Soil and Agricultural Assessment for the proposed Droogfontein Solar Photovoltaic (PV 5) Project

Kimberley, Sol Plaatje Local Municipality, Northern Cape Province

July 2022 (Updated November 2022)

CLIENT

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Report Name	**Soil and Agricultural Assessment for the proposed Droogfontein Solar Photovoltaic (PV 5) Project**
Submitted to	ENVIRONAMICS
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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 5.2
Acceptability of impacts towards agricultural production capability associated with proposed activities	Section 6
Declaration of specialist(s)	Page vi
Project components with 500 m regulated area superimposed to that of the agricultural sensitivities of the screening tool	Section 5.2
Confirmation from specialist that mitigation to avoid fragmentation has been considered	Section 6
Statement from specialist regarding the acceptability and approval of proposed activities	Section 6
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	N/A
Assumptions and uncertainties	Section 3.4

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

July 2022

1 Introduction

The Biodiversity Company (TBC) was appointed to undertake a soil and agricultural assessment for the proposed Droogfontein Solar Photovoltaic (PV) project. The proposed project involves the development of a solar facility and associated infrastructure, located between the towns of Kimberley and Riverton in the Northern Cape province.

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 50 m regulated area. The report will also identify the soil suitability and land potential of these soils, the land uses within the assessment area and the risks associated with the proposed solar renewable development project.

1.1 Project Description

The following project description is applicable:

- PV Panel Array - To produce up to 200MW direct current and up to 180MW alternating current, the proposed SEF will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted in order to capture the most sun or using axis tracker structures to follow the sun to increase the Yield;

- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency; and

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is approximately 480V and this is fed into step up transformers to 132kV. An onsite facility substation and switching stations will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid via the proposed new collector substation and power line. The power line route will be assessed within a 300m wide corridor.

- As there are five alternative development areas proposed for the placement of the project development footprint, the developer has identified a suitable grid connection corridor for each of the development areas which connects the facility to an existing power line located near to the development area. All grid connection corridors have a width of 300m. The respective grid connection solutions proposed for each of the alternative development areas are considered to be feasible from a technical and capacity perspective and provides an opportunity for limited linear disturbance within the landscape based on the limited power line infrastructure proposed to be developed (i.e. no power lines longer than 2.5km are required). Refer to the below.

