Soil Pedology Assessment for the proposed Tetra4 Cluster 2 Project

Virginia, Free State Province

April 2022

Client

Prepared by:

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Report Name	**Soil Pedology Assessment for the proposed Tetra4 Cluster 2 Project**
Reference	**Tetra 4 Cluster 2**
Submitted to	EIMS Environmental Impact Management Services
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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, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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Document Guide

According to the Government Notice 320 dated 20 March 2020 and the 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 criteria is applicable to that of an agricultural compliance statement;

Requirement	Reference
Specialist Details and CV	Appendix A
Locality of the proposed activity	Section 2
Sensitivity verification	Section 8.2
Acceptability of impacts towards agricultural production capability associated with proposed activities	Section 9
Declaration of specialist(s)	Page vi
Project components with 50 m regulated area superimposed to that of the agricultural sensitivities of the screening tool	Section 8.2
Confirmation from specialist that mitigation to avoid fragmentation has been considered	Section 9.1
Statement from specialist regarding the acceptability and approval of proposed activities	Section 9.2
Conditions to acceptability of proposed activities	
Probability of land being returned to current state after decommissioning	N/A
Monitoring requirements and/or any inclusions into EMPr	Section 9.1
Assumptions and uncertainties	Section 4

DECLARATION

I, **Matthew Mamera** declare that:

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

Matthew Mamera

Soil Specialist

The Biodiversity Company

May 2022

1 Introduction

The Biodiversity Company was appointed to compile an agricultural compliance statement, as part of the environmental authorisation process for the proposed Tetra 4 Cluster 2 project in Virginia Free State (see Figure 2-1). The project area and the associated infrastructure is located approximately 17 km south-east of the town of Welkom and 25 km north of the Theuniseen town. The area is found along the R30 and R730 located in between the R710 and R73 roads.

1.1 Background

The following information was provided by EIMS:

In 2012, a Production Right (Ref: 12/4/1/07/2/2) was granted which spans approximately 187 000 hectares for the development of natural gas (Helium and Methane) production operations around the town of Virginia in the Free State Province. Within the approval of the Production Right, the 2010 Environmental Management Programme (EMPr) was approved which is applicable to a large portion of the Production Right area (Figure 1-1).

The activities in the Production Right include:

- Continued exploration activities;
- Drilling and establishment of further production wells throughout the entire production area (260 production wells);
- Installation of intra-field pipelines throughout the entire production area (~500km);
- Installation of boosters and main compressors; and
- Central gas processing plant (not approved in the original EIA and approved EMPr).

On 21 September 2017, the Department of Mineral Resources and Energy (DMRE) issued an integrated environmental authorisation (“Cluster 1 EA”) (reference: 12/04/07) to Tetra4 in terms of the NEMA. The Cluster 1 EA (as amended by Cluster 1 EA amendments dated 26 August 2019 and 1 September 2020) authorises the development of “Cluster 1” of the Project. In this EA approval, various new wells and pipelines, booster and compressor stations, a Helium and LNG Facility and associated infrastructure was approved which comprises the first gas field for development within the approved Production Right area. The Cluster 1 EA also authorises certain waste management activities as per the List of Waste Management Activities (Government Notice 921, as amended) published under the National Environmental Management: Waste Act 59 of 2008 (NEMWA).

Furthermore, the following licences have been issued to Tetra4 in respect of Cluster 1 of the Project:

- Provisional Atmospheric Emission Licence (PAEL) dated 4 August 2017 (reference: LDM/AEL/YMK/014) for the Storage and Handling of Petroleum Products [Category 2: Subcategory 2.4 of the Listed Activities (Government Notice 893, as amended) published under the National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA)] by the Lejweleputswa District Municipality. A final atmospheric emission licence will be issued after operation of the plant which is currently under construction; and
- Water Use Licence (WUL) dated 22 January 2019 (reference: 08/C42K/CI/8861) for the construction of pipelines for the Project in terms of section 21(c&i) water uses of the National Water Act 36 of 1998 (NWA) by the Department of Water and Sanitation (DWS).

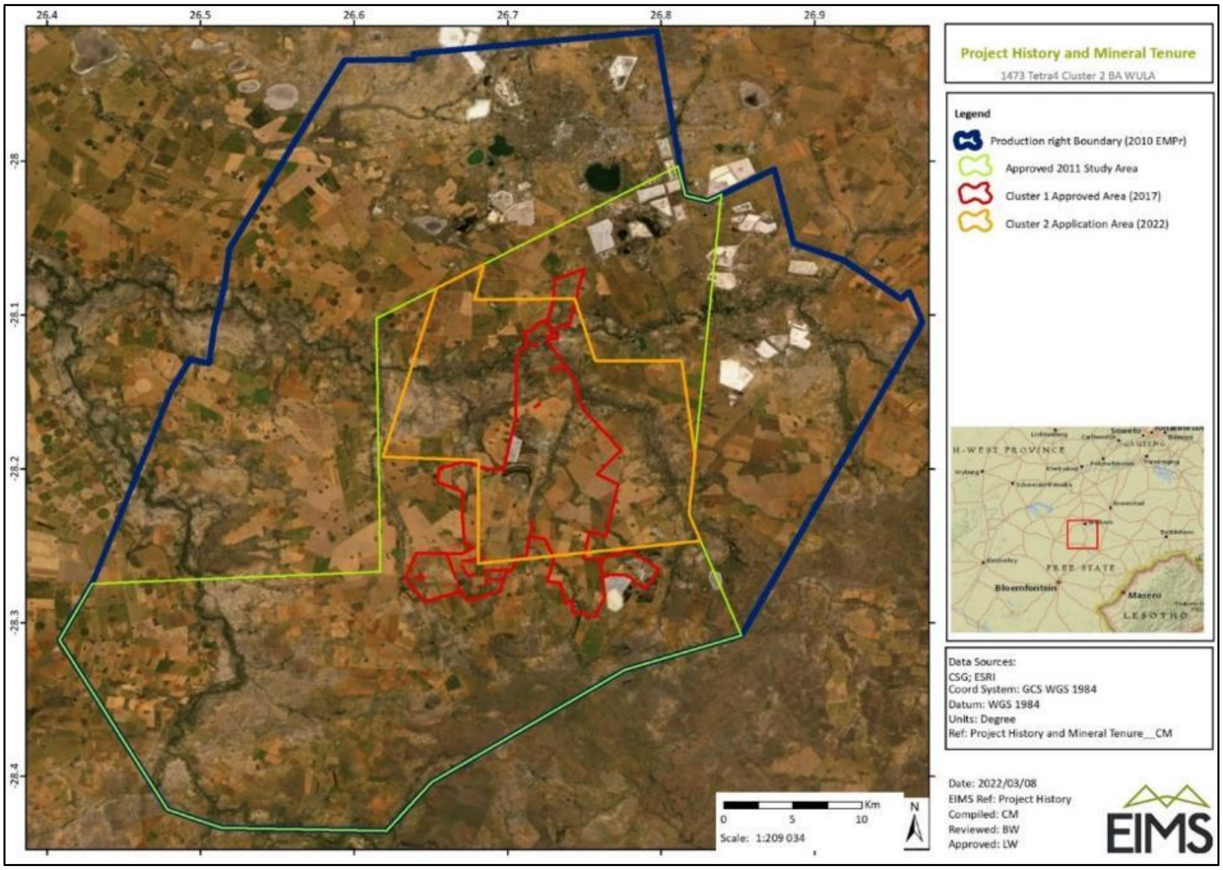

Figure 1-1 Project history and mineral tenure.

The following information is as provided by EIMS:

"Tetra 4 has a natural gas production right over a very large area in the Free State Province, near Virginia. They also have an existing environmental authorisation and associated water use licence for their current production activities (referred to as Cluster 1 above). Tetra 4 wishes to expand their current production operations onto other areas which still fall within the approved Production Right, but outside of the areas approved in the EA and WUL. The planned expansions will include the following (Figure 1-2):

- Expansions to the current LNG and Helium production plant located on the Farm Mond van Doorn Rivier. The planned expansions will be to increase the helium and LNG production capacities significantly (~30 fold increase) and increase the footprint of the existing approved plant by approximately 10ha.
- The drilling of new gas wells ~300 wells spread over a total study area (Cluster 2) of approximately 27500ha.
- The installation of trenched pipelines connecting the wells to localised booster compressors and then to in-field compressor stations (~3 sites) and subsequently the compressor stations to the main plant area.
- There will be a requirement to have short powerline and water connections to the compressor sites."

