Soil and Agricultural Assessment Report for the proposed Phala Photovoltaic (PV) Facility

Bela Bela, Limpopo Province

December 2022

CLIENT

ENVIRONAMICS

Prepared by:

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Report Name	**Soil and Agricultural Assessment Report for Phala SPP**
Reference	
Submitted to	ENVIRONAMICS
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Report Writer / Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 years' experience in the environmental consulting field.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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DECLARATION

I, Matthew Mamera, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Matthew Mamera

Soil Scientist

The Biodiversity Company

December 2022

1 Introduction

The Biodiversity Company was appointed to undertake an agricultural potential assessment for the proposed Phala Solar Photovoltaic (PV) project near Bela Bela, Limpopo Province (**Error! Reference source not found.**). The project area of interest (PAOI) is located 500 m from Bela Bela town Centre and transverse the R101 and the R516 roads.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the published Government Notices (GN) 320 in terms of NEMA, dated 20 March 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation" (Reporting Criteria).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities and enable informed decision making. This report aims to also present and discuss the findings from the soil resources identified within the regulated 50 m, the soil suitability and land potential of these soils, the land uses within the regulated area and also the risk associated with the proposed project.

1.1 Technical Information

The following technical information was provided by Environamics:

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e., semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 350MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun.
- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid via the proposed power line. It is expected that generation from the facility will connect to the national grid via the existing Eskom Warmbad 275/132/66kV MTS Substation. The grid connection route will be assessed within a 200m wide (up to 550m wide in some instances) corridor. The Project will inject up to 300MW into the National Grid. The installed capacity will be approximately 350MW
- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.
- Supporting Infrastructure – The supporting infrastructure such as the auxiliary buildings will be situated in an area measuring up to 1.3 ha.

- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 m3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via the R101 regional road to the west of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor. Access Points: coordinates 24°55'19.96"S 28°18'18.58"E
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used

Table 1-1 Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	550 hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	Central inverters + LV/MV trafo: 750 m2 HV/MV substation with switching station: 15 000m2 BESS: 40 000 m2
Capacity of on-site substation	132kV
Capacity of the power line	132kV
Area occupied by both permanent and construction laydown areas	Total Footprint Area: 570 hectares Construction laydown area: within ~ 3.7 ha
Area occupied by buildings	Security Room: ~150 m^2 O&M laydown: Within 1.3 ha
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3 Capacity: Up to 500 MW
Length of internal roads	Approximately 30 km
Width of internal roads	Between 4 to 6 meters
Proximity to grid connection	The grid connection route will be assessed within a 200m wide (up to 550m wide in some instances)
Grid connection corridor width	200m wide but up to 550m wide in some instances
Grid connection corridor length	± 2,6 km
Power line servitude width	15 – 25 m
Height of fencing	Approximately 2.5 meters

1.2 Project Area

The proposed project area is located near Bela Bela, in the Waterberg District of the Limpopo Province (**Error! Reference source not found.**). The project area of interest (PAOI) is located 500 m from Bela Bela town Centre and transverse the R101 and the R516 roads. The area is also found 4km east of the N1 road. The surrounding land use includes watercourses, agricultural activities (Crop and livestock), game farms and mining.

