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-CHARLIE (PTY) LTD

SPECIALIST REPORT: AGRICULTURE

12 August 2016

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1. SPECALIST DETAILS

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He has 43 years of experience in planning and managing natural resources to ensure optimal utilisation, without exploiting such resources to the detriment of future generations.

The past 15years he has spent 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.

The previous 17 years, he lectured agricultural engineering subjects at the Tshwane University of Technology, teaching 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.

His first ten years in the agricultural environment he spent on the survey, design and supervising the construction of soil conservation structures in the agricultural field, mainly for farm planning.

A curriculum vitae is attached as Annexure A.

The site investigation was conducted in late summer, during February 2016, the expected rain season. During this period, the natural veld can be assessed and drainage patterns noted. These are important for rehabilitation after construction and decommissioning and serve as benchmark for mitigation measures.

2. SCOPE AND PURPOSE OF REPORT

Cape Environmental Assessment Practitioners (Pty) Ltd is conducting an Environmental Impact Assessment for AMDA-CHARLIE (Pty) Ltd to construct a 75 MW Solar PV facility on Portion 1 of the farm N'Rougas Zuid No121 in the Kenhardt Registration Division, Northern Cape Province.

The technology to be used will be horizontal single axis trackers.

The total property size of the farm is 5232,8138 ha, but the total development area will be approximately 275 ha, including the solar PV field, a sub-station, office buildings and roads.

The project will connect to the Niewehoop MTS near Kenhardt.

As part of this EIA, an agricultural impact study has been commissioned. **This document** reports on a study that focuses specifically on the potential impacts of the project on **agriculture**.

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 are 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 by construction;
- Veld conditions for grazing and current palatable vegetation;
- Erosion risks

3.3 ASSESSMENT CRITERIA AND RATING OF IMPACTS

Potential impacts of the proposed project on agriculture were identified and evaluated. Impacts identified through the study were rated in terms of the following variables:

3.3.1 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

3.3.2 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.

3.3.3 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.

3.3.4 Intensity

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

3.3.5 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).

3.3.6 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.

4. SENSITIVITIES OF THE SITE

As far as agriculture is concerned, there are no specific sensitivity to the proposed PV power facility and no area to be avoided. This does not take the areas into account indicated by the other specialist studies.

However, there is a hard carbonate sub soil layer that will be disturbed during excavation, which will accumulate. With the necessary management, it could be used to benefit environment and facility, by using it for combatting wind erosion and building access roads.

The illustration in Figure 1 superimposes the activity and its associated structures on the site. There are no areas to avoid on account of agricultural sensitivities.

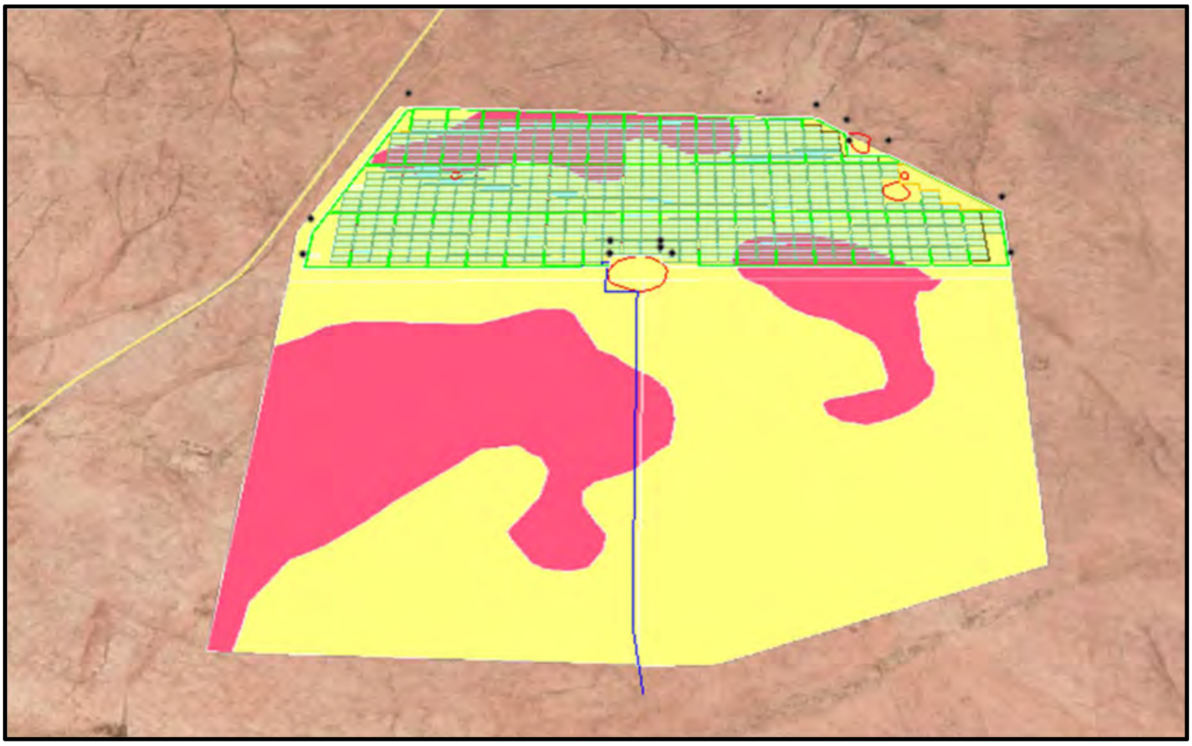


Figure 1: Associated structures on the site

5. 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.