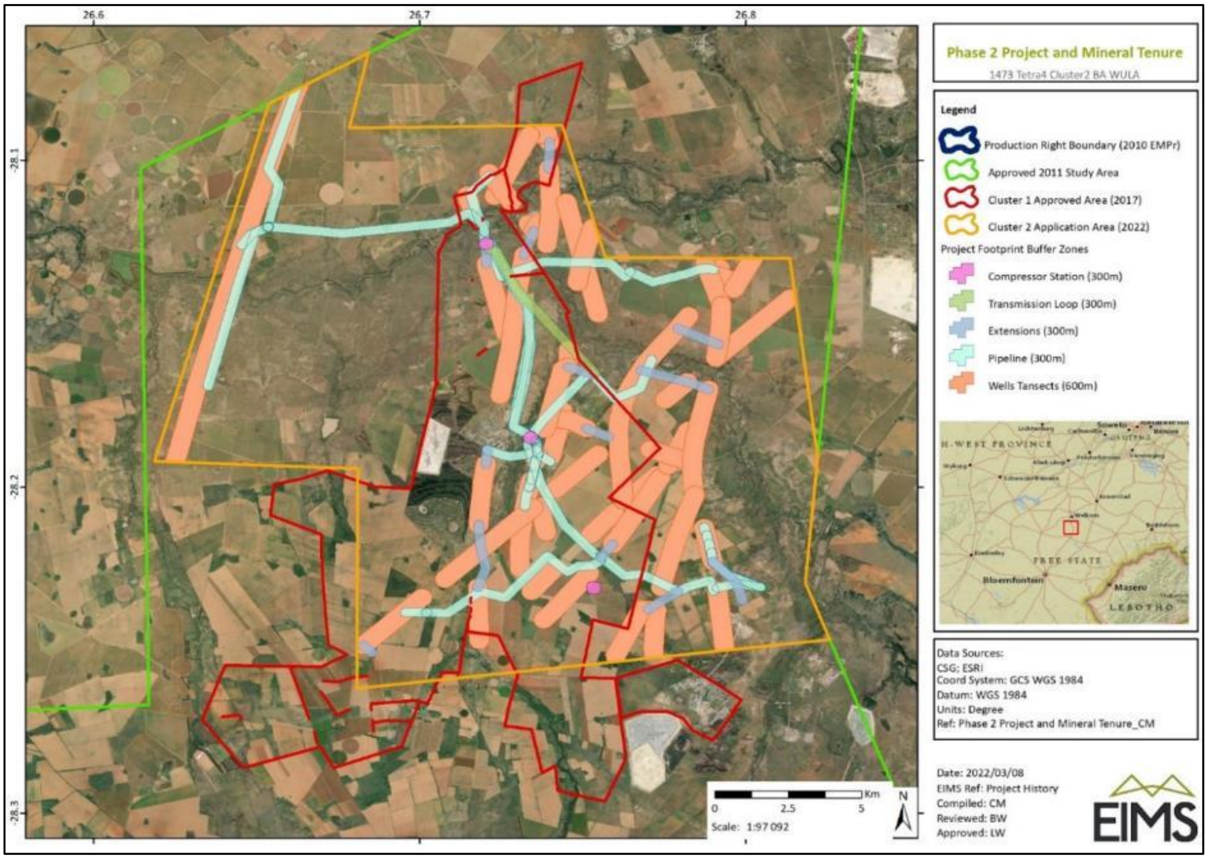

Figure 1-2 Cluster 2 study area and proposed infrastructure footprint buffer zones

The approach adopted for the assessments has taken cognisance of the recently published Government Notice 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".

This report aims to present and discuss the findings from the soil resources identified within the regulated 50 m, the agricultural and land potential of these resources, the land uses within the regulated area and also the risk associated with the proposed structure.

1.2 Terms of Reference

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

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

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

2 Project Area

The proposed Tetra 4 Cluster 2 gas production project is located in Virginia, Free State province. Virginia is a gold mining town located in the Lejweleputswa District Municipality and on goldfields of the Free State province in South Africa about 140 km northeast of Bloemfontein the provincial capital. The Tetra 4 Cluster 2 project is approximately 17 km south-east of the town of Welkom and 25 km north of the Theuniseen town (see Figure 2-1). The area is found along the R30 and R730 located in between the R710 and R73 roads. The Tetra4 Production Right is located within the Sand River Play or Virginia Gas Field. Despite not being clearly defined, the field is composed predominantly of Karoo, Ventersdorp and Witwatersrand Supergroup lithologies complete with younger dolerite intrusions. The surrounding land use predominantly includes agriculture (crop and grazing), game reserves and mining.

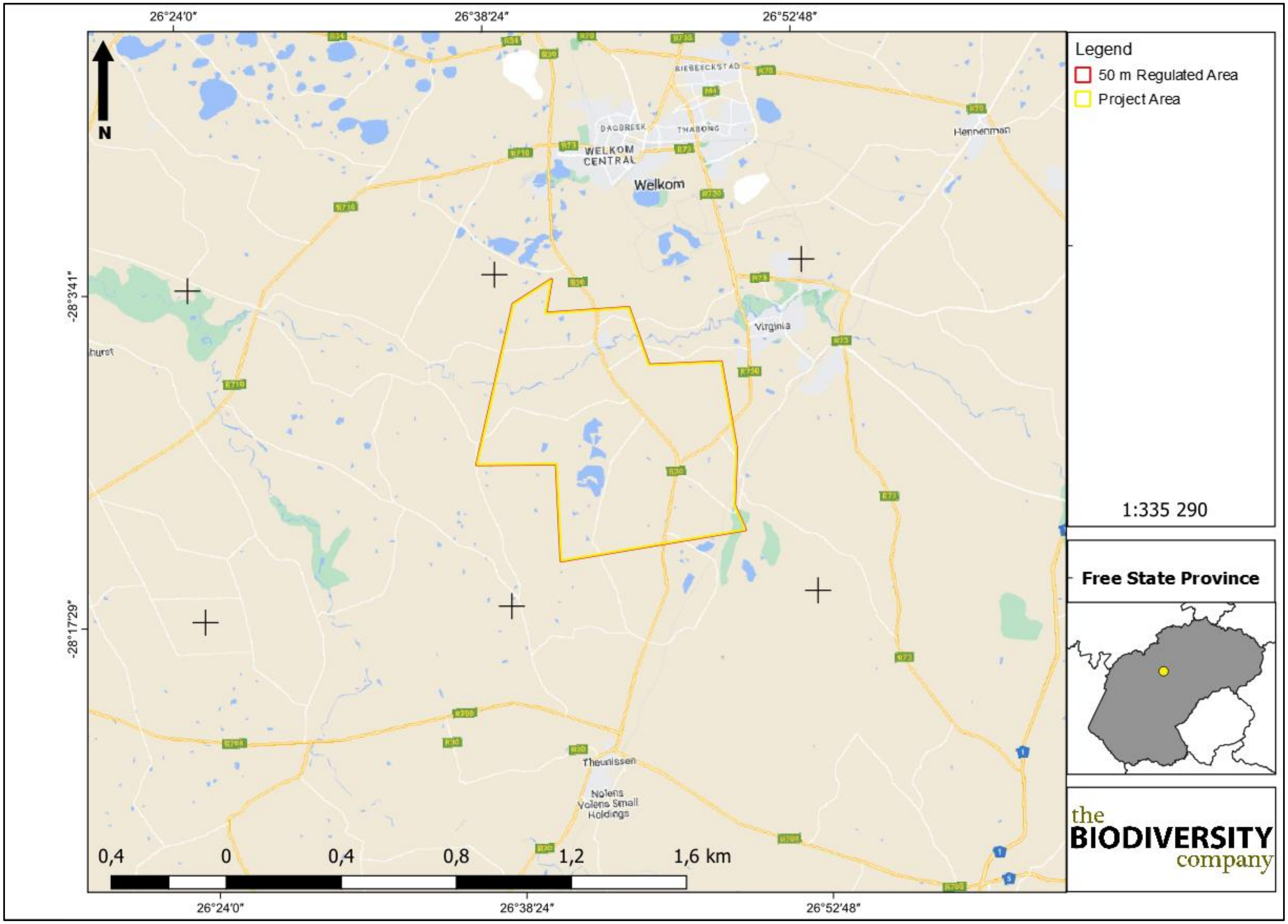

Figure 2-1 Locality map of the project area

3 Expertise of the Specialists

3.1 Ivan Baker

Ivan Baker is Pr. Sci Nat registered (119315) in environmental science with Cand. Sci. Nat recognition in geological science. Ivan is a wetland and soil specialist with vast experience in wetlands, pedology, hydropedology and land contamination and has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom. Ivan is also affiliated with the Fertiliser Society of South Africa after the acquiring a certificate of competence following the completion of the FERTASA training course.

