



**Soil and Agricultural Assessment Report for the
proposed D3 Energy Production Right 016
Application**

**Matjhabeng and Masilonyana Local Municipalities,
Lejweleputswa District Municipality, Free State
Province, South Africa**

7/24/2026

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Report Name	Soil and Agricultural Assessment Report for the proposed D3 Energy Production Right 016 Application	
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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, Amended. We have no conflicting interests in the undertaking of this activity and have no interest 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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1 Introduction

1.1 Background

The Biodiversity Company was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) on behalf of D3 Energy South Africa (Pty) Ltd to conduct a soil and agricultural assessment for the proposed Motuoane Production Right 016 Application. The proposed project covers an area of approximately 14 386 ha across multiple farm portions. It is located approximately 12 km southeast of Virginia Town in the Free State Province, within the Matjhabeng and Masilonyana Local Municipalities, and the Lejweleputswa District Municipality (Figure 1-1). For the purposes of this report, reference is made either to the Project Area of Influence (PAOI) and Project Area¹. The PAOI represents the broader area identified during the desktop assessment, while the Project Area assessed in detail comprises the target areas, gathering lines, seismic transects including a 500 m buffer, and gas plant locations (Figure 1-2).

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). The National Web based Environmental Screening Tool (DFFE, 2026) has characterised the agricultural theme sensitivity of the project area having sensitivity ranging from "Low to Very High", with a key consideration of this assessment being the determination of agricultural theme sensitivities for the project.

This report aims to present and discuss the findings from the soil resources identified within the Project Area and the PAOI. The report will also identify the soil suitability and land potential of these soils, the land uses within the PAOI and the risks associated with the proposed Motuoane Production Right project and associated infrastructure.

This report should be interpreted after taking into consideration the findings and recommendations provided by the specialist herein. Further, this report should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2 Project Description

D3 Energy South Africa (Pty) Ltd. has requested a quotation to undertake an Environmental Impact Assessment (EIA) process for its planned new Production Right Area.

The proposed Production Right makes provision for ongoing exploration drilling and seismic activities, with preliminary seismic transects. Existing wells within the area may be worked over and possibly included as production sites.

Drilling and production are proposed from approximately 30 to 50 production wells located within three identified well production corridors. The intention is to assess these corridors in detail during the EIA process in order to allow for drilling and production to occur within these areas.

The applicant wishes to convert a portion of their existing Exploration Right area (ER315) into a Production Right (PR). The proposed extraction and production will target helium and methane gas, and will consist of up to 43 production wells, gas gathering pipelines, a helium recovery and gas

¹ Throughout this report, any reference to "Project Area" should be understood to include the seismic transects together with the 500 m buffer and all associated components, such as gathering lines, seismic lines and gas plant locations. All assessments, findings, and discussions related to Seismic Transects are therefore based on this buffered area and its various components.

processing plant (CNG and/or LNG) and associated infrastructure. In addition, ongoing exploration activities will include drilling of up to 48 exploration wells, and 8 seismic transects with a combined length of ~62.5 km of seismic and/or audio magnetotelluric surveys. The proposed production right application area covers a total of ~14 440 hectares. The proposed project will involve the following activities:

- Pre-drilling seismic and/or audio magnetotelluric surveys to optimize well locations for maximum deliverability;
- Drilling and completion of wells;
- Maintenance workovers of wells;
- Construction of gas gathering pipeline systems;
- Installation of gas compression and processing facilities;
- Construction of a helium recovery facility (gas or liquid helium) and gas (methane) processing plant (CNG and/or LNG); and

Construction of associated infrastructure including roads, communications facilities and temporary accommodation facilities, if necessary.

The proposed project layout is presented in Figure 1 2.

1.3 Project Area

The extent of the property/development footprint is referred to as the Project Area of Influence and pertains to the project area. A map of the PAOI in relation to the local region is presented in Figure 1-1. A map illustrating the proposed layout assessed is presented in Figure 1-2. The current surrounding land use includes crop production and animal production, water courses and open veld.

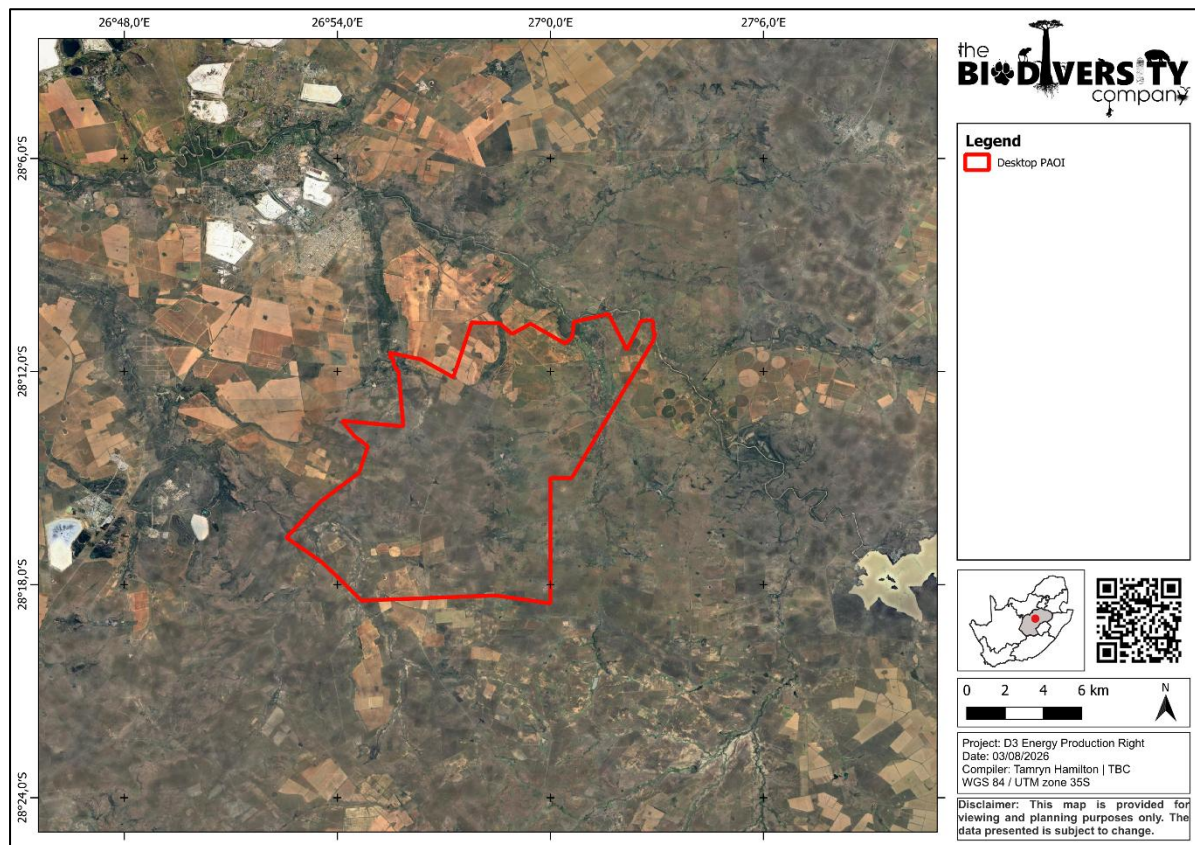


Figure 1-1 *Spatial context of the proposed development*

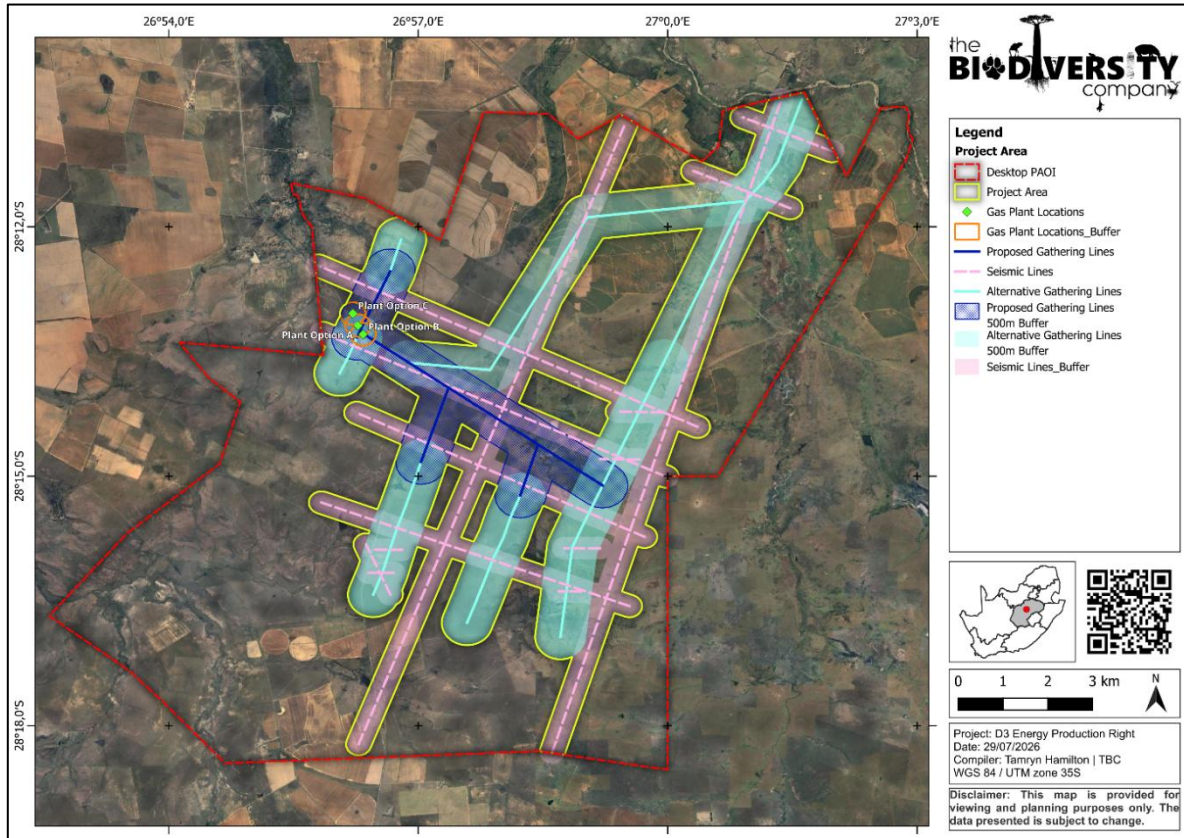


Figure 1-2 *Map illustrating the proposed Gas Plant Locations, Well Locations, Seismic Transects, Gathering Lines, Seismic Transect with a 500 m buffer and Project Area of Influence (Provided by EIMS, 2026)*

1.4 Terms of Reference

The principal aim of the assessment was to provide information to inform on the risk that the proposed activity has on the Agricultural Impact Assessment within the proposed project area. This was achieved through the following:

- Identification and description of any soil resources sensitive receptors that occur in the project area, and the manner in which these sensitive receptors may be affected by the proposed activity;
- Conducting a desktop assessment to identify the relevant soil and agricultural important geographical features within or nearby to the project area;
- Conducting a desktop assessment to compile soil resources and their sensitivity that may occur within the project area;
- Conducting a field survey to ascertain the baseline findings of the present soil resources within the project area;
- Delineation and mapping of the soils and their respective sensitivities that occur within the project area;

- Identification of the manners in which the proposed project impacts the agricultural sensitivity of soil resources, and an evaluation of the level of risk that these potential impacts present; and
- The prescription of mitigation measures and associated recommendations for the identified risks.

1.5 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) stipulates that if a proposed development is located within “High” sensitivities, an agricultural EIA assessment should be carried out. It is worth noting that according to the Assessment Protocol, a site inspection was conducted to determine the accuracy of these sensitivities following the generation of the site sensitivity report. After acquiring baseline information pertaining to soil resources within the PAOI, 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 assessment was compiled. This includes:

- The feasibility of the proposed activities;
- Confirmation about the “Medium” and “High” sensitivities;
- The effects that the proposed activities will have on agricultural production in the area;
- Assessment must be undertaken on the project area and within the proposed PAOI footprint.
- A map superimposing the proposed footprint areas, as well as the sensitivities pertaining to the screening tool;
- Assessing 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 management programme.

1.6 Assumptions and Limitations

The following aspects were considered as limitations;

- Soil fertility analysis was not conducted on-site for this report;
- The GPS used for ground truthing is accurate to within five meters. Therefore, the observation site's delineation plotted digitally may be offset by at up to five meters to either side;
- No heavy metals have been assessed, nor fertility been analysed for the relevant classified soils;
- Site assessment and verification for soil resources was only done on the proposed seismic transects; desktop information was used for soil resources within the entire production right areas due to large spatial area and sensitivities in these areas were based on the desktop information; and

- Certain portions of the project area were not assessed due to access limitations.

1.7 Legislative Framework

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on soil and agricultural assessment as per the Government Notice 320 published 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” – the following has been assumed:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of:
- “High sensitivity” for agriculture, must submit an Agricultural Agro-Ecosystem Specialist Assessment.

An Agricultural Agro-Ecosystem Specialist Assessment Report must contain the information as presented in below.

Table 2-1 *Agricultural Agro-Ecosystem Specialist Assessment report information requirements as per the relevant protocol, including the location of the information within this report*

Information to be Included (as per GN 320, 20 March 2020)	Report Section
details and relevant expertise as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the statement including a curriculum vitae;	8.4
a signed statement of independence by the specialist;	8.3
the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	2
a description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant;	Appendix A: Methodology
a map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	4.5 or Figure 4-7
an identification of any areas to be avoided, including any buffers;	4
any conditions to which this statement is subjected;	6.1
a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;	5.3.2
where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMP; and	5
a description of the assumptions made and any uncertainties or gaps in knowledge or data.	1.5.3

A signed copy of the assessment must be appended to the Environmental Impact Assessment Report.

2 Fieldwork

The field surveys were undertaken from the 16th to the 19th of March 2026 and from the 15th to the 16th of July 2026 to determine the soil forms, and current land uses within the assessed area. An additional field survey was undertaken on the 15th to the 16th of July 2026 following a proposed layout alternation (Figure 2-1Error! Reference source not found.). It should be noted that although the study was undertaken during the dry season, seasonality has no bearing on the soil assessment and fieldwork is therefore deemed sufficient for the proposed development.