6. STUDY FINDINGS

6.1 LOCALITY

The proposed power facility will be located approximately 28km north-northeast of Kenhardt via the Louisvale road (R388) – see Figure 2.

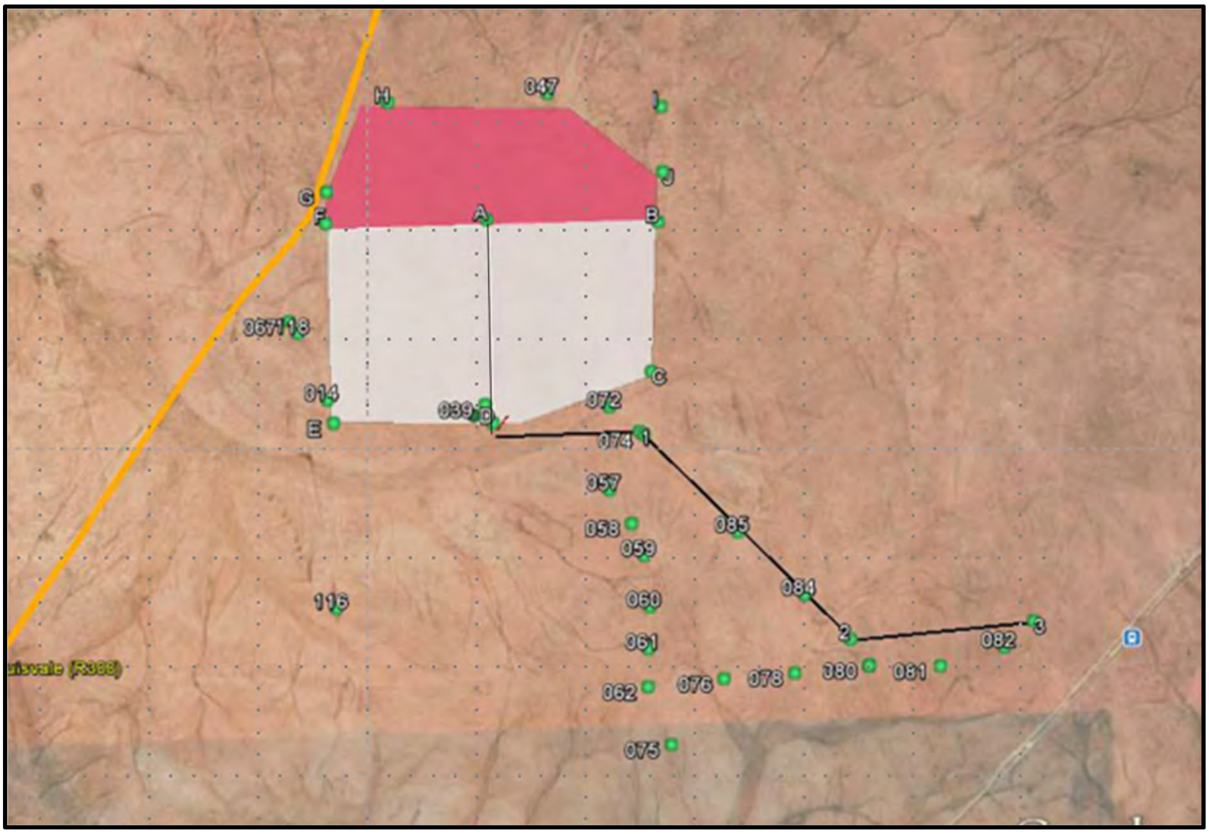


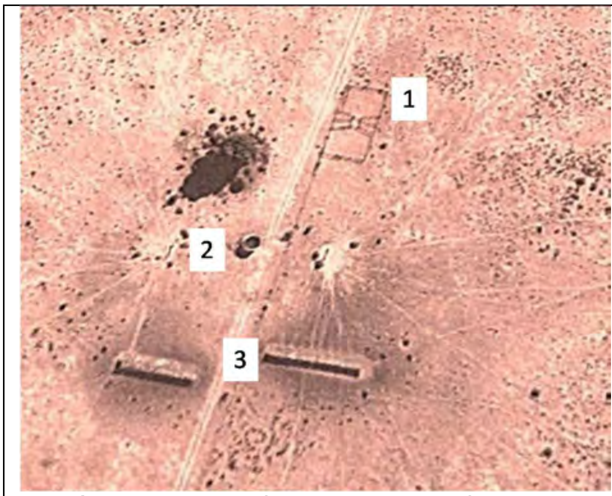
Figure 2: Location of the proposed power facility

6.2 PHYSICAL DESCRIPTION OF SITE

AMDA-CHARLIE 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.