3.2 Matthew Mamera

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

4 Methodology

4.1 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.

4.2 Field Survey

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

4.3 Erosion Potential

Erosion has been calculated by means of the (Smith, 2006) methodology. The steps in calculating the Fb[2] ratings relevant to erosion potential is illustrated in Table 4-1 with the final erosion classes illustrated in Table 4-2.

[2] The soil erodibility index

Table 4-1 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			

Table 4-2 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

4.4 Land Capability

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

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

Land capability is divided into eight classes and these may be divided into three capability groups. Table 4-3 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 4-3 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing Land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife
W - Wildlife		**MG - Moderate Grazing**			**MC - Moderate Cultivation**					
F- Forestry		**IG - Intensive Grazing**			**IC - Intensive Cultivation**					
LG - Light Grazing		**LC - Light Cultivation**			**VIC - Very Intensive Cultivation**					

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

Table 4-4 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 4-5 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

4.5 Limitations

- The information contained in this report is based on auger points taken and observations on site. There may be variations in terms of the delineation of the soil forms across the area;
- Due to the size of the proposed area only the key areas where infrastructure is located were focused on, the remaining areas were predominantly delineated through means of desktop; and
- The GPS used for delineations is accurate to within five meters. Therefore, the delineation plotted digitally may be offset by at least five meters to either side.

5 Project Area

5.1 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the assessment corridor to be focused on falls within the Ae40, Bd20, Dc8, Dc9 and Dc12 land types. The Ae land type mostly consist of apedal (yellow/red), duplex soils characterised with high clay contents and shallow profiles associated with partially weathered/ un-weathered material with the possibility of other soils occurring throughout. Lime is generally present in low-lying areas. The Bd land type consists of mostly apedal and duplex soils with miscellaneous land classes including rocky areas with Mispah and Oakleaf soils forms according to the SA soil classification working group (1990). The Dc land types is characterised with duplex, transitional young alluvial soil deposits with occasional red soils, some saturated profiles, shallow soils, and intrusive hard rocks. The terrain units and expected soils for the Ae40 land type is illustrated in Figure 5-1 and Table 5-1 respectively. Similarly, those for the Bd20 land type is depicted in Figure 5-2 and Table 5-2; Dc8 land type in Figure 5-3 and Table 5-3; Dc9 land type in Figure 5-4 and Table 5-4 and Dc12 in Figure 5-5 and Table 5-5 respectively.

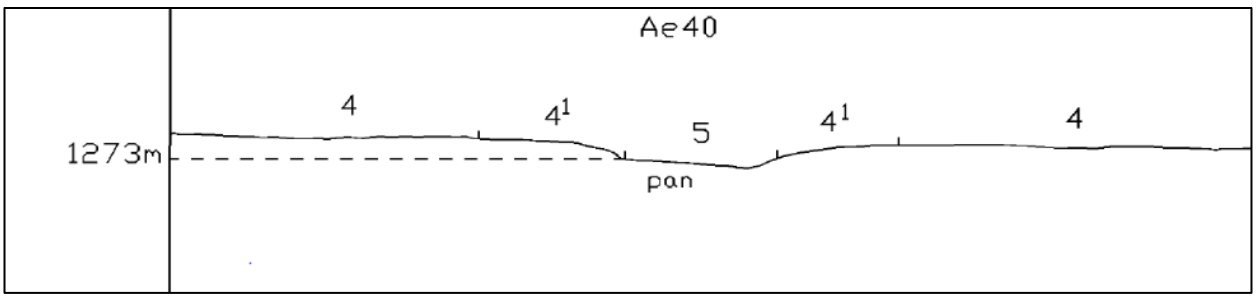

Figure 5-1 Illustration of land type Ae40 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 5-1 Soils expected at the respective terrain units within the Ae 40 land type (Land Type Survey Staff, 1972 - 2006)

4 (92%)		4 (1) (4%)		5 (4%)	
Hutton	89%	Swartland	25%	Katspruit, Rensburg	75%
Clovelly	7%	Mispah	50%	Swartland	25%
Bainsvlei	2%	Oakleaf	25%		
Avalon	2%				

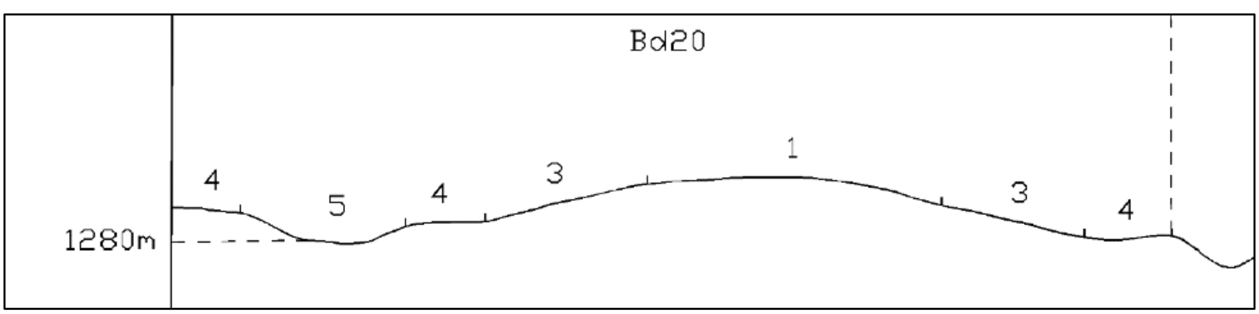

Figure 5-2 Illustration of land type Bd 20 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 5-2 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	50%	Valsrivier	55%
Avalon	30%	Avalon	20%	Valsrivier	18%	Arcadia, Rensburg	30%
Arcadia, Rensburg	1%	Hutton	25%	Avalon	10%	Oakleaf	10%
Katspruit	1%	Valsrivier	8%	Clovelly	5%	Katspruit	10%
Valsrivier	3%	Arcadia, Rensburg	1%	Oakleaf	5%		
		Katspruit	1%	Arcadia, Rensburg	1%		

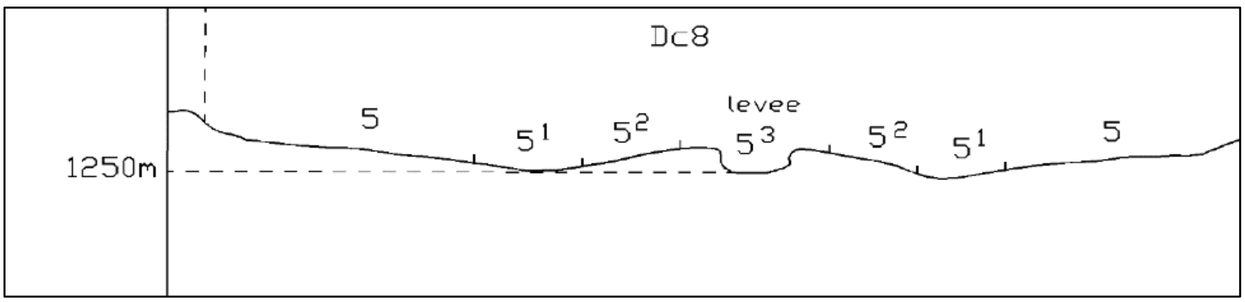

Figure 5-3 Illustration of land type Dc 8 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 5-3 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) (40%)**		**5 (2) 27%)**		**5 (3) (16%)**	
Arcadia	42%	Arcadia	41%	Oakleaf	66%	Dundee	7%
Valsrivier	48%	Rensburg	59%	Valsrivier	32%	Stream beds	28%
Sterkspruit	6%			Stream beds	2%	Fernwood	22%
Katspruit	1%					Oakleaf	13%
Bonheim	4%						