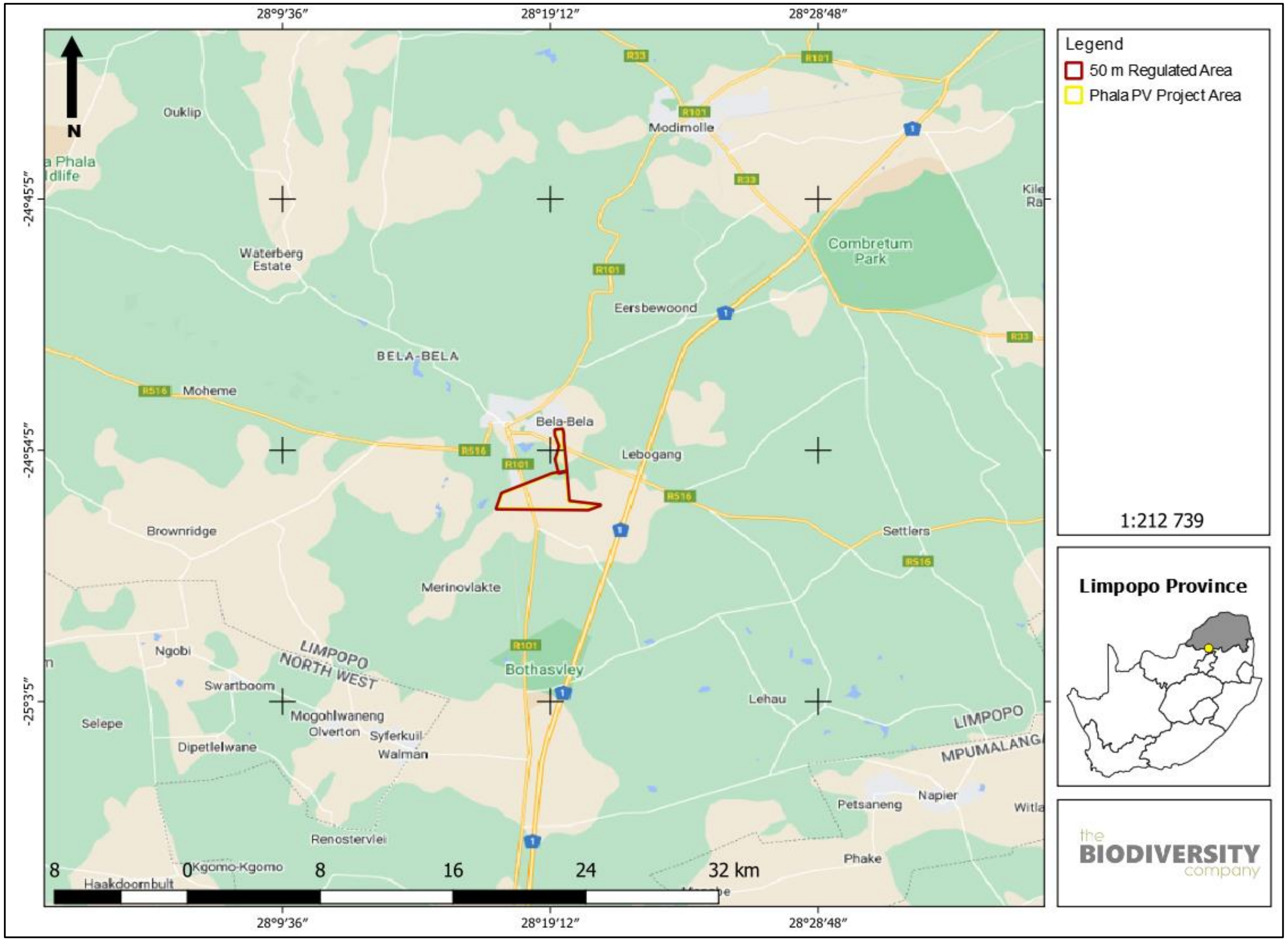

Figure 1-1 The location of the project area

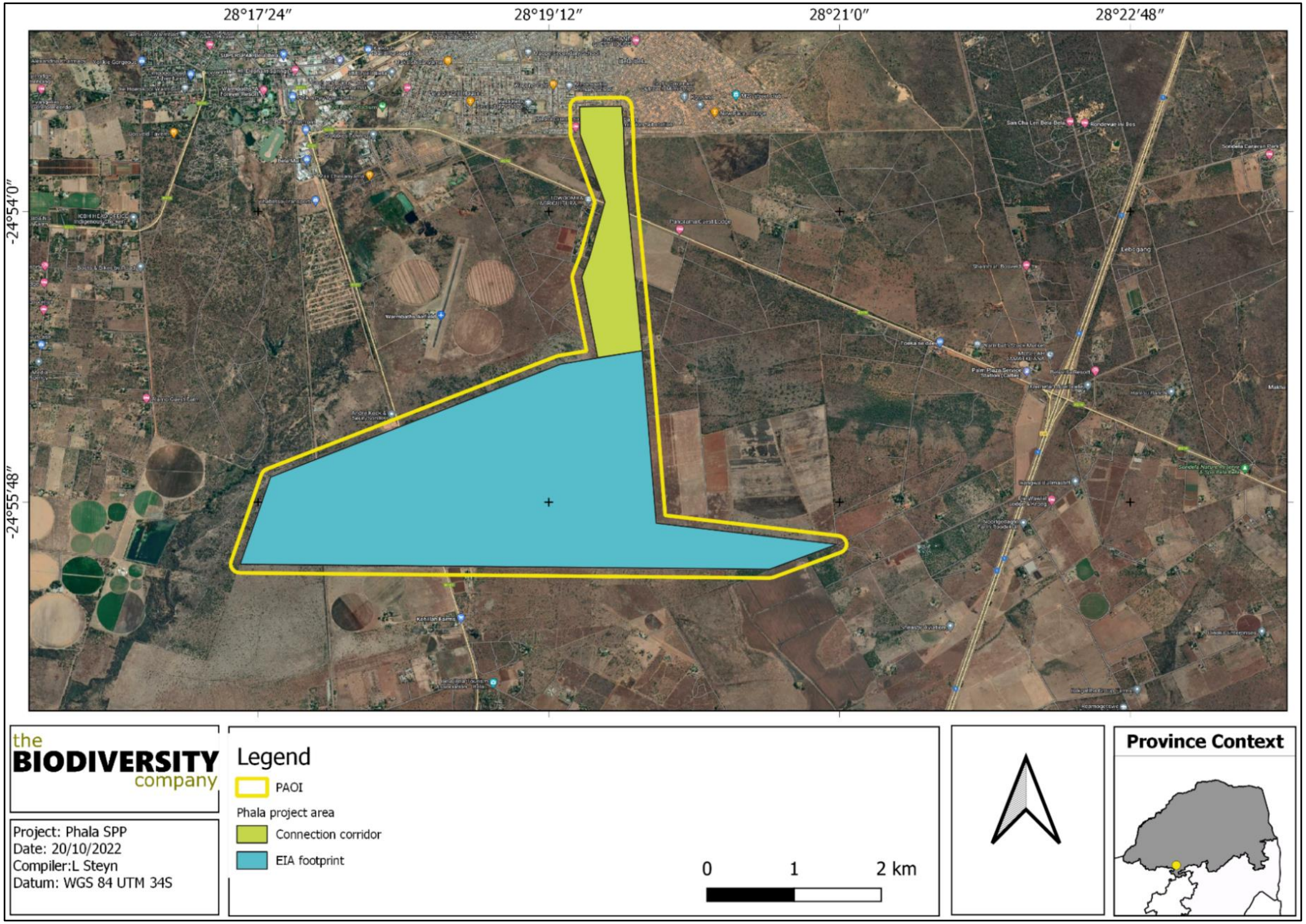

Figure 1-2 Map illustrating the details of the project area

1.3 Scope of Work

According to the National Web based Environmental Screening Tool, the proposed development is located within a "High" sensitivity land capability area. The protocols for minimum requirements (DEA, 2020)[1] stipulates that in the event that a proposed development is located within "High" sensitivities, an agricultural EIA statement should be carried out. It is worth noting that according to these protocols, a site inspection will still need to be conducted to determine the accuracy of these sensitivities. After acquiring baseline information pertaining to soil resources within the 50 m regulated areas, it is the specialist's opinion that the soil forms and associated land capabilities concur with the sensitivities stated by the screening tool. Therefore, an agricultural EIA statement will be compiled. This includes:

- The feasibility of the proposed activities;
- Confirmation about the "Low" and "High" sensitivities;
- The effects that the proposed activities will have on agricultural production in the area;
- A map superimposing the proposed footprint areas, a 50 m regulated area as well as the sensitivities pertaining to the screening tool;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation;
- The specialist's opinion regarding the approval of the proposed activities; and
- Any potential mitigation measures described by the specialist to be included in the EMPr.

2 Expertise of the Specialists

2.1 Andrew Husted

Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 years' experience in the environmental consulting field.

2.2 Matthew Mamera

Matthew Mamera is a Cand. Sci Nat registered (116356) in natural and agricultural sciences, recognition in soil science. Matthew is a soil and hydropedology specialist with experience in soil pedology, hydropedology, water and sanitation management and land contamination and has field experience and numerous scientific publications in international peer reviewed journals. Matthew completed his MSc in soil science, hydropedology and water management at the University of Fort Hare, Alice. He is also a holder of a PhD in soil science, hydropedology, water and sanitation obtained at the University of the Free State, Bloemfontein. Matthew is also a member of the Soil Science Society of South Africa (SSSSA).

3 Methodology

3.1 Desktop Assessment

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The

[1] A site identified by the screening tool as being of 'High" or "Very High" sensitivity for agricultural resources must submit a specialist assessment unless the impact on agricultural resources is from an electricity pylon (item 1.1.2).

land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types. In addition, a Digital Elevation Model (DEM) as well as the slope percentage of the area was calculated by means of the NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data by means of QGIS and SAGA software.

3.2 Field Survey

An assessment of the soils present within the project area was conducted during a field survey in October 2022. The site was traversed on foot. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 1,5 m. Soil survey positions were recorded as waypoints using a handheld GPS. Soils were identified to the soil family level as per the "Soil Classification: A Taxonomic System for South Africa" (Soil Classification Working Group, 2018). Landscape features such as existing open trenches were also helpful in determining soil types and depth.

3.3 Erosion Potential

Erosion has been calculated by means of the (Smith, 2006) methodology. The steps in calculating the Fb[2] ratings relevant to erosion potential is illustrated in Table 3-1 with the final erosion classes illustrated in

Table 3-1 Fb ratings relevant to the calculating of erosion potential (Smith, 2006)

Step 1- Initial value, texture of topsoil horizon				
Light (0-15% clay)		**Medium (15-35% clay)**		**Heavy (>35% clay)**
Fine sand	Medium/coarse sand	Fine Sand	Medium/coarse sand	All sands
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment value (permeability of subsoil)				
Slightly restricted		Moderately restricted		Heavily restricted
-0.5		-1.0		-2.0
Step 3- Degree of leaching (excluding bottomlands)				
Dystrophic soils, medium and heavy textures		Mesotrophic soils		Eutrophic or calcareous soils, medium and heavy textures
+0.5		0		-0.5
Step 4- Organic Matter				
Organic topsoil			Humic Topsoil	
+0.5			+0.5	
Step 5- Topsoil limitations				
Surface crusting			Excessive sand/high swell-shrink/self-mulching	
-0.5			-0.5	
Step 6- Effective soil depth				
Very shallow (<250 mm)			Shallow (250-500 mm)	
-1.0			-0.5	

[2] The soil erodibility index

Table 3-2 Final erosion potential class

Erodibility	Fb Rating (from calculation)
Very Low	>6.0
Low	5.0 - 5.5
Moderate	3.5 – 4.5
High	2.5 – 3.0
Very High	<3.0

3.4 Land Capability

Given the nature of the assessment statement and the fact that baseline findings correlate with the screening tool's sensitivities, land capability was solely determined by means of the National Land Capability Evaluation Raster Data Layer (DAFF, 2017). Land capability and land potential will also briefly be calculated to match to that of the screening tool to ultimately determine the accuracy of the land capability sensitivity from the DAFF, (2017) sensitivities.

Land capability and agricultural potential will briefly be determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

Land capability is divided into eight classes, and these may be divided into three capability groups. Table 3-3 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 3-3 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing Land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife

W - Wildlife	MG - Moderate Grazing	MC - Moderate Cultivation
F- Forestry	IG - Intensive Grazing	IC - Intensive Cultivation
LG - Light Grazing	LC - Light Cultivation	VIC - Very Intensive Cultivation

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 3-4. The final land potential results are then described in Table 3-5.

Table 3-4 The combination table for land potential classification

Land capability class	Climate capability class							
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 3-5 The Land Potential Classes.

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable

3.5 Limitations

- The information contained in this report is based on auger points taken and observations on site. There may be variations in terms of the delineation of the soil forms across the area;
- The GPS used for delineations is accurate to within five meters. Therefore, the delineation plotted digitally may be offset by at least five meters to either side.

4 Project Area

4.1 Soil and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae 18, Dc 1 and Ea 146 land types. The Ae 18 and Ba 13 land types mainly have Hutton and Arcadia soil forms according to the Soil classification working group, (1991), with the occurrence of other soils within the landscape. The Ae land type is dominated with red and yellow apedal soils. These soils have a high drainage potential with a high base status. The profiles are mostly deeper that 300 mm without the occurrence of dunes. The Dc 1 land type is characterised with occurrence of Sterkspruit soil forms associated to other soils occurring in the terrain. The Ea land types are characterised of vertic, melanic and red structured diagnostic horizons with are usually undifferentiated. The land terrain units for the featured Ae 18 land type are illustrated in Figure 4-3 with the expected soils listed in Table 4-3; the Dc 1 land types are illustrated in **Error! Reference source not found.** and the soils are shown in **Error! Reference source not found.**; the Ea 146 land types in Figure 4-3 and Table 4-3 .