6.3 PAST AND CURRENT AGRICULTURAL ACTIVITIES ON SITE

Extensive sheep farming is practised. The farm is sub-divided into grazing camps with very effective workstations for the handling of sheep. One of these stations is just outside the confinement of the proposed PV field. See Figure 3.



Google image of sheep handling facilities


2. Reservoir with kraal in back


Special gate extension for forcing sheep


3. Shade area

Figure 3: Sheep handling facilities on site

6.4 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.

6.5 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 ultra metamorphic rocks, forming small hills.

6.6 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		

6.7 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.

6.7.1 Veld Condition Assessment

Typical Nama Karoo vegetation of the Bushmanland region covers the surface, e.g. dwarf woody shrubs, *Stipagrostis* grass species and Karee Rhus, as can be seen in Figure 4. The cover is very sparse with bare rocky areas.

Figure 4: Veld condition

6.8 WATER AVAILABILITY/PROVISION

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

6.9 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.

6.9.1 Soil Classification

An augering survey was carried out. At each augering point (indicated by numbers on Figure 5), an observation record was completed.

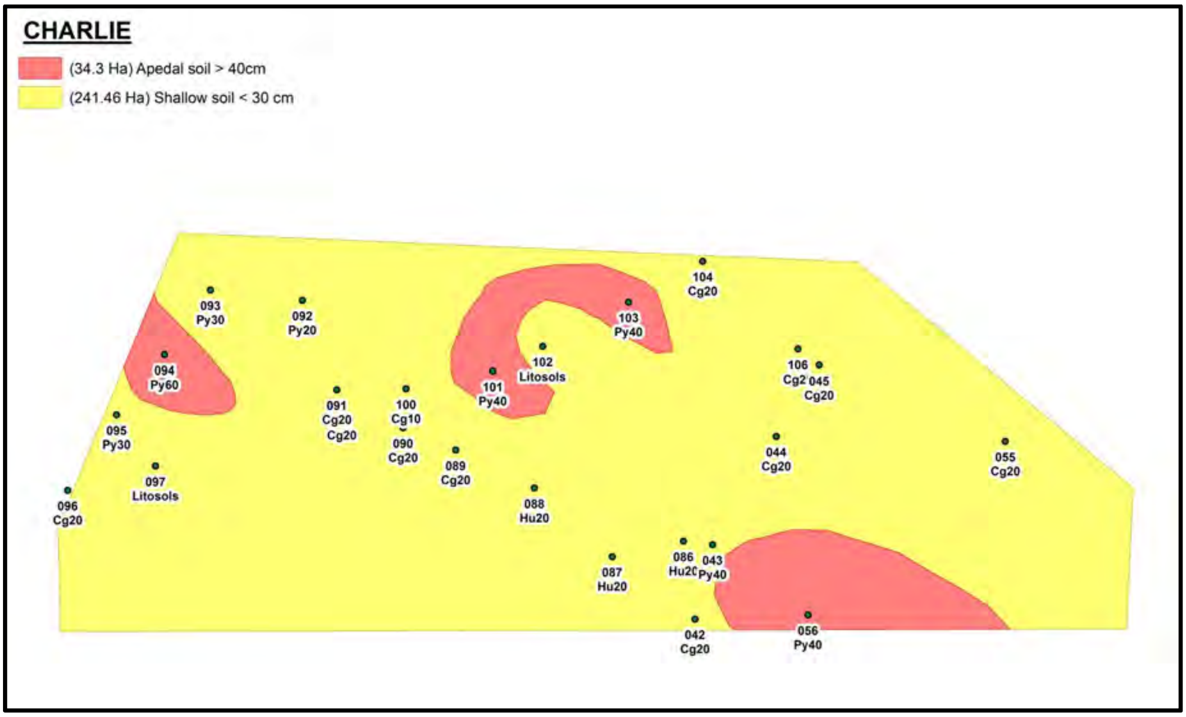


Figure 5: Observation points on soil map

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.

Table 2: Soil Forms

Plooysburg form (Family Brakkies)

OBS	103	COMMENT												
LAT	29 06 32.3	SLOPE GRAD	1			MOISTURE		L						
LONG	21 17 21.1	SLOPE SHAPE	R			EROSION		M						
	FORM	Py	TSD	40	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	1000	ESD	40	C	l	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:														
	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

Hutton form (Family Stella)

OBS	88	COMMENT												
LAT	29 06 49.0	SLOPE GRAD	1			MOISTURE		L						
LONG	21 17 11.5	SLOPE SHAPE	R			EROSION		M						
	FORM	Hu	TSD	20	WET	0	HOR	TYPE	DEPTH	COL	CLAY	S-GR	CONS	STRUC	STONE
	FAM	3100	ESD	20	C	l	1	A	20	2.5YR56	6	m	4	sg	s3
	ROUGH	1	ASD	20	GEO	G1	2								
	TERR_POS	1	LTN	rr	PHOTO		3								
	L.COVER/USE:	Surface rock karoo shrubs													
	VIS.VELD.COND	A		B		C		D		E		TOTAL			

Profile:

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

Restricted by rock layer

6.9.2 Connecting power 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 6.

The overhead connecting line will follow the route as shown in Figure 7. From point A 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 (currently under construction).

