ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED CONSTRUCTION AND IMPLEMENTATION OF A PHOTOVOLTAIC POWER PLANT ON PORTION 1 OF N'ROUGAS NO 121, NEAR KENHARDT IN THE NORTHERN CAPE PROVINCE

APPLICANT: AMDA-ALPHA (PTY) LTD

AGRICULTURAL SCOPING REPORT

21 MARCH 2016

STUDY CONDUCTED AND REPORT COMPILED BY: C R LUBBE

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1. INTRODUCTION

Cape Environmental Assessment Practitioners (Pty) Ltd is conducting an Environmental Impact Assessment for AMDA-ALPHA (Pty) Ltd to construct a solar power plant. The development site is on Portion 1of N'Rougas No121 Kenhardt registration Division 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 scoping study has been commissioned to scope possible impacts of the project on its immediate agricultural environment.

This document reports on a study that focuses specifically on the potential impacts of the project on **agriculture**. CR Lubbe undertook the study during February 2016. The scope and purpose of the study are described in detail below.

2. OBJECTIVES

The objectives of this study were to consider the possibility of temporary and permanent impacts on agricultural production that may result from the construction and operation of the PV Power Plant. Appropriate mitigation measures would be recommended to avoid or minimise the severity of the impacts.

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

The site was visited and assessed for land use and agricultural potential. An augering survey was carried out and plotted and soil groups were indicated in uniform polygons.

Potential impacts of the proposed project on agriculture were identified and considered, with particular attention to the following aspects:

- The possibility of permanent loss of high potential agricultural land;
- Impairment of land capability due to construction;
- Veld conditions for grazing.
- Analysis of erosion risk because of altered drainage patterns and poor rehabilitation in erosion-sensitive areas.

4. 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 potential study reported in this document.

5. DESCRIPTION OF THE PROPOSED PROJECT

The company AMDA-ALPHA (Pty) Ltd intends to construct a 75 MW Solar PV facility on Portion 1 of the farm N'Rougas Zuid No 121 near Kenhardt in the Northern Cape.

The technology to be used will be either a fixed tilt structure or mounted on horizontal axis trackers

The total property size of the farm is 5232,8138 ha, but the total development area will be approximately 250 ha, including the solar PV field, a sub-station, office buildings and roads.

The project will connect to the Niewehoop MTS near Kenhardt.

6. THE POTENTIALLY AFFECTED ENVIRONMENT

This section provides a general description of the immediate environment potentially affected by the construction, operation and closure of the proposed PV power plant.

6.1. Locality

The proposed power facility will be located approximately 28km north-northeast of Kenhardt via the the Louisvale road (R388) – see Figure 1.

Figure 1: Location of the proposed power facility

6.2. Physical description of site

AMDA Alpha is situated in the Bushmanland region of the Nama Karoo at 1000m amsl in the Kenhardt district, Northern Cape province. The general visual impression is open shrubland with low relief and very sparsely populated. Only sheep farming appears to take place as agricultural activity.

The following natural physical data is applicable:

6.3. Geology

The general geological description is that of Namaqualand Natal Province metamorphic complex

It consists dominantly of sedimentary rocks and sub dominant Gneiss. Rocks included in the Namaqualand Metamorphic Complex are migmatite, gneiss and granite; with occasional small outcrops of ultrametamorphic rocks, forming small hills.

6.4. Climate

The region is classified as an arid zone with desert climate. The following specific parameters are applicable:

Table 1: Climate data

Climate				
Rainfall		**Evaporation**	**Temperature**	
Month	**Precipitation monthly**	**Daily**	**Season**	**Temperature**
January	22m	7.3mm	Summer Max	33.1-35°C
February	33mm	6.6mm	Summer Min	29.3-31°C
March	39mm	5.2mm	Winter Max	13.4-15.2°C
April	18mm	4.0mm	Winter Min	4 to -5.5°C
May	13mm	2.8mm		
June	3mm	2.3mm		
July	2mm	2.6mm		
August	3mm	3.6mm		
September	3mm	4.6mm		
October	7mm	5.7mm		
November	9mm	6.6mm		
December	12mm	7.4mm		

6.5. Soils

Considering the geology and climate associated with the investigated area, typical soil characteristics will include soils with minimal development, 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, structureless soils may occur.
- Soils may have favourable physical properties.
- Soils may also have restricted depth, excessive drainage, high erodibility and low natural fertility.