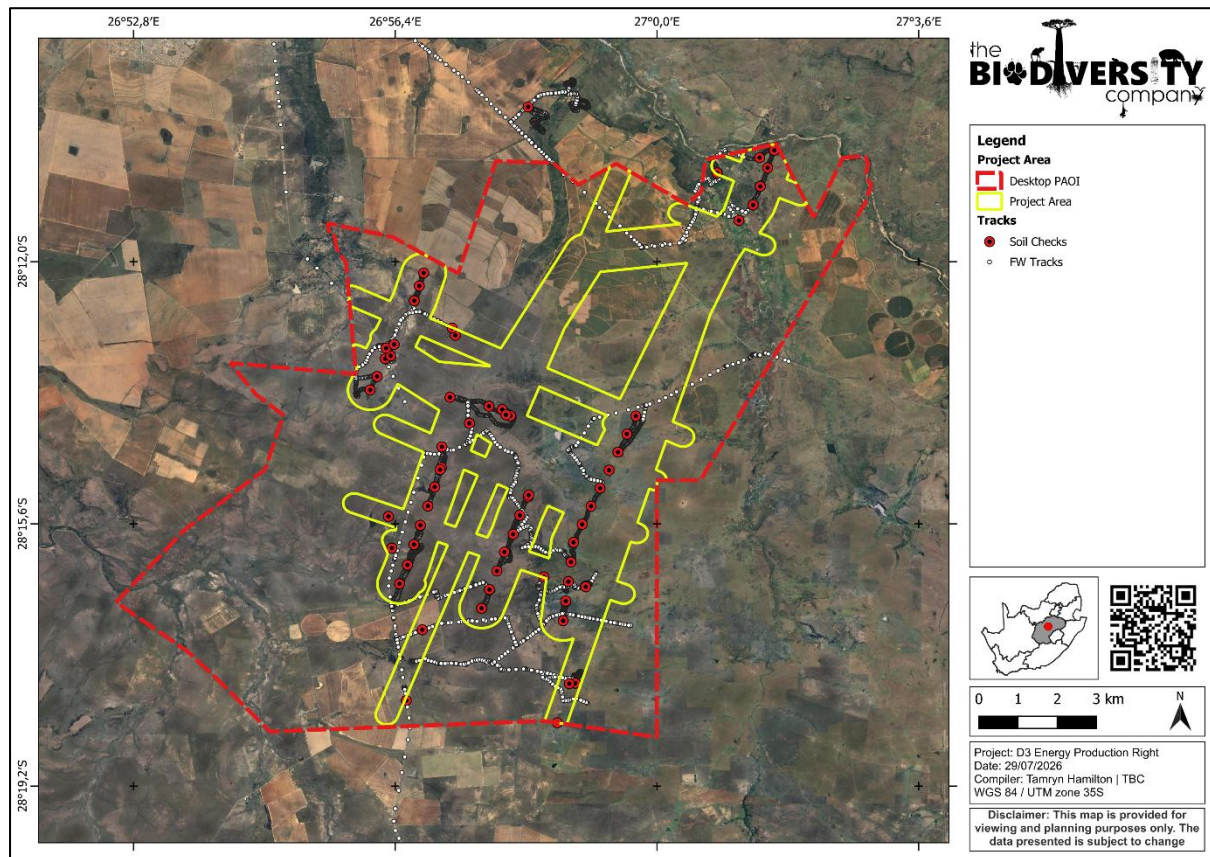


Figure 2-1 Map illustrating the sampled soil points of the field survey

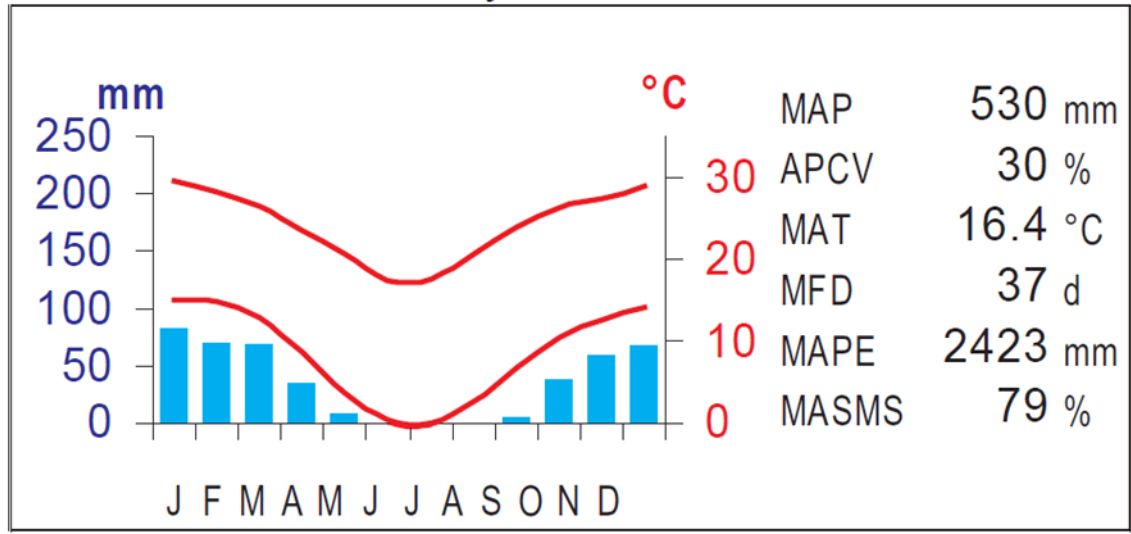
3 Project Area

3.1 Desktop Information

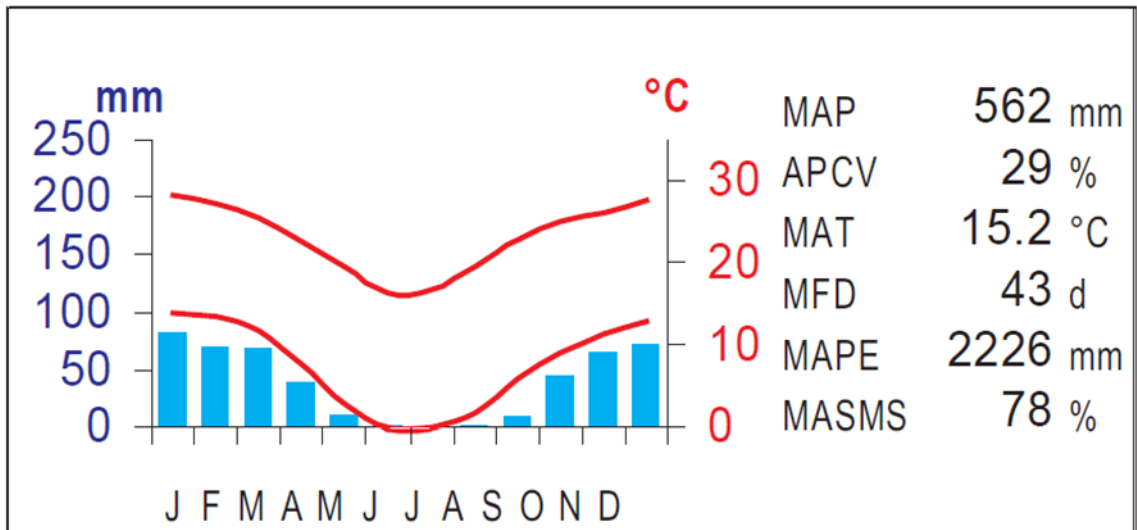
3.1.1 Climate

The project area is characterised with summer-rainfall. Majority of the rainfall is of convectional origin and peaks in December to January. The overall mean average precipitation (MAP) of the proposed project area is 560 mm. The area receives high frost incidences of about 43 days on average in Winter (Mucina & Rutherford, 2006; Figure 3-1 and South African Weather Service (SAWS, 2021). Moreover, the project area falls predominately under Central Free State Grassland, and other areas falls under Vaal-Vet Sandy Grassland, Highveld Alluvial Vegetation, and Bloemfontein Karroid Shrubland vegetation.

Gh 10 Vaal-Vet Sandy Grassland



Gh 6 Central Free State Grassland



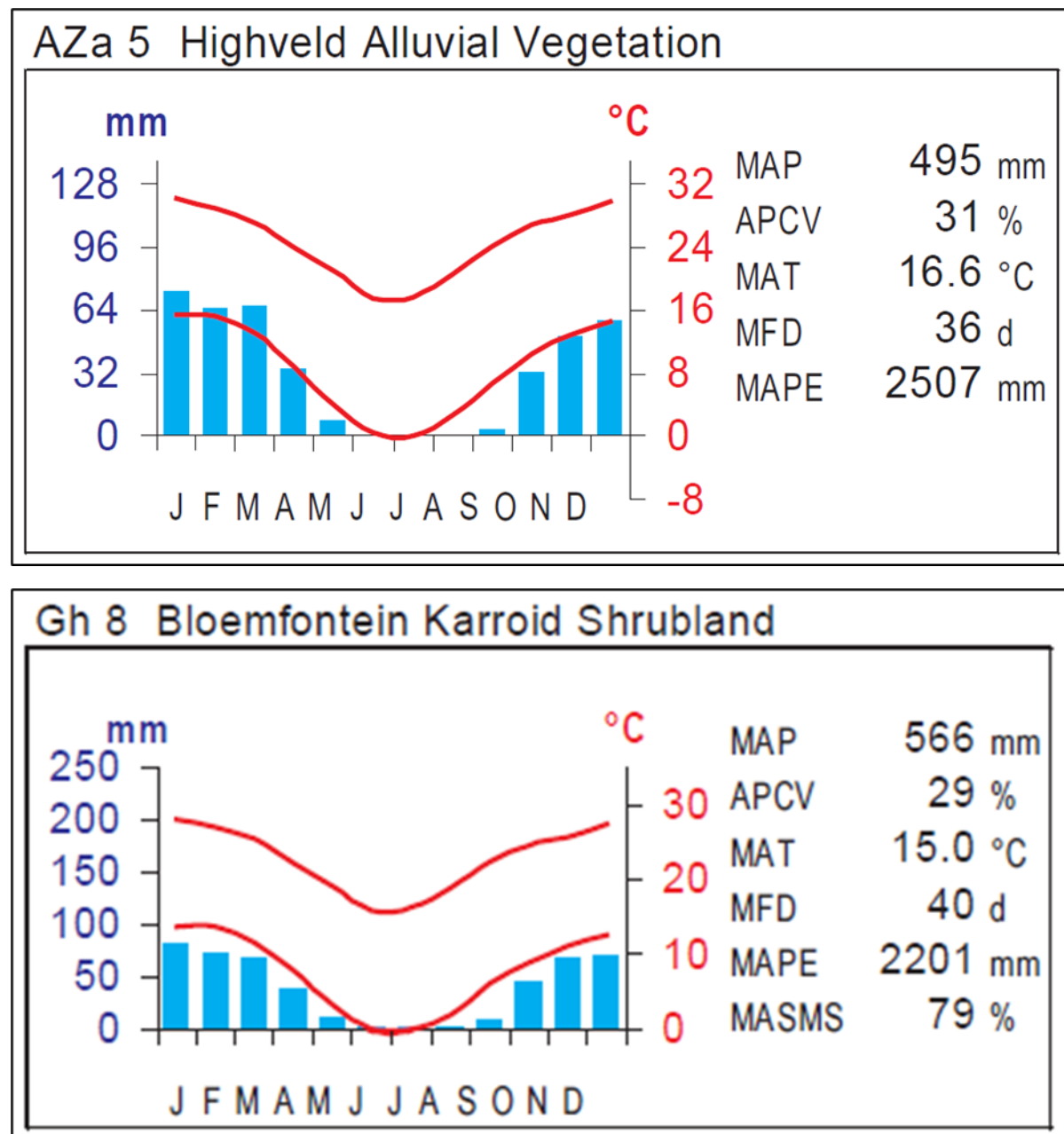


Figure 3-1 Summarised climate for the region (Mucina & Rutherford, 2006)

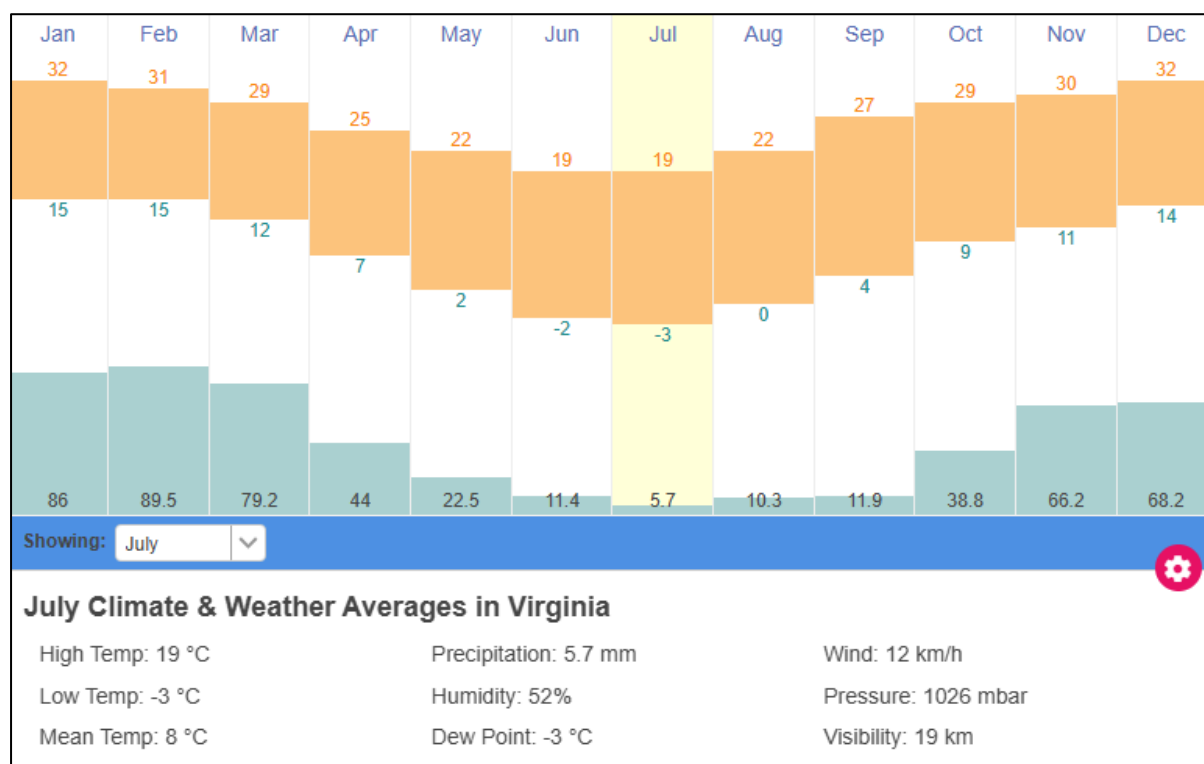


Figure 3-2 Summarised climate for Virginia, 1992-2021 (SAWS, 2021)

3.1.2 Geology & Soils

The geology of the area consists of Sedimentary mudstones and sandstone mainly of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as those of the Eccu Group (Karoo Supergroup) found in the extreme northern section of this grassland. The geology in turn supports vertic, melanic and red soils (typical forms are Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg)—typical of Dc land type (dominating the landscape). Additionally, the less common intrusive dolerites of the Jurassic Karoo Dolerite Suite support dry clayey soils typical of the Ea land type.

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area falls within the Bd 20, Dc 12 and Dc 8, land types (Figure 3-3). The Bd 20 land type mainly consists of Clovelly, Hutton and Valsrivier soil forms according to the Soil classification working group (1991), with the occurrence of other soils within the landscape. The Dc 8 land type consists mainly of Valsrivier, Rensburg, Oakleaf and Dundee soil forms according to the Soil classification working group (1991), with the occurrence of other soils within the landscape. The Dc 12 consists mainly of Mayo, Mispah, Swartland, Bonheim, Dundee and Oakleaf soil forms according to the Soil classification working group (1991), with the occurrence of rocky areas and other soils within the landscape. The land terrain units for the featured land types and the illustrated expected soils are listed in the Figures and Tables below.

The land terrain units for the featured land types and the illustrated expected soils are listed in the Figures and Tables below.

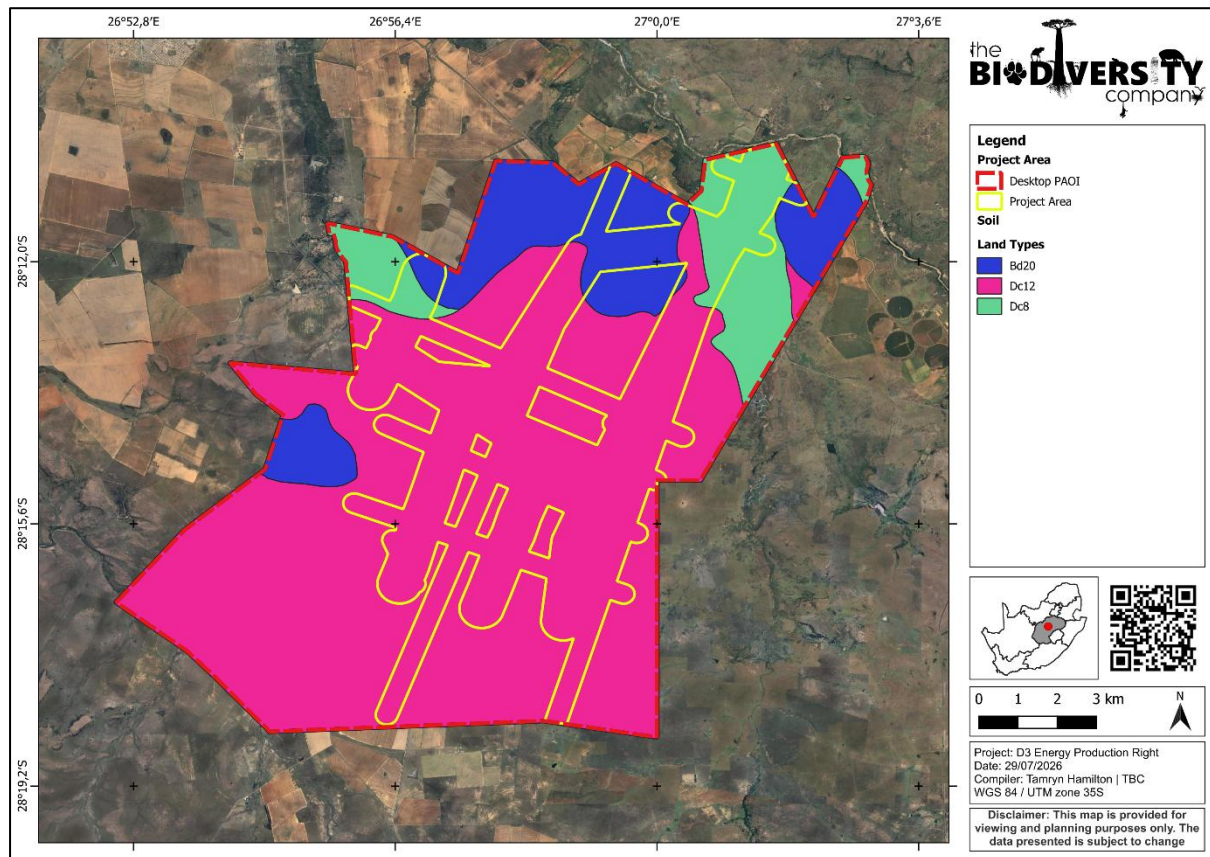


Figure 3-3 Land types associated with the proposed project area

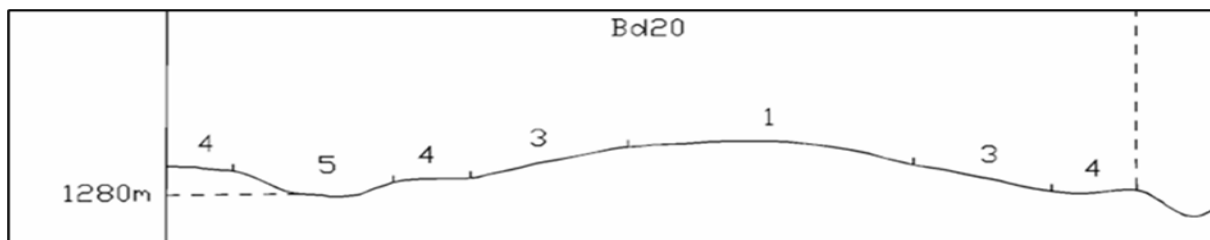


Figure 3-4 Illustration of land type Bd 20 terrain units (Land Type Survey Staff, 1972 - 2006)