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

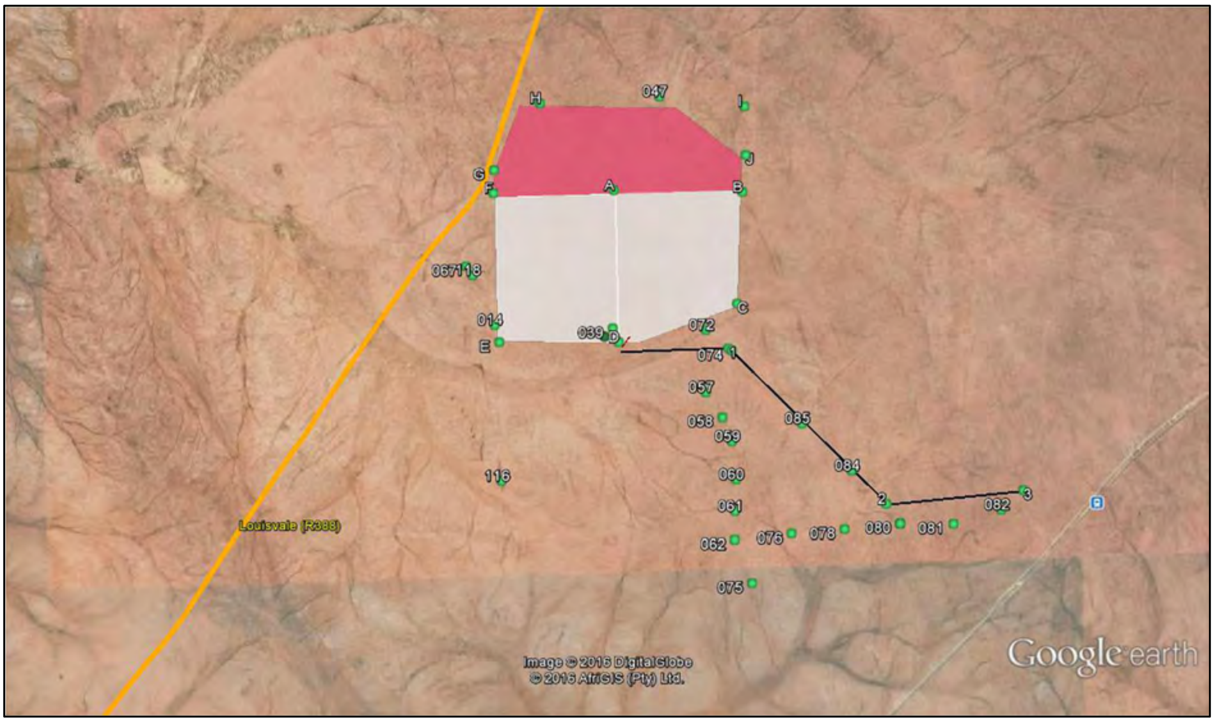


Figure 6: Connection line – also see Figure 7

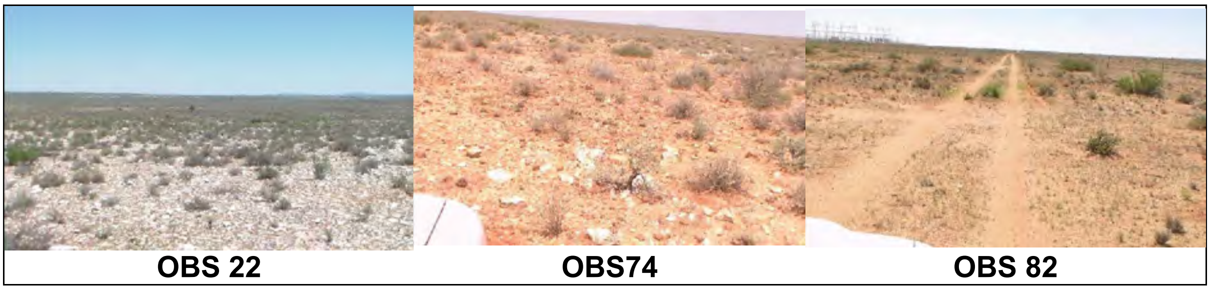


Figure 7: Photos along the route of the proposed connecting line – also see Figure 6.

6.9.3 Effective rooting depth

The larger part (88% - 241 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 (34ha) 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.

6.9.4 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.

6.9.5 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.

6.9.6 Land Capability and Suitability for agriculture

The land falls in capability class VI, generally not suited for cultivation. Very severe limitations restrict land use to grazing, woodlands or wildlife. See *Table 3* and *Table 4*.

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	241 ha	88
Class IV Py>40cm	Low	Low water holding capacity Severe climate	34 ha	12

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	275ha	100

7. POTENTIAL IMPACTS ON THE AGRICULTURAL ENVIRONMENT

When debating the authorisation of the proposed activity or not, the findings set out in par 6 above identify the following potential impacts on the land:

- The possibility of permanent loss of high potential agricultural land and the impairment of land capability due to construction;

- Veld conditions for grazing and the possible impact of vegetation removal during construction;

- The alteration of drainage patterns and its associated risk for erosion; due to the removal of vegetation during construction of the facility, the building of service and access roads if rehabilitation is not properly done in erosion-sensitive areas.