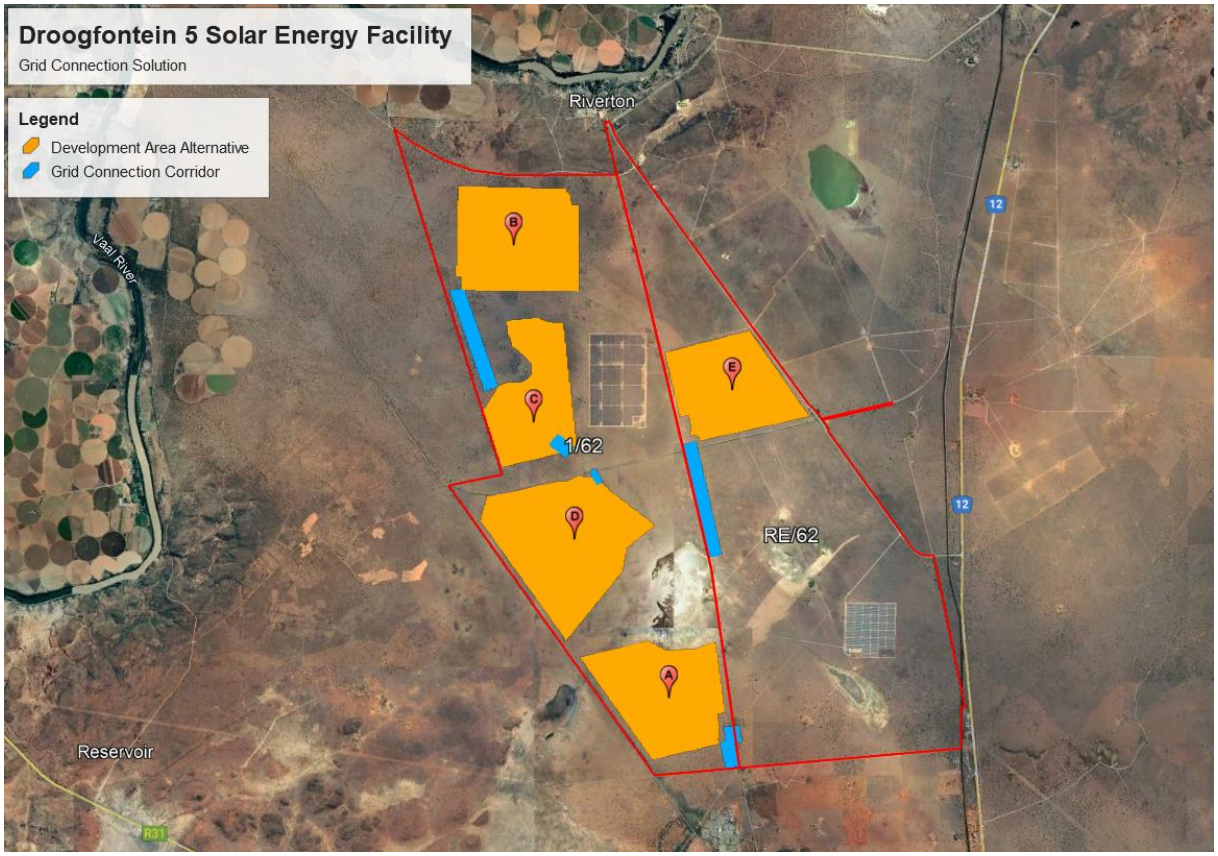

Figure 1-1 Proposed grid connection corridors (indicated in blue) associated with each of the development area options

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.

- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required:

    - Administration Office (~300m²);
    - Switch gear and relay room (~400m²);
    - Staff lockers and changing room (~200m²);
    - Security control (~60m²);
    - Operations & Maintenance (O&M) room; and
    - Warehouse.

- Battery Energy Storage System (BESS) – The battery energy storage system will make use of Lithium-ion as a preferred technology and will have a capacity of up to 40MW. The extent of the system will be 20m long, 23m high, 2.5m wide. The containers may be single stacked only to reduce the footprint. There may be up to a maximum of 40 containers of BESS. The containers will include

cells, HVAC, fire, safety and control systems and will comprise of Lithium-Ion technology providing a maximum capacity of 50MW in total

- Roads – Access will be obtained via the tarred Riverton Road and various gravel farm roads within the area and affected properties. An internal site road network will also be required to provide access to the solar field and associated infrastructure. Roads are expected to be between 8m and 12m wide.

- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a maximum height of 3 meters will be used.

Component	Description / dimensions
Height of PV panels	Up to 3 meters
Area of PV Array	Up to 160 hectares (within the up to 500ha development footprint)
Number of inverters required	To be determined as part of the final facility layout design.
Area occupied by inverter / transformer stations / substations	On-site Facility Substation: up to 3ha Collector Substation: up to 3ha BESS: up to 5ha
Capacity of the on-site substation	33kV / 132kV
Capacity of the collector substation	33kV / 132kV
Capacity of the power line	33kV / 132kV
Area occupied by both permanent and construction laydown areas	Up to 3 hectares
Area occupied by buildings	• Administration Office (~300m²); • Switch gear and relay room (~400m²); • Staff lockers and changing room (~200m²); • Security control (~60m²);
Width of internal roads	Between 8 and 12 meters
Grid connection corridor width	300m
Grid connection corridor length – as associated with each development area alternative	• Option A: up to 600m • Option B: up to 2km • Option C: up to 140m (two power lines of 140m is required) • Option D: up to 145m • Option E: up to 2.3km
Power line servitude width	Up to 32m
Height of fencing	Approximately 3 meters

1.2 Scope of Work

According to the National Web based Environmental Screening Tool, the proposed development is located within the "Low to Medium" sensitivity land capability area. The protocols for minimum requirements (DEA, 2020)1 stipulates that in an 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, terrain and climate features within the 50 m regulated areas, it is the specialist's opinion that the soil forms and associated land capabilities concur with the

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

sensitivities stated by the screening tool. Therefore, only an agricultural compliance statement will be compiled. This includes:

- 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 500 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.

1.3 Expertise of the Specialists

1.3.1 Andrew Husted

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

1.3.2 Matthew Mamera

Matthew Mamera is a Cand. Sci Nat registered (116356) in natural and agricultural sciences recognized 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 peer reviewed scientific publications in international journals. Matthew completed his M.Sc. 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).