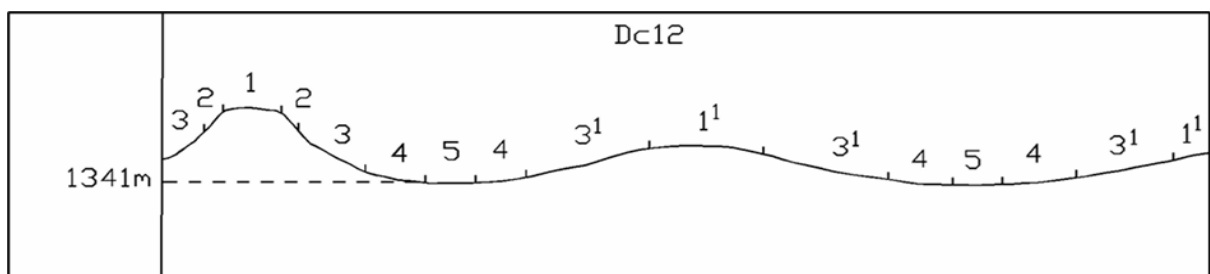


Figure 3-5 Illustration of land type Dc 12 terrain units (Land Type Survey Staff, 1972 - 2006)

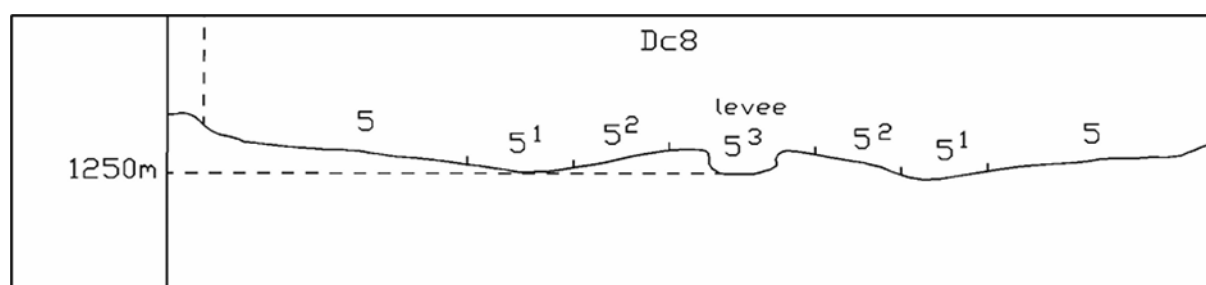


Figure 3-6 Illustration of land type Dc 8 terrain units (Land Type Survey Staff, 1972 - 2006)

Table 3-1 Soils expected at the respective terrain units within the Bd 20 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (55%)		3 (40%)		4 (3%)		5 (2%)	
Clovelly	65%	Clovelly	45%	Hutton	60%	Valsrivier	55%
Avalon	30%	Hutton	25%	Valsrivier	18%	Arcadia, Rensburg	20%
Valsrivier	3%	Avalon	20%	Avalon	10%	Katspruit	15%
Katspruit	1%	Valsrivier	8%	Clovelly	5%	Oakleaf	10%
Arcadia, Rensburg	1%	Katspruit	1%	Oakleaf	5%		
		Arcadia, Rensburg	1%	Katspruit	1%		
				Arcadia, Rensburg	1%		

Table 3-2 Soils expected at the respective terrain units within the Dc 8 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
5 (44%)		5 (1) (13%)		5(2) (27%)		5 (3) (16%)	
Valsrivier	48%	Rensburg	59%	Oakleaf	66%	Dundee	37%
Arcadia	42%	Arcadia	41%	Valsrivier	32%	Stream Beds	28%
Sterkspruit	6%			Stream Beds	2%	Fernwood	22%
Bonheim	4%					Oakleaf	13%

Table 3-3 Soils expected at the respective terrain units within the Dc 12 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units													
1 (3%)		1 (1) (20%)		2 (1%)		3 (6%)		3 (1) (38%)		4 (24%)		5 (8%)	
Bare Rocks	33%	Mispah	37%	Bare Rocks	60%	Bare Rocks	33%	Swartland	34%	Bonheim	29%	Dundee, Oakleaf	41%
Mayo	23%	Swartland	19%	Mispah	30%	Mayo	25%	Mispah	18%	Swartland	27%	Katspruit	27%
Mispah	21%	Glenrosa	13%	Glenrosa	10%	Swartland	17%	Bonheim	14%	Valsrivier	15%	Stream Beds	13%
Glenrosa	13%	Westleigh	12%			Mispah	17%	Valsrivier	9%	Arcadia	15%	Valsrivier	6%
Swartland	10%	Mayo	6%			Glenrosa	8%	Glenrosa	7%	Sterkspruit	4%	Bonheim	5%
		Bonheim	5%					Arcadia	7%	Mispah	4%	Arcadia	4%
		Valsrivier	3%					Westleigh	5%	Mayo	3%	Mayo	4%

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Bare Rocks	3%	Mayo	3%	Glenrosa	2%
Hutton	2%	Sterkspruit	2%	Bare Rocks	1%
		Bare Rocks	1%		

3.1.3 Terrain

The slope percentage of the proposed project area has been calculated and is illustrated in Figure 3-7. Most of the project area is characterised by a slope percentage ranging between 0 to 5% with some irregularities in areas with slopes between 20 to 22%. This illustration indicates a mostly uniform topography with occurrence of some fairly gentle sloping being present. The Digital Elevation Model (DEM) of the project area (Figure 3-8) indicates an elevation of 1 312 to 1 475 Metres Above Sea Level (MASL).

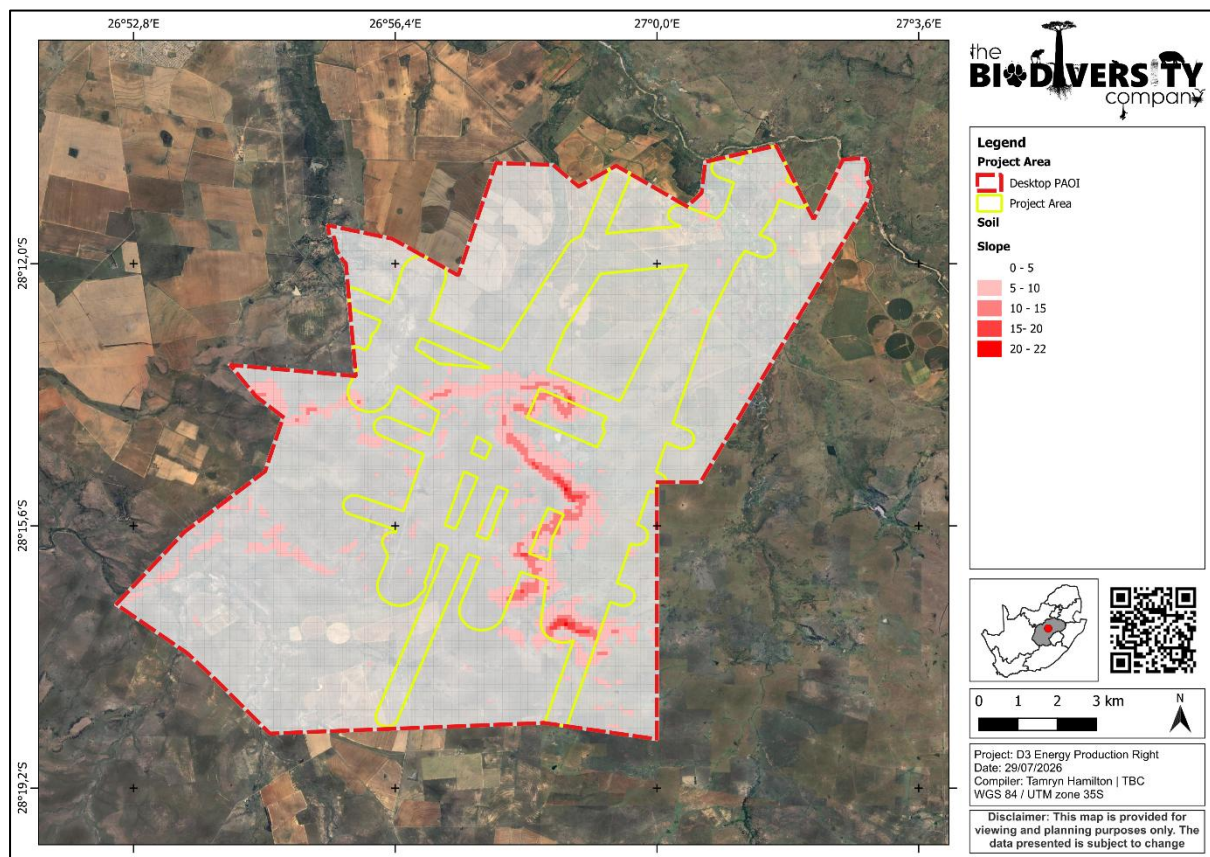


Figure 3-7 Slope percentage map for the project area

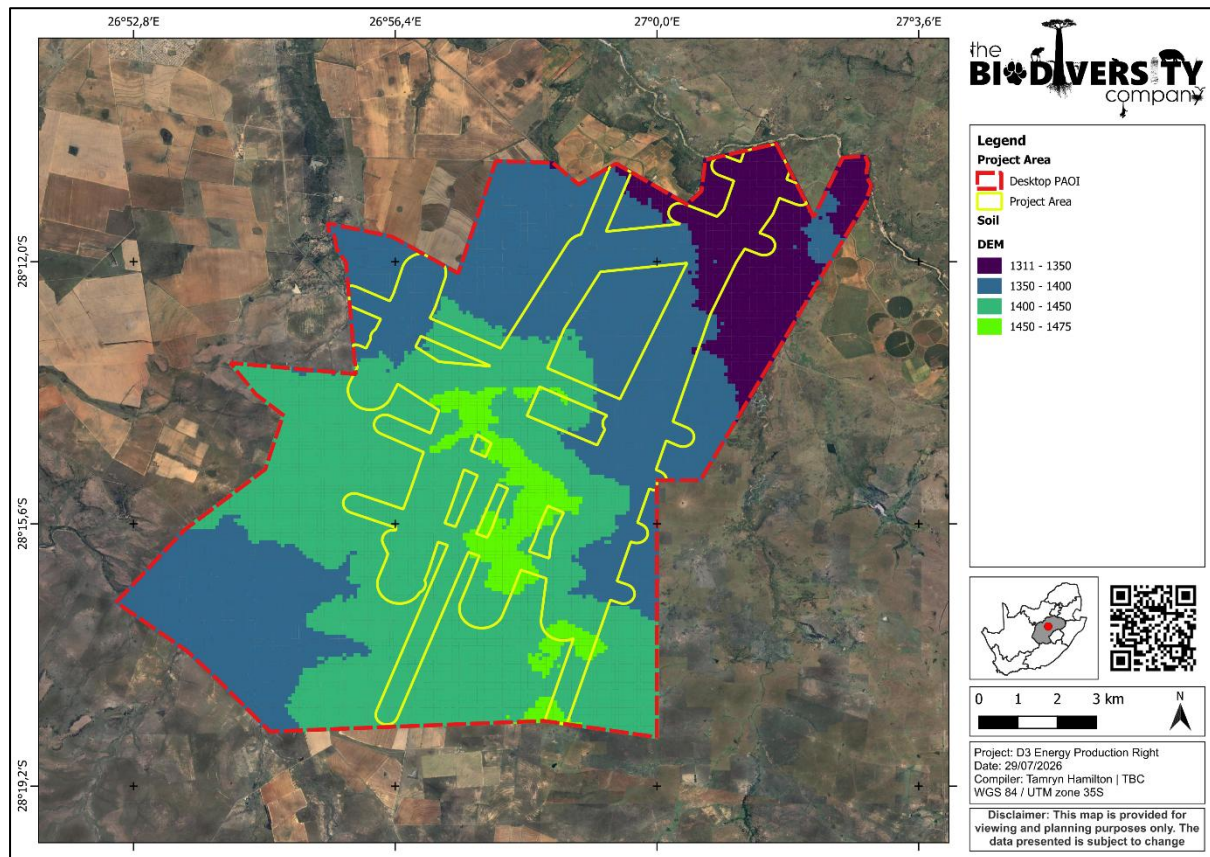


Figure 3-8 Digital Elevation Model of the project area (Metres Above Mean Sea Level)

4 Results and Discussion

4.1 Description of Soil Profiles and Diagnostic Horizon

Soil profiles were studied up to the bedrock where possible or a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification processes 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 horizon;
- Vertic topsoil horizon;
- Yellow-brown apedal subsoil horizon;
- Red apedal subsoil horizon;
- Albic subsoil horizon;
- Gley horizon;
- Alluvial subsurface horizon;
- Pedocutanic subsoil horizon;
- Lithic horizon; and

- Hard rock horizon.

4.1.1 Orthic topsoil horizon

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).

4.1.2 Vertic topsoil horizon

Vertic horizons are strongly structured, dark clay horizons, with high smectic clay content that gives rise to pronounced swell-shrink processes. Vertic horizons crack strongly when dry and sticky when wet, some vertic horizons have a strong tendency to invert, depositing calcium carbonate nodules and/or stones and rocks on the surface. Mechanical disturbance of vertic horizons may give rise to massive or altered surface structural aggregates (Soil Classification Working Group, 2018).

4.1.3 Yellow-brown apedal subsoil horizon

The yellow-brown apedal horizon is similar to that of the red apedal horizon in all aspects except for the colour and the iron-oxide processes involved with the colouration thereof. This diagnostic soil horizon rarely occurs in parent rock high in iron-oxides and will rather be associated with Quartzite, Sandstone, Shale, and Granites (Soil Classification Working Group, 2018).

4.1.4 Red apedal subsoil horizon

The red apedal horizon has defined red colour and has a structure weaker than moderate in the moist state. The essential uniform, red pigmentation is due to the presence of evenly distributed hematite which, even when it is not necessarily the dominant iron oxide present, typically indicates well aerated soil conditions in warmer climates. The sandy loam and finer textured horizons have a strong micro-aggregates structure, resulting in stable pores and a moderate to high infiltration rate. The red apedal horizons are easily tilled and usually support an active microflora and macrofaunal populations (Soil Classification Working Group, 2018).

4.1.5 Albic subsoil horizon

Albic horizons are often characterised by uniform white-greyish colours from the residual clay and quartz particles making up the matrix of the horizon. The main characteristic of this diagnostic horizon is a bleached colouration, which is a resultant product of distinct redox and ferrolysis pedological processes combined with eluvial processes. According to the Soil Classification Working Group (2018), albic horizons often receive lateral sub-surface flows from hillslope processes.

4.1.6 Gley horizon

Gley horizons that are well developed and have homogenous dark to light grey colours with smooth transitions. Stagnant and reduced water over long periods is the main factor responsible for the formation of a gley horizon and could be characterised by green or blue tinges due to the presence of a mineral called Fougerite which includes sulphate and carbonate complexes. Even though grey colours are dominant, yellow and/or red striations can be noticed throughout a gley horizon. The structure of a gley horizon mostly is characterised as strong pedal, with low hydraulic conductivities due to high clay content (clayey texture), although sandy gley horizons are also known to occur. The gley soil form commonly occurs at the toe of hillslopes (or benches) where lateral water inputs (sub-surface) are dominant and the underlying geology is characterised by a low hydraulic conductivity. The gley horizon usually is second in diagnostic sequence in shallow profiles yet is known to be lower down in sequence and at greater depths (Soil Classification Working Group, 2018).

4.1.7 Alluvial subsoil horizon

Alluvial horizons consist of unconsolidated fluvial, lacustrine or marine sediments or occasionally colluvial materials in various early stages of soil development. Soils with recently deposited alluvial or colluvial materials as subsoil have little evidence of pedogenic horizonation, although a diagnostic topsoil may be present. Soils containing alluvial subsoil horizon are consequently often intensively used for agriculture, including under permanent irrigation (Soil Classification Working Group, 2018).