These correlate with the focus points during the field investigation and are discussed below.

7.1 AN AREA LOST FOR AGRICULTURE

Agricultural production is confined to specific parameters, such as size of land, climatic conditions, soil potential, availability of supplementary water, infrastructure and management.

Soil potential is defined as the inherent ability of land to give a certain yield within the limits of its restrictive soil physical properties and climatic conditions.

According to the study, the agricultural potential is low due to the following limitations:

The climate of the region is essentially arid with a variable rainfall of between 70-240 mm per annum, mostly in the late summer. Summer noon temperatures of 40°C and winter dawn of minus 5°C is not unusual with frost to occur 10-40 days per annum. High loss of plant available water takes place due to evaporation. This climate characteristics restrict the growing season to a very small window for crop production.

Soil properties are very limited on crop production because of the following reasons:

- 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 phosphate and trace elements (especially iron), toxic levels of extractable Boron 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.

This combination of soil properties and climate conditions indicate that the land is only suitable grazing.

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

The grazing capacity is low (32ha/LSU) or ± 5,3 ha/SSU.

When determining what is lost for agriculture in terms of produce or livestock, it is only the livestock to be answered for. On the original area of 5235ha, the herd would be 988 SSU and without the 275ha, it will be 936SSU or a deficit of 5%

The borehole will still be available during the lease to provide drinking water for the sheep.

The loss of grazing area could also be befitting, when taking into account the opinion of a sheep farmer from the Loxton area, which has similar agricultural conditions as the Kenhardt area:

One of the principles is to utilize only 80% of the recommended carrying capacity (8ha/SSU instead of 6ha/SSU). The reason is to have more crude material from the veld, which requires less lick and concentrated feed supplements when grazing get scarce .This is very important where the rainfall is not so predictable. With management, the loss of income can be accounted for. (Landbouweekblad, 22 April 2016).

Then the area is not permanently excluded from the farm. It could be considered as a grazing camp in rest to be reinstalled after the lease as a rehabilitated grazing camp.

No mitigation measures are applicable under this scenario.

7.2 VEGETATION REMOVAL

Vegetation removal during construction may have a negative impact on veld conditions for grazing and may cause erosion.

The development of the proposed facility will take place in three phases, construction, operational and decommissioning. During each of these phases, vegetation will be exposed to specific impacts caused by the stripping of vegetation and mechanical disturbance of the soil profile:

7.2.1 Construction phase

During this phase stripping of vegetation takes place, topsoil is removed and stock piled, access roads are constructed, structures are erected and vegetation resettled. Where soil conditions allow, topsoil will be left in situ as far as possible.

The resettlement of vegetation form the basis on which the last two phases shall perform. Therefore, this is the starting point of the rehabilitation process.

7.2.2 Operational phase:

This is the longest phase (25-30 years). During this phase, the re-vegetated surface must be conserved and most probably reseeded and constructed roads and structures be maintained.

7.2.3 Decommissioning phase

When the facility reaches the end of its economic lifespan, decommissioning will take place.

The area must be restored to its natural stage. Not necessarily the pre-settlement condition, but rather adhering to the following principles:

- Stabilisation of erosion
- Establishment of dense and protective cover
- Introduction of palatable plant species

The rehabilitation process is subject to environmental conditions and the benchmark has to be correlated to the general composition of surrounding farms.

Mitigation measures are set out in par 0.

7.3 ALTERING OF DRAINAGE PATTERNS BY CONSTRUCTION

The facility will be built on the Plateau and Upper-Mid slope.

The drainage system consists of numerous seasonal drainage lines conveying flash downpours to seasonal rivers.

With a slope of less than 2%, small catchment area and multiple drainage lines, there will be no concentration of run off. The single axis trackers also will have low diversion abilities.

With the construction of access roads, the necessary drainage and conservation principles should be applied to avoid impacts on existing drainage lines and rather complement them.