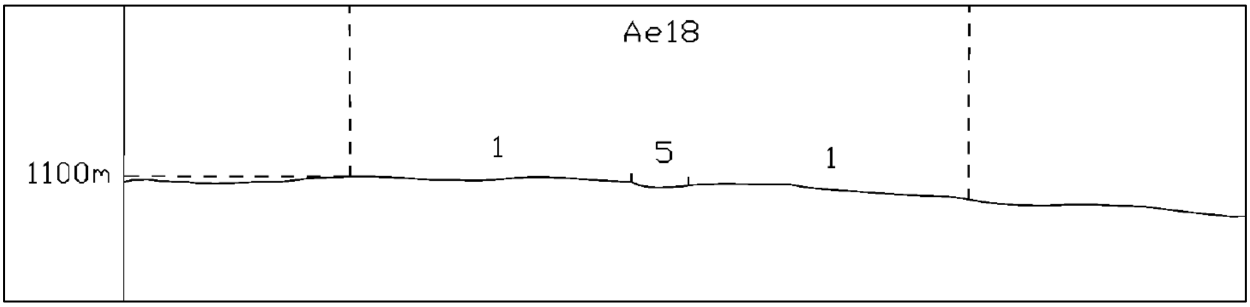

Figure 4-1 Illustration of land type Ae 18 terrain unit (Land Type Survey Staff, 1972 - 2006)

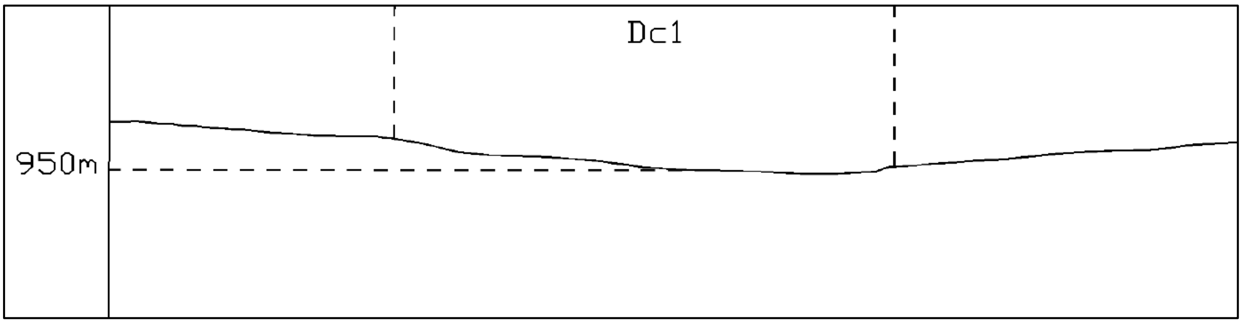

Figure 4-2 Illustration of land type Dc terrain unit (Land Type Survey Staff, 1972 - 2006)

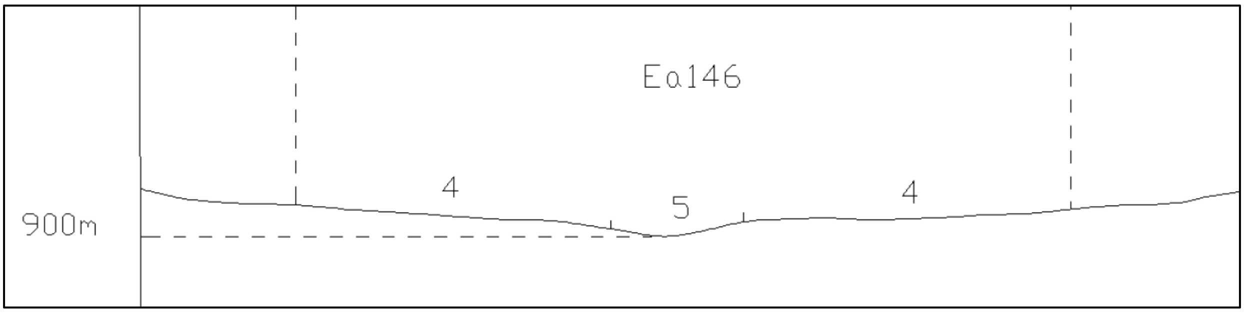

Figure 4-3 Illustration of land type Ea 146 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 4-1 Soils expected at the respective terrain units within the Ae 18 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units			
1 (95%)		**5 (5%)**	
Hutton	65%	Arcadia	50%
Shortlands	20%	Shortlands	20%
Arcadia	15%	Hutton	10%
		Valsrivier	10%

Table 4-2 Soils expected at the respective terrain units within the Dc 1 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units	
5 (100%)	
Sterkspruit	40%
Arcadia	20%
Oakleaf	20%
Bonheim	10%
Stream beds	10%

Table 4-3 Soils expected at the respective terrain units within the Ba 13 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units			
4 (95%)		**5 (5%)**	
Arcadia	80%	Arcadia	70%
Shortlands, Hutton	15%	Rensburg	20%
Oakleaf	5%	Oakleaf	10%

4.2 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 4-4. Most of the project area is characterised by a slope percentage between 0 and 4%, with some smaller patches within the project area characterised by a slope percentage ranging from 4 to 10%. This illustration indicates a few irregularities in the topography in scattered areas the majority of the area being characterised by a gentle slope. The DEM of the project area (Figure 4-5) indicates an elevation of 1 096 to 1 140 Metres Above Sea Level (MASL).