2 Project Area

The project area is located in the Northern Cape Province and falls within the Frances Baard District Municipality and Sol Plaatjie Local Municipality. Kimberly is located approximately 20 km south of the proposed development. The project area can be seen in Figure 2-1 and Figure 2-2, the project area contains all expected infrastructure related to the project

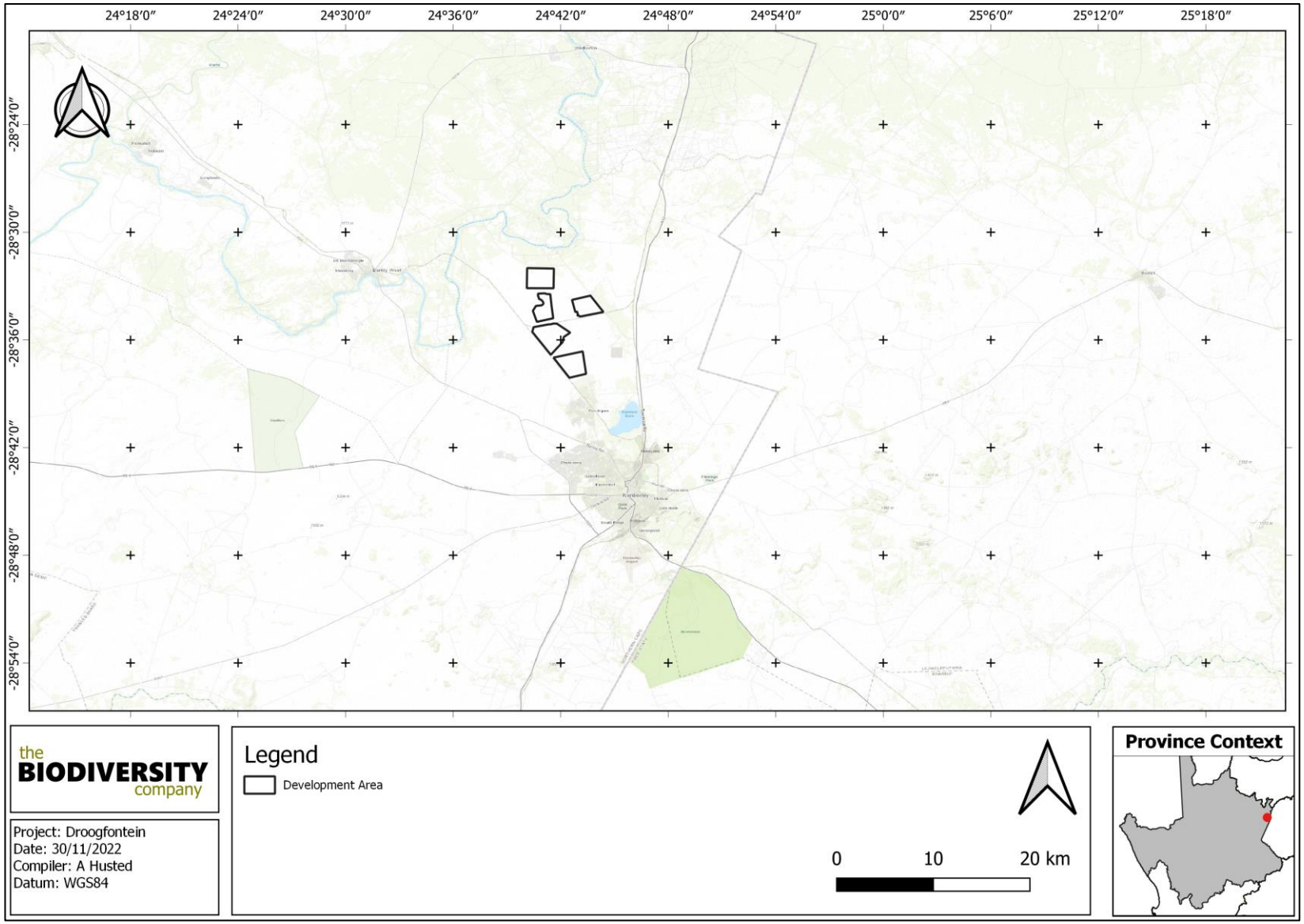

Figure 2-1 Locality map of the project area

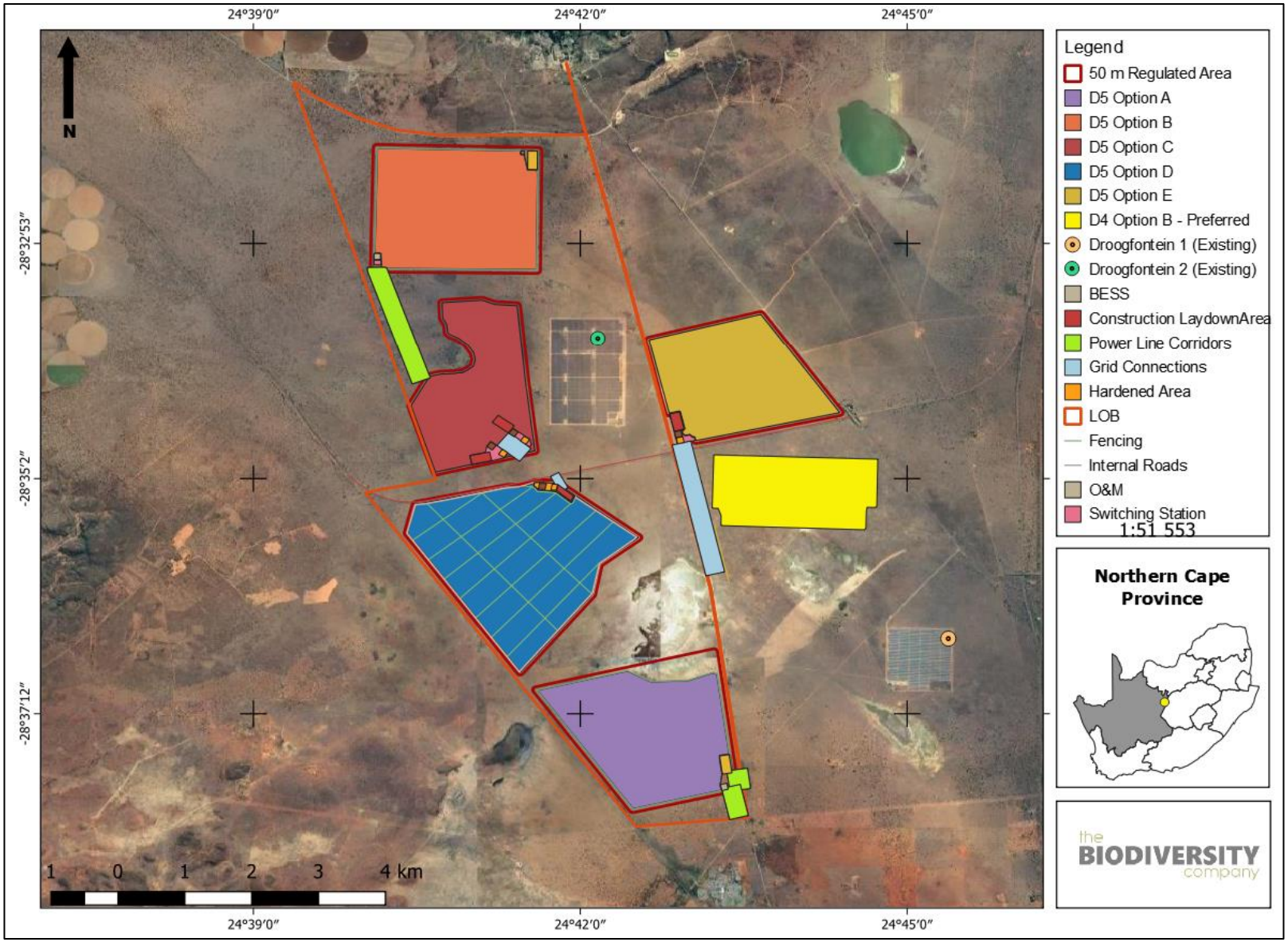

Figure 2-2 Layout map of the project area

3 Methodology

3.1 Desktop Assessment

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types. In addition, a Digital Elevation Model (DEM) as well as the slope percentage of the area was calculated by means of the NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data by means of QGIS and SAGA software.

3.2 Field Survey

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

3.3 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 3-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 3-1 Land capability class and intensity of use (Smith, 2006)

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

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

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 3-2. The final land potential results are then described in Table 3-3.

Table 3-2 The combination table for land potential classification

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

Table 3-3 The Land Potential Classes.

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

3.4 Limitations

The following limitations are relevant to this agricultural potential assessment.

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m: and
- No heavy metals have been assessed or fertility has been analysed for the relevant classified soils.