4.1.8 Pedocutanic subsoil horizon

The pedocutanic horizon is a moderately to strongly structured subsurface horizon, with distinct to prominent cutans on the ped surfaces and a sandy clay loam to clay texture. A clear textural contrast between a sandier surface horizon and a higher clay upper subsurface horizon is a common feature of the pedocutanic horizon. peds commonly exhibits brown to dark brown matrix colours while yellowish to brownish colour variation within ped interiors is permitted ((Soil Classification Working Group, 2018).

4.1.9 Lithic horizon

A lithic horizon is a subsurface horizon with morphology expression of pedogenic alteration that ranges from strong weathering of the underlying country rock, with a friable soil-like morphology, through to the soil materials intimately mixed with partly weathered to hard rock fragments. Evidence of gleying in the form of iron minerals in the soil matrix or in the partly weathered fragments may be present in the wetter variants (Soil Classification Working Group, 2018).

4.1.10 Hard Rock horizon

The horizon comprises hard country rock where primarily physical weathering has taken place, ranging from a fractured rock horizon variant with numerous closely aligned fracture planes, but lacking soil development between fractures, to a solid rock horizon variant with limited and widely spaced fractures. It includes all igneous, sedimentary and metamorphic rock types. The horizon has very limited capability for root development of most annual plants, though roots of selected trees and shrubs may penetrate the limited planes occupying specialized ecological niche environments (Soil Classification Working Group, 2018).

4.2 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified (Figure 4-1 and Figure 4-2). These soil forms are described in Table 4-1 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 4-2.

Table 4-1 **Summary of soils identified within the project area**

Diagnostic Horizon	Soil Forms													
		Dundee 2112 (15)	Griffin 2220 (15)	Hutton 2222 (15)	Clovelly 2222 (15)	Swartland 1212 (15)	Arcadia 1120 (35)	Rustenburg 1120 (35)	Rensburg 1000 (35)	Cartref 2130 (15)	Glen 2000 (35)	Glenrosa 2120 (15)	Mispah 2220 1(5)	Grabouw 2000 (15)
Topsoil	Depth (mm)	0-300	0-300	0-300	0-300	0-150	0-400	0-700	0-300	0-50	0-300	0-150	0-30	-
	Clay (%)	0-15	0-15	0-15	0-15	0-15	35	35	35	0-15	35	0-15	0-15	-
	Signs of Wetness	None	None	None	None	None	None	None	None	None	None	None	None	-
	Rock (%)	0	0	5	0	0	0	0	0	0	0	0	0	-
	Surface crusting	None	None	None	None	None	Yes	Yes	Yes	None	Yes	None	None	-
Subsoil B1	Depth (mm)	300-1200	300-800	300-1200	5300-750	150-400	400-800	+700	300-1200	50-300	300-900	150-300	+300	-
	Clay (%)	0-15	0-15	0-15	0-15	25-35	15-20	0-15	35	15	35	15	0-15	-
	Signs of Wetness	None	None	None	None	None	None	None	Bleached	Bleached	None	No	None	-
	Rock (%)	0	10	0	0	0	40	60	0	0	0	30	60	-
Subsoil B2	Depth (mm)	-	800-1200	-	750-1200	400-600	-	-	-	300-500	-	-	-	-
	Clay (%)	-	15	-	0-15	0-15	-	-	-	0-15	-	-	-	-
	Signs of Wetness	-	-	-	None	None	-	-	-	Mottles	-	-	-	-
	Rock (%)	-	0	-	30	30	-	-	-	30	-	-	-	-

Table 4-2 **Description of soil family characteristics**

Soil Form/Family	Topsoil Colour	Base Status	Textural Contrast
Dundee	Chromic Topsoil	Mesotrophic	Luvic
Griffin	Chromic Topsoil	Mesotrophic	Luvic
Hutton	Chromic Topsoil	Mesotrophic	Luvic
Clovelly	Chromic Topsoil	Mesotrophic	Luvic
Swartland	Dark Topsoil	Dystrophic	Luvic
Arcadia	Dark Topsoil	Dystrophic	Luvic
Rustenburg	Dark Topsoil	Dystrophic	Luvic
Rensburg	Dark Topsoil	Dystrophic	Luvic
Cartref	Chromic Topsoil	Mesotrophic	Aluvic
Glenrosa	Chromic Topsoil	Eutrophic	Aluvic
Mispah	Chromic Topsoil	Eutrophic	Aluvic
Johannesburg	-	-	-

4.3 Discussion

Thirteen (14) representative soil forms were identified in the proposed Project Area namely, Dundee, Ermelo, Hutton, Griffin, Clovelly, Cartref, Rensburg, Swartland, Glen, Arcadia, Rustenburg, Glenrosa, Mispah and Grabouw soil forms (Figure 4-1).

The most sensitive soil forms suitable for crop production identified within the seismic transects includes the Dundee, Griffin, Hutton and Clovelly soil forms. The Dundee soil form consists of an orthic topsoil horizon on top of a thick alluvial horizon. The Ermelo soil form consists of an orthic topsoil horizon on top of a thick yellow brown apedal horizon. The Griffin soil form consists of an orthic topsoil horizon on top of a yellow brown apedal horizon underlain with a red apedal horizon below. The Hutton soil form consist of an orthic topsoil horizon top of a thick red apedal horizon. The Clovelly soil form consists of an orthic topsoil horizon on top of a yellow brown apedal underlain with a lithic horizon below. These soils are usually used for crop farming due to their good drainage, aeration and nutrient and water holding capabilities. Furthermore, these soils are characterised with a high suitability for crop production due to the permeability of their underlying horizons that promotes water infiltration, root penetration and gas exchange.

Two (2) hydromorphic soils with signs of wetness identified within the proposed target areas includes the Rensburg and Cartref soil forms. The Rensburg soil form consists of a vertic topsoil horizon underlain with a gley horizon. The Cartref soil form consists of an orthic topsoil horizon on top of an albic horizon underlain with a lithic horizon.

Three clayey soils also identified within the proposed seismic transects includes the Swartland, Glen, Arcadia and Rustenburg soil forms. The Swartland soil form consists of an orthic topsoil horizon on top of a pedocutanic horizon underlain with a lithic horizon. The Glen soil form consists of a vertic topsoil on top of a thick pedocutanic horizon. The Arcadia soil form consists of a vertic topsoil on top of a lithic horizon. The Rustenburg soil form consists of a vertic topsoil horizon on top of a hard rock substratum horizon. These soils are characterised by high clay content which may impede drainage, aeration, and root penetration.

The less sensitive soil forms identified within the seismic transacts with severe with to very severe limitations to crop production includes the Glenrosa, Mispah and Grabouw soil forms. The Glenrosa consists of an orthic topsoil horizon on top of a lithic horizon. The Mispah soil form consists of an orthic

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topsoil horizon on top of a hard rock substratum horizon. These soils have limited soil profile which in turn restrict their soil water holding capacity, root penetration and aeration. The Grabouw physically disturbed Anthrosols is characterised as the land which is physically disturbed by anthropogenic activities for agricultural purposes. This soil form is characterised by extremely severe limitation for crop production and is more suitable for wildlife practices.

The desktop assessment database (Land Type Survey Staff, 1972 – 2006) for the areas forming the entire production right area excluding the site verified proposed Project area indicates that the areas are characterised with the Clovelly, Hutton, Valsrivier, Rensburg, Oakleaf, Dundee, Swartland, Bonheim, and Mispah soil forms. The Dundee, Hutton, Clovelly and Oakleaf soil forms are mostly suitable for cropping practices. The Rensburg soil form is characterised by hydromorphic conditions associated with watercourse and wetlands areas. The Valsrivier, Swartland, and Bonheim soil forms have high clay contents which can limit most cropping practices. The Mispah soil form have restrictive limitations and therefore less suitable for crop production. Some of the identified soil horizons within the proposed Project Area, as well as the current land uses are illustrated in Figure 4-2 to Figure 4-3, and Figure 4-4, respectively.

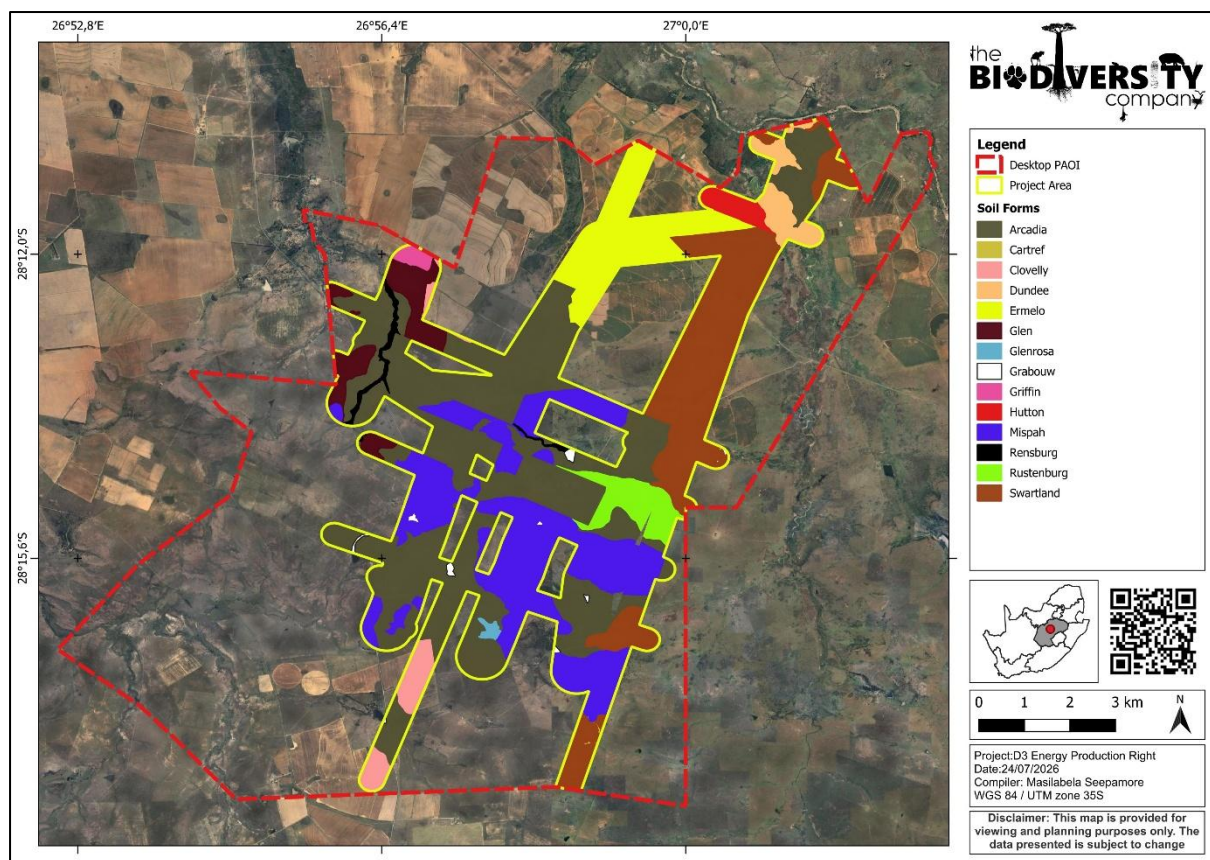


Figure 4-1 Soil forms found within the proposed Project Area

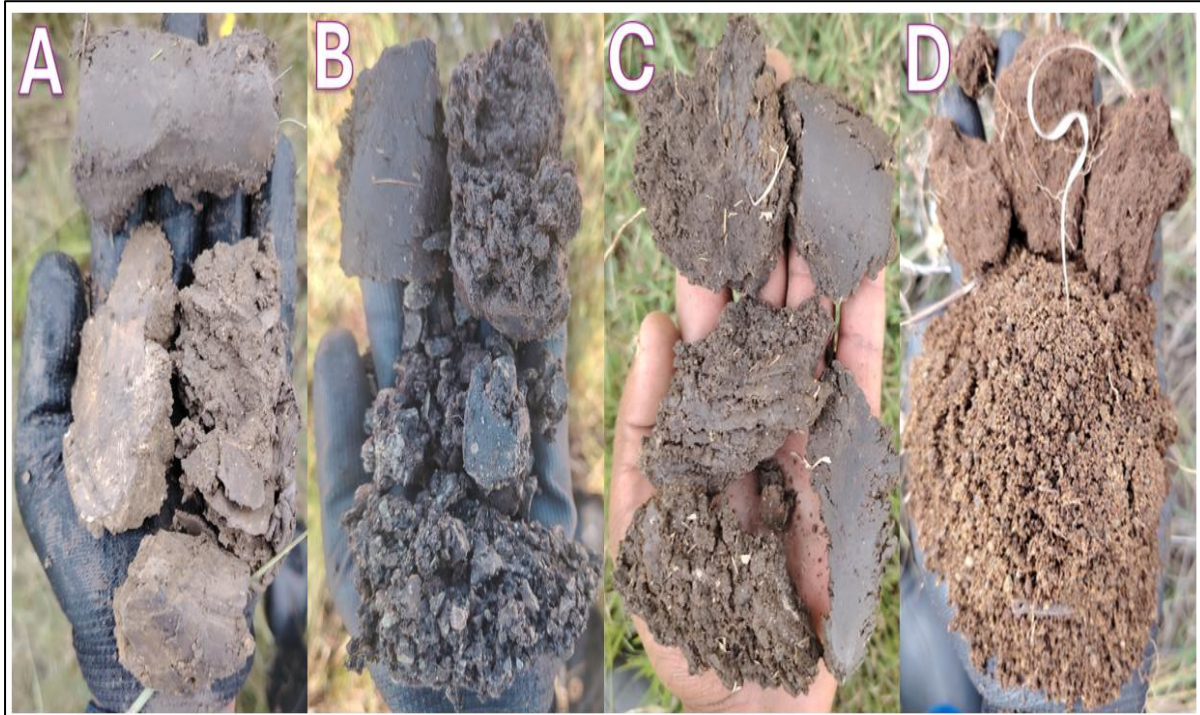


Figure 4-2 *Diagnostic soil horizons identified on-site: A) Glen soil form; B) Arcadia soil form; C) Rustenburg soil form; and D) Glenrosa soil form.*

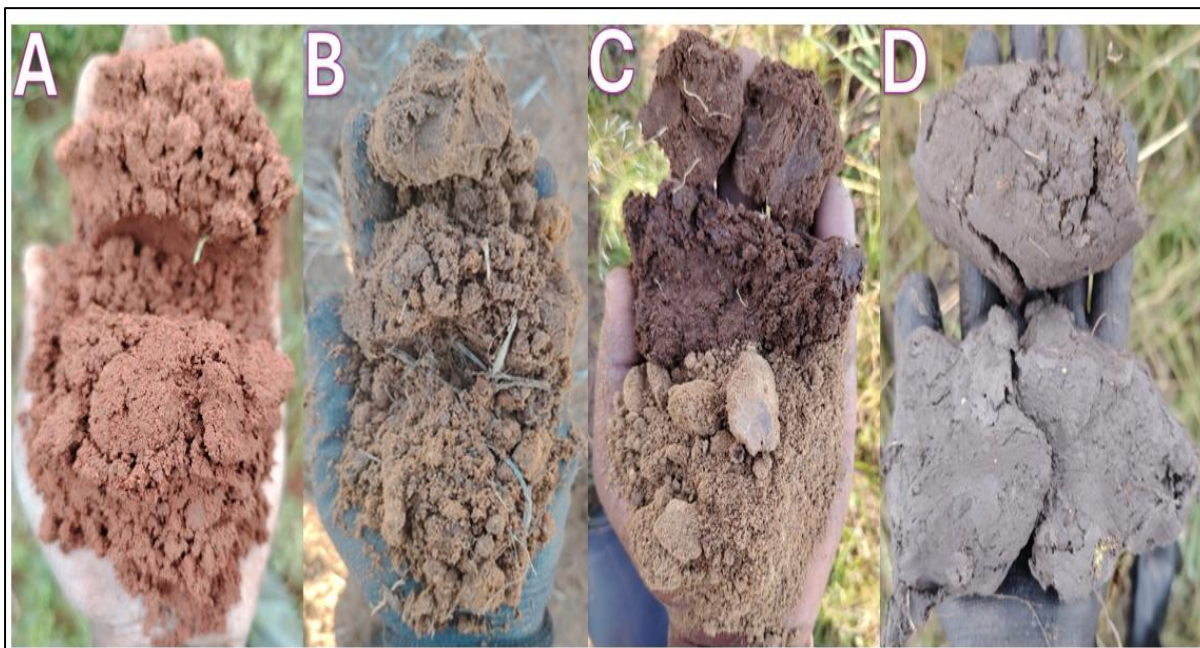


Figure 4-3 *Diagnostic soil horizons identified on-site: A) Hutton soil form; B) Clovelly soil form; C) Swartland soil form; and D) Rensburg soil form.*

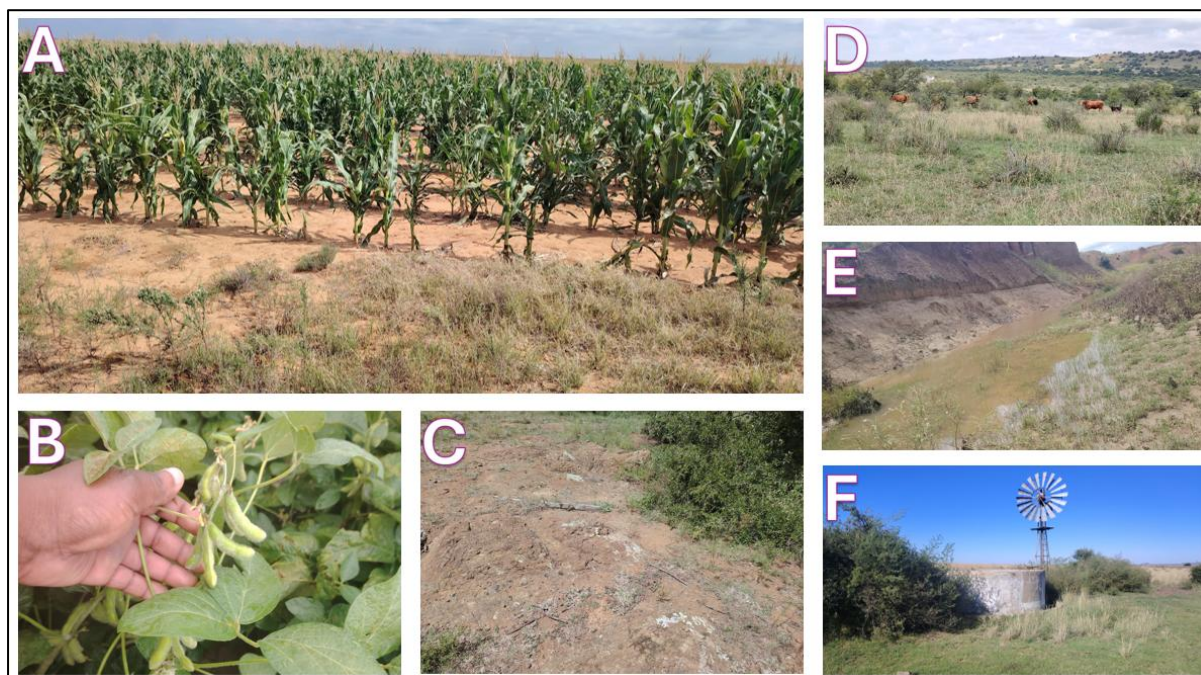


Figure 4-4 Current land use found within the proposed Project Area; A) & B) Active crop fields; C) Rocky areas; D) Livestock grazing; E) River; and F) Windmill.