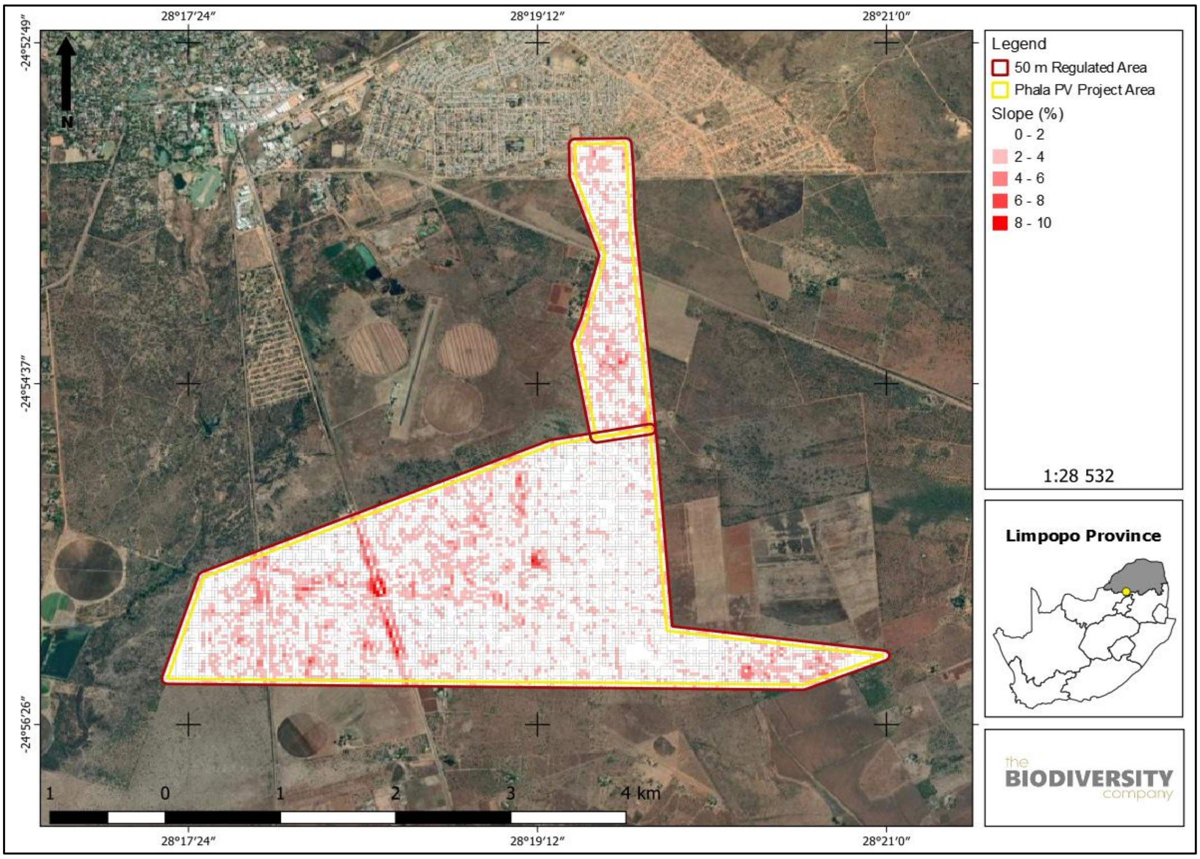

Figure 4-4 The slope percentage calculated for the project area

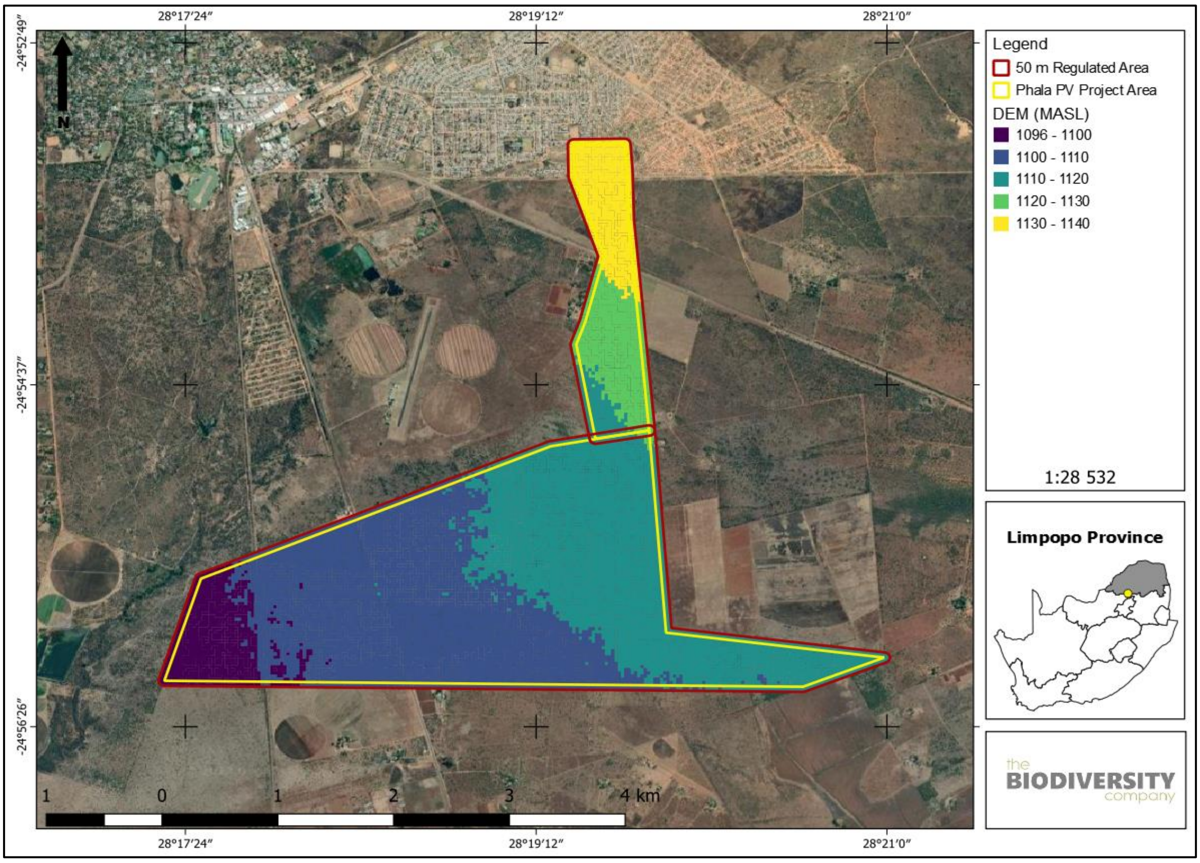

Figure 4-5 The DEM generated for the project area

5 Results and Discussion

5.1 Description of Soil Profiles and Diagnostic Horizons

Soil profiles were studied up to a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. The most sensitive soil forms have been considered. The following diagnostic horizons were identified during the site assessment:

- Orthic topsoil;
- Red apedal;
- Vertic topsoil;
- Pedocutanic horizon;
- Lithic and;
- Hard rock horizon;

5.1.1 Orthic Topsoil

Orthic topsoil are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one Orthic A topsoil to another (i.e., colouration, structure etc) (Soil Classification Working Group, 2018).

5.1.2 Red Apedal Horizon

The red apedal horizon has red colours in the matrix and a weak than moderate structure in the moist state. The dominant uniform red pigmentation occurs due to the presence of even distributed hematite, even though they are also other dominant iron oxides present which indicates well aerated soil conditions. The clay mineral elements of red apedal horizons are similar to yellow-brown apedal horizons. Kaolinite is the dominant clay mineral. Poorly ordered or amorphous clay minerals are also present in the clay fraction in humid climates and 2:1 clay mineral can be present in semi-arid conditions. The apedal or weak structure forms in sandy textured soils. The sandy loam and finer textured horizons have a strong micro-aggregate structure resulting in stable pores and a moderate to high infiltration rate. These soils are easily tilled and support an active microfloral and microfaunal population.

5.1.3 Vertic topsoil horizon

Vertic horizons consist of are strongly structured, dark clay horizons, with a high smectitic clay content that is characterised with swelling and shrinking properties. Occasionally, red or gley coloured variation occur. Thick vertic horizons exhibit slickensides and wedge-shaped structural aggregates at some depth. They may also exhibit self-mulching characteristics. Mechanical disturbance of vertic horizon may give rise to massive or altered surface structural aggregates. Vertic horizons crack strongly when dry and are sticky when wet. Some vertic horizons have a strong tendency to invert, depositing calcium carbonate nodules, and or stones and rocks on the surface. Vertic soils may also exhibit gilgai microrelief.

5.1.4 Pedocutanic horizon

Pedocutanic horizons are characterised with moderately to strongly developed structure, with distinct to prominent cutans (shinny clay skins due to illuviation) on the ped surfaces. The common feature of a pedocutanic is clear textural contrast with a sandier surface topsoil underlain to a higher clay subsurface horizon. This is common in groups of soils referred to as duplex soils. The aggregates usually exhibit brown to dark brown matrix colours with also some occurrence of yellowish to brownish colour variations within ped interiors permitted. Red pedocutanic horizons inherent the colour from the underlying parent material mostly from red to maroon shales and mudstones (Soil Classification Working Group, 2018). Pedocutanic horizons have restricted vertical flows due to the clays and mostly lateral flow paths are common.

5.1.5 Lithic horizon

A lithic horizon is subsurface horizon with morphological expression of pedogenic alteration that range from strong weathering of the underlying country rock, with friable soil-like structure. The soil material is intimately mixed with partially weathered to hard rock fragments. Evidence of gleying in the form of reduction of iron minerals in the soil matrix or in the partially weathered fragments may be present in the wetter variants. However, redo-morphological properties are absent in drier conditions.

5.1.6 Hard Rock Horizon

Hard rock horizon comprises of hard rock characterised with primarily physical weathering ranging from fractured and solid rock lacking soil development between the fractures. The underlain parent material includes igneous, sedimentary and metamorphic rocks. The horizon restricts most root penetrations of plants except for some selected annual trees and shrubs which can grow through the fractured sections in specialized ecological niche environments.