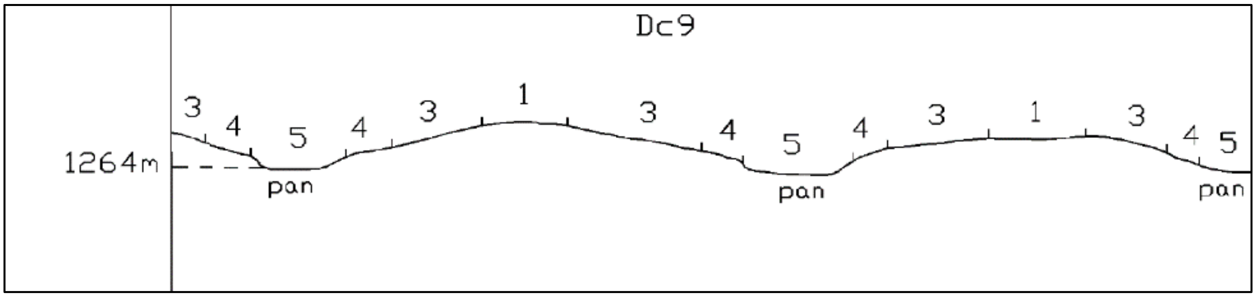

Figure 5-4 Illustration of land type Dc 9 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 5-4 Soils expected at the respective terrain units within the Dc 9 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (10%)		**3 (27%)**		**4 (41%)**		**5 (22%)**	
Hutton	100%	Hutton	88%	Swartland	28%	Willowbrook	91%
		Clovelly	11%	Valsrivier	24%	Valsrivier	5%
		Oakleaf	1%	Oakleaf	23%	Arcadia	2%
				Sterkspruit	17%	Sterkspruit	1%
				Arcadia	4%	Mispah	1%
				Estcourt	3%		
				Mispah	1%		

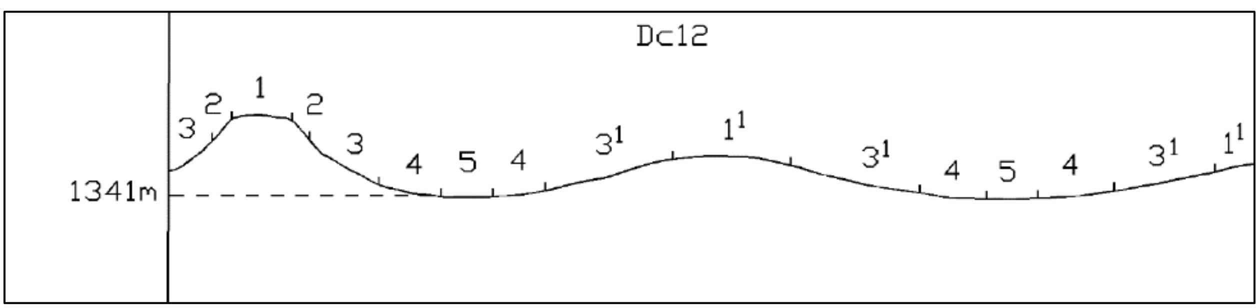

Figure 5-5 Illustration of land type Dc 12 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 5-5 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)**	
Rocks	33%	Mispah	37%	Rocks	60%	Rocks	33%	Swartland	34%	Bonheim	29%	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%	Glenrosa	4%
		Valsrivier	3%					Westleigh	5%	Mayo	3%	Mayo	4%
		Rocks	3%					Mayo	3%	Glenrosa	2%		
		Hutton	2%					Hutton	2%	Rocks	1%		

5.2 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 5-6. The majority of the regulated area is characterised by a slope percentage between 0 and 20%, with some smaller patches within the project area characterised by a slope percentage above 40. This illustration indicates mostly a uniform area with few undulating slopes, mountainous areas and ridges. The Digital Elevation Model (DEM) of the project area (Figure 5-7) indicates an elevation of 1 272 to 1 410 Metres Above Sea Level (MASL).