4.4 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.

4.4.1 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 4 -3Table 4 -3).

Table 4 -3 Climate 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	0.44-0.47	

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		moderate range of adapted crops but planting date options more limited than C3.		
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 (i.e. Vaal-Vet Sandy Grassland, MAP 530 mm and MAPE of 2423 mm with a MAP: A pan Class of 0.22, respectively. The Central Free State Sandy Grassland, Highveld Alluvial Vegetation, and Bloemfontein Karroid Shrubland MAP 562, 495 and 566 mm, MAPE of 2226, 2507 and 2201 mm, with a MAP: A pan Class of 0.25, 0.20 and 0.26, respectively) has been determined to be “C8” for the project area.

4.4.2 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 (0-5%, 5-10%, 10-15% and 15-20%) 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 “I” (i.e. maize and soyabean cultivation), land capability “II” (i.e. Griffin, Hutton, Dundee and Clovelly soil forms), land capability “III” (i.e. Swartland, Glen, Arcadia and Rustenburg soil forms), land capability “V” (i.e. Rensburg and Cartref soil forms), land capability “VI” (i.e. Glenrosa and Mispah soil forms) and land capability “VIII” (i.e. Grabouw soil form).

Land capability is defined as the combination of the slope class and soil morphological properties (i.e. topsoil texture, profile depth and permeability class of the upper soil layers). Accordingly, following Smith, (2006) which the national DAFF, (2017) land capabilities protocols were further expanded from, the above-mentioned identified Ermelo and Clovelly soil forms associated with active cropping is restricted to land capability class “I” (i.e. Maize and soyabeans) categorised by LC 8-10 (Moderate to Moderate-High), land capability classes “II” (i.e. Dundee, Clovelly, Griffin, Hutton soil forms) categorised by LC 6-7 (Low-Moderate); land capability “III” (i.e. Swartland, Glen, Arcadia and Rustenburg soil forms) categorised by LC 1-5 (Very Low to Low), land capability “V” (i.e. Rensburg and Cartref soil forms) categorised by LC 6-7 (Low-Moderate), land capability “VI” (i.e. Glenrosa and Mispah soil forms) categorized by LC 1-5 (Very Low to Low), and land capability “VIII” (i.e. Grabouw soil form) categorized by LC 1-5 (Very Low to Low). The baseline soil land capability was aligned and - compared to the National Land Capability data (DAFF, 2017).

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

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
I	No or few limitations. Very high arable potential. Very low erosion hazard.	Good agronomic practice.	Annual cropping.	Arable	High
II	Slight limitations. High arable potential. Low erosion hazard.	Adequate run-off control.	Annual cropping with special tillage or ley (25%).	Arable	Medium

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III	Moderate limitations. Some erosion hazard.	Special conservation practices and tillage methods.	Rotation of crops and ley (50%)	Arable	Medium
V	Water course and land with wetness limitations.	Protection and control of water table.	Improved pastures, suitable for wildlife	Arable	Medium
VI	Limitations preclude cultivation. Suitable for perennial vegetation.	Protection measures for establishment, e.g., sod-seeding	Veld, pasture, and afforestation.	Non-Arable	Low
VIII	Extremely severe limitations. Not suitable for grazing or afforestation.	Total protection from agriculture.	Wildlife	Non-Arable	Low

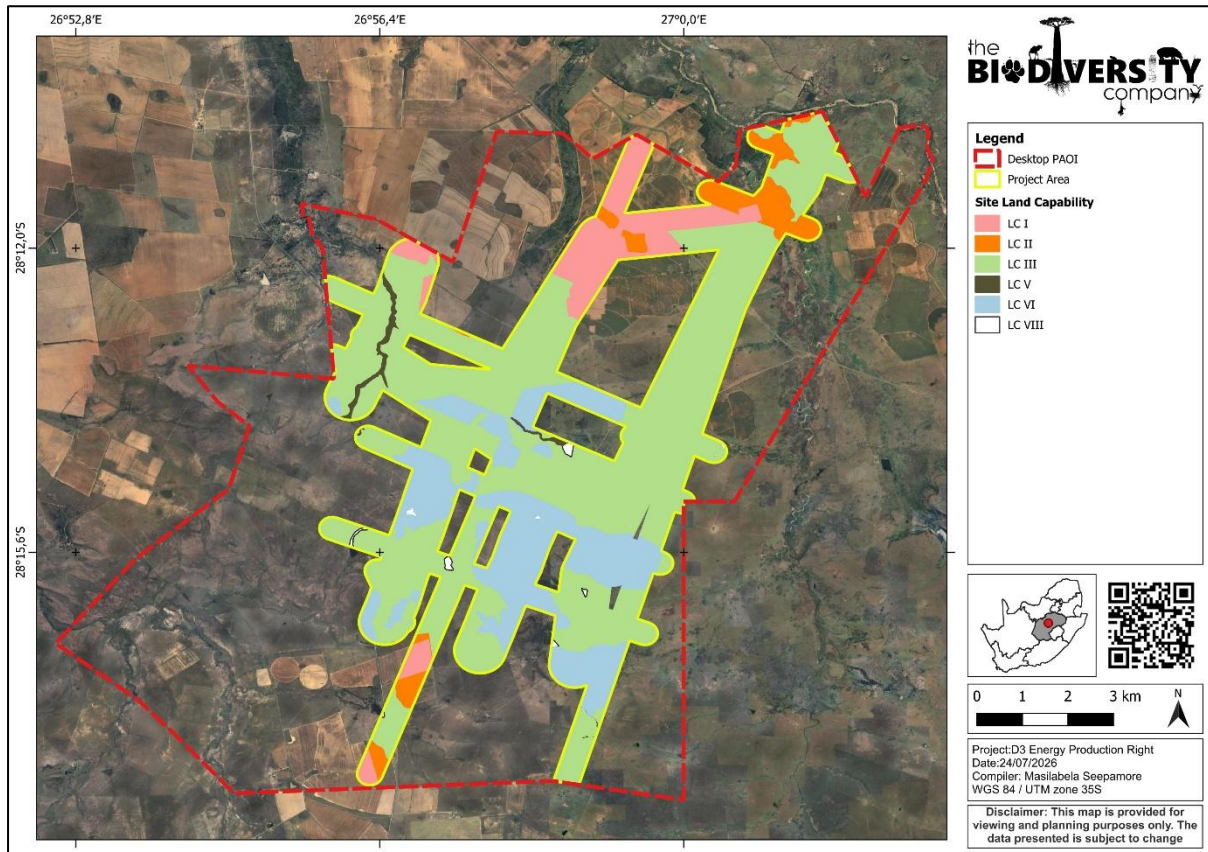


Figure 4-5 Site land capability of the dominant soil forms identified in the proposed Project Area and PAOI.

4.4.3 Land Potential

The land potential was determined to further verify the land capability to the National Land Capability data (DAFF, 2017). The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 4-5 and Table 4-7.

From the three land capability classes, the land potential levels have been determined by means of the Guy and Smith (1998) methodology. The land capability class "I" is equivalent to land potential 4, land capability "II" is equivalent to land potential 5, land capability class "III" were equivalent to land potential level 6, land capability class V to VI, land capability class "VII" to land potential level 7 and land capability "VIII" to land potential 8 due to available climatic conditions. Areas under grain production are categorised with a land potential 4. The categorized land potentials for the site identified soil forms are illustrated in Table 4-6 below.

Table 4-5 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	<u>L4*</u>
LC2	L1	L2	L2	L3	L3	L4	L4	<u>L5*</u>
LC3	L2	L2	L2	L2	L4	L4	L5	<u>L6*</u>
LC4	L2	L3	L3	L4	L4	L5	L5	L6
LC5	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	<u>Vlei*</u>
LC6	L4	L4	L5	L5	L5	L6	L6	<u>L7*</u>
LC7	L5	L5	L6	L6	L7	L7	L7	L8
LC8	L6	L6	L7	L7	L8	L8	L8	<u>L8*</u>

*Land potential level applicable to the climate and land capability

Table 4-6 Land potential categories for the soil forms identified in the project area

Soil Form/Family	Land Potential
Ermelo, Clovelly (Maize and Soyabeans cultivation)	4
Dundee, Clovelly, Griffin and Hutton, soil forms	5
Swartland, Glen, Arcadia and Rustenburg soil forms	6
Rensburg and Cartref soil forms	Vlei
Glenrosa and Mispah soil forms	7
Grabouw	8

Table 4-7 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Description of Land Potential Class	Sensitivity
4	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.	High
5	Restricted potential. Regular and/or moderate to severe limitations due to soil, slope temperatures or rainfall.	Medium
6	Very restricted potential. Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
7	Low potential. Severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
8	Very low potential. Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
Vlei	-	Medium
Disturbed	N/A	None

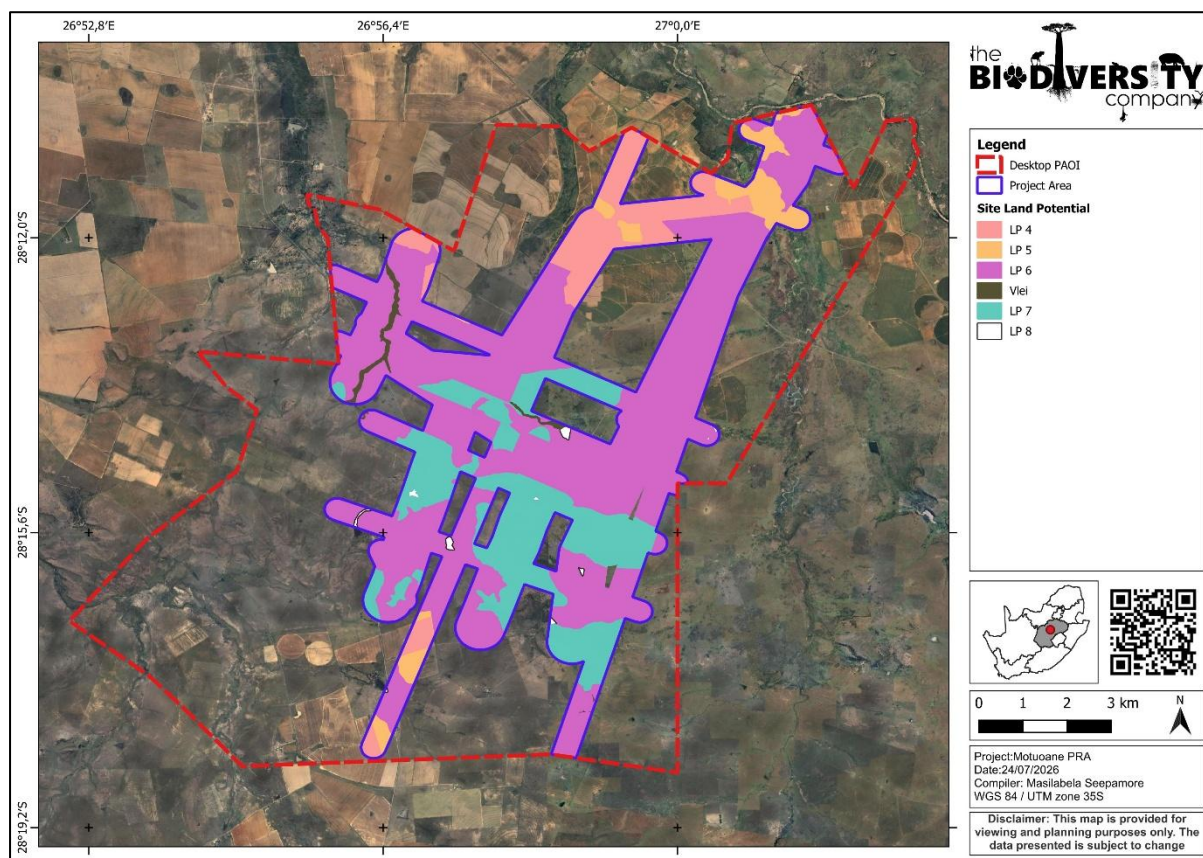


Figure 4-6 Site land potential of the dominant soil forms identified in the proposed Project Area and PAOI.

4.4.4 Erosion Potential

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

4.4.4.1 Dundee

Table 4-8 illustrates the values relevant to the erosion potential of the Dundee soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Moderate” potential for erosion.

Table 4-8 Erosion potential calculation for the Dundee soil form

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
<u>3.5</u>	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	<u>0</u>		-0.5	
Step 4- Organic Matter				

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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

4.4.4.2 Griffin

Table 4-9 illustrates the values relevant to the erosion potential of the Griffin soil forms. The final erosion potential score has been calculated at 4.0, which indicates a “Moderate” potential for erosion.

Table 4-9 Erosion potential calculation for the Griffin soil form

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		

4.4.4.3 Hutton

Table 4-10 illustrates the values relevant to the erosion potential of the Hutton soil forms. The final erosion potential score has been calculated at 4.0, which indicates a “Moderate” potential for erosion.

Table 4-10 Erosion potential calculation for the Hutton soil form

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

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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	

4.4.4.4 Clovelly

Table 4-11 illustrates the values relevant to the erosion potential of the Clovelly soil forms. The final erosion potential score has been calculated at 4.0, which indicates a “Moderate” potential for erosion.

Table 4-11 Erosion potential calculation for the Clovelly soil form

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		

4.4.4.5 Swartland

Table 4-12 illustrates the values relevant to the erosion potential of the Swartland soil forms. The final erosion potential score has been calculated at 1.5, which indicates a “Very High” potential for erosion.

Table 4-12 Erosion potential calculation for the Swartland soil form

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
3.5	<u>4.0</u>	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted	Heavily Restricted	
-0.5		-1.0	<u>-2.0</u>	
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	<u>-0.5</u>	
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		

4.4.4.6 Glen

Table 4-13 illustrates the values relevant to the erosion potential of the Glen soil forms. The final erosion potential score has been calculated at 3.0, which indicates a “High” potential for erosion

Table 4-13 Erosion potential calculation for the Glen soil form

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	<u>6.0</u>
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted	Heavily Restricted	
-0.5		-1.0	<u>-2.0</u>	
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	<u>-0.5</u>	
Step 4- Organic Matter				
Organic Topsoil		Humic Topsoil		

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

4.4.4.7 Arcadia

Table 4-14 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 4-14 Erosion potential calculation for the Arcadia soil form

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	<u>6.0</u>
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted	Heavily Restricted	
-0.5		-1.0	<u>-2.0</u>	
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	<u>-0.5</u>	
Step 4- Organic Matter				
Organic Topsoil		Humic Topsoil		
+0.5		+0.5		
Step 5- Topsoil Limitations				
Surface Crusting		Excessive Sand/High Shrink/Self-Mulching		
<u>-0.5</u>		-0.5		
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)		Shallow (<250-500 mm)		
-1.0		-0.5		

4.4.4.8 Rustenburg

Table 4-15 illustrates the values relevant to the erosion potential of the Rustenburg soil forms. The final erosion potential score has been calculated at 3.0, which indicates a “High” potential for erosion.