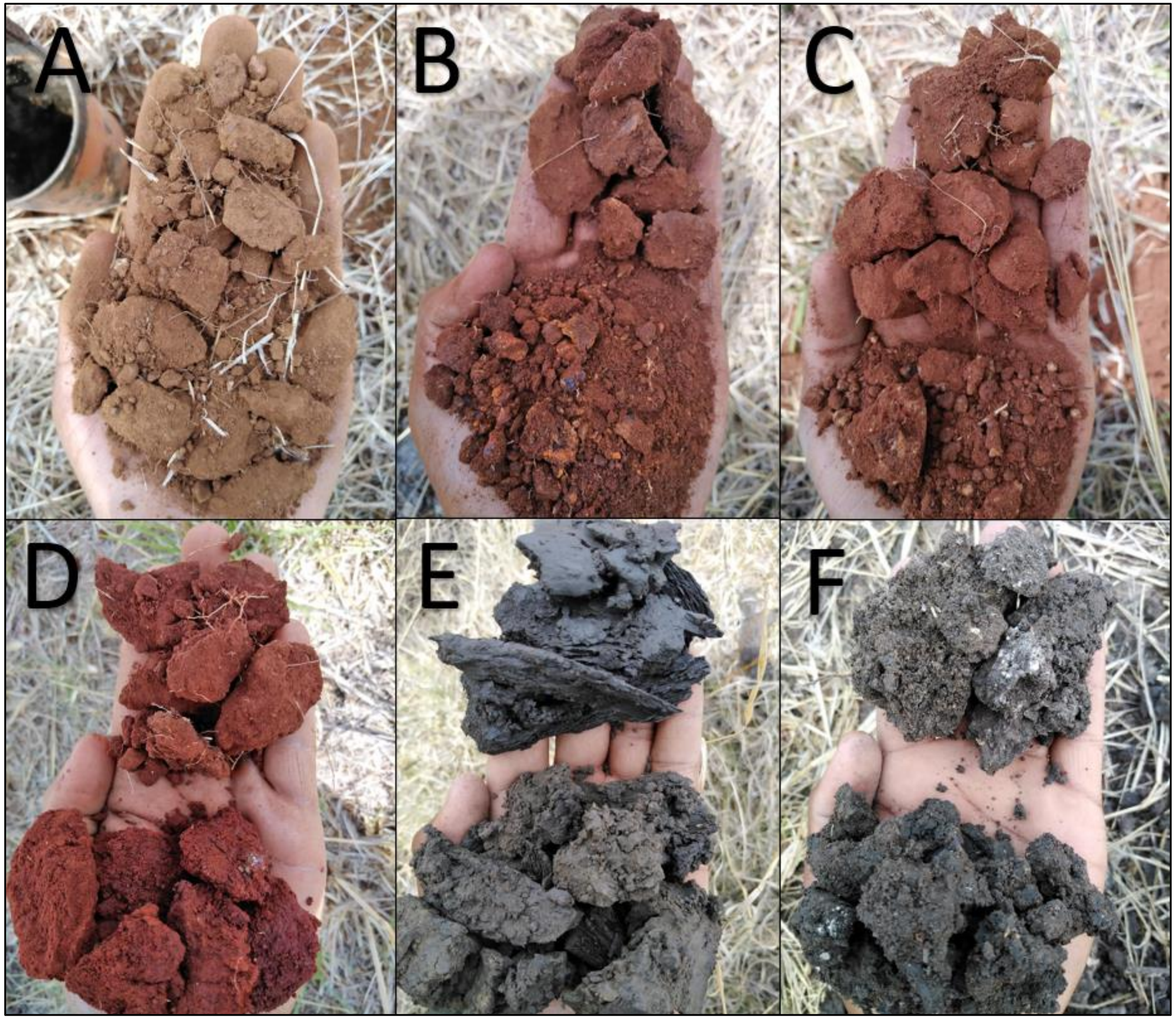

Figure 5-1 ***Dominant soils identified during the site assessment. A) Orthic topsoil with a hard rock substratum below. B) Lithic subsurface horizon. C) Orthic topsoil with a Red apedal horizon below. D) Vertic horizon. E; F) Pedocutanic subsurface horizon***

5.2 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified. These soil forms are described in Table 5-1 according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock. The soil forms are followed by the soil family and in brackets the maximum clay percentage of the topsoil. Soil family characteristics are described in

Table 5-2.

Table 5-1 Summary of soils identified within the project area

	Topsoil					Subsoil B1				Subsoil B2			
	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Depth (mm)	Clay (%)	Signs of wetness	Rock %
Hutton 2320(15)	0-300	0-15	None	0	None	300-1200	15-30	None	0	-	-	-	40
Nkonkoni 2221 (15)	0-200	0-15	None	0	None	200-300	15-30	None	0	300-500	15-30	-	10
Vaalbos 2221 (15)	0-300	0-15	None	0	None	300-600	15-30	None	0	600-650+	-	-	50+
Valsrivier 1210 (30)	0-250	15-30	None	0	None	250-1200	30-45	None	0	-	-	-	-
Rensburg 1000 (35)	0-1100	35-45	None	0 0	None	1100-1200	30-45	None	0	-	-	-	-
Arcadia 1110 (35)	0-900	35-45	None	0	None	900-1200	30-45	None	0	-	-	-	-
Glenrosa 1110 (15)	0-30	0-15	None	5	None	30-100	0-15	None	30	100+	-	-	60+
Mispah 1110 (15)	0-50	0-15	Present	0	None	50-600+	-	-	60+	600+	-	-	60+

Table 5-2 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Base Status	Textural Contrast
Hutton 2320 (15)	Chromic Topsoil	Eutrophic	Luvic
Nkonkoni 2221 (15)	Chromic Topsoil	Eutrophic	Luvic
Vaalbos 2221 (15)	Chromic Topsoil	Eutrophic	Luvic
Rensburg 1000 (35)	Dark Topsoil	Mesotrophic	Luvic
Arcadia 1110 (35)	Dark Topsoil	Mesotrophic	Luvic
Glenrosa 1110 (15)	Dark Topsoil	Mesotrophic	Luvic
Mispah 1110 (15)	Dark Topsoil	Dystrophic	Luvic

5.3 Agricultural Potential

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions.

The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

5.4 Climate Capability

The climatic capability has been determined by means of the Smith (2006) methodology, of which the first step includes determining the climate capability of the region by means of the Mean Annual Precipitation (MAP) and annual Class A pan (potential evaporation) (see Table 5-3).

Table 5-3 Climatic capability (step 1) (Scotney et al., 1987)

Central Sandy Bushveld region				
Climatic Capability Class	**Limitation Rating**	**Description**	**MAP: Class A pan Class**	**Applicability to site**
C1	None to Slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.	0.75-1.00	
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.	0.50-0.75	
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.	0.47-0.50	
C4	Moderate	Moderately restricted growing season due to the occurrence of low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.	0.44-0.47	
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.	0.41-0.44	
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops that frequently experience yield loss.	0.38-0.41	
C7	Severe to Very Severe	Severely restricted choice of crops due to heat and moisture stress.	0.34-0.38	
C8	Very Severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.	0.30-0.34	✓

According to Smith (2006), the climatic capability of a region is only refined past the first step if the climatic capability is determined to be between climatic capability 1 and 6. Given the fact that the climatic capability has been determined to be “C8” for the project area, no further steps will be taken to refine the climate capability.

5.5 Land Capability

The land capability was determined by using the guidelines described in “The farming handbook” (Smith, 2006). The delineated soil forms were clipped into the four different slope classes (0-3%, 3-7%, 7-12% and >12%) to determine the land capability of each soil form. Accordingly, the most sensitive soil forms associated with the project area are restricted to land capability 2 and 3 classes.

Table 5-4 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall.	Appropriate contour protection must be implemented and inspected.	Rotation crops and ley (50%)	Arable	High
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	Arable	High

5.6 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 5-5 and Table 5-6. From the two land capability classes, the land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability II and III have been reduced to a land potential levels L4 and L5 due to climatic limitations.

Table 5-5 Land potential from climate capability vs land capability (Guy and Smith, 1998)

Land Capability Class	Climatic Capability Class							
	C1	C2	C3	C4	C5	C6	C7	C8
LC1	L1	L1	L2	L2	L3	L3	L4	L4
LC2	L1	L2	L2	L3	L3	L4	L4	L5*
LC3	L2	L2	L2	L2	L4	L4	L5	L6*
LC4	L2	L3	L3	L4	L4	L5	L5	L6
LC5	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
LC6	L4	L4	L5	L5	L5	L6	L6	L7
LC7	L5	L5	L6	L6	L7	L7	L7	L8
LC8	L6	L6	L7	L7	L8	L8	L8	L8

*Land potential level applicable to climatic and land capability

Table 5-6 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Description of Land Potential Class	Sensitivity
5	**Restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
6	**Very Restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
Disturbed	N/A	None

5.7 Erosion Potential

The erosion potential of the identified soil forms has been calculated by means of the (Smith, 2006) methodology. In some cases, none of the parameters are applicable, in which case the step was skipped.

5.7.1 Hutton

Table 5-7 illustrates the values relevant to the erosion potential of the Hutton soil forms. The final erosion potential score has been calculated at 4.5, which indicates a “Moderate” potential for erosion.