4 Project Area

4.1 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 Ae 15, Ae 45 and Fb 1B land types. The Ae land types mostly consist of Hutton, Mispah and Katspruit soil forms following the South African soil classification working group (1990) with the possibility of other soils occurring throughout. The area is also characterised with shallow profiles and occurrence of rocky areas. The Ae land types area characterised with red to yellow apedal and freely drained soils. The soils have a high base status with profiles deeper than 300 mm without any occurrence of dunes. The Fb 1 land types are commonly dominated with shallow Glenrosa, Mispah soil forms and bare rocks with also the possibility of other soils occurring within the terrains. Lime is rare or absent in the upper terrain soils and generally present in the low-lying terrain soils. The terrain units and expected soils for the Ae 15 and Ae 45 land types are presented in Figure 4-1 and Table 4-1, **Error! Reference source not found.**; the Fb 1 land types is illustrated in Figure 4-2 and Table 4-3 respectively.

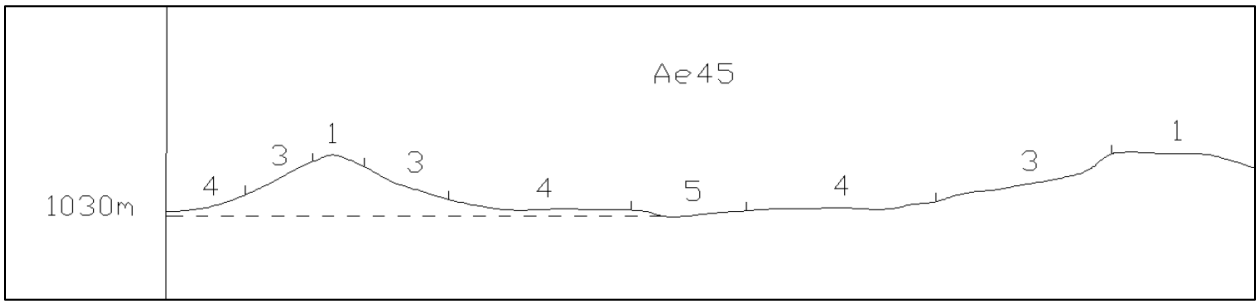

Figure 4-1 Illustration of land type Ae 15 and Ae 45 terrain units (Land Type Survey Staff, 1972 – 2006)

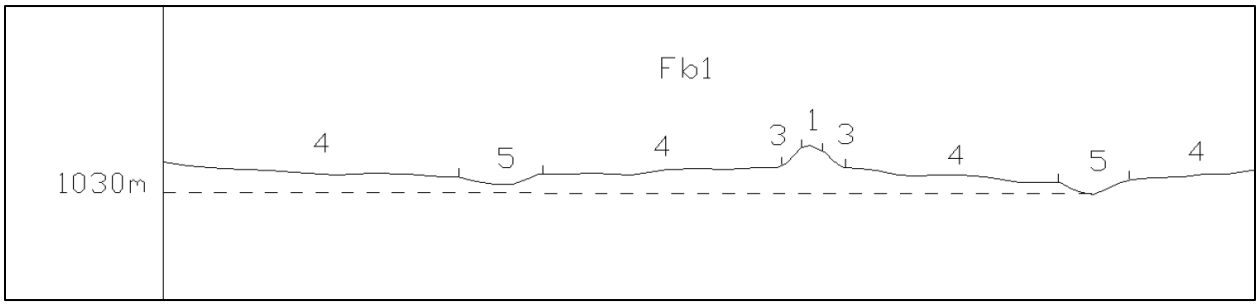

Figure 4-2 Illustration of land type Fb 1 terrain units (Land Type Survey Staff, 1972 – 2006)

Table 4-1 Soils expected at the respective terrain units within the Ae 15 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (10%)		**3 (9%)**		**4 (82%)**		**5 (5%)**	
Bare Rocks	90%	Bare Rocks	85%	Hutton	77%	Mispah, Hutton	55%

Mispah, Hutton	6%	Mispah, Hutton	10%	Mispah, Hutton	18%	Valsrivier, Swartland	25%
Sterkspruit, Valsrivier	4%	Sterkspruit, Valsrivier	5%	Clovelly	5%	Dundee, Katspruit	20%
				Mispah	3%		
				Sterkspruit	3%		
				Hutton	2%		
				Valsrivier, Swartland	2%		

Table 4-2 Soils expected at the respective terrain units within the Ae 45 land type (Land Type Survey Staff, 1972 – 2006)

Terrain Units							
1 (4%)		**3 (13%)**		**4 (77%)**		**5 (6%)**	
Bare Rocks	70%	Bare rocks	50%	Hutton	60%	Mispah	50%
Swartland	15%	Hutton	20%	Mispah	25%	Katspruit	50%
Hutton, Glenrosa	15%	Hutton, Glenrosa	10%	Sterkspruit	10%		
		Swartland	10%	Glenrosa	5%		
		Sterkspruit	10%				