6.6. Vegetation

According to Acocks, the vegetation type is Karoo and Karroid veld types. AGIS classifies the biome as Nama Karoo and the vegetation type as Bushmanland arid Grassland with a carrying capacity of 32 ha/LSU.

6.7. Topography

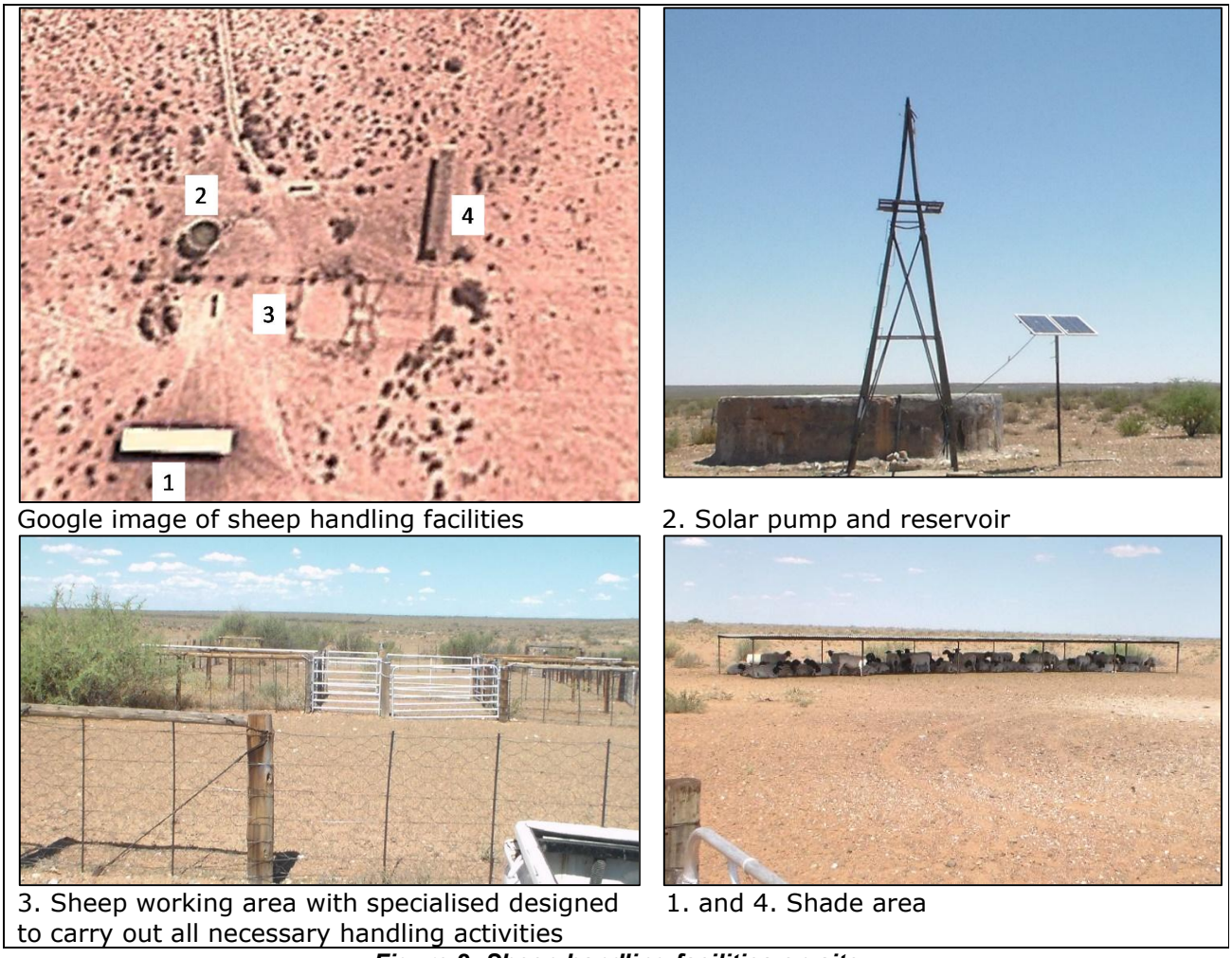
The terrain type is level plains with some relief and a slope less than 2%. Terrain shape is regular with the terrain position Crestline to upper midslope.