Table 5-7 Erosion potential calculation for the Hutton soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)			**Shallow (<250-500 mm)**	
-1.0			-0.5	

5.7.2 Nkonkoni

Table 5-8 illustrates the values relevant to the erosion potential of the Nkonkoni soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “High” potential for erosion.

Table 5-8 Erosion potential calculation for the Nkonkoni soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	**4.5**	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	

Step 6- Effective Soil Depth		
Very Shallow (<250 mm)		Shallow (<250-500 mm)
-1.0		-0.5

5.7.1 Vaalbos

Table 5-8 illustrates the values relevant to the erosion potential of the Nkonkoni soil forms. The final erosion potential score has been calculated at 3.5, which indicates a "High" potential for erosion.

Table 5-9 Erosion potential calculation for the Nkonkoni soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
3.5	4.0	**4.5**	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted		Heavily Restricted
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		Mesotrophic Soils		Eutrophic or Calcareous Soils, Medium and Heavy Textures
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil				Humic Topsoil
+0.5				+0.5
Step 5- Topsoil Limitations				
Surface Crusting				Excessive Sand/High Shrink/Self-Mulching
-0.5				-0.5
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)				Shallow (<250-500 mm)
-1.0				-0.5

5.7.1 Valsrivier

Table 5-8 illustrates the values relevant to the erosion potential of the Valsrivier soil forms. The final erosion potential score has been calculated at 2.5, which indicates a "High" potential for erosion.

Table 5-10 Erosion potential calculation for the Valsrivier soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted		Heavily Restricted
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		Mesotrophic Soils		Eutrophic or Calcareous Soils, Medium and Heavy Textures
+0.5		0		-0.5

Step 4- Organic Matter			
Organic Topsoil		**Humic Topsoil**	
+0.5		+0.5	
Step 5- Topsoil Limitations			
Surface Crusting		**Excessive Sand/High Shrink/Self-Mulching**	
-0.5		-0.5	
Step 6- Effective Soil Depth			
Very Shallow (<250 mm)		**Shallow (<250-500 mm)**	
-1.0		-0.5	

5.7.2 Rensburg

Table 5-8 illustrates the values relevant to the erosion potential of the Rensburg soil forms. The final erosion potential score has been calculated at 3.0, which indicates a "High" potential for erosion.

Table 5-11 Erosion potential calculation for the Rensburg soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	**4.5**	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)			**Shallow (<250-500 mm)**	
-1.0			-0.5	

5.7.3 Arcadia

Table 5-8 illustrates the values relevant to the erosion potential of the Arcadia soil forms. The final erosion potential score has been calculated at 3.0, which indicates a "High" potential for erosion.

Table 5-12 Erosion potential calculation for the Arcadia soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	**4.5**	5.0	6.0

Step 2- Adjustment Value (Permeability of Subsoil)		
Slightly Restricted	**Moderately Restricted**	**Heavily Restricted**
-0.5	-1.0	**-2.0**
Step 3- Degree of Leaching (Excluding Bottomlands)		
Dystrophic Soils, Medium and Heavy Textures	**Mesotrophic Soils**	**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5	**0**	-0.5
Step 4- Organic Matter		
Organic Topsoil		**Humic Topsoil**
+0.5		+0.5
Step 5- Topsoil Limitations		
Surface Crusting		**Excessive Sand/High Shrink/Self-Mulching**
-0.5		-0.5
Step 6- Effective Soil Depth		
Very Shallow (<250 mm)		**Shallow (<250-500 mm)**
-1.0		-0.5

5.7.1 Glenrosa

Table 5-13 illustrates the values relevant to the erosion potential of the Glenrosa soil forms. The final erosion potential score has been calculated at 3.0, which indicates a “High” potential for erosion.

Table 5-13 Erosion potential calculation for the Glenrosa soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	4.5	5.0	**6.0**
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		**-1.0**		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil				**Humic Topsoil**
+0.5				+0.5
Step 5- Topsoil Limitations				
Surface Crusting				**Excessive Sand/High Shrink/Self-Mulching**
-0.5				-0.5
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)				**Shallow (<250-500 mm)**
-1.0				-0.5

5.7.1 Mispah

Table 5-14 illustrates the values relevant to the erosion potential of the Mispah soil forms. The final erosion potential score has been calculated at 1.5, which indicates a “Very High” potential for erosion.

Table 5-14 Erosion potential calculation for the Mispah soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	4.5	5.0	**6.0**
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)			**Shallow (<250-500 mm)**	
-1.0			-0.5	

6 Sensitivity Verification

The following land potential level has been determined;

- Land potential level 5 (this land potential level is characterised by a restricted potential**.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall.
- Land potential level 6 (this land potential level is characterised by a very restricted potential**.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non arable.

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which four potential land capability classes are located within the proposed footprint area’s assessment corridor, including;

- Land Capability 6 to 8 (Low/Moderate to Moderate Sensitivity) and;
- Land Capability 9 to 10 (Moderate High Sensitivity).

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project focus area, which is predominantly ““Moderate High” sensitivity. The other portions in the project area are characterised by sensitivities with “Moderately Low” to “Moderate” (Figure 6-1). Furthermore, various crop field boundaries were identified by means of the DEA Screening Tool (2022), which are predominantly characterised by “High” sensitivity with some areas being classified as “Very High” sensitivity (see Figure 6-2). The current layout for the proposed Highveld SPP project and associated grid connection infrastructure will directly impact assigned "Very High to High" sensitive crop fields. The development within these area, and potential loss of these resources is not regarded to be a fatal flaw. In the event these "Very High to High" sensitive crop fields are to be developed, engagement must be undertaken with the relevant landowner / user for permission, and to agree on compensation, if required. It`s also worth-noting that, some sections of the project area are characterised with vertic soils characterised with high clays, swelling and shrinking properties. Such soils are usually difficult to work with and mostly not recommended for most activities.

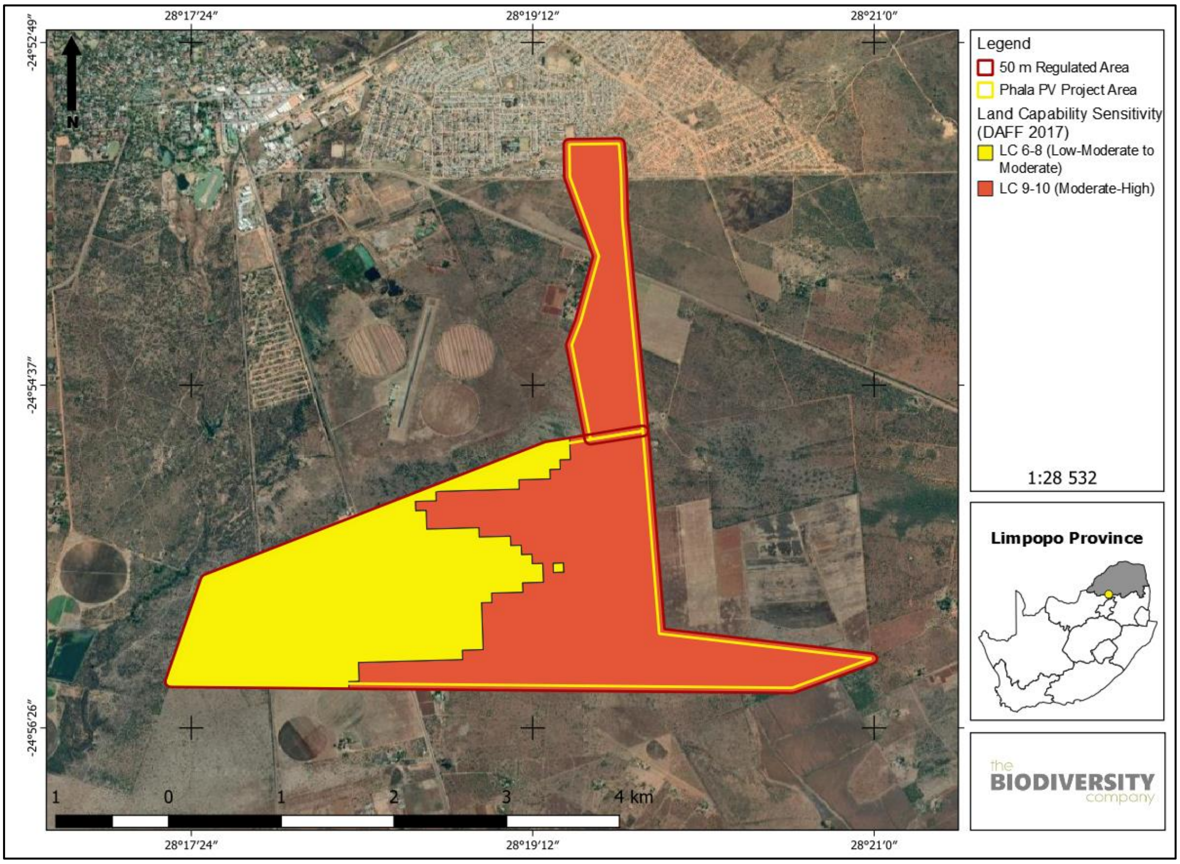

Figure 6-1 The land capability sensitivity (DAFF, 2017)