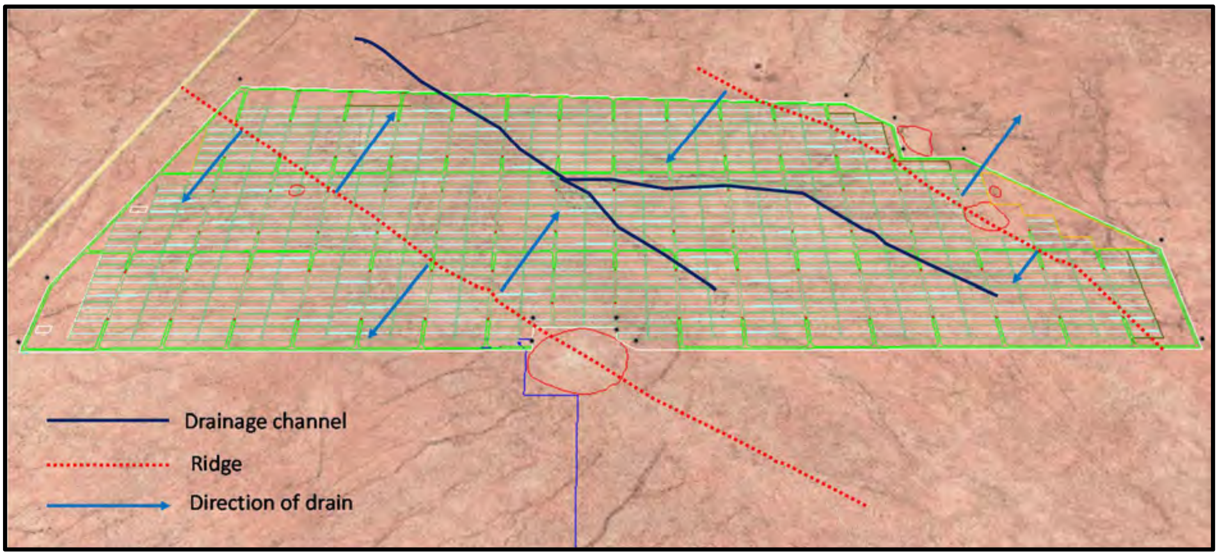


Figure 8: Drainage pattern

Considering these impacts, my opinion is that the proposed facility may be authorised, as long as avoidance management and mitigation measures are followed. This should be included in the EMPR and Closure Plan.

8. MITIGATION MEASURES

8.1 VEGETATION

The rehabilitation process starts during construction already and is subject to environmental conditions. The benchmark should correlate with the general composition of surrounding farms.

Mitigation procedures are dependent on the prevention of erosion and related to the rehabilitation of sheet erosion.

The goal would be to stabilise the erosion, establish a dense and protective plant cover and finally introduce palatable plant species.

The site preparation should be carried out in phases to reduce the risk of erosion and keeping the topsoil ''alive'' in the stockpiles.

Natural growth of vegetation under the PV panels is possible due to the use of horizontal single axis trackers. These units do not prevent natural sunlight or rain to reach the soil surface.

The arid nature of the climate and soil characteristics of the region prevent quick transformation when rehabilitation is considered. The *Rhigozum* species can become invasive and must be controlled. These plants can be chipped and used as mulching to enhance regrowth.

Further procedures are described in par 8.2.

8.2 EROSION

Soil moisture increases cohesion of sand and loam, temporarily preventing wind erosion. Therefore, excavation and road construction should take place during the peak rain season in March.

- Establish a rough surface left by cloddy tillage or ridges perpendicular to the prevailing wind to slow down the wind speed at ground level. Ridges must not be higher than 40cm).
- Permeable barriers could be constructed to retain runoff and trap any transported material. Hard carbonate lumps created with the excavation of cabling trenches can be used to build permeable barriers (low stonewalls) to detain surface runoff and trap transported materials. See Figure 9

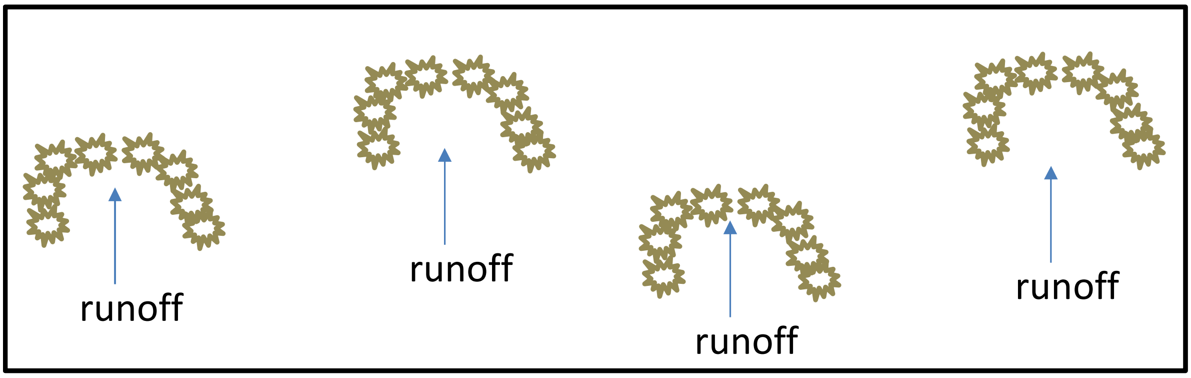


Figure 9: Permeable barriers

To break the capped surface or provide seedbeds for when topsoil is replaced, a puddle plough can be used for range pitting. The method involves the creating of hollows over the effected site. These are demonstrated in Figure 10.

If covered with the stockpiled soil, these hollows act as miniature seedbeds for re-vegetation. Further advantages are to capture runoff water, transported organic material and windblown seed.

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.

An alternative for stripping by grader is using a tine implement, which leaves the top soil with a rough effect but not removing it.