7. STUDY FINDINGS

The site was visited in February 2016.

7.1. Past and Current Agricultural Activities on Site

Extensive sheep farming is practised. The farm is sub-divided into grazing camps with very effective work stations for the handling of sheep. One of these stations fall in the confinement of the proposed PV Field – see Figure 2.



Google image of sheep handling facilities

2. Solar pump and reservoir

3. Sheep working area with specialised designed to carry out all necessary handling activities

1. and 4. Shade area

Figure 2: Sheep handling facilities on site

7.2. Soil Classification

An augering survey was carried out. At each augering point (indicated by numbers on Figure 3), an observation record was completed.

The soil observation records in Table 2 are representative of the two dominant soil forms found on the site. These are further described below each observation record.

The soils were then grouped in two utilization polygons, using effective rooting depth as yardstick.

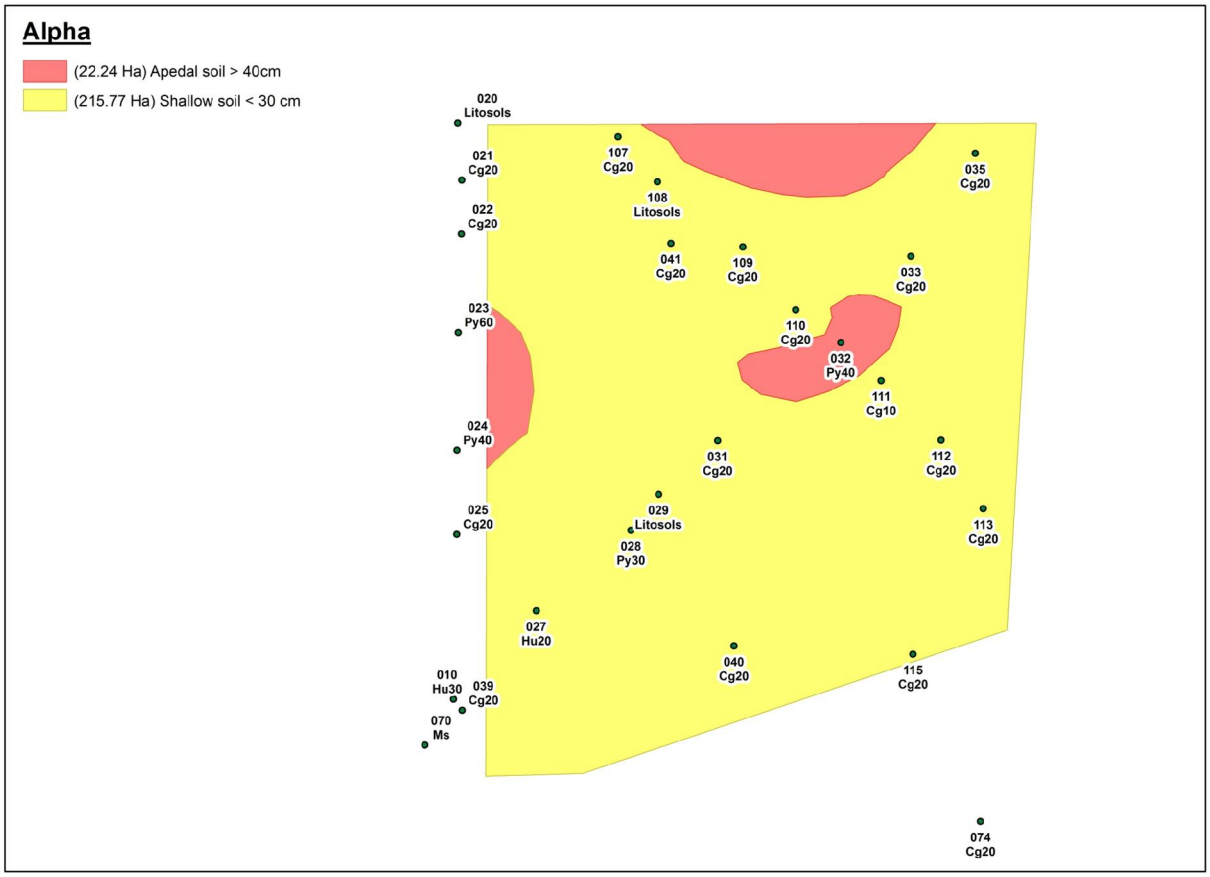


Figure 3: Observation points on soil map

Table 2: Soil Forms

Plooysburg form (Family Brakkies)