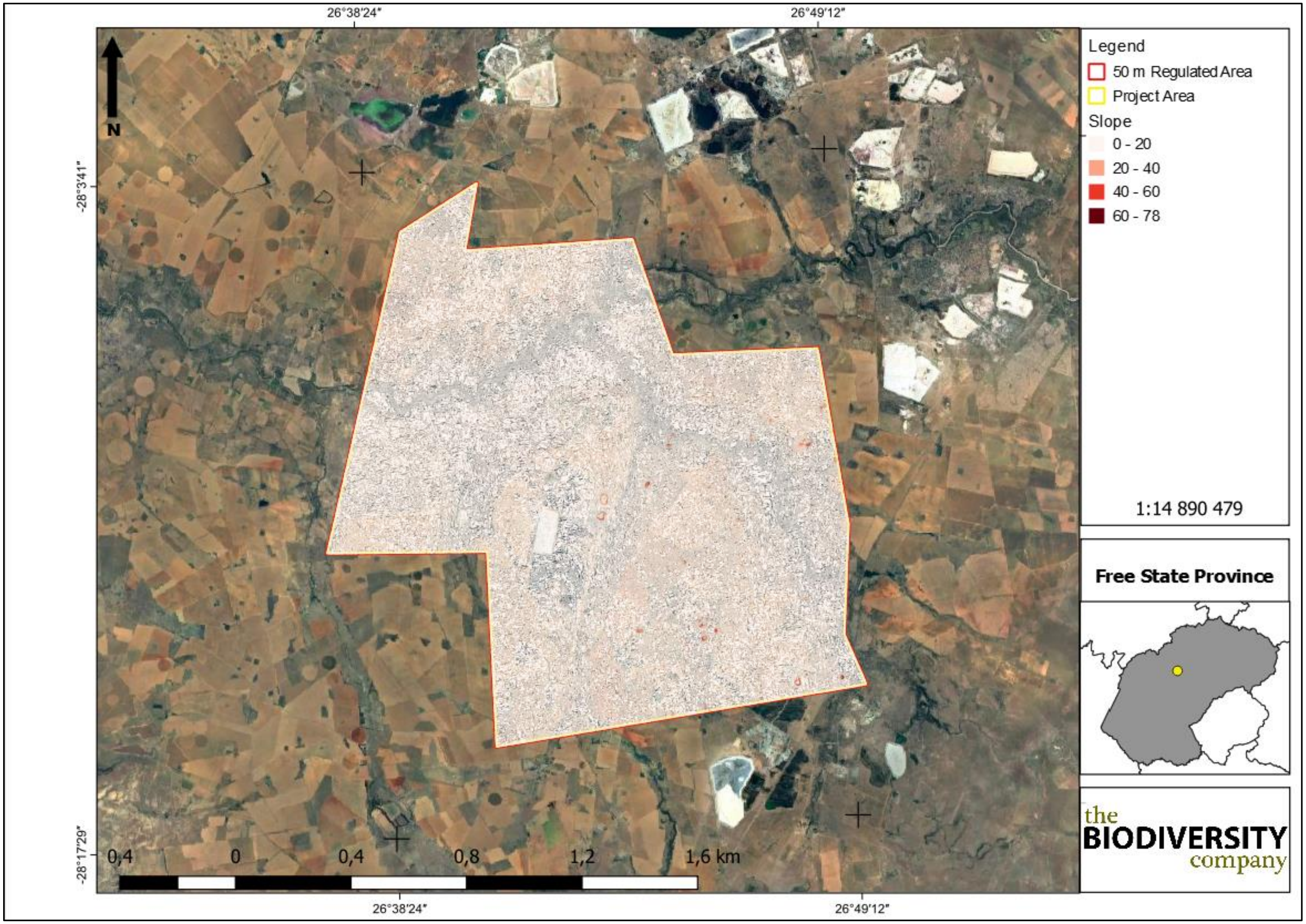

Figure 5-6 Slope percentage map for the assessment area

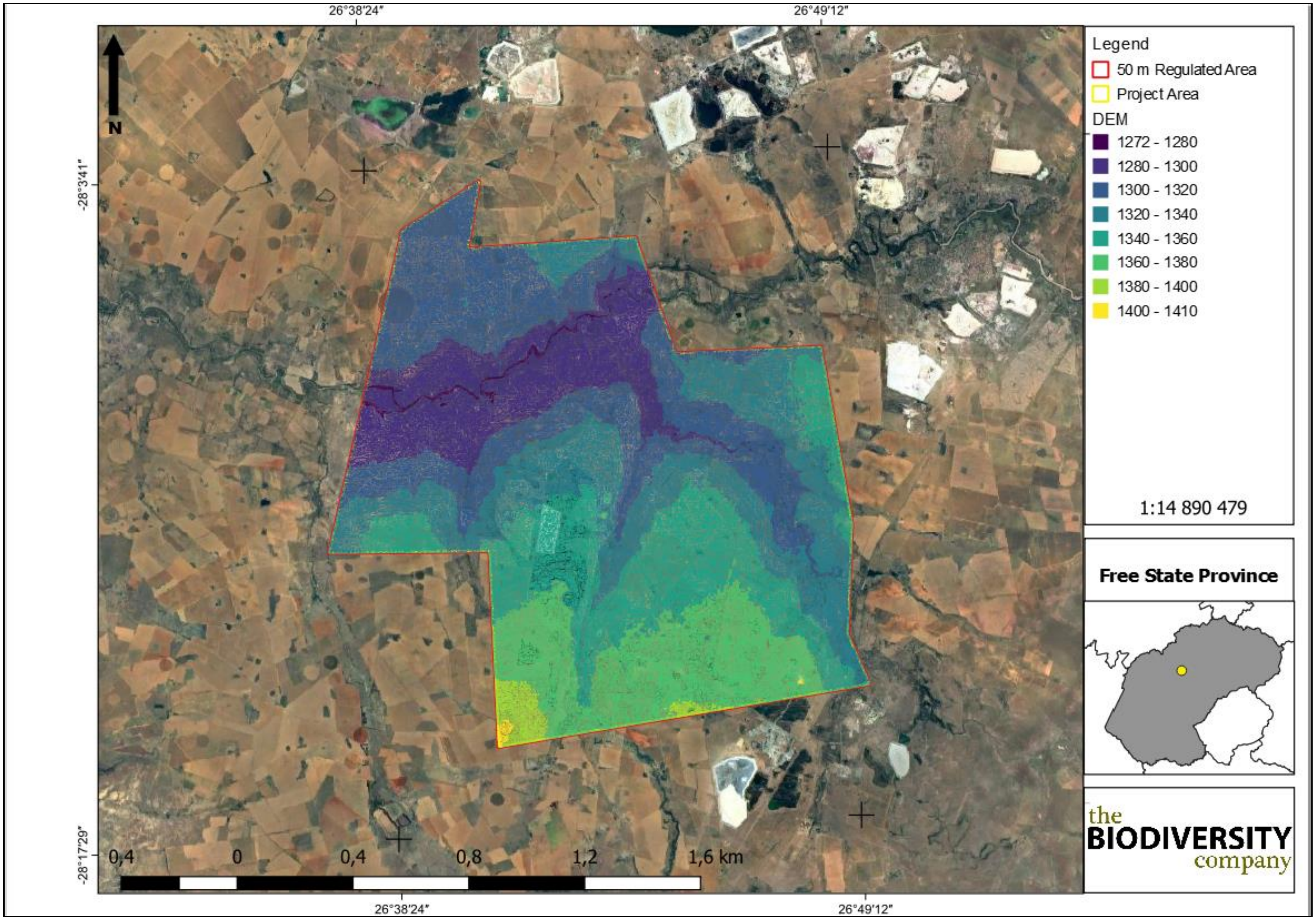

Figure 5-7 Elevation map for the assessment area

6 Results and Discussion

6.1 Description of Soil Profiles and Diagnostic Horizons

Soil profiles were studied up to a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. Considering the large scale of the project area, only the most sensitive soil forms have been considered. The following diagnostic horizons were identified during the site assessment (also see Figure 6-1):

- Orthic topsoil;
- Gley horizon;
- Soft Plinthic horizons;
- Lithocutanic horizon;
- Red apedal horizon; and
- Yellow-brown apedal horizon.

6.1.1 Orthic Topsoil

Orthic topsoils 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).

6.1.2 Soft Plinthic Horizon

The accumulations of iron (and in some cases manganese) as hydroxides and oxides with the presence of high chroma striations and concretions with black matrixes are associated with the Soft Plinthic horizon. This diagnostic horizon forms due to fluctuating levels of saturation. The iron and manganese concentration result in soft marks within the soil matrix which transform in concretions with high consistencies (Soil Classification Working Group, 1991).

If this process continues for long enough periods, a massive continues impermeable layer of hard plinthite forms. A Soft Plinthic horizon and a Hard Plinthic horizon can be distinguished from one another by means of a simple spade test. A Soft Plinthic horizon can be penetrated by means of a spade in wet conditions whereas a Hard Plinthic horizon cannot (Soil Classification Working Group, 1991).

According to Soil Classification Working Group (2018), this horizon commonly occurs as a result of hillslope hydrology in flat, sandy landscapes. This horizon is known to have an apedal structure together with the presence of concretions.

6.1.3 Lithocutanic Horizon

For the lithocutanic horizon, i*n situ* weathering of rock underneath a topsoil results in a well-mixed soil-rock layer. The colour, structure and consistency of this material must be directly related to the parent material of the weathered rock. The Lithocutanic horizon is usually followed by a massive rock layer at shallow depths. Hard rock, permeable rock and horizontally layered shale usually is not associated with the weathering processes involved with the formation of this diagnostic horizon.

6.1.4 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 and a clay texture, although sandy gley horizons are known to occur. The gley soil form commonly occurs at the toe of hillslopes (or benches) where lateral water inputs (sub-surface) is dominant and the underlaying 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).

6.1.5 Yellow-Brown Apedal 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.

6.1.6 Red Apedal Horizon

The red apedal diagnostic soil horizon has no well-formed peds, but rather small porous aggregates. The poor structure associated with this diagnostic profile is a result of weathering processes under well drained oxidising conditions. Iron-oxide precipitations form on the outside of soil particles (hence the red colour) and non-swelling clays dominate the clay particles. This diagnostic soil horizon is widely spread across South Africa and can be associated with any parent material expected (Soil Classification Working Group, 1991).