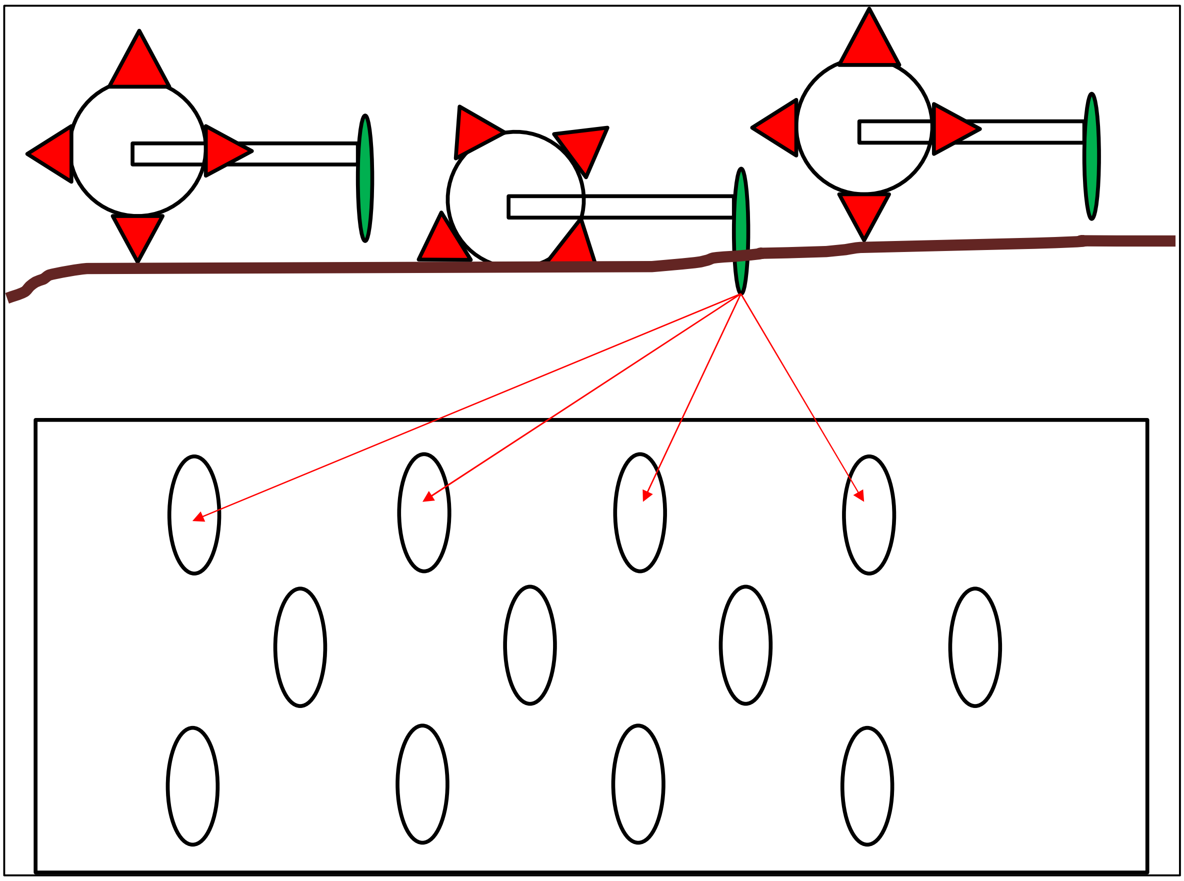


Figure 10: Range pitting with puddle plough

Closure Plan

The aim of the closure plan is to restore the site. .All components of the facility will be dissembled and roads will be demolished. Rehabilitation should focus on:

- Stabilisation of erosion
- Establishment of dense protective vegetation cover and even introducing a more palatable plant cover.
- Former access roads should evenly be re-vegetated.

As already mentioned, rehabilitation will be an ongoing process, starting at construction.

A summary of findings, possible impacts and the results of mitigation measures are set out in Table 5

Table 5: Summary of impacts before and after mitigation

Nature of impact	**Extent of impact**	**Duration of impact**	**Intensity**	**Probability of occurrence**	**Level of significance**	**Significance after mitigation**
The possibility of permanent loss of high potential agricultural land and the impairment of land capability due to construction	Development site	Long term	Low	Highly probable	Low	Low
Veld conditions for grazing and the possible impact of vegetation removal during construction;	Development site	Short term	medium	Highly probable	medium	medium
The alteration of drainage patterns and its associated risk for erosion; due to the removal of vegetation during construction of the plant, the building of service and access roads if rehabilitation is not properly done in erosion-sensitive areas.	Site and its immediate surroundings	Short term	Low	Improbable	Low	Low

9. CUMMULATIVE EFFECTS ASSESMENT

Figure 11 shows the various farms on which similar developments are constructed / planned. In combination with this proposed AMDA-CHARLIE facility, they may have a cumulative effect on the agricultural region.

