandoned railway line on the northern border currently acts as a cut-off drain and potentially have higher influence in diverting run-off water. There is no difference in vegetation growth above or below this structure.
- The PV-field will be standing on the plateau, with very low potential for water run-off.

10. IMPACT ASSESSMENT

Potential impacts of the proposed project on agriculture were assessed with particular attention to the issues identified during the Scoping Phase.

10.1 Assumptions and Uncertainties

A study of this nature will inherently contain various assumptions and limitations.

As far as **regional** information is concerned, this is primarily a desktop-based study. Climatic conditions, land uses, land type and terrain are readily available from literature, GIS information and satellite imagery.

Notwithstanding these limitations, the **site-specific** field studies confirmed most of the desktop findings and I am confident that the findings provide sufficient detail for the agricultural assessment reported in this document.

10.2 Assessment Criteria

Potential impacts of the proposed project on agriculture were identified and evaluated. Particular attention was paid to the following issues:

- An area is lost for agriculture.
- Vegetation removed will have a negative impact on erosion.
- Altering of drainage patterns by construction.
- Possible impacts of service and access roads to be constructed.

10.3 Rating of Impacts

Impacts identified through the study were rated in terms of the following variables:

Nature of the impact
This is an appraisal of the type of effect the construction, operation and maintenance of a development would have on the affected environment

Extent of the impact
This indicates whether the impact will be local extending only as far as the development site area; or limited to the site and its immediate surroundings; or will have an impact on the region, or will have an impact on a national scale or across international borders.

Duration of the impact
Duration indicates whether the lifespan of the impact would be short term (0-5 years), medium term (5-15 years), long term (16-30 years) or permanent.

Intensity
Intensity refers to the impact as destructive or benign and is qualified as low, medium or high.

Probability of occurrence
This indicates the likelihood of the impact actually occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

Degree of confidence in predictions
Based on a synthesis of the information contained in the above-described procedure, impacts are assessed in terms of the following significance criteria:

- No significance: The impacts do not influence the proposed development and/or environment in any way.

- Low significance: The impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.
- Moderate significance: The impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.
- High significance: The impacts will have a major influence on the proposed development and/or environment and will result in the “no-go” option on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

10.4 Possible Impacts

10.4.1 Loss of agricultural land

The PV field is fenced and secured, therefore 220 ha is lost for agricultural production.

The soil and environmental conditions of the proposed PV field restrict agricultural production to sheep farming as the only sustainable option. The area fixed with PV panels will take grazing away but at a rate of 40ha/LSU or 7ha/SSU the loss would be 30 sheep.

No mitigation measures can be proposed

10.4.2 Land surface disturbance, changing run-off characteristics and increasing erosion risks

With the construction of the PV field, the site is cleared from vegetation. With the low rainfall figures, wind erosion, rather than water erosion is possible.

For the highest efficiency of the PV panels the aim would be to minimise the dust generated by wind erosion.

Mitigation measures are described in paragraph 10.5.

10.4.3 Loss of topsoil

Poor topsoil management during construction, with related soil profile disturbance (excavations etc.), may result in a decrease of the soil's agricultural suitability.

If mitigating measures (paragraph 10.5) are applied, the loss would be kept to the minimum.

10.4.4 Placement of spoil material during construction

Excavation material not properly managed during construction may render adjacent agricultural land unsuitable for future use. The mechanised drill-planting of PV panel supports eliminate foundation excavations with only trenches for cabling to be excavated, which would be refilled with the excess material.

10.4.5 Generation of alternative farm income

This is a positive impact of the development on the financial sustainability of farmers.

With the financial benefit from the lease of the property, fodder can be bought from irrigation farmers at Gariep.

Loss of grazing land to the PV facility can therefore be recouped with a more intensive farming practise, subsidised by the PV facility.

10.5 Mitigating Measures

When draining the PV fields, the aim is to spread run-off water instead of collecting it.

This is done by constructing a corrugated surface. The construction can be done with normal farming machinery or special build equipment such as an Imprinter – see Figure 15.

The roughness of the surface slow down water speed for better infiltration as well as wind speed for control of wind erosion.

Figure 15: Imprinter

(Source: Soil conservation, Northam Hudson)

The impact assessment is summarised in *Table 9*.