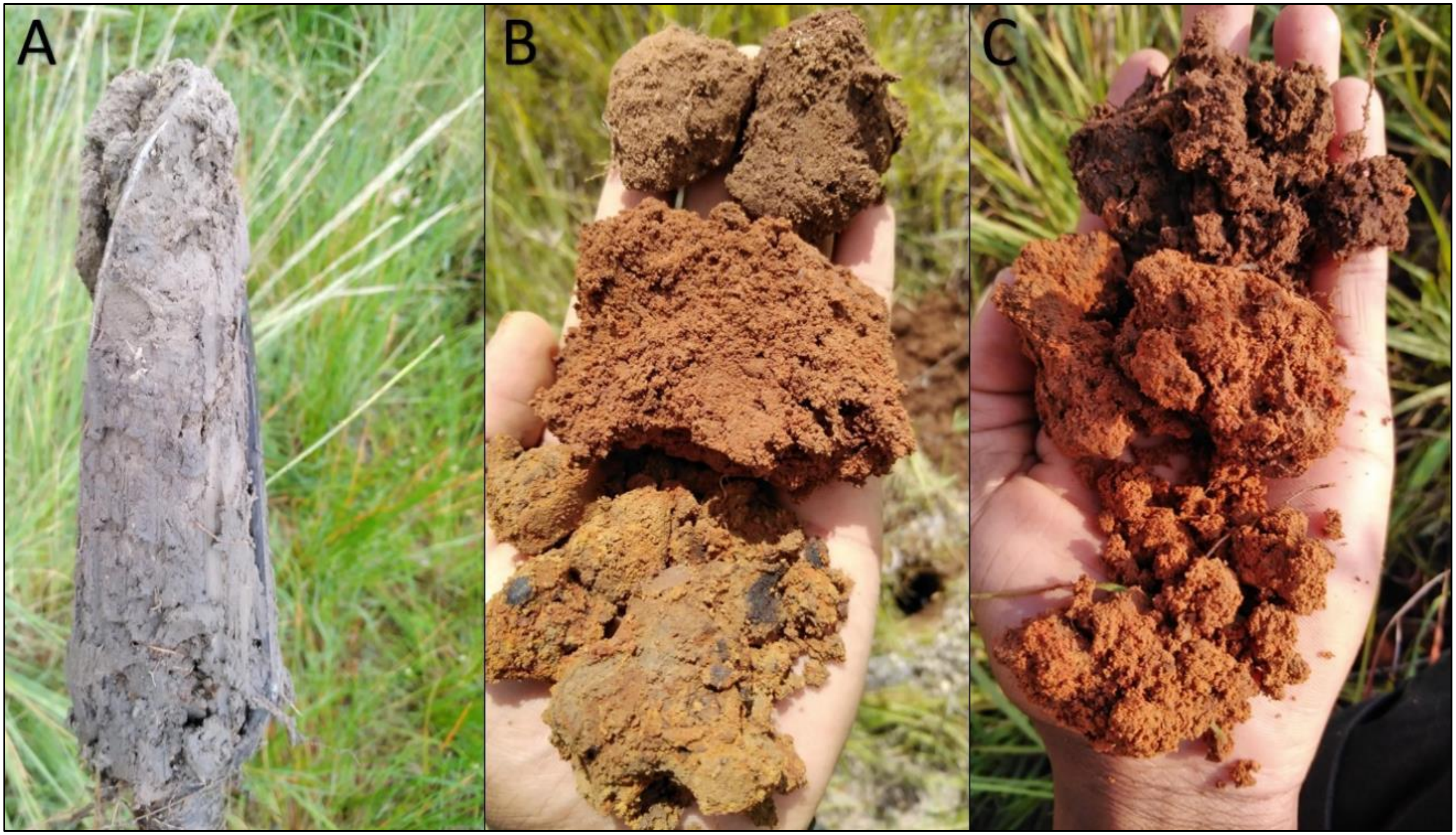

Figure 6-1 Dominant soils identified during the site assessment. A) Gley horizon. B) Orthic on top of yellow-brown apedal, underlined by soft-plinthite (Avalon). C) Orthic on top of red apedal horizon.

6.1.7 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified. These soil forms are described in Table 6-1 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 6-2.

Table 6-1 Summary of soils identified within the project area

	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	**Clay (%)**	**Signs of wetness**	**Rock %**	**Surface crusting**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**
Griffin 1120(15)	0-300	0-15	None	0	None	300-700	15-30	None	0	700-1200 (+)	15-30		
Avalon 1220(15)	0-300	0-15	None	0	None	300-700	15-35	None	0	700-1200 (+)	>35	Plinthic conditions	
Ermelo	0-300	0-15	None	0	None	300-1 200 (+)	0-15	None	0			N/A	
Hydromorphic	0-300	0-15	None	0	None	300- 800	0-15	None	0			N/A	

Table 6-2 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Base Status	Textural Contrast
Griffin 1120(15)	Dark Topsoil	Mesotrophic	Luvic
Avalon 1220(15)	Dark Topsoil	Mesotrophic	Luvic
Ermelo 1120(15)	Dark Topsoil	Mesotrophic	Luvic

6.2 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.

6.2.1 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 6-3).

Table 6-3 Climatic capability (step 1) (Scotney et al., 1987)

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

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

6.2.2 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 (0-3%, 3-7%, 7-12% and

>12%) to determine the land capability of each soil form. Accordingly, the most sensitive soil forms associated with the project area are restricted to land capability 3, 4 and 5 classes.

Table 6-4 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	Arable	Moderate
5	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	Grazing	Low

6.3 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 6-5 and Table 6-6. From the three land capability classes, two land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability III and IV have been reduced to a land potential level L6 due to climatic limitations. The land capability V has been allocated a land potential "Vlei" considering its hydromorphic characteristics.

Table 6-5 Land potential from climate capability vs land capability (Guy and Smith, 1998)

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

*Land potential level applicable to climatic and land capability

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

Land Potential	Description of Land Potential Class	Sensitivity
6	**Very restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
Vlei	Wetland (grazing and wildlife)	Low
Disturbed	N/A	None

6.4 Erosion Potential

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

6.4.1 Griffin

Table 6-7 illustrates the values relevant to the erosion potential of the Griffin soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Moderate” potential for erosion.

Table 6-7 Erosion potential calculation for the Avalon soil forms

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

6.4.2 Avalon

Table 6-8 illustrates the values relevant to the erosion potential of the Avalon soil forms. The final erosion potential score has been calculated at 4.0, which indicates a “Moderate” potential for erosion.

Table 6-8 Erosion potential calculation for the Hutton soil forms

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

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

6.4.3 Ermelo

Table 6-9 illustrates the values relevant to the erosion potential of the Ermelo soil forms. The final erosion potential score has been calculated at 4.0, which indicates a "High" potential for erosion.

Table 6-9 Erosion potential calculation for the Dundee soil forms

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

6.4.4 Hydromorphic Soils

Table 6-10 illustrates the values relevant to the erosion potential of the hydromorphic soil forms. The final erosion potential score has been calculated at 5.5, which indicates a "Low" potential for erosion.

Table 6-10 Erosion potential calculation for the Katspruit soil forms

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

6.5 Sensitivity Verification

The following land potential levels have been determined;

- Land potentials level 6 (these land potential levels are defined as having restricted to very restricted potentials. Regular, moderate and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable. The sensitivity of these land potentials are characterised by a "Low Sensitivity").

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

- Land Capability 1 to 5 (very low to low);
- Land Capability 6 to 8 (moderately low to moderate); and
- Land Capability 8 to 10 (moderate to moderate high).

The baseline findings and the sensitivities as per the Department of Agriculture, Forestry and Fisheries (DAFF, 2017) national raster file concur with one another. It therefore is the specialist's opinion that the land capability and land potential of the resources in the regulated area is characterised by "Low" to "Moderate High" sensitivities (see Figure 6-2), which conforms to the requirements of an agricultural compliance statement only.

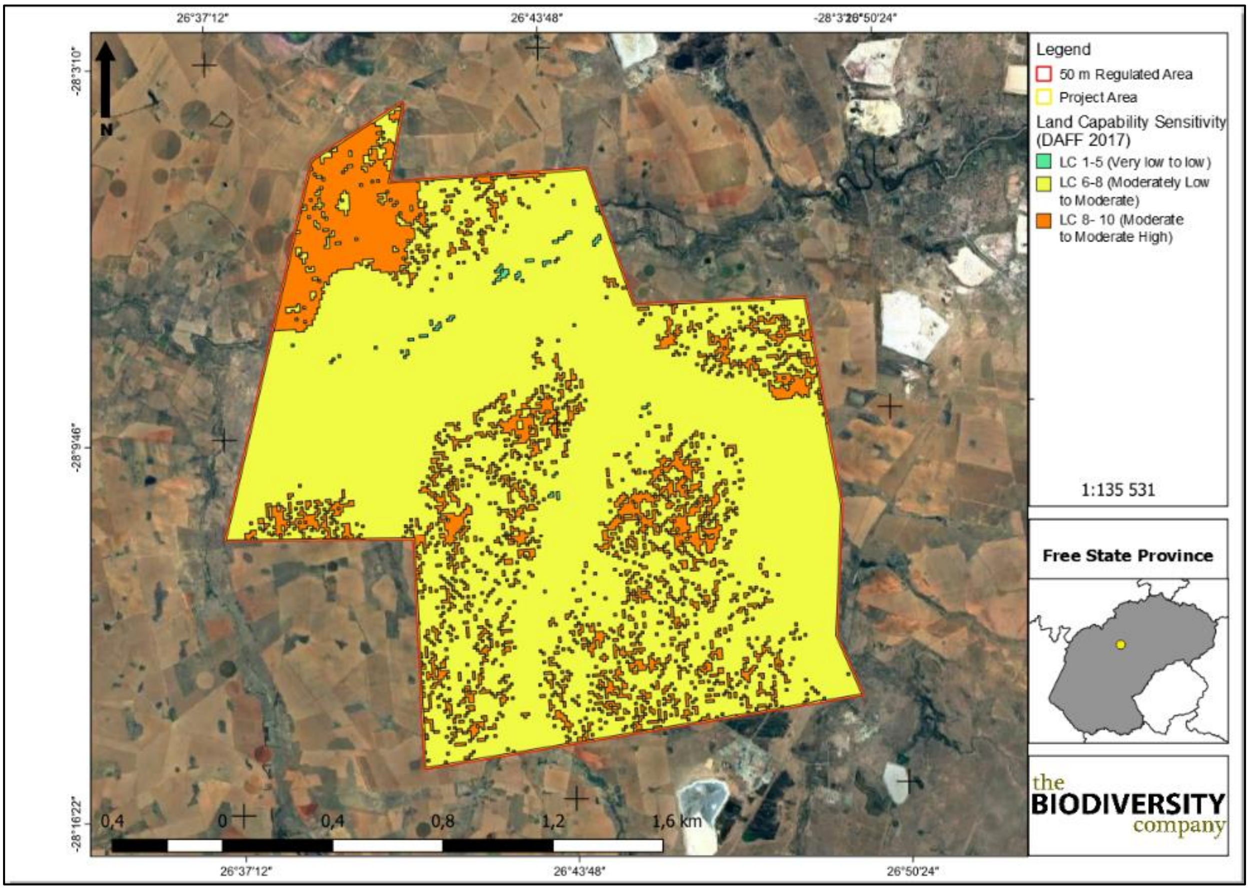

Figure 6-2 Land Capability Sensitivity (DAFF, 2017)

According to the DEA Screening Tool (2022) land capability was identified as very low to moderate high and the farming field crop sensitivity as high to very high in some areas (See Figure 6-3).