OBS	32	COMMENT													
LAT	29 07 21.1	SLOPE GRAD		1		MOISTURE		L							
LONG	21 17 52.5	SLOPE SHAPE	R			EROSION		L							
	FORM	Py	TSD	40	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	40	C	I	1	A	20	2.5YR56	6	m	4	sg	0
	ROUGH	1	ASD	40	GEO	G1	2	B	40	2.5YR56	6	m	4	a	0
	TERR_POS	4	LTN	h	PHOTO		3								
	L.COVER/USE:	Small shrub Three thorn lot surface rock													
	VIS.VELD.COND	A		B		C		D		E		TOTAL			

Profile:

20 cm red, sandy, (medium grade) single grain structure top soil.

20 cm red sandy, (medium grade) with apedal structured sub soil.

Restricted by Hardpan carbonate layer

Coega form (Family Nabies)

OBS	40	COMMENT		lithos											
LAT	29 07 42.0	SLOPE GRAD		1			MOISTURE		L						
LONG	21 17 41.7	SLOPE SHAPE		R			EROSION		L						
	FORM	Cg	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	20	C	I	1	A	20	2.5YR59	6	m	4	sg	s 3
	ROUGH	2	ASD	20	GEO	G1	2								
	TERR_POS	1	LTN	h	PHOTO		3								
	L.COVER/USE:	shrubs Three thorn													
	VIS.VELD.COND	A		B		C		D		E		TOTAL			

Profile:

10 cm red sandy, (medium grade) single grain structure top soil.

Restricted by Hardpan Carbonate layer

7.2.1. EFFECTIVE ROOTING DEPTH

The larger part (91% - 216 ha) of the area surveyed has an effective depth of less than 30cm. 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 rest of the area (22ha) has an average depth of 40 cm. The root development area is restricted by carbonate hard setting or rock, as indicated in Table 2 above. The stony nature reduces available soil for root development and water retention, and creates a high mechanical risk for agricultural machinery.

7.2.2. TEXTURE

The clay content of the top horizon is 6% and the sub-horizon is 6% with medium sand grade. The texture class is sand.

The 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.

7.2.3. DEPTH LIMITING LAYER

The hard setting layer (Hard carbonate horizon) and/or Carbonate rock results in:

- Mechanical limitations for cultivation (stoniness)
- Prevention of root development
- Limited water holding capacity

7.3. Veld Condition Assessment

Typical Nama Karoo vegetation of the Bushmanland region covers the surface, eg. dwarf woody shrubs and *Stipagrostis* grass species. The cover is very sparse with bare areas or areas where rocks surface – see Figure 4

Figure 4: Veld condition

Higher shrubs, such as *Rhigozum* species tend to become invasive. Trees are absent, except for the Quiver tree Aloe.

Moderate wind erosion is noticed.

7.4. Land Capability and Suitability for agriculture

The land surveyed falls in capability class Vl, generally not suited for cultivation. Very severe limitations restrict land use to grazing, woodlands or wildlife - see **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 3: Land Capability and Suitability Assessment for Crop Production

Land capability class	Suitability Rating	Major Limitation to Crop Production	Area (ha)	% of Local Study Area
Class VI Cg/Lithosols	Very low	Low water holding capacity Shallow rooting zone Severe climate Severe erosion hazard	216 ha	91
Class lV Py>40cm	Low	Low water holding capacity Severe climate	22 ha	9

Table 4: Land Capability and Suitability Assessment for Grazing

Area Description	Suitability Rating	Major Limitation to Grazing	Area (ha)	% of Local Study Area
Cattle	Medium -	Very shallow rooting depth on carbonate hard setting layer. Low clay content Low rainfall Carrying capacity of 32ha /LSU	238 ha	100

7.5. Water Availability/Provision

Water is provided to livestock from a borehole pumped to a reservoirs and troughs.

7.6. Assessment of connecting lines

The PV field is to be connected to the National grid via an overhead line to the Niewehoop MTS sub-station near Kenhardt - see Figure 5.