Table 4-3 Soils expected at the respective terrain units within the Fb 1 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (0.5%)		**3 (2%)**		**4 (91%)**		**5 (6.5%)**	
Bare Rocks	90%	Bare rocks	85%	Mispah	45%	Mispah	40%
Shortlands	10%	Shortlands	15%	Hutton	30%	Pans	20%
				Clovelly	9%	Oakleaf	15%
				Shortlands	9%	Valsrivier, Swartland	14%
				Valsrivier, Swartland	3%	Clovelly	11%
				Oakleaf	2%		
				Glenrosa	2%		

4.2 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 4-3. Most of the regulated area is characterised by a slope percentage between 0 to 6% with some irregularities in areas with slopes reaching 10%. This illustration indicates a non-uniform topography with occurrence of some steep sloping areas being present. The Digital Elevation Model (DEM) of the project area (Figure 4-4) indicates an elevation of 1 134 to 1 181 Metres Above Sea Level (MASL).

Figure 4-3 Slope percentage map for the project area

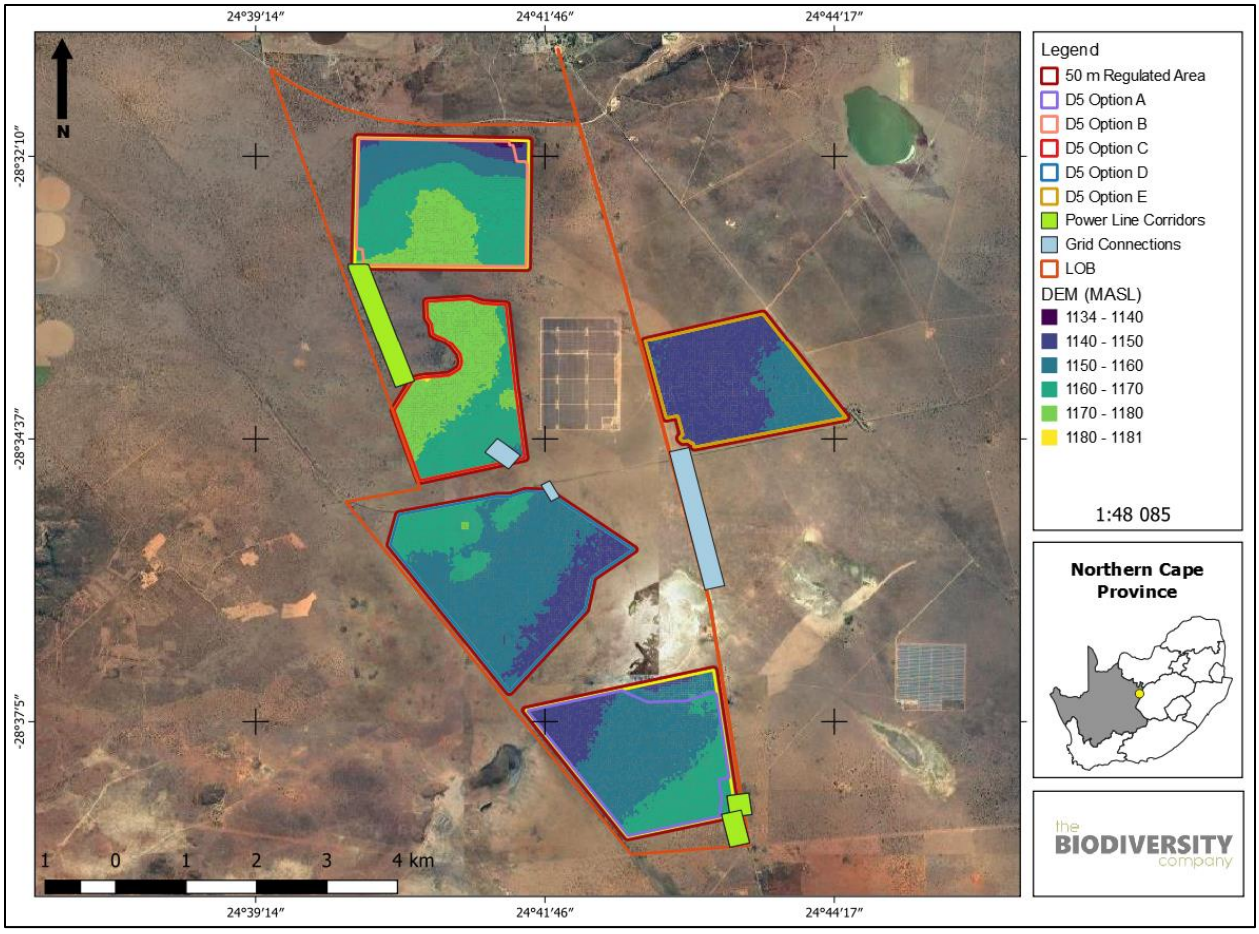

Figure 4-4 Digital Elevation Model of the project area (Metres above sea level)