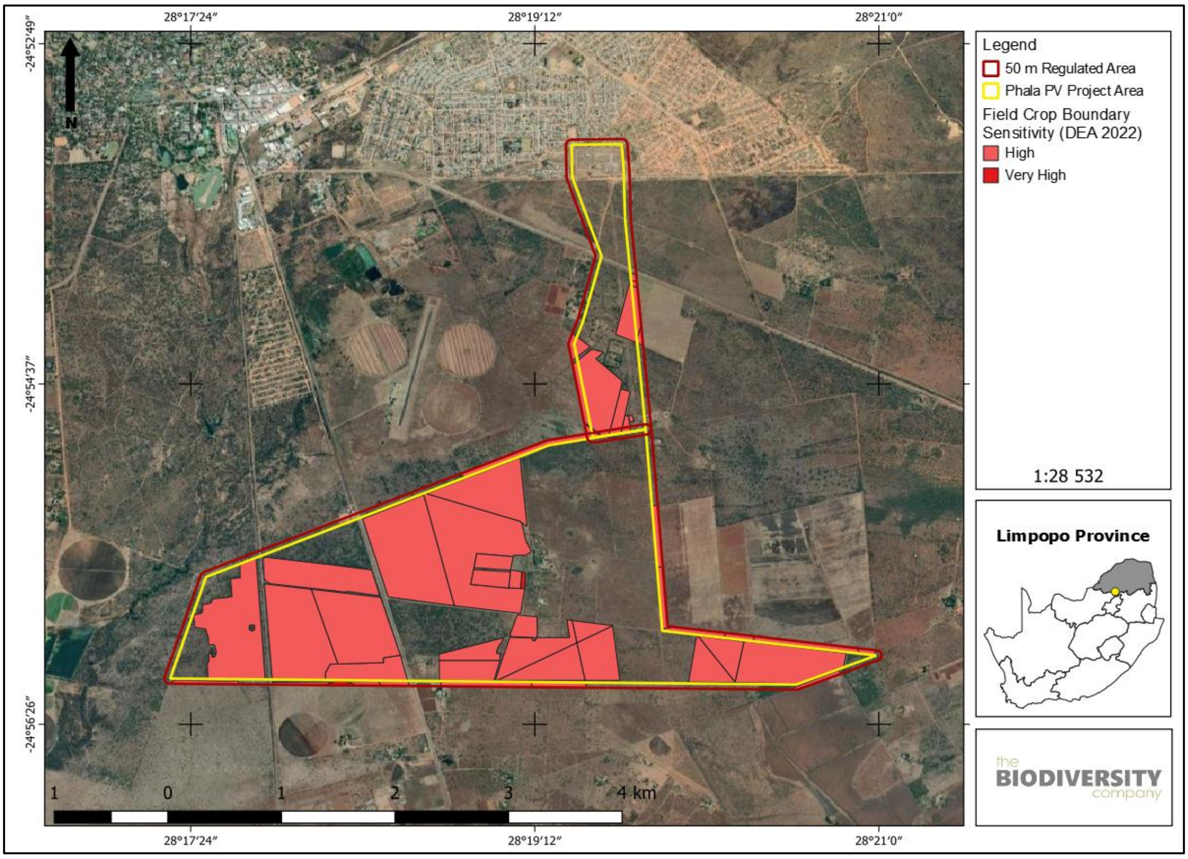

Figure 6-2 Crop boundary sensitivity (DEA Screening Tool, 2022)

7 Impact Assessment

Infrastructure within the Phala PV facility and associated grid connection infrastructure project area assigned to the available land includes transmission towers, transmission loops and access roads. The proposed activities often impede into "High" sensitivity crop fields. Even though these sensitivities are not associated with arable land potential conditions in some sections, high production agricultural activities will be impacted on.

Impacts were assessed in terms of the Phala PV facility project and associated infrastructure grid connection construction, operational and decommissioning phases. Mitigation measures were only applied to impacts deemed relevant.

7.1 Anticipated Activities

The proposed activities associated with the Phala PV facility project can be seen overlaid with the overall sensitivity (**Error! Reference source not found.**). The following activities will take place;

- Solar PV panels layout
- Construction layout camps
- Grid Connection cabling between project components.
- BESS
- Power Substation
- Access roads

7.1.1 Alternatives Considered

There are no alternatives which were considered within the assessment area for the proposed Phala PV facility project. Areas designated high sensitivity crop fields were identified and should be considered for avoidance. Some of the sections of the project crosses areas characterised with crop fields categorised as high and very high sensitivity.

7.1.2 Unplanned Events

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need management. Table 7-1 is a summary of the findings of an unplanned event assessment from an agricultural potential perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 7-1 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment	Contamination of soil as well as water resources associated with spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.

7.1.3 Planning Phase Impacts

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This would include preparations and desktop work in support of waste management plans, environmental and social screening assessments, finalising well sites and facilities and consultation with various contractors involved with a diversity of proposed project related activities going forward.

7.2 Phala PV Facility Project

7.2.1 Construction Phase

The proposed development will result in the stripping of topsoil where access routes to the existing power lines need expanding and alterations to the existing land uses. The changes in the land use will be from agricultural to the Power Line development (or transformed). The proposed activities will impact on areas expected to be high agricultural production (in some areas), with some aspects affecting covers “Moderately Low” to “Moderate” sensitivity areas. It is possible that suitable agricultural land could become fragmented, resulting in these smaller portions no longer being deemed feasible to farm

During the construction phase, topsoil often will be cleared, stripped and stockpiled. Access roads will be created with trenches being dug for the installation of relevant cables. Erection of transmission lines where relevant to the current existing lines will occur. Contractor and laydown yards will also be cleared with construction material being transported to laydown yards. Potential erosion is expected during the construction phase due to some erodable soils within the footprint assessment area, such as the Rensburg, Arcadia, Glenrosa and Mispah soil forms. The removal vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. Erosion of the area could result in further loss of topsoil, and soil forms suitable for agriculture. Soil compaction can also result due to increased traffic on site along the proposed power line.

Table 7-2 Impact assessment related to the loss of the land capability during the Solar Project construction phase – Pre Mitigation

Impact	Pre Mitigation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability	2	4	2	2	2	3	2	
	Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**

Table 7-3 Impact assessment related to the loss of the land capability during the Solar Project construction phase – Post Mitigation

Impact	Post Mitigation						
	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability	2	1	1	1	1	1	
	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementatio n of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

7.2.1.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Medium – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative"** which are ***negligible*** cumulative effects in the proposed power line with post mitigation measures. Further mitigation is however detailed in Table 7-14 . The following specific measures are intended to secure a low residual risk:

- Avoidance of all high agricultural production land and other actively cultivated areas, where avoidance is not feasible stakeholder engagement should occur to compensate affected landowners;
- Make use of existing roads or upgrades tracks before new roads are constructed. The number and width of internal access routes must be kept to a minimum;
- A stormwater management plan must be implemented for the development. The plan must provide input into the road network and management measures;
- Substations foundation and pylons placement must be (preferably) located in already disturbed areas that are not actively cultivated; and
- Rehabilitation of the area must be initiated from the onset of the project. Soil stripped from infrastructure placement can be used for rehabilitation efforts; and
- An alien invasive plant species and control programme must be implemented from the onset of the project.

7.2.1 Operational Phase

During the operational phase, limited impacts are foreseen. Only the footprint area will be disturbed to minimise soil and vegetation disturbance of the surrounding area. Revegetation will be carried out on exposed surrounding areas to avoid surface erosion. Maintenace of vegetation, infrastructure maintenance will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour.