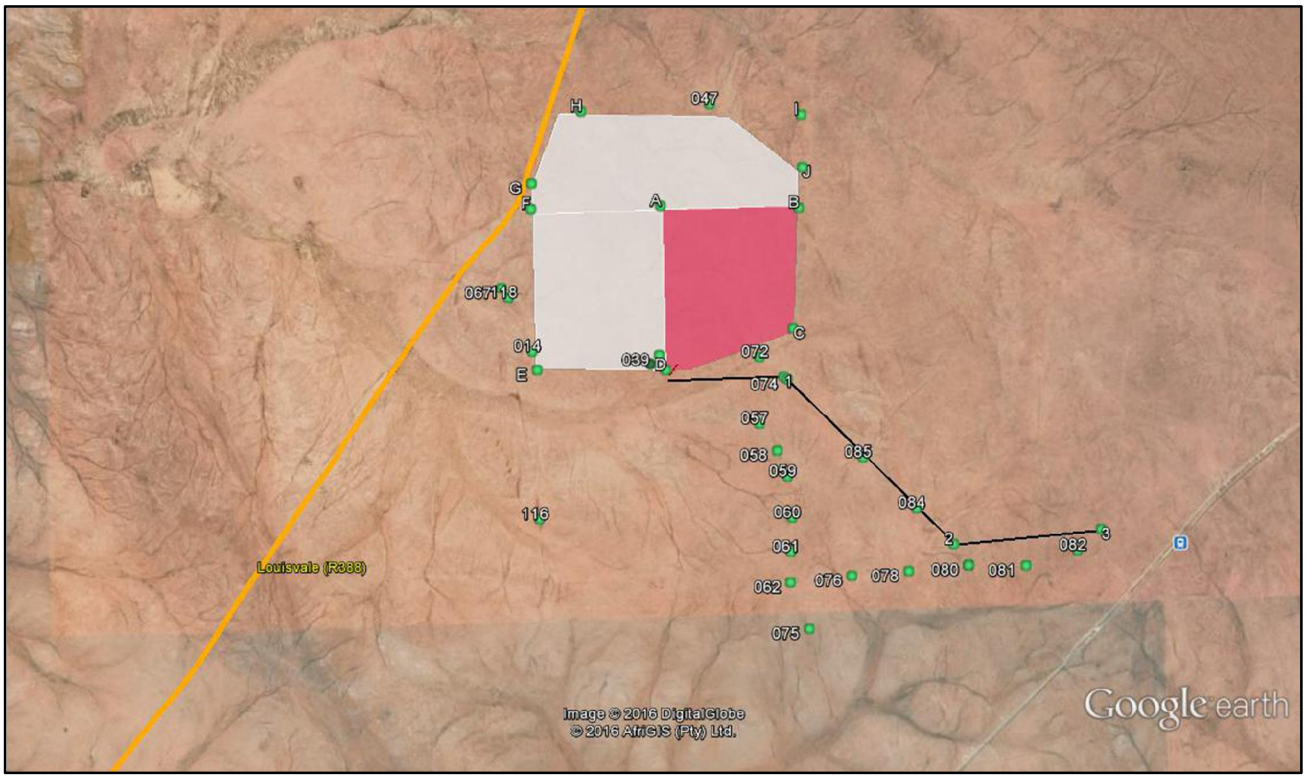


Figure 5: Connection line – also see Figure 6.

The Overhead connecting line will follow the route as shown in Figure 6. From point 39 to 74 it will be in the premises of the applicant then to point 2 from where it will follow the same alignment as the Eskom line (in construction at the moment).

The soil and vegetation cover is of the same characteristics as the proposed site.

Figure 6: Photos along the route of the proposed connecting line – also see Figure 5.

7.7. Summary of findings

The site is largely unsuitable for cultivation due to the following limiting factors:

- Extremely 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 soils have carbonate-rich B-horizons. The use of Calcic soils is limited by climate (low rainfall and high evaporation), shallow soil depth, high pH, low plant available P and trace elements (especially Fe), toxic levels of extractable B and stoniness. All calcic soils are highly susceptible to water erosion.
- The 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.

Although the grazing potential is very low, the area could be utilised for grazing.