No “High” land capability sensitivities were identified within proximity to any of the proposed activities. However, for those components located within high and very high sensitivity agricultural land uses, stakeholder engagement with the landowners can be undertaken to compensate for the loss of any high-productivity crop fields. Furthermore, it is advisable to rearrange proposed components around high/very high sensitivity crop fields to ensure the conservation thereof where possible.

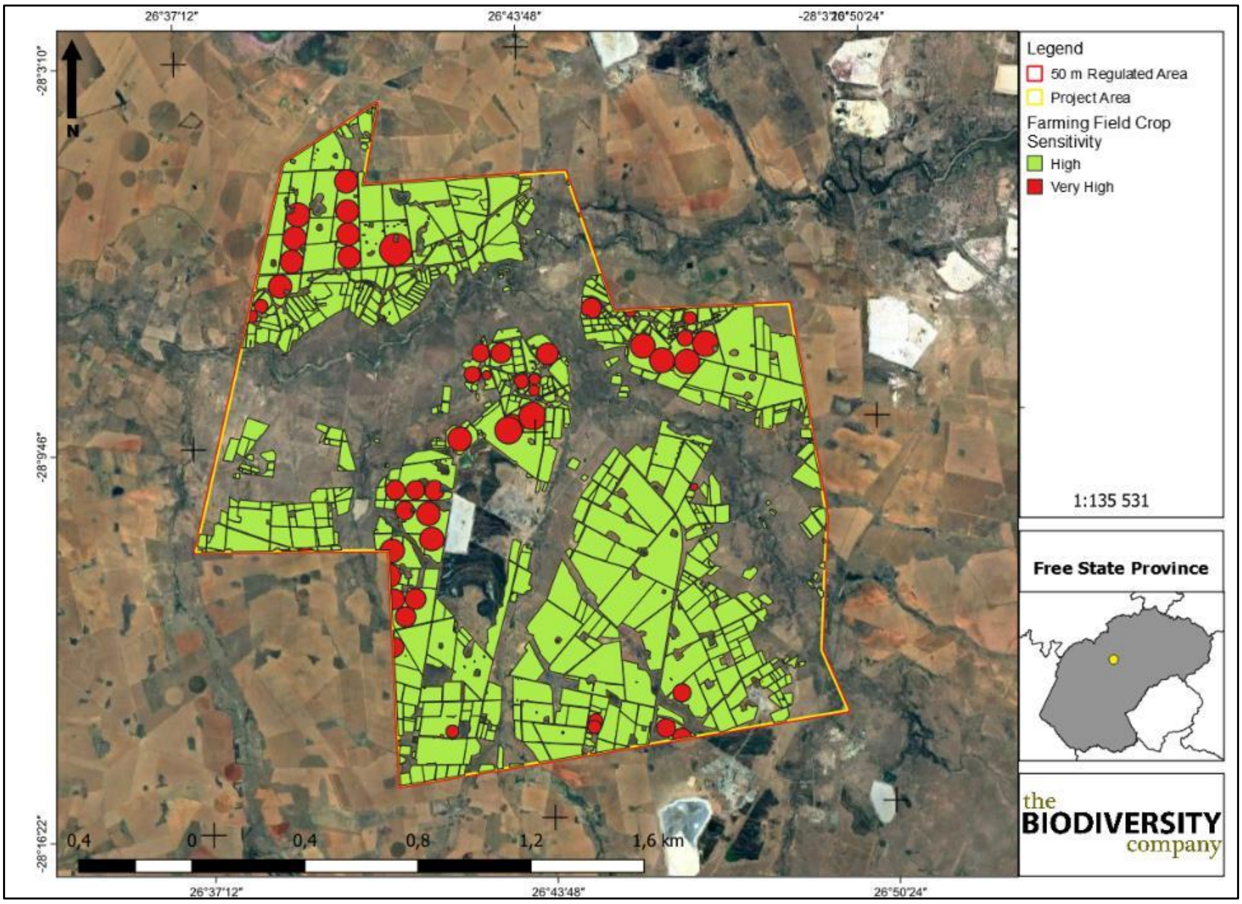

Figure 6-3 Farming Field crop Sensitivity (DEA, 2022)

7 Impact Assessment

Infrastructure within the study area includes compressor stations, gas pipelines, well heads and a transmission loop. The proposed activities often impede into "Very High" and "High" sensitivity crop fields. Even though these sensitivities aren't associated with arable land potential conditions, high production agricultural activities will be impacted on.

Impacts were considered in terms of the construction/operational phases, with no impacts on the watercourse receiving environment being identified that will occur during the decommissioning phase of the project. Mitigation measures were only applied to impacts deemed relevant.

7.1 Anticipated Activities

The proposed activities associated with the expansion of gas production can be seen overlaid with the overall sensitivity (Figure 6-3). It is evident from the figure that the following may have a negative effect on more sensitive wetland features, most impacts involve the wetland and its associated buffer area:

- Expansions to the current LNG and Helium production plant located on the Farm Mond van Doorn Rivier. The planned expansions will be to increase the helium and LNG production capacities significantly (~30 fold increase) and increase the footprint of the existing approved plant by approximately 10 ha;
- The drilling of new gas wells ~300 wells spread over a total study area (Cluster 2) of approximately ~27 500 ha;
- The installation of trenched pipelines connecting the wells to localised booster compressors and then to in-field compressor stations (~3 sites) and subsequently the compressor stations to the main plant area; and
- There will be a requirement to have short powerlines (132kV and 33kV) and water connections to the compressor sites."

7.2 Stakeholder Comments

No comments pertinent to wetlands were provided for a response.

Highlighted concerns/comments from stakeholders relevant are represented and discussed in Table 7-1 below.

Table 7-1 Stakeholder considerations relevant to the report

Comment	Tetra4 EIA formal response	Specialist Response
Here we are dealing with commercial agricultural land, game farms, livestock farms and retirement land. This is productive land that has been acquired through hard work and generates income for many families. It is an asset, in certain cases the only asset of the landowners and it is well looked after. It is a way of life, a privilege. Any interference from outside has an impact and the impact is always negative.	Thank you for this comment. As mentioned above, we wish to have open engagement with yourself and all affected landowners to discuss what (if any) realistic mitigation measures we can develop or improve upon, and which will be legally binding on Tetra4 to achieve an amicable outcome for all.	It is recommended he avoidance of active agricultural lands be prioritised. Where avoidance is not feasible, then rehabilitation objectives for the disturbed areas must be agreed between the applicant and land user. In the event disturbed areas cannot be suitably rehabilitated to achieve the agreed targets, compensation must be provided.

7.3 Review of Cluster 1 EIA and EMPr

Several impacts were identified for the soil and agricultural assessment completed by the ARC-Institute for Soil, Climate and Water (2017), which were also considered for the Cluster 2 gas exploration project. The impacts and mitigation measures from Cluster 1 that are still relevant/adequate are represented and discussed in Table 7-2.