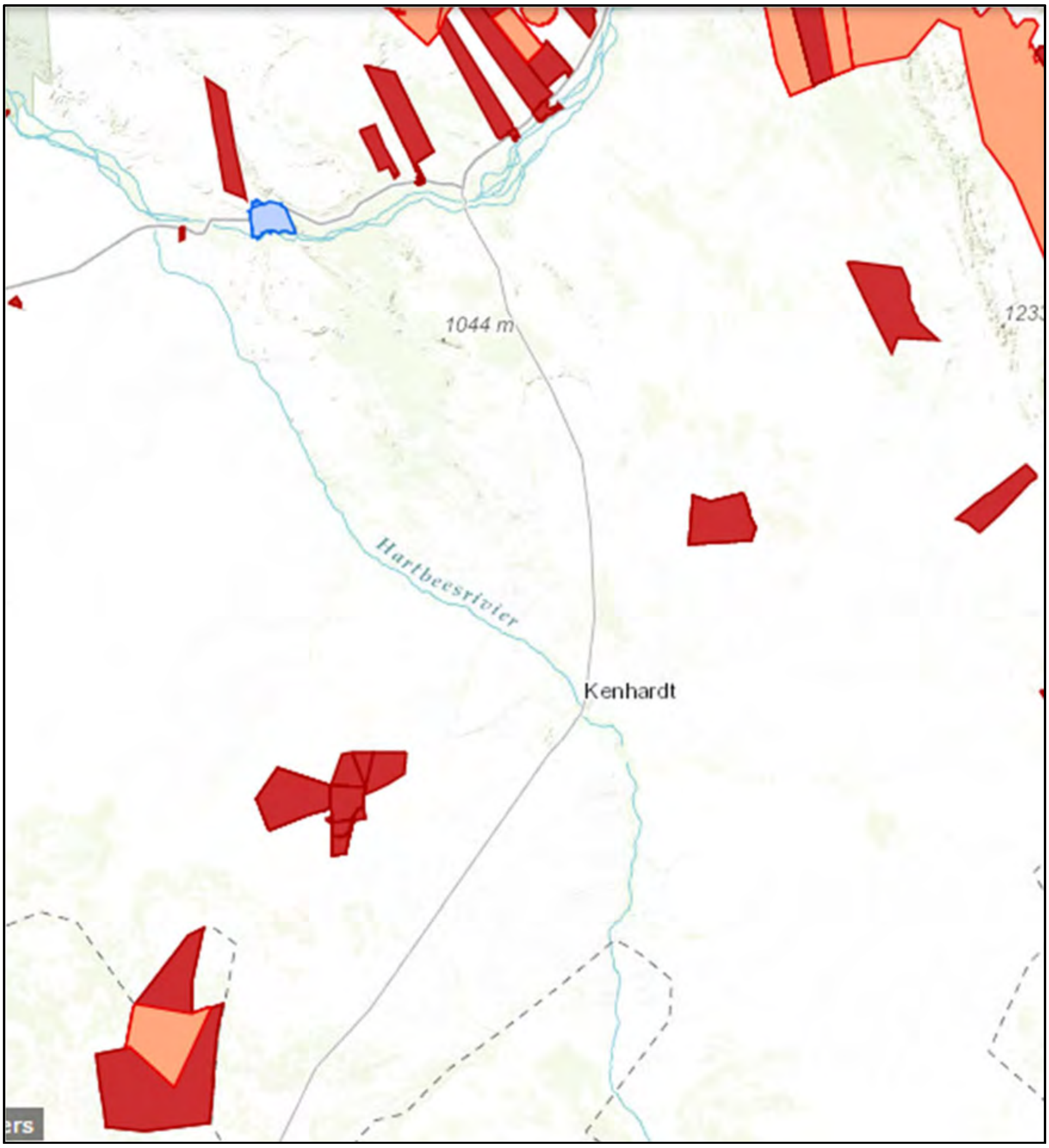


Figure 11: Renewable Energy Farms in the Kenhardt area

(Source: Department of Environmental Affairs)

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

9.1 CHANGES IN HYDROLOGICAL REGIMES

The hydrological regimes will not be effected because.

- The low amount of water used for cleaning is still available to groundcover after use. The same apply to rainwater due to the positioning of the panels

- Runoff water from roads is safely released to infiltrate and refill ground reservoir
- Predominantly seasonal rivers and pans with no outlets, forms the drainage system. The effect to river systems depending on the catchment is very low.

9.2 DECREASE IN QUANTITY AND QUALITY OF SOILS

The aridity conditions of soils and climate reserve the agricultural potential for low potential grazing. No cultivated fields are effected

9.3 LOSS OF NATURAL HABITAT OR HISTORIC CHARACTER THROUGH INDUSTRIAL DEVELOPMENT

The farms follow in the same corridor as the alignment of Eskom transmission lines. This association softens the reaction evoked to someone seeing an industrial development in a solely agricultural environment.

From a distance, the PV facility resembles the image of an area covered under shade netting for grapes or vegetables, giving it an agricultural camouflage.

9.4 LOSS OF BIODIVERSITY

The proposed facility is planned to operate in the Nama Karoo Eco zone. The biodiversity is limited to the arid habitat of open shrubland, knee high dwarf woody shrubs white bushman grass and scattered succulents and primarily used for sheep farming.

The habitat will be lost for sheep farming for the lease period only. With appropriate management, the habitat could change to a grazing composition containing more palatable grasses than before it was transformed.

No specific comments were received during the consultation and public participation processes and no additional information was thus far requested by the competent authority.

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 **12 August 2016**

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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.

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)