Table 4-15 Erosion potential calculation for the Rustenburg soil form

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	<u>6.0</u>
Step 2- Adjustment Value (Permeability of Subsoil)				

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Slightly Restricted	Moderately Restricted	Heavily Restricted
-0.5	-1.0	<u>-2.0</u>
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	<u>-0.5</u>
Step 4- Organic Matter		
Organic Topsoil	Humic Topsoil	
+0.5	+0.5	
Step 5- Topsoil Limitations		
Surface Crusting	Excessive Sand/High Shrink/Self-Mulching	
<u>-0.5</u>	-0.5	
Step 6- Effective Soil Depth		
Very Shallow (<250 mm)	Shallow (<250-500 mm)	
-1.0	-0.5	

4.4.4.9 Rensburg

Table 4-16 illustrates the values relevant to the erosion potential of the Rensburg soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Moderate” potential for erosion

Table 4-16 Erosion potential calculation for the Rensburg soil form

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	<u>6.0</u>
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted	Heavily Restricted	
-0.5		-1.0	<u>-2.0</u>	
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	<u>-0.5</u>	
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		

4.4.4.10 Cartref

Table 4-17 illustrates the values relevant to the erosion potential of the Cartref soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Medium” potential for erosion.

Table 4-17 Erosion potential calculation for the Cartref soil form

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		

4.4.4.11 Glenrosa

Table 4-18 illustrates the values relevant to the erosion potential of the Glenrosa soil forms. The final erosion potential score has been calculated at 1.5, which indicates a “Very High” potential for erosion.

Table 4-18 Erosion potential calculation for the Glenrosa soil form

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
<u>3.5</u>	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	<u>-2.0</u>	
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		Mesotrophic Soils	Eutrophic or Calcareous Soils, Medium and Heavy Textures	
<u>+0.5</u>		0	-0.5	
Step 4- Organic Matter				
Organic Topsoil		Humic Topsoil		

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+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

4.4.4.12 Mispah

Table 4-19 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 4-19 Erosion potential calculation for the Mispah soil form

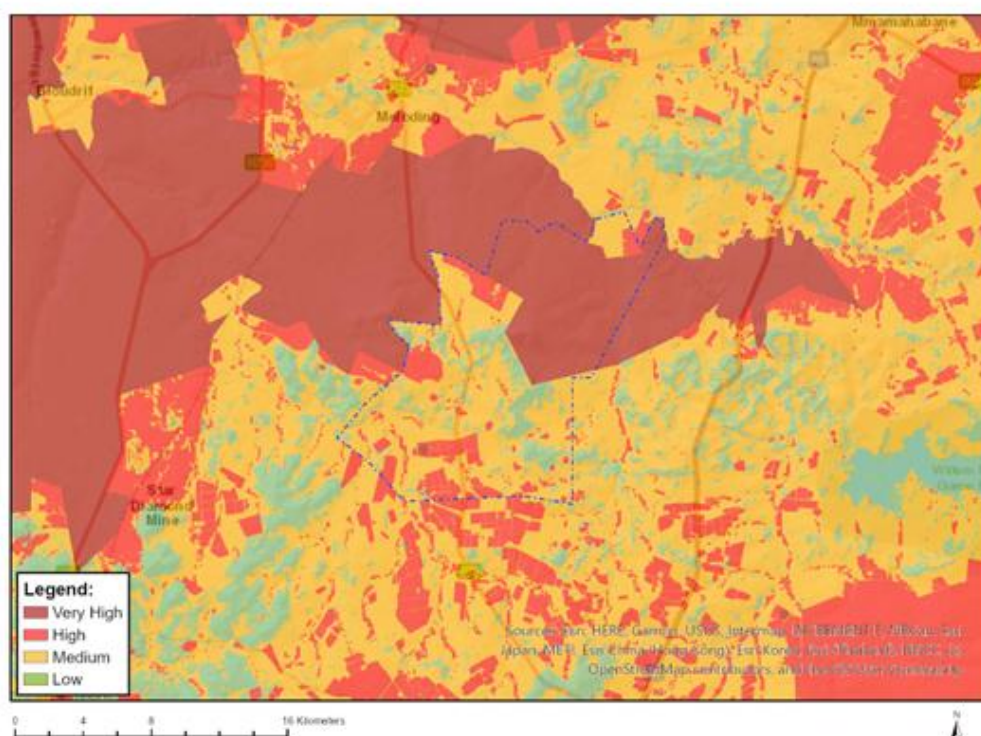
Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
<u>3.5</u>	4.0	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted	Heavily Restricted	
-0.5		-1.0	<u>-2.0</u>	
Step 3- Degree of Leaching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

4.5 Sensitivity Verification**4.5.1 Screening Report – D3 Energy Production Right**

The following is deduced from the National Web-based Environmental Screening Tool Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Agriculture Theme Sensitivity indicates that the Project Area falls within the “Very Low to Very High” agricultural sensitivity (Figure 4-7).

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Old_Fields
High	Rainfed Annual Crop Cultivation / Planted Pastures
High	09. Moderate-High
High	08. Moderate
Low	05. Low
Low	04. Low-Very low
Low	03. Low-Very low
Medium	07. Low-Moderate
Medium	06. Low-Moderate
Very High	Horticulture

Very High	Non-pivot Irrigated Annual Crop Cultivation / Planted Pastures
Very High	Pivot_Irrigation
Very High	Virginia PAA

Figure 4-7 Map of Relative Agricultural Theme Sensitivity for the D3 Energy Production Right Application generated by the Environmental Screening Tool

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which six potential land capability classes are located within the Project area and PAOI, including;

- Land Capability 3 to 5 (Very Low to Low Sensitivity);
- Land Capability 6 to 7 (Low-Moderate Sensitivity); and
- Land Capability 8 to 9 (Moderate to Moderate-High Sensitivity).

The land capability dataset (DAFF, 2017) indicates a range of categories expected throughout the project focus areas. The proposed project area falls predominantly within “Low-Moderate” land capability sensitivity and with other areas having “Moderate to Moderate-High” and “Very Low to Low” land capability sensitivities (see Figure 4-8). Furthermore, the agricultural theme tool also indicated the presence of very highly and highly sensitive field crop boundaries (Figure 4-9). Moreover, portions of the project focus area, falls within Protected Agricultural Areas (PAAs), as stipulated by the DALRRD (2020; Figure 4-10).

The baseline soil findings, current land uses and the calculated land potential concur to an extent with the agricultural theme tool, in areas demarcated “Low-Moderate” and “Very Low to Low” land capability sensitivities and with highly sensitive field crop boundaries within the project focus areas. They further dispute to an extent the agricultural theme tool on all areas demarcated as highly sensitive for field crop boundaries and “Moderate to Moderate-High” land capability sensitivity. Commercial maize and soyabean production under rainfed conditions were confirmed within the Project Area.

Additionally, the proposed PAOI and portions of the Project Area falls within an area that is classified as Virginia Protected Agricultural Area (PAA). The PAA are generally considered conducive for agricultural production, as these areas have made a significant contribution to the cultivation of various essential crops. Their protection is critical to ensure sustainable food production within South Africa. Evidently, not all demarcated (PAA) within Project Area are suitable for crop production, due to the presence of low potential soils and areas physically disturbed by solar PV construction. However, some areas overlap with active cropping under rainfed, and irrigation infrastructure and these areas should be conserved. The proposed activities associated with the project should ensure no/or minimal segregation of such areas.

Moreover, low and medium potential soils were identified within the project area. According to the Land Type Survey Staff (1972 – 2006), low and medium potential soils were confirmed within the entire PAOI. Moreover, highly and very highly sensitive field crop boundaries were identified within the PAOI by the help of the agricultural theme tool.

The current Project Area and associated activities of the proposed project will have acceptable expected changes to soil resources. As a result, based on the verified baseline findings, the proposed development will have a minimal impact on the soil resources.

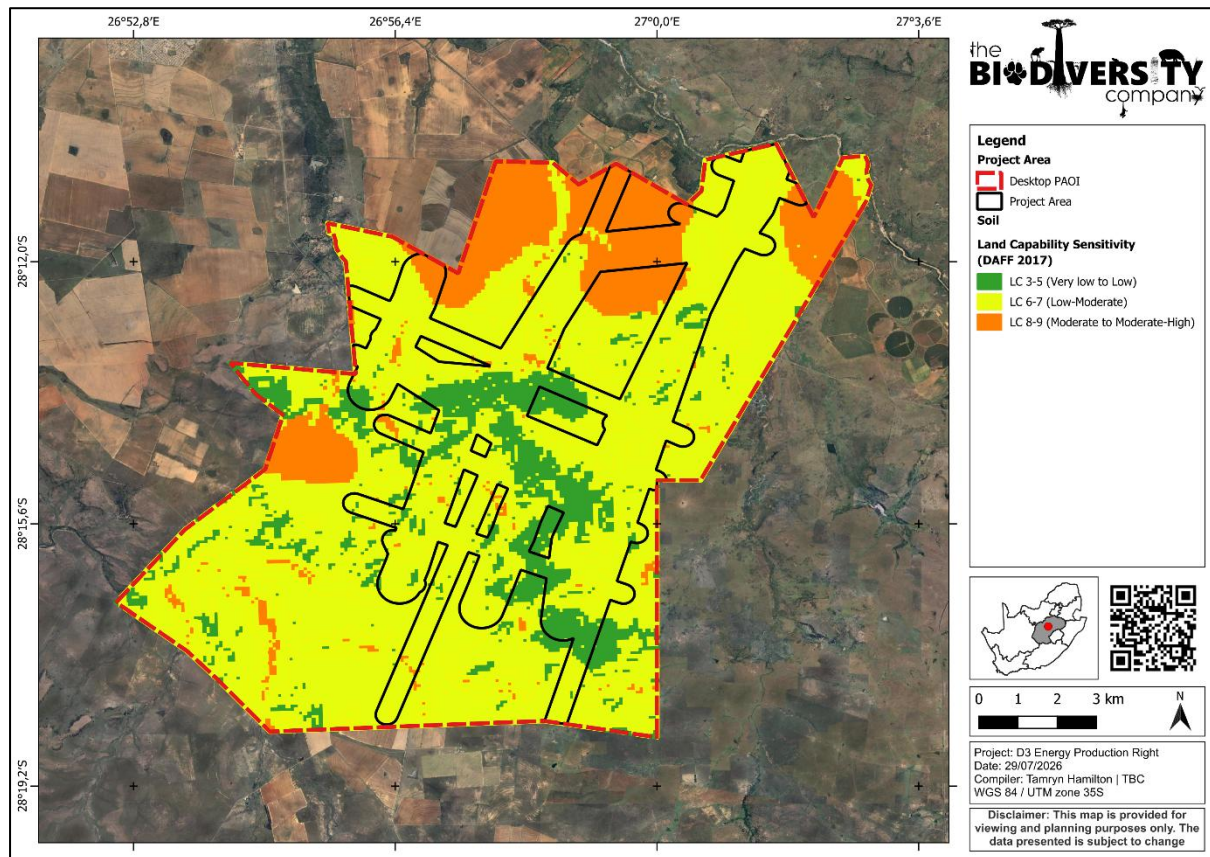


Figure 4-8 Land Capability Sensitivity (DAFF, 2017)

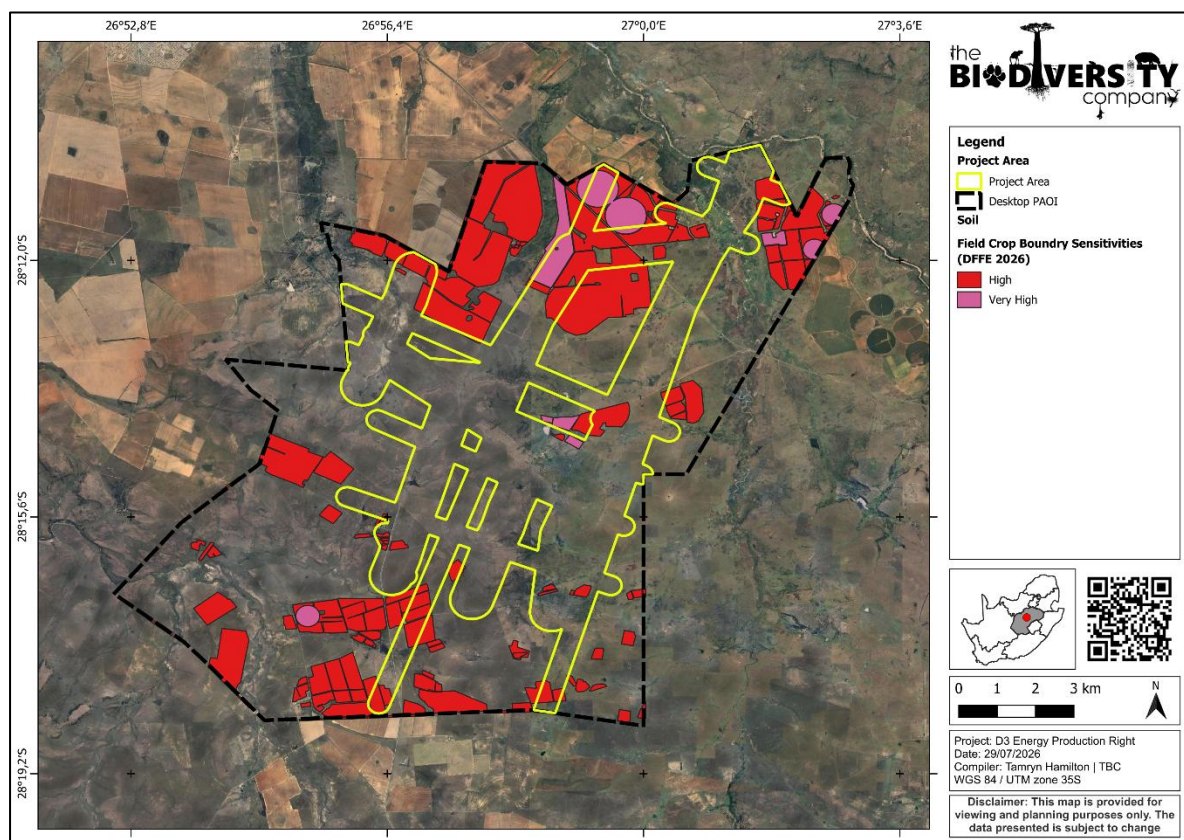


Figure 4-9 Field crop boundary sensitivity (DFFE 2026)

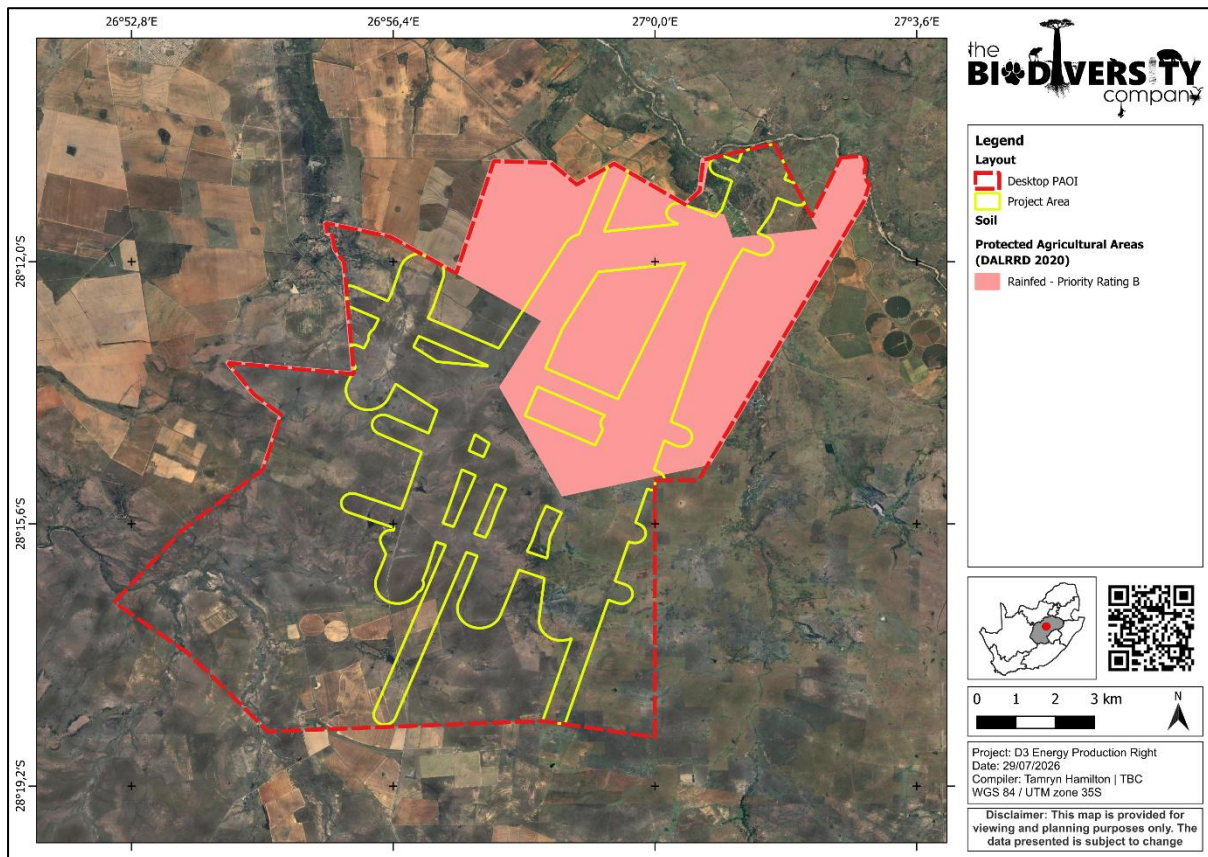


Figure 4-10 Protected Agricultural Areas (DALRRD, 2020)

Site Ecological Importance (SEI)

The following land potential levels have been determined:

- Land potential level 4 (this land potential level is characterised by 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. Arable soils);
- Land potential level 5 (this land potential level is characterised by restricted potential. Regular and/or moderate to severe limitations due to soil, slope, temperatures or rainfall. Arable);
- 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);
- Land potential level 7 (this land potential level is characterised by low potential. Severe limitations due to soil, slope, temperatures or rainfall. Non-arable);
- Land potential level 8 (this land potential level is characterised by very low potential. Very severe limitation due to soil, slope, temperatures or rainfall. Non-arable); and
- Vlei

The climatic conditions, soil forms, land use and land capability features were used to determine the overall sensitivity of the soil resources. The land capability level "I" areas were scored a "High" sensitivity, land capabilities "II" and "Vlei" were assigned "Medium" sensitivity. Land capabilities "III", "VI" and "VIII" was assigned "Low" sensitivity. (Figure 4-11).