Table 7-2 Cluster 1 Environmental Impacts and EMPr

#	Activities	Impact/ Aspect	Management/ Mitigation Measures	Suggested Amendment
3	Pipelines	Impacts on land-use	Infrastructure routes should follow existing servitudes and farm boundaries wherever possible. Where necessary pipelines should be laid underground below plough ripping level. In the event that surface pipelines are to be utilised, written approval must first be obtained from the relevant landowner. Pipelines that will be buried at a minimum of 1.5m below surface which is deeper than the rip-depth to ensure that the farmer has full utilization of their land.	
5	Exploration/ Production drilling	Impacts on land-use	The identified drill site should, where possible, not infringe on the landowners surface activities. Irrigation Pivot points should remain unaffected by infrastructure, and must be deviated around or buried to allow for continued pivot irrigation operation.	
12	Exploration/ Production drilling	Impacts on land-use	The location of the drilling site should be done so as to impact minimally on the daily activities of the landowner. The location of the site should be consulted with the landowner. Drilling site should not be situated near visually sensitive areas or residential areas. Steep areas should be avoided.	
19	All	Loss of agricultural land	Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas. Ensure that pipelines are buried at sufficient depth (>1 m minimum) to avoid interference with arable agriculture activities.	In the event agricultural lands cannot be avoided, rehabilitation of these disturbed areas must be agreed with the land user. In the event rehabilitation cannot be achieved, compensation must be provided.
32	Pipelines	Impacts on land-use	The pipelines will be buried in accordance with the schedule as agreed upon with landowners to minimise disturbance to farming operations.	
57	All	Increased soil erosion	Ensure that topsoil (0-30 cm approx.) and subsoil (30 cm +) are stored separately during excavation, so they can be replaced in the correct order. Ensure that pipeline route is re-vegetated as soon as possible after construction and that soil surface is in good condition.	In an event soil will not be returned to the profile, these soils can be used for rehabilitation efforts elsewhere. Avoid importing soils from 'outside' the project area for rehabilitation of affected areas.
82	ALL	Spill response and pollution clean-up	All necessary measures should be taken to prevent spills from occurring on site. However, should a spill occur, the following procedure must be followed: A spill response kit should be available on site at all times. Where potential contaminants are transported along access roads, emergency containment and mitigation measures must be developed to minimize impacts should accidental spills occur. Any spillage will be investigated and immediate action must be taken. In the event of a significant spill (>35 litres) of any hazardous substance, these must also be recorded and reported to the PASA, DWA (DWS) and the local/provincial authority where necessary. Depending on the nature and the extent of the spill, contaminated soil must be either excavated or treated on-site. The EO should determine	

			the exact method of treatment. Clean up should be immediate and to the satisfaction of the EO. A register of the treatment method and clean up close out report must be kept and be made available reviewed by the ECO during independent audits. Treatment could include the use of absorbent material or hydrocarbon-digesting substances. It is therefore, recommended that a spill kit and hydrocarbon digesting substance should be kept on site at all times. Clean up should be immediate and to the satisfaction of the ECO. Excavation of contaminated soil must involve careful removal of soil using appropriate tools/machinery to storage containers until treated or disposed of at a licensed hazardous landfill site. Materials used for the remediation of spills must be used according to product specification and guidance for use. A record of all spills and actions taken to remediate the spills should be kept at all times. Proper and frequent maintenance should be done to minimise spillage risk..	
85	Exploration/ Production drilling	Contamination from leakage and spillage	All wells should be capped to prevent the spilling of contaminated groundwater.	

7.4 Soil Impact Assessment

The development of the project will result in the loss of potentially productive agricultural land due to the establishment of infrastructure in these areas. This is notable for the high crop sensitivity areas and areas actively cultivated. The development in the area could also increase the potential for soil erosion because of the clearing of vegetation and creation of bare / open areas. Erosion risk is increased during high rainfall events and high winds. The results of such erosion being unchecked could include loss of topsoil, surface crusting/sealing and even rill or donga formation in the worst cases. Soil quality could also be impacted by spills and leaks from machinery, equipment and vehicles operating in the area. These pollutants would filter through the soil body, into underground water sources and even into watercourses.

The additional impacts associated with the proposed activities, which weren't considered covered in the existing approved Cluster 1 EIA and EMPr, are considered in this section. No 'new' impacts are expected for the Cluster 2 gas exploration project, except for a consideration of seismicity sensitivity. This is a consideration for soils that are prone to erosion, notably duplex soils or sodium rich soils would be more sensitive to seismic activity. The erosion risk for soils identified in the project area ranges from moderate to high, with high risks associated with the Hutton soil form. This soil form is not associated with a vertic horizon and is not a duplex form. Despite the high erosion risk of this soil form the associated seismicity risk is expected to be negligible for the area.

7.5 Recommendations

The following recommendations are provided for the project:

- No mitigation measures have been prescribed for the decommissioning phase of the project. It is recommended that the closure plan and objective be reviewed, and appropriate measures be included for the local water resources;
- Implement the "Erosion Control and Storm Water Management" (document number T4-PP-SHERQ-043) detailed in the operating procedures document;
- Once the pipeline has been installed, the disturbed area must be cleaned up in accordance with the Environmental Management Plan, and in accordance to the Tetra4 Rehabilitation Plan and Procedure;
- All activities related to these works shall comply with all applicable Environmental Laws, Tetra4's approved Environmental Management Programme (EMPR) and Tetra4's Environmental Procedures when undertaking any works; and
- The number and extent of 'bare' areas must be kept to a minimum. These bare areas must be ripped and vegetated. Compacted areas must also be ripped (in two directions) and re-vegetated to facilitate the establishment of ground cover. See below.

7.5.1 Ripping Compacted Areas

All areas outside of the footprint areas that will be degraded (by means of vehicles, laydown yards etc.) must be ripped where compaction has taken place. According to the Department of Primary Industries and Regional Development (Agriculture and Food) (2017), ripping tines must penetrate to just below the compacted horizons (approximately 300 – 400 mm) with soil moisture being imminent to the success of ripping. Ripping must take place within 1-3 days after seeding, and also following a rain event to ensure a higher moisture content.

To summarise;

- Rip all compacted areas outside of the developed areas that have been compacted;

- This must be done by means of a commercial ripper that has at least two rows of tines; and
- Ripping must take place between 1 and 3 days after seeding and following a rainfall event (seeding must therefore be carried out directly after a rainfall event).

7.5.2 Revegetate Degraded Areas

Vegetation within the footprint areas will be cleared to accommodate the excavation activities coupled with the proposed footprint areas' foundations. This impact will degrade soil resources, ultimately decreasing the land capability of resources and increasing erosion. According to Russell (2009), areas characterised by a loss of soil resources should be revegetated by means of vegetation with vigorous growth, stolons or rhizomes that more or less resembles the natural vegetation in the area.

It is recommended that all areas surrounding the development footprint areas that have been degraded by traffic, laydown yards etc. must be ripped and revegetated by means of indigenous grass species. Mixed stands or monocultures will work sufficiently for revegetation purposes. Mixed stands tend to blend in with indigenous vegetation species and are more natural. Monocultures however could achieve high productivity. In general, indigenous vegetation should always be preferred due to various reasons including the aesthetical presence thereof as well as the ability of the species to adapt to its surroundings.

Plant phase plants which are characterised by fast growing and rapid spreading conditions. Seed germination, seed density and seed size are key aspects to consider before implementing revegetation activities. The amount of seed should be limited to ensure that competition between plants are kept to a minimum. During the establishment of seed density, the percentage of seed germination should be taken into consideration. *E curvula* is one of the species recommended due to the ease of which it germinates. This species is also easily sown by means of hand propagation and hydro seeding.

The following species are recommended for rehabilitation purposes;

- *Eragrostis teff;*
- *Cynodon species (Indigenous and altered types);*
- *Chloris gayana;*
- *Panicum maximum;*
- *Digitaria eriantha;*
- *Anthephora pubescens; and*
- *Cenchrus ciliaris.*

8 Conclusion

Three main sensitive soil forms were identified within the assessment area, namely the Avalon, Ermelo and Griffin soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with "Low" and "Moderate high" sensitivities, which correlates with the findings from the baseline assessment.

The assessment area is associated with arable soils, due to the type of soils which the DEA Screening Tool (2022) also identified as high to very high sensitivity for field crops farming. However, the available climatic conditions of low annual rainfall and high evapotranspiration potential severely limits crop production significantly resulting in land capabilities with "Low" and "Moderate high" sensitivities. The land capabilities associated with the regulated area are suitable for cropping and grazing, which corresponds with the current land use.

8.1 Specialist Recommendation

The final results indicate "Insignificant" to "Very Low" post-mitigation significance ratings for the proposed components. It is therefore clear that the proposed activities are expected to have a minimal impact on land potential resources. It is worth noting that some "High" sensitivity crop field areas were identified by means of the DEA Screening tool (2022) which is not expected to be avoided throughout the life of the operation. Therefore, stakeholder engagement must be undertaken to compensate land owners for high crop field land use areas where necessary.

With this being considered, it is recommended that the proposed activities may proceed as have been planned.

9 References

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