Christo Lubbe

C R LUBBE 11 April 2016

Table 9: Summary of Impact Ratings – Pre and post mitigation

Nature of impact	Extent of impact	Duration of impact	Intensity	Probability of occurrence	Level of significance	Significance after mitigation
Loss of agricultural land	Development site	Long term	Low	Highly probable	Low	Low
Land surface disturbance, changing run-off characteristics and increasing erosion risks	Development site	Short term	Low	Highly probable	Low	Low
Loss of topsoil	Site and its immediate surroundings	Short term	Low	Improbable	Low	Low
Placement of spoil material during construction.	Site and its immediate surroundings	Short term	Low	Improbable	Low	Low
Generation of alternative farm income	Development site	Long term	Low	Improbable	Low	Low

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Thomas V, Moll E and Grant R, 2008. *Sappi Tree Spotting: Cape –From Coast to Kalahari.* Jacana, Johannesburg

Van Oudtshoorn F.1994. *Gids tot Grasse van Suid-Afrika*. Briza, Arcadia.

Appendix A

CURRICULUM VITAE

Christiaan Rudolf Lubbe

KEY QUALIFICATIONS:

National Higher Diploma in Agriculture (Irrigation), Technikon Pretoria, 1982
Certificate in Stereoscopic Interpretation, Geology and Resource Classification and Utilisation, Department of Agriculture, 1979
National Diploma in Agriculture, Technikon Pretoria, 1976

OTHER EDUCATION:

Certificate in Turf Grass Management, Technikon Pretoria, 1987
Certificate in Landscape Management, Technikon Pretoria, 1988
Cultivated pastures (Mod 320), University of Pretoria, 1995
FSC Auditors Course (Woodmark, UK), Sappi Ltd, 2003
NOSA Health and Safety Certificate, 1996
Certificate of Competence: Civil Designer - Design Centre and Survey and Design (Knowledge Base, August 2005)

EMPLOYMENT RECORD:

July 2006 to date	**CR LUBBE** Self employed Involved in various projects (see project related experience).	
June 2004- June 2006	**Gauteng Department of Agriculture Conservation and Environment** (Component: Technology Development and Support) **Acting Assistant Director: Resource Planning and Utilization**	**Johannesburg, SA**
Jan 1997 – May 2004	**CR LUBBE** **Self employed** Involved in various projects (See Project related experience below)	**Pretoria, SA**
1980 to 1996	**Technikon Pretoria** **Lecturer** Teaching Agricultural Engineering and Land Use Planning subjects. Teaching included practical courses, examination and moderation	**Pretoria, SA**
1974 - 1979	**Department of Agriculture (Transvaal Region)** **Senior Extension Technician** Farm Planning, Surveying, Design of soil conservation systems, Agricultural Extension.	**Carolina and Ermelo, SA**

SUMMARY OF EXPERIENCE

Has 42 years of experience in planning and managing natural resources to ensure optimal utilisation, without exploiting such resources to the detriment of future generations.

Fourteen years experience as a soil consultant, doing mainly soil surveys, terrain classification and agricultural potential studies. Reports include a variety of maps and GIS aspects thus play a large role in these surveys and studies.

Seventeen years of lecturing agricultural engineering subjects: Soil Conservation Techniques I, II and III, which dealt with the surveying, design and drawing of soil conservation structures; Farm Planning, which dealt with optimal resource utilization and Agricultural Mechanization, which dealt with the implements and machinery used to mechanize farming.

Ten years experience in the survey, design and supervising the construction of soil conservation structures in the agricultural field, mainly for farm planning.

<u>PROJECT RELATED EXPERIENCE</u>

PROJECTS UNDERTAKEN IN INDIVIDUAL CAPACITY

Cape EA **Apr 2015**
Agricultural Impact Assessment : EIA for the Construction and Operation of two Photovoltaic Power Stations at Kathu in the Northern Cape.

Savannah Environmental **Mar 2015**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Wind Farm near Moorreesburg, Western Cape.

Department of Agriculture, Forestry and Fisheries **Mar 2015**
Eastern Cape Land Capability Verification Survey

Department of Agriculture, Forestry and Fisheries **Dec 2014**
Western Cape Land Capability Verification Survey

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington (RE Cap 5)in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Postmasburg (RE Cap 5)in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington (Joram) in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Copperton (RE Cap 5) in the Northern Cape.

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Establishment of a Cemetery at Zoar, near Ladismith in the Western Cape. .

Cape EA **Aug 2014**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Copperton (RE Cap 5) in the Northern Cape.

Macroplan **Jun 2014**
Agricultural Impact Assessment: Application for rezoning of Agricultural land at Upington (Sweet Sensation), Northern Cape

Macroplan **Mar 2014**
Agricultural Potential Study: Application for change of land use at Upington (McTaggarts), Northern Cape

Agricultural Development Corporation **Jan to March 2014**
Design of Feedlot infrastructure and stock watering systems for Kenana Sugar in Sudan.