5 Results and Discussion

5.1 Baseline Findings

The most sensitive soil forms identified within the assessment area is the Ermelo, Hutton and Vaalbos soil forms, with other associated soils also occurring. The Ermelo soil form has an orthic topsoil with a thick yellow brown apedal subsurface horizon. The Hutton soil form consists of an orthic topsoil horizon on top of a thick red apedal subsurface diagnostic horizon below. The Vaalbos soil form consists of an orthic topsoil on top of a red apedal horizon merging into a hard rock substratum (see

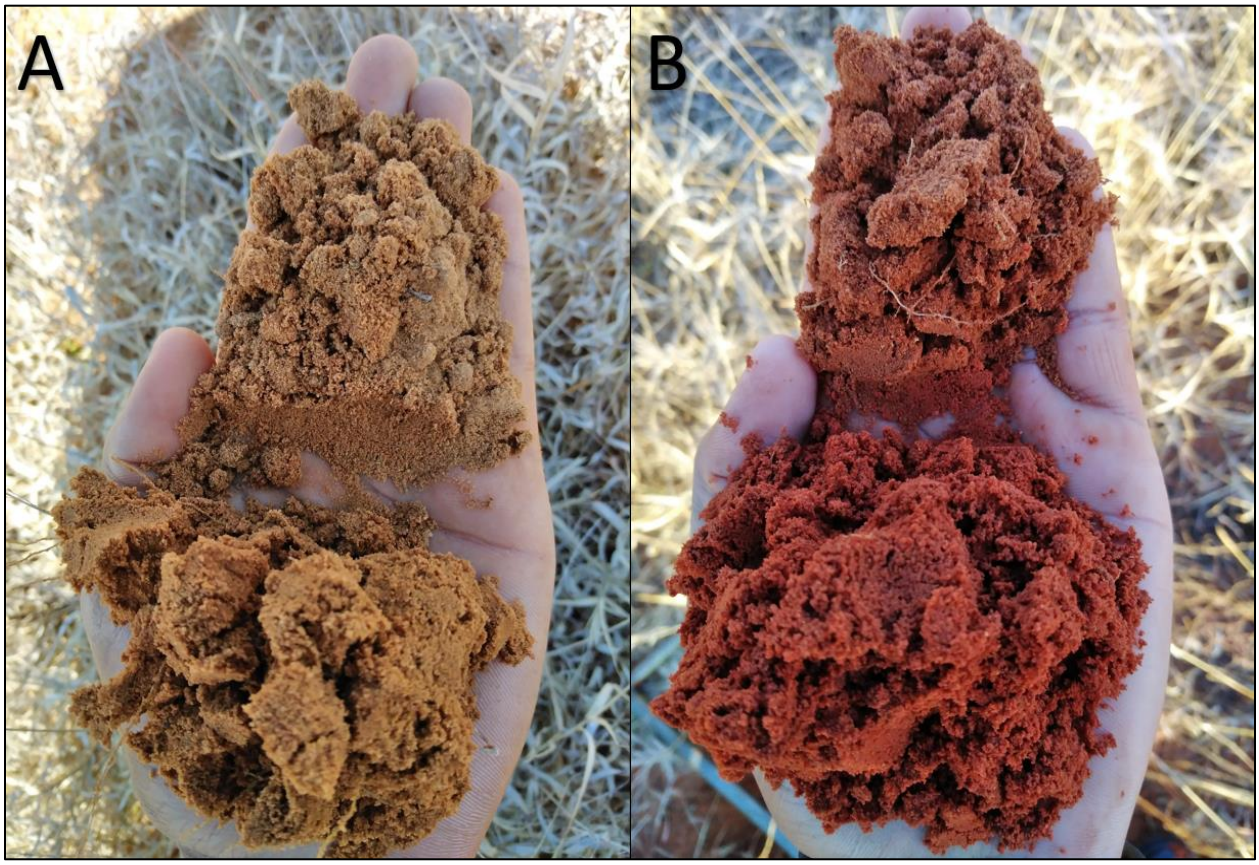

Figure 5-1).