7.2.1.1 Infrastructure

The operational phase of the Phala PV facility project (Constructed Infrastructure) includes anthropogenic movement and activities. The relevant infrastructure will be maintained by professionals throughout the lifetime of the operation. Besides compaction and erosion caused by increased traffic and surface water run-off for the area, few aspects are expected to be associated with this phase. The spread of alien invasive species will be a risk, predominantly adjacent to developed aeras (edge effect).

Table 7-4 Impact assessment related to the loss of the land capability during the Solar Project Operation phase – Pre Mitigation

Impact	**Pre Mitigation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability, Soil erosion and compaction effects	2	3	2	2	2	2	2	
	Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Table 7-5 Impact assessment related to the loss of the land capability during the Solar Project Operation phase – Post Mitigation

Impact	**Post Mitigation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability, Soil erosion and compaction effects	1	2	1	1	2	1	1	
	Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

7.2.1.2 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Low – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative."** Further mitigation is however detailed in Table 7-14.

7.2.2 Cumulative Impacts

The cumulative impacts have been scored "Low," indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

Table 7-6 Impacts related to the loss of land capability with the proposed Highveld Solar Power project– Project in Isolation.

Impact	Project in Isolation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of land capability, soil erosion and compaction effects	1	2	2	2	2	1	2	
	Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Table 7-7 Cumulative impacts related to the loss of land capability with the proposed Highveld Solar Power project.

Impact	Cumulative Effect							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of land capability, soil erosion and compaction effects	2	3	2	2	2	2	2	
	Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

7.2.2.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Low – Negative"** and the post- mitigation significance rating being scored as Negligible **"Low – Negative."** Further mitigation is however detailed in Table 7-14.

7.3 Grid Connection Infrastructure

7.3.1 Construction Phase

The proposed grid connection and associated infrastructure has similar anthropogenic activities and effects to the Phala PV facility project. Such activities as topsoil stripping, installation of relevant cables, construction of various substations and pylons will occur. Some of the alternative connection will be located in areas with high crop sensitivity, even though the effect to the land capability is minimal. Only the disturbed routes and areas will be exposed to soil erosion and compaction when the vegetation is cleared.

Table 7-8 Impact assessment related to the loss of the land capability during the Grid Connection construction phase – Pre Mitigation

Impact	**Pre Mitigation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability	2	4	3	2	2	3	2	
	Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**

Table 7-9 Impact assessment related to the loss of the land capability during the Grid Connection construction phase – Post Mitigation

Impact	**Pre Mitigation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability	2	2	2	1	1	1	1	
	Local/district: Will affect the local area or district.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

7.3.1.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Medium – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative."** The following specific measures similar to the Phala PV facility Project are intended to secure a low residual risk for the Grid connection:

- Avoidance of all high agricultural production land and other actively cultivated areas, where avoidance is not feasible stakeholder engagement should occur to compensate affected landowners;
- Make use of existing roads or upgrades tracks before new roads are constructed. The number and width of internal access routes must be kept to a minimum;
- A stormwater management plan must be implemented for the development. The plan must provide input into the road network and management measures;
- Substations foundation and pylons placement must be (preferably) located in already disturbed areas that are not actively cultivated; and
- Rehabilitation of the area must be initiated from the onset of the project. Soil stripped from infrastructure placement can be used for rehabilitation efforts; and
- An alien invasive plant species and control programme must be implemented from the onset of the project.

7.3.2 Operational Phase

During the operational phase, limited and negligible impacts are foreseen. Concrete areas will be equiped with drains and revegetated to reduce soil erosion on exposed areas. Maintenace of the grid connection will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour.

7.3.2.1 Infrastructure

The operational phase of the grid connection will only include maintenance activities with professionals. Besides compaction and erosion caused by traffic along access routes, few aspects are expected to be associated with this phase. The spread of alien invasive species will be a risk, predominantly adjacent to developed aeras (edge effect).

Table 7-10 Impact assessment related to the loss of the land capability during the Grid Connection Operation phase – Pre Mitigation

Impact	Pre Mitigation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability, Soil erosion and compaction effects	2	3	2	2	2	2	2	
	Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Table 7-11 Impact assessment related to the loss of the land capability during the Grid Connection Operation phase – Post Mitigation

Impact	Pre Mitigation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of Land Capability, Soil erosion and compaction effects	1	2	1	1	2	1	1	
	Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

7.3.2.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Low – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative."** Further general mitigation is however detailed as the impacts are low.

7.3.3 Cumulative Impacts

The cumulative impacts have been scored "Low," indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

Table 7-12 Impacts related to the loss of land capability with the proposed Phala SPP Grid Connection– Project in Isolation.

Impact	**Project in Isolation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of land capability, soil erosion and compaction effects	1	2	2	1	2	1	2	
	Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Table 7-13 Cumulative impacts related to the loss of land capability with the proposed Phala SPP Grid Connection.

Impact	**Project in Isolation**							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of land capability, soil erosion and compaction effects	2	3	3	2	2	2	2	
	Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

7.3.3.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Low – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative."** The cumulative impacts associated to the grid are deemed negligible. Further mitigation is however detailed in Table 7-14.

7.4 Specialist Management Plan

Table 7-14 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators. The mitigations within this section have been taken into consideration during the impact assessment in cases where the post-mitigation environmental risk is lower than that of the pre-mitigation environmental risk. Additionally, the implementation of these strategies will improve the possibility of restoring degraded soil resources, which are likely to be impacted upon the construction and operational phases, respectively.

Table 7-14 Mitigation measures, including requirements for timeframes, roles and responsibilities

Action plan				
Phase	**Management Action**	**Timeframe for implementation**	**Responsible party for implementation**	**Responsible party for monitoring/audit/review**
Construction	Vegetate or cover all stockpiles after stripping/removing soils	During construction phase	Contractor	ECO
	Storage of potential contaminants should be undertaken in bunded areas	During construction phase	Contractor	ECO
	All contractors must have spill kits available and be trained in the correct use thereof.	During construction phase	Contractor	ECO
	All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".	During construction phase	Environmental Officer (EO)/Contractor	ECO
	No cleaning or servicing of vehicles, machines and equipment may be undertaken in water resources.	During construction phase	Contractor	ECO
	Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.	During construction phase	Contractor	ECO

Operation	Continuously monitor erosion on site	During the timeframe assigned for the life of the Solar Power Project	Operator	dEO
	Monitor compaction on site	During the timeframe assigned for the life of the Solar Power Project	Operator	dEO

7.5 Specialist Recommendation

The results indicate ""Low" post-mitigation significance score ratings for the proposed Phala PV facility project and associated infrastructure. It is therefore clear that the proposed activities are expected to have a low impact on land potential resources. It is worth noting that some "High" and "Very High" sensitivity crop field areas were identified by means of the DEA Screening tool (2022). In areas where these crop fields are still under production, engagement must be undertaken with the relevant landowner / user for permission, and to agree on compensation, if required.

8 Conclusion and Impact Statement

Three main sensitive soil forms were identified within the assessment area, namely the Vaalbos, Nkonkoni and Hutton soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with "Moderate" to "Moderate high" sensitivities, which correlates with the findings from the baseline assessment. There are isolated discrepancies when comparing the desktop (screening) sensitivities with the baseline findings, but the overall agricultural theme sensitivity for the area was determined to be "Moderate".

The assessment area is associated with arable and non-arable soils. However, the available climatic conditions of low annual rainfall and high evapotranspiration potential limits crop production resulting in land capabilities with "Moderate" and "Moderate high" sensitivities. The land capabilities associated with the assessment area are suitable for rainfed cropping, irrigated cropping and livestock grazing, which aligns to the current land use in the area.

It is the specialist's opinion that the proposed Phala PV facility project and associated grid connection infrastructure will have an overall low residual impact on the agricultural production ability of the land. The proposed activities will result in the segregation of some high and very high production agricultural land. However, the grid connection for the proposed development will occur on already established infrastructure powerlines with negligible impacts to the land potential of crop fields. In areas where these crop fields are still under production, engagement must be undertaken with the relevant landowner / user for permission, and to agree on compensation, if required. The development within these area, and potential loss of these resources is not regarded to be a fatal flaw. It is, therefore, the specialist`s recommendation that the proposed Phala PV facility project and associate infrastructure may be favourably considered for development with implementation of mitigation measures in place to ensure low expected significant impacts occurrence.

9 References

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