Cape EA **Nov 2013**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station in the Richtersveld, Western Cape.

Cape EA **Jul 2013**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station at Upington in the Northern Cape.

Cape EA **Oct 2012**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station near Danielskuil in the Northern Cape.

Senter360 **Oct 2012**
Agricultural Potential Study for a Food Security Development Units in the Democratic Republic of the Congo.

Africa Livestock Project Development Consortium **Aug 2012**
Agricultural Impact Assessment for the Construction and Operation of a Beef Cattle Handlings Facility for a Sugar Company in Northern Sudan

Van Zyl Environmental Consultants **Mar 2012**
Agricultural Impact Assessment : EIA for the Construction and Operation of a Photovoltaic Power Station in the Northern Cape.

Bushveld Eco Services **Nov 2011**
Design and cost estimate of a stock watering system in the Lephalale disctrict.

WSM Leshika **Sep 2011**
Soil suitability survey for two new upcoming farmers at Vhuawela & Tshoga in the Limpopo Province.

National Department of Agriculture **Aug 2011**
Soil survey investigating soil potential for change of land use at the Levendal Development in the Paarl district, Western Cape.

Van Zyl Environmental Consultants **Mar 2011**
Agricultural Impact Assessment : EIA for the Construction and Operation of four Photovoltaic Power Stations in the Northern Cape.

WSM Leshika **Nov 2010**
Potential assessments and land use plans for four new upcoming farmers in the Limpopo Province.

FP Botha **Apr 2010**
Potential assessments and land use plans for various new Limpopo agricultural development hubs

Golder Associates Africa (Pty) Ltd **May 2009 – Apr 2010**
Potential assessments and Landuse plans for the resettlement of land tenants at Mafube Coal Mine in the Belfast district of the Mpumalanga Province
Sappi **Vryheid, RSA**
Undertook reconnaissance soil surveys on various plantations and farms in the Vryheid and Piet Retief districts to establish forestation potential and evaluation for species choice (covering a total area of 5173 ha).

Environmentek, CSIR **Nelspruit, RSA**
Undertook soil and terrain classification surveys on the Jessievale (8313 ha) and New Agatha (1 700 ha) plantations.

Safcol (Komatieland) **Limpopo Province**
Undertook environmental, soil and terrain classification surveys on the Thatevondo (4 500 ha), Mafela (920 ha) and Mmamatola (1 263 ha) plantations.

Measured Farming **Gabon, Swaziland & RSA**
Undertook soil and terrain classification surveys on Ranch Lope and Ranch Suba in Gabon, Kubuta Farm in Swaziland and on the farms Madikwe in the Limpopo Province and Stoffelsrus in the Free State, South Africa.

Loxton Venn and Associates **Potgietersrus, RSA**
Assess comparative soils and area for relocating Village Ga-Sekhaolelo on Overysel 815LR to Rooibokfontein 812LR and Village Ga-Puka on Swartfontein 818 LR to Armoed on Potgietersrus Platinum Mine.

Department of Water Affairs and Forestry **Gauteng**
GPS survey and alien identification for mapping of Jukskei and Swartspruit areas, as part of the Working for Water Program.

Sustainable Forestry Management Ltd **Limpopo and Mpumalanga**
Participated in a due diligence audit on various SAFCOL plantations in the Limpopo and Mpumalanga Provinces as part of the preparation of a British company's tender to purchase these plantations.

Mustek Engineering **Ghana**
Survey to provide a detailed inventory of the forest resources in 17 specified Forest Reserves in Ghana to develop a practical and operationally sound methodology for monitoring the natural forest resources in Ghana, based on satellite imagery for the Ghana Forestry Commission.

Afrigis Environmental Solutions, Pretoria
Various Soil Surveys and Landuse Plannings – Domestic and Neighbouring Countries

Rural Integrated Engineering, Pretoria
Various Soil Surveys and Landuse Plannings

Africa Land-Use Training, Modimole
Lectures at Basic Farm Planning Course (Limpopo and Gauteng)

Declaration of Independence

CR Lubbe was appointed by Humansrus Solar 3 (Pty) Ltd via Cape Environmental Assessment Practitioners, the EAP, to conduct an independent agricultural study for the proposed power facility near Coperton.

He is not a subsidiary or in any way affiliated to Humansrus Solar 3 (Pty) Ltd.

CR Lubbe also does not have any interest in secondary developments that may arise from the authorisation of the proposed project.

Christo Lubbe

CR Lubbe

11 April 2016