8. POSSIBLE IMPACTS

The following possible impacts should be considered:

- Loss of agricultural land.
- Placement of spoil material generated from construction related excavations, which can cover agricultural land and thereby render it unsuitable for future agriculture.
- Land surface disturbance and alteration of its run-off.

9. CUMMULATIVE EFFECTS ASSESMENT

Figure 7 shows the various farms on which similar developments are constructed / planned. In combination with this proposed AMDA ALPHAfacility, they may have a cumulative effect on the agricultural region.

To assess the cumulative effect that the various developments may have on agriculture, the following situations will have to be addressed:

- Changes in hydrological regimes
- Decreases in quantity and quality of soils
- Loss of natural habitat or historic character through industrial development
- Loss of biological diversity

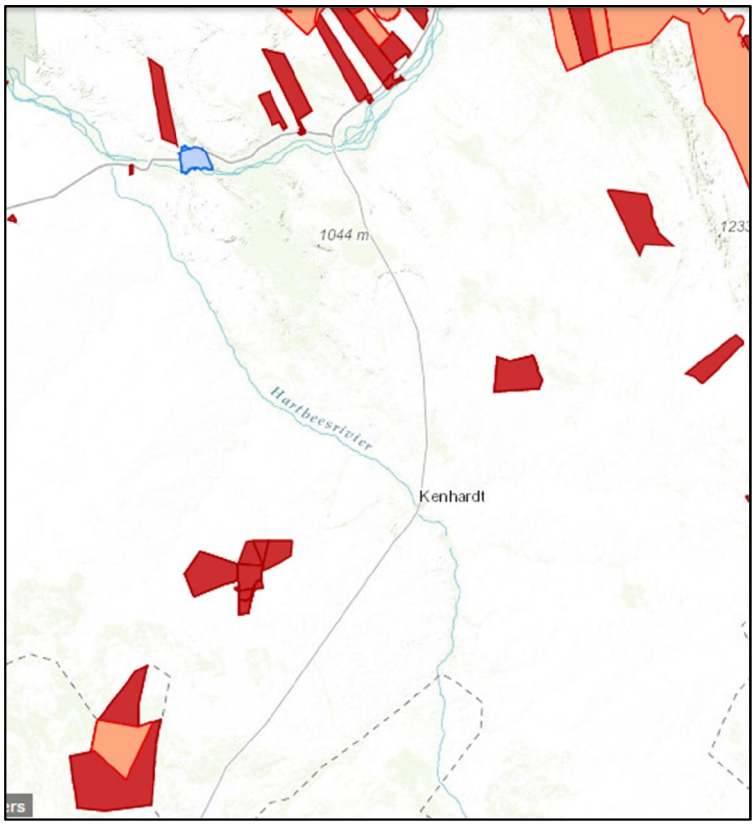


Figure 7: Renewable Energy Farms in the Kenhardt area
(Source: Department of Environmental Affairs)

10. CONCLUSION

The findings of this study indicate that the site's agricultural potential is low. Due to poor soil properties and extreme climatic conditions, farming activities consist of grazing for sheep.

The proposed power facility will have minimal impacts on agriculture, locally and on site, and will have very little influence on the current commercial farming.

Christo Lubbe

C R LUBBE **21 March 2016**

LIMITATIONS

This Document has been provided subject to the following limitations:

(i) This Document has been prepared for the particular purpose outlined in the proposal and no responsibility is accepted for the use of this Document in other contexts or for any other purpose.

(ii) CR Lubbe did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document.

(iii) Conditions may exist which were undetectable given the limited nature of the enquiry CR Lubbe was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

(iv) It is recognised that the passage of time affects the information and assessment provided in this Document. CR Lubbe's opinions are based upon information that existed at the time of the production of the Document. CR Lubbe's opinion rests on the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site.

(v) Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

(vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted for incomplete or inaccurate data supplied by others.

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

Appendix A

Environmental Practitioner 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.

PROJECT RELATED EXPERIENCE

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)

Appendix B

Declaration of Independence

CR Lubbe was appointed by AMDA-ALPHA (Pty) Ltd via Cape Environmental Assessment Practitioners (Pty) Ltd, the EAP, to conduct an independent agricultural study for the proposed power facility near Kenhardt.

He is not a subsidiary or in any way affiliated to AMDA-ALPHA (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

21 March 2016