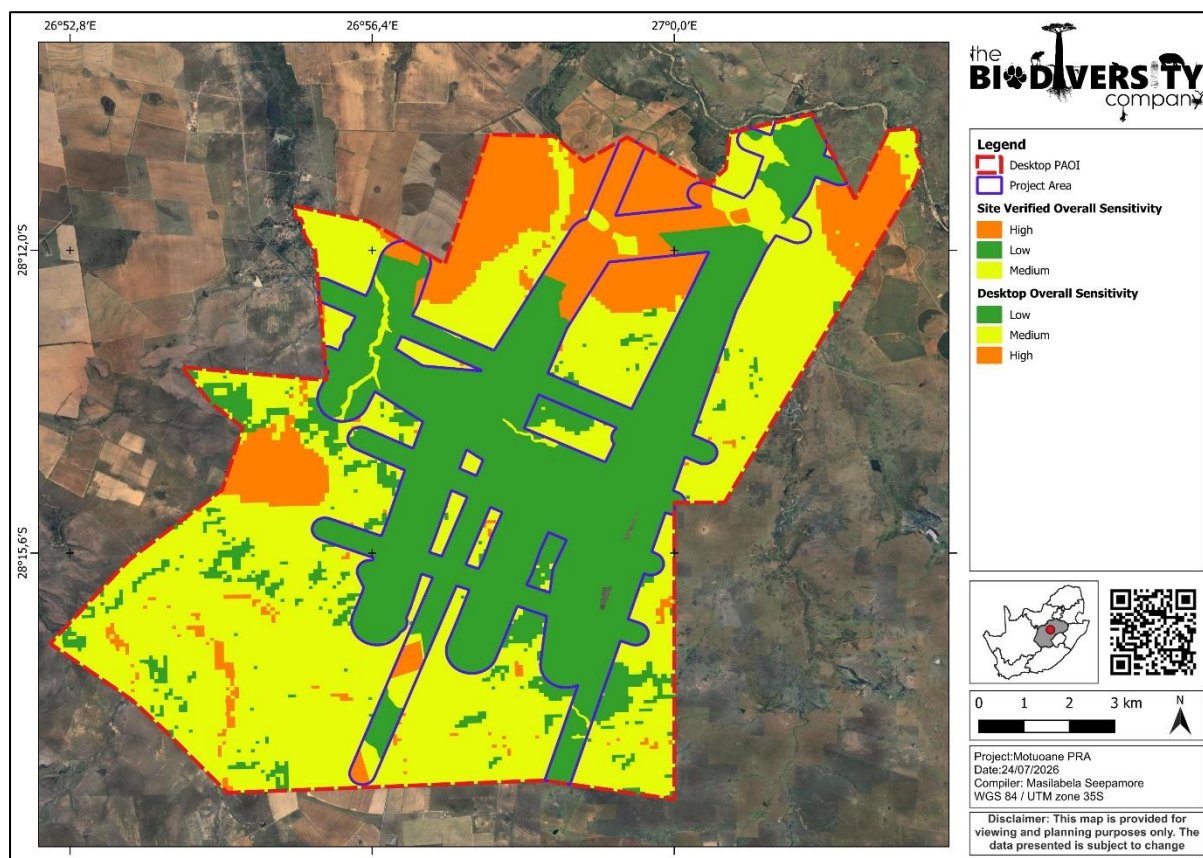


Figure 4-11 Overall sensitivity for the proposed Project Area and PAOI

Considering the soil properties, agricultural potential as well as the current land use of the proposed target drilling areas, the area has a predominately “Low” agricultural sensitivity, with “Medium” and marginal “High” sensitive areas (see Figure 4-11). The allocated sensitivities for the theme are either disputed or validated in Table 4-20 below.

Table 4-20 Summary of the screening tool vs specialist assigned sensitivities

Screening Tool Theme	Feature	Screening Tool	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Agricultural Theme	Virginia PAA	Very High	High	Disputed – Moderate to Moderate-High capability. The presence of maize and soya beans cultivation under rainfed conditions within the seismic transect buffer area.
	Virginia PAA	Very High	Medium	Disputed – Low-Moderate land capability. The absence of active cropping either rainfed or under irrigation infrastructure. Moreover, the presence of medium potential soils such as Dundee, Griffin, Hutton and Clovelly soil forms. Moreover, the presences of hydromorphic soils with signs of wetness such Rensburg and Cartref soil forms.
	Virginia PAA	Very High	Low	Disputed – Very Low to Low. The absence of active cropping either rainfed or under irrigation infrastructure. Moreover, the presence of low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Mispah and Glenrosa soil forms which require irrigation to enhance their productivity. Additionally, the presence of anthropogenic soil materials such as Grabouw.
	Pivo Irrigation	Very High	Very High	Could not be verified – Lack of access
	Horticulture	Very High	Very High	Validated/Disputed – Lack of access, desktop verified
	Rainfed Annual Crop Cultivation	High	High	Validated – Moderate to Moderate-High capability. The presence of maize and soya beans cultivation under rainfed conditions in

/ Planted Pastures			seismic transects buffer area.
Rainfed Annual Crop Cultivation / Planted Pastures	High	Medium	Disputed - Low-Moderate land capability. The presence of historical crop fields on medium potential soils such as Dundee and Hutton soil forms.
Rainfed Annual Crop Cultivation / Planted Pastures	High	Low	Disputed – Very Low to Low land capability. The presence of historical crop fields on low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Glenrosa, Mispah and Grabouw soil forms.
Old Fields	High	High	Could not be verified – Lack of access.
Old Fields	High	High	Disputed - The presence of maize and soya beans cultivation under rainfed conditions within the seismic transects buffer area.
Old Fields	High	Medium	Disputed - Low-Moderate land capability. The presence of historical crop fields on medium potential soils such as Dundee and Hutton soil forms.
Old Fields	High	Low	Disputed - Very Low to Low land capability. The presence of historical crop fields on low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Glenrosa, Mispah and Grabouw soil forms.
Moderate to Moderate-High (LC 8-9)	High	Medium	Disputed – Low-Moderate land capability. The presence of medium potential such as Dundee, Griffin, Hutton and Clovelly soil forms. Moreover, the presences of hydromorphic soils with signs of wetness such Rensburg and Cartref soil forms.
Moderate to Moderate-High (LC 8-9)	High	Low	Disputed – Very Low to Low land capability. The presence of low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Mispah and Glenrosa soil forms which require irrigation to enhance their productivity. Additionally, the presence of anthropogenic soil materials such as Grabouw.
Low-Moderate (LC 6-7)	Medium	Medium	Validated - Low-Moderate land capability. The presence of medium potential such as Dundee, Griffin, Hutton and Clovelly soil forms. Moreover, the presences of hydromorphic soils with signs of wetness such Rensburg and Cartref soil forms.
Low-Moderate (LC 6-7)	Medium	Low	Disputed – Very Low to Low land capability. The presence of low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Glenrosa, Mispah and Grabouw soil forms.
Very Low to Low (LC 3-5)	Low	Medium	Disputed – Low-Moderate land capability. The presence of medium potential such as Dundee, Griffin, Hutton and Clovelly soil forms. Moreover, the presences of hydromorphic soils with signs of wetness such Rensburg and Cartref soil forms.
Very Low to Low (LC 3-5)	Low	Low	Validated - Very Low to Low land capability. The presence of low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Mispah and Glenrosa soil forms which require irrigation to enhance their productivity. Additionally, the presence of anthropogenic soil materials such as Grabouw.

5 Impact Assessment

Potential impacts were assessed to identify relevance to the proposed target drilling areas to available soils resources. The relevant impacts were determined following the prescribed EIMS impact assessment methodology. The impacts are based on the proposed production right activities (i.e. seismic transects, exploration and production drilling wells, installation of subsurface gas gathering pipelines, and the development of a local; gas production plant).

5.1 Planning Phase Impacts

Involves a series of steps to ready the site for exploration activities including obtaining necessary licenses / permits, review of available information, identifying existing blowers, determination of final drilling sites, and undertaking additional consultation i.e., landowner agreements. This phase will also involve the undertaking of an asset and services baseline register within the affected exploration site,

pre-drilling survey, compilation of emergency response plans, acquisition and training of relevant personnel.

Ancillary Activities:

- I&AP Consultation;
- Landowner agreements;
- Developing emergency plans to address potential accidents or incidents, such as drilling equipment failures or spills;
- Ensuring access to power and water sources if needed;
- Installing warning signs and fencing to protect the area and prevent unauthorized access;
- Comprehensive safety and environmental awareness training for all personnel; and
- Establishing and maintaining effective communication/grievance systems between the exploration crew, landowners and community members.

5.2 Construction Phase, Operational, and Rehab and Closure

The proposed Seismic activities are associated with vehicle movement along the planned transects line during the operation phase. During this phase, planned impacts on soil are expected to be localised and predominately temporary, and may include soil compaction, and minor topsoil disturbance which may result in increased soil erosion risk. Unplanned impacts may include additional soil disturbance and contamination arising from vehicle leaks, accidental hydrocarbon spills, and activities undertaken during wet conditions. During the rehabilitation and closure phase, the planned impacts are mainly restorative and include soil stabilization, revegetation, while unplanned impacts include soil contamination from spills and leaks of hydrocarbons.

The proposed Drilling activities including site clearance and earthworks for drilling pads, drilling operations, movement of vehicles and equipment to and from the well locations, trench excavation, pipe installation, and backfilling, are expected to result in planned impacts on soil resources during the construction and operational phases, including topsoil stripping, soil compaction, disturbance and mixing of soil horizons, an increased risk of erosion within the project footprint. As active crop fields occur within parts of the affected area, these activities may also result in the temporary or permanent loss of cultivated land, damage to standing crops, disruption of farming activities. Unplanned impacts may include localised soil contamination from accidental spills or leaks of fuel, oil, drilling fluids, or other hazardous substances, excessive disturbance outside the approved footprint due to off-route vehicle movement, poor topsoil handling, erosion and sedimentation following rainfall events, settlement of backfilled areas, and damage to adjacent crop fields. During the rehabilitation and closure phase, activities such as the removal of redundant infrastructure, regrading, decompaction, topsoil replacement, and revegetation may result in short-term soil disturbance, but are intended to restore soil function, stability, and, where feasible, the agricultural potential of affected land. unplanned impacts include soil contamination from spills and leaks of hydrocarbons.

Table 5-1 *Summative results of the Impacts Assessment conducted for the proposed activities in relation to the Seismic Activities*

ID: SoilA1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Soil Compaction	Operation	Medium to Low	Low	Low
Mitigation Measures				

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- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant). - Restrict vehicle access to only those essential for seismic work. - Prohibit vehicle movement during or immediately after heavy rainfall to avoid excessive compaction. - Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils.				
ID: SoilA2	Operation	Medium to Low	Low	Low
Impact: Soil Erosion				
Mitigation Measures				
- Minimise vegetation clearance. - Cover exposed soil with mulch or brush immediately after disturbance to reduce erosion risk.				
ID: SoilA3	Operation	Medium to Low	Low	Low
Impact: Soil Contamination for planned events				
Mitigation Measures				
- All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to the people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the events of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Any spills of hydrocarbons or fluids used during operation, must be cleaned up immediately. - Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum. - Refueling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures. Refueling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil.				
ID: SoilA4	Operation	Medium to High	Low	Low
Impact: Soil Contamination for unplanned events				
Mitigation Measures				
- Contingency plans for spillage and fire risk must be prepared. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to the people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the events of a spill. - Pollutants and contaminants must be handled in bunded areas on impermeable substrates. - Any stationary equipment that may leak must be placed on watertight drip trays of adequate capacity. - Drip trays must be used at refuelling points and transfer inlets, outlets and other likely leak points. - Contaminated soils must be removed and suitably disposed of.				
ID: SoilA5	Rehab and closure	Medium to Low	Low	Low
Impact: Soil Contamination during unplanned events				
Mitigation Measures				
- Contingency plans for spillage and fire risk must be prepared. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to the people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the events of a spill. - Pollutants and contaminants must be handled in bunded areas on impermeable substrates. - Any stationary equipment that may leak must be placed on watertight drip trays of adequate capacity. - Drip trays must be used at refuelling points and transfer inlets, outlets and other likely leak points.				
Contaminated soils must be removed and suitably disposed of.				

Table 5-2 Summative results of the Impacts Assessment conducted for the proposed activities in relation to the Drilling Activities

ID: SoilA1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Loss of Cultivated Lands	Construction	High	Medium to Low	Medium to High
Mitigation Measures				
- Avoidance of all highly agricultural lands and other actively cultivated areas, where feasible. - Landowner engagement must be undertaken to investigate the possible scenarios for appropriate compensation of landowners for loss/disturbance of high land capability areas.				
ID: SoilA2	Construction	Medium to Low	Low	Low
Impact: Soil Compaction				
Mitigation Measures				
- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant). - Restrict vehicle access to only those essential for seismic work; use vehicles with wide, low-pressure tires - Prohibit vehicle movement during or immediately after heavy rainfall to avoid excessive compaction. - Speed restriction of no more than 20 km/h must be implemented for all construction vehicles within the construction site. - Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils				
ID: SoilA3	Construction	Medium to Low	Low	Low
Impact: Soil Erosion				
Mitigation Measures				
- Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils. - Minimise vegetation clearance. Existing gravel roads must be used as far as possible, and the closest disturbed areas must be considered for drill pads. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad and gas plant footprint ~1.5ha). - Minimise removal of vegetation as far as possible. - Minimise dust generated. - Implement dust suppression measures in all areas that will be affected by construction activities and where dust will be generated. Dust suppression must also be undertaken during windy and dry weather conditions. - Implementation of embedded controls such as geotextiles, gabion baskets can effectively control soil erosion on-site where detected. - Cover exposed soil with mulch or brush immediately after disturbance to reduce erosion risk.				
ID: SoilA9	Operation	Medium to Low	Low	Low
Impact: Soil Contamination for unplanned events				
Mitigation Measures				
- Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilized. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to the people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the events of a spill. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. The following measures are recommended in the EMPr; - Adequate fuel containment facilities to be used during exploration phase;				

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- The use of all materials, fuels and chemicals which could potentially leach into the environment must be controlled; - All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages.				
ID: SoilA10	Construction	Medium to Low	Low	Low
Impact: Soil Contamination during unplanned events				
Mitigation Measures				
- Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. - All debris and contaminated soils must be removed and suitably disposed of. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. - Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: A	Construction	Medium to Low	Low	Low
Impact: Soil Contamination during unplanned events				
Mitigation Measures				
- Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. - All debris and contaminated soils must be removed and suitably disposed of. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. - Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				

Table 5-3 **Summative results of the Impacts Assessment conducted for the proposed activities in relation to the Gathering Lines**

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ID: SoilA6	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Soil Compaction	Operation	Medium to Low	Low	Low
Mitigation Measures				
- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant). - Restrict vehicle access to only those essential for seismic work. - Prohibit vehicle movement during or immediately after heavy rainfall to avoid excessive compaction. - Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils.				
ID: SoilA7	Operation	Medium to Low	Low	Low
Impact: Soil Erosion				
Mitigation Measures				
- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant). - Restrict vehicle access to only those essential for seismic work. - Prohibit vehicle movement during or immediately after heavy rainfall to avoid excessive compaction. - Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils.				
ID: A8	Operation	Medium to Low	Low	Low
Impact: Soil Contamination for planned events				
Mitigation Measures				
- Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils. - Minimise vegetation clearance. Existing gravel roads must be used as far as possible, and the closest disturbed areas must be considered for drill pads. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad and gas plant footprint ~1.5ha). - Minimise removal of vegetation as far as possible. - Minimise dust generated. - Implement dust suppression measures in all areas that will be affected by construction activities and where dust will be generated. Dust suppression must also be undertaken during windy and dry weather conditions. - Implementation of embedded controls such as geotextiles, gabion baskets can effectively control soil erosion on-site where detected. - Cover exposed soil with mulch or brush immediately after disturbance to reduce erosion risk.				
ID: SoilA9	Operation	Medium to Low	Low	Low
Impact: Soil Contamination for unplanned events				
Mitigation Measures				
- Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilized. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to the people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the events of a spill. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures. Refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. The following measures are recommended in the EMP:				

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• Adequate fuel containment facilities to be used during exploration phase; • The use of all materials, fuels and chemicals which could potentially leach into the environment must be controlled; • All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages.				
ID: SoilA10	Construction	Medium to Low	Low	Low
Impact: Soil Contamination during unplanned events				
Mitigation Measures				
• Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. • All debris and contaminated soils must be removed and suitably disposed of. • Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. • Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: A	Construction	Medium to Low	Low	Low
Impact: Soil Contamination during unplanned events				
Mitigation Measures				
• Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. • All debris and contaminated soils must be removed and suitably disposed of. • Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. • Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				

5.3 Cumulative Impacts

The quantitative impact of the proposed project in isolation on agriculture is anticipated to be “Low” due to the avoidance of highly sensitive field crops through the adherence of the stipulated measures in this report and the EMPr. The cumulative impact with other similar projects with 30 km to 50 km radius of the proposed project is anticipated to be “Medium” (see Table 5-1 to **Error! Reference source not found.**). The project area has undergone historic and current modification, like the developmental disturbances associated to the mining activities that the local area has currently.

After implementation of the mitigation measures such as implementation of erosion control methods, preventing soil contamination and rehabilitating disturbed and bare surfaces as stipulated above the agricultural productivity of the area is not expected to deteriorate further because of the proposed development and no irreplaceable loss of resources is anticipated.

6 Conclusion

The proposed Project Area is dominated by low potential soils such as Swartland, Glen, Arcadia, Rustenburg, Glenrosa, Mispah and Grabouw soil forms. The remaining extent of the proposed Project Area is associated with medium potential soils namely the Dundee, Griffin, Hutton, Clovelly, Rensburg and Cartref soil forms. Active crop fields were confirmed within the Project Area.

The land capability sensitivity (DAFF, 2017) indicates the proposed project area falls within “Low-Moderate” and “Moderate to Moderate-High” land capability sensitivities and with marginal areas having “Very Low to Low” land capability sensitivity. Furthermore, highly and very highly sensitive field crop boundaries were also identified using the DFFE Screening Tool Report. The verified baseline findings, current land uses and the calculated land potential concur to an extent with areas associated with “Low-Moderate” and “Very Low to Low” land capability sensitivities and highly sensitive field crop boundaries. They further dispute to an extent with all areas demarcated with very highly sensitive field crop boundaries and “Moderate to Moderate-High” land capability sensitivity within the proposed target areas. Commercial maize and soyabean production under rainfed conditions were confirmed within the target drilling areas alongside historical crop fields. It is worth noting that the proposed activities include once-off seismic surveys, one approximately 1.5ha processing and production plant and drilling within the target areas within a defined minor footprint (50 × 50 m) per drill site and therefore, is expected to have a negligible impact of soil and agricultural resources of the area.

The desktop assessment database (Land Type Survey Staff, 1972 – 2006) for the desktop PAOI indicates that the areas are characterised with the Clovelly, Hutton, Valsrivier, Rensburg, Oakleaf, Dundee, Swartland, Bonheim and Mispah soil forms. Moreover, active cropping under rainfed and irrigation infrastructure were confirmed with the help of the agricultural theme tool. These areas have sensitivity ranging from “Very Low to High to Very High”, which can be verified through specialist field assessments.

6.1 Impact Statement

Active crop fields (Maize and Soyabeans) were identified within the proposed Project Area. The proposed project will result in marginal land segregation and fragmentation of high production crop fields with the current proposed infrastructure layout. It is the opinion of the specialist that the proposed D3 Energy Production Right Application project and associated infrastructure project can be considered for authorisation with recommended mitigations to be adhered to, by the Competent Authority.

6.2 Statement Conditions

The conclusion of this assessment, regarding the acceptability of the project and the recommendation of its approval, is subject to adoption and implementation of the mitigation measures approved in the

Amended Environmental Management Programme (EMPr) prepared by EIMS (2024), with additional measures outlined in this report.

7 References

Brady, N.C. and Weil, R.R. 2008. The nature and properties of soils. Pearson Education Inc., Upper Sadle River, New Jersey. 14th Edition.

Department of Environmental Affairs (DEA). (2010) Framework for the Management of Contaminated Land

Department of Primary Industries and Regional Development. 2019. Measuring soil salinity. <https://www.agric.wa.gov.au/soil-salinity/measuring-soil-salinity>.

Environmental Impact Management Services (EIMS). 2024. AMENDED ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR). Part II Amendment of the Approved Environmental Management Programme for The Proposed Exploration of Hydrocarbons and Associated Gas on Various Farms Near the Town of Hennenman, within the Fezile Dabi District and Lejweleputswa District Municipalities, Free State Province. EA Reference number: 12/3/315. Johannesburg, South Africa.

Fertilizer Society of South Africa. (2016). Fertilizer Handbook. Lynnwood ridge, South Africa: Fertilizer Society of South Africa.

Land Type Survey Staff. 1972 - 2006. Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Mucina, L., & Rutherford, M. C. 2006. The Vegetation of South Africa, Lesotho, and Swaziland. Strelitzia 19. Pretoria: National Biodiversity Institute.

Schulte, E.E. 2004. Soil and Applied Chlorine. Understanding plant nutrients. <http://corn.agronomy.wisc.edu/Management/pdfs/a3556.pdf>

Smith, B. 2006. The Farming Handbook. Netherlands & South Africa: University of KwaZulu-Natal Press & CTA.

Soil Classification Working Group. 1991. Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development.

Soil Classification Working Group. 2018. Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development/

8 Appendix Items

8.1 Appendix A: Methodology

8.1.1 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 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.

8.1.2 Field Survey

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 1.2 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.

8.1.3 Erosion Potential

Erosion has been calculated by means of the Soil Loss Estimation for Southern Africa (SLEMSA) methodology described in Smith (2006). The steps in calculating the Fb ratings relevant to erosion potential is illustrated in Table 8-1, with the final erosion classes illustrated in Table 8-2.

Table 8-1 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
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Table 8-2 *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

8.1.4 Land Capability

Land capability and agricultural potential will 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 8-3 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 8-3 *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 the table below.

The land capability was determined by using the guidelines described in “The farming handbook” (Smith, 2006) which the DAFF land capabilities were further developed from. Accordingly, the identified soil forms associated with the PAOI are restricted to land capability I and II categorised between LC 9-10, land capability III and IV (under marginal soyabean rye grass cultivation, respectively), and V categorised between LC 6-8 and land capability IV and VI (under open veld) categorised between LC 1-5. The baseline soil land capability was compared to the National Land Capability data (DAFF, 2017), respectively.

Table 8-4 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 8-5 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

The land capability of the proposed footprint will be compared to the National Land Capability which was refined in 2014- 2016. The National Land Capability methodology is based on a spatial evaluation modelling approach and a raster spatial data layer consisting of fifteen (15) land capability evaluation values (Table 8-6), usable on a scale of 1:50 000 – 1:100 000 (DAFF, 2017). The previous system is based on a classification approach, with 8 classes (Table 8-3). Land capability and land potential will also be determined in consideration of the screening tool to ultimately establish the accuracy of the land capability sensitivity from (DAFF, 2017).

Table 8-6 National Land Capability Values (DAFF,2017)

Land Capability Evaluation Value	Land Capability Description
1	Very low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High

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12	High to Very High
13	
14	Very High
15	

8.2 Appendix B Impact Assessment

Table 8-7 Impact assessment related to the loss of the land capability during the construction, operation and decommissioning phases for the D3 Energy production Right Application.

Impact	Phase	Event	Pre-Nature	Pre-Extent	Pre-Duration	Pre-Magnitude	Pre-Reversibility	Consequence	Pre-Probability	Pre-Mitigation Significance Score	Pre-Mitigation Significance	Post-Nature	Post-Extent	Post-Duration	Post-Magnitude	Post-Reversibility	Consequence2	Post-Probability	Post-mitigation Significance Score	Post-Mitigation Significance	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score	Final Significance
Loss of Cultivated Lands	Construction	Normal operations or events	-1	3	2	3	3	-2,75	3	-8,25	Medium to low -	-1	2	2	2	3	-2,25	1	-2,25	Low -	Medium	2	3	1,38	-3,09	Low -
Soil Compaction	Construction	Normal operations or events	-1	3	2	3	3	-2,75	3	-8,25	Medium to low -	-1	2	2	2	3	-2,25	1	-2,25	Low -	Low	2	3	1,38	-3,09	Low -
Soil Erosion	Construction	Normal operations or events	-1	3	2	3	3	-2,75	3	-8,25	Medium to low -	-1	2	2	2	3	-2,25	1	-2,25	Low -	Low	2	3	1,38	-3,09	Low -
Soil Contamination	Construction	Normal operations or events	-1	3	2	3	3	-2,75	3	-8,25	Medium to low -	-1	2	2	2	3	-2,25	1	-2,25	Low -	Low	2	3	1,38	-3,09	Low -
Soil Compaction	Operation	Normal operations or events	-1	2	3	2	2	-2,25	2	-4,5	Medium to low -	-1	2	2	2	2	-2	1	-2	Low -	Low	2	2	1,25	-2,50	Low -
Soil Erosion	Operation	Normal operations or events	-1	2	3	2	2	-2,25	2	-4,5	Medium to low -	-1	2	2	2	2	-2	1	-2	Low -	Low	2	2	1,25	-2,50	Low -
Soil Contamination	Operation	Normal operations or events	-1	2	3	2	2	-2,25	2	-4,5	Medium to low -	-1	2	2	2	2	-2	1	-2	Low -	Low	2	2	1,25	-2,50	Low -
Soil Compaction	Decommissioning	Normal operations or events	-1	2	1	1	1	-1,25	2	-2,5	Low -	-1	1	1	1	1	-1	1	-1	Low -	Low	1	1	1,00	-1,00	Low -
Soil Erosion	Decommissioning	Normal operations or events	-1	2	1	1	1	-1,25	2	-2,5	Low -	-1	1	1	1	1	-1	1	-1	Low -	Low	1	1	1,00	-1,00	Low -

Soil Contamin ation	Decommissi oning	Normal operations or events	- 1	2	1	1	1	- 1,2 5	2	- 2,5	Low -	- 1	1	1	1	1	-1	1	-1	Lo w -	Low	1	1	1, 00	- 1,0 0	Lo w -
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8.3 Appendix C: Specialist declarations

DECLARATION

I, Masilabela Seepamore, 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 48 and is punishable in terms of Section 24F of the Act.



Masilabela Seepamore

Soil & Agricultural Scientist

The Biodiversity Company

May 2026

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 48 and is punishable in terms of Section 24F of the Act.



Dr Matthew Mamera

Soil Scientist

The Biodiversity Company

May 2026

8.4 Appendix D Curriculum vitae

Masilabela Seepamore Pr Sci Nat 113907 +27 78 815 1878 masilabela@thebiodiversitycompany.com 									
PROFILE SUMMARY Soil and Agricultural specialist with ~ 3 years' consulting experience. Specialist experience in project exploration, mining, engineering, hydropower, renewable energy, and private sector developments. Project management of national I multi-disciplinary projects. Provides specialist guidance, technical support, and facilitation for compliance with in-country legislative requirements and international lender standards. Registered Pr Sci Nat with the South African Council for Natural Scientific Professions.									
PERSONAL INFO Nationality: South African Date of birth: 08 June 1988	ACADEMIC QUALIFICATIONS FERTILIZER ASSOCIATION OF SOUTHERN AFRICA (FERTASA) (2021) – Fertilizer Advisory Certificate & Training Scheme (FACTS) University of the Free State (2019): MAGISTER SCIENTIAE (MSc) <i>Cum Laude</i> – Soil Science: Title: <i>Impact of long-term production management practices on wheat grain yield under a semi-arid climate.</i> University of the Free State (2015): BACCALAUREUS SCIENTIAE AGRICULTURAE Honores (Hons) – Soil Science. University of the Free State (2013): BACCALAUREUS SCIENTIAE AGRICULTURAE. Majors: Agronomy & Soil Science.								
EXPERIENCE Environmental Impact Assessment (EIA) Environmental Management Programmes (EMP) Rehabilitation Plans Agricultural potential assessments Soil taxonomy classification (SA form)	PROFESSIONAL EXPERIENCE <table><tr><td>Sep 2023 – Present</td><td>The Biodiversity Company Soil Ecologist</td></tr><tr><td>Nov 2022 – Aug 2023</td><td>ARC-NRE Intern</td></tr><tr><td>Mar 2021 – Sep 2021</td><td>Central University of Technology Lecturer (Part-Time)</td></tr><tr><td>July 2016 – Dec 2018</td><td>University of the Free State Research Assistant</td></tr></table>	Sep 2023 – Present	The Biodiversity Company Soil Ecologist	Nov 2022 – Aug 2023	ARC-NRE Intern	Mar 2021 – Sep 2021	Central University of Technology Lecturer (Part-Time)	July 2016 – Dec 2018	University of the Free State Research Assistant
Sep 2023 – Present	The Biodiversity Company Soil Ecologist								
Nov 2022 – Aug 2023	ARC-NRE Intern								
Mar 2021 – Sep 2021	Central University of Technology Lecturer (Part-Time)								
July 2016 – Dec 2018	University of the Free State Research Assistant								
SKILLS ✓ Soil Classification ✓ Project Management ✓ Soil & Crop Management ✓ Monitoring & Management Plans	INTERNATIONAL EXPERIENCE South Africa								
LANGUAGES English – Proficient Afrikaans & IsiZulu – Conversational Tswana, Sesotho, Sepedi - Proficient  Signed: Masilabela Seepamore									

Matthew Mamera

Pr Sci Nat 116356  +27 785 772 668 matthew@thebiodiversitycompany.com

PROFILE SUMMARY

Environmental and ecological specialist with 10 years' consulting experience, with international working experience. Specialist experience in project exploration, mining, engineering, hydropower, renewable energy, and private sector developments. Project management of national and international multi-disciplinary projects. Provides specialist guidance, technical support, and facilitation for compliance with in-country legislative requirements and international lender standards. Registered Pr Sci Nat with the South African Council for Natural Scientific Professions and the Soil Science Society of South Africa.

PERSONAL INFO

Nationality: South African Permanent Residence

Date of birth: 31 October 1988

EXPERIENCE

- Environmental Impact Assessments (EIA)
- Soil taxonomic classification (SA forms and WRB groups)
- Soil Hydropedology, Agricultural and Land contamination assessments
- Soil Carbon credits

SKILLS

- ✓ Soil and Soil Hydropedology Assessments
- ✓ Agricultural, soil and water contamination Assessments
- ✓ Rehabilitation
- ✓ Monitoring & Management Plans

LANGUAGES

English – Proficient

Zulu, Xhosa, Ndebele, Sotho – Conversational

Afrikaner - Basic

Signed: Dr Matthew Mamera

ACADEMIC QUALIFICATIONS

University of the Free State (2021): Doctor of Philosophy (PhD)**- Soil Science:****Title:** *Assessing pollution and managing faecal sludge through biochar applications in Phuthaditjhaba, South Africa.***University of the Fort Hare (2018): Master of Science (MSc) -****Soil Science:****Title:** *Pollution potential of on-site dry sanitation systems associated with the Mzimvubu Water Project, Eastern Cape, South Africa.***University of the Fort Hare (2015): Bachelor of Science****Honours Cum laude (Hons) – Soil Science****University of the Fort Hare (2001 - 2004): Bachelor of Science****Agriculture in Soil Science. Majors: Soil Science.**

PROFESSIONAL EXPERIENCE

Mar 2022 – **The Biodiversity Company**
Present Soils Unit Manager / Soil & Soil
Hydropedology

Feb 2018 – **University of the Free State**
Dec 2020 Junior Researcher, lecturer / Soil Science

Jan 2015 – **University of Fort Hare**
Dec 2017 Junior Research, Tutor / Soil Science

INTERNATIONAL EXPERIENCE

Angola, Botswana, Namibia, Zambia, South Africa