The land capability of the above-mentioned soils has been determined to have land capability classes of “II” and “III” with a climate capability level 8 given the low Mean Annual Precipitation (MAP) and the high Mean Annual Potential Evapotranspiration (MAPE) rates. The combination between the determined land capabilities and climate capabilities results in land potentials “L5” and “L6”. The “L5” land potential level is characterised by a *restricted potential. Regular and/or moderate to severe limitations occur due to soil, slope, temperatures or rainfall*. The “L6” land potential level is characterised by a *very restricted potential. Regular and/or severe limitations occur due to soil, slope, temperatures or rainfall. These areas are non-arable*. The “L5” and “L6” land potential are characterized with a “Low Sensitivity”.

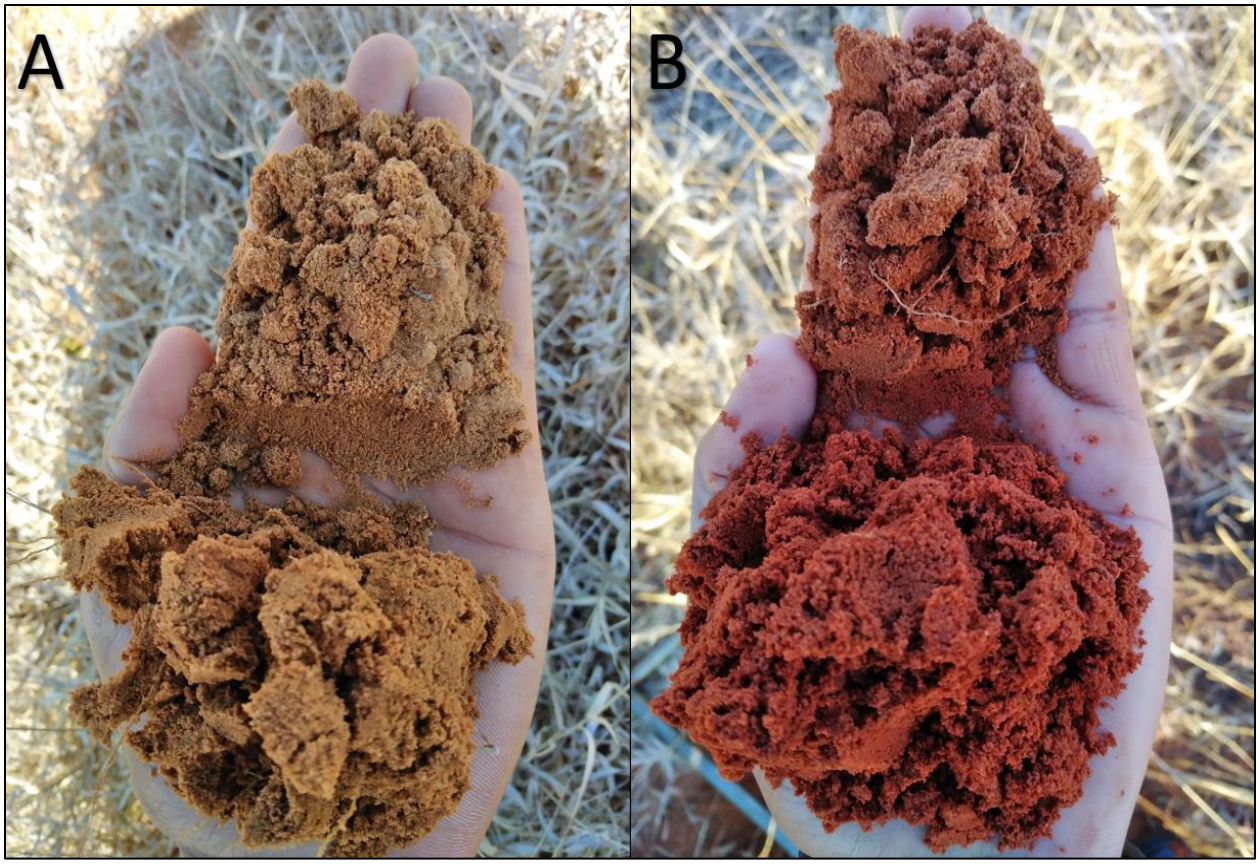

Figure 5-1 Ermelo soil form and Red apedal subsurface horizon; in the Hutton and Vaalbos soil forms (A and B respectively).

5.2 Sensitivity Verification

The following land potential levels has been determined;

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

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

- Land Capability 1 to 5 (Very Low to Low Sensitivity)
- Land Capability 6 to 8 (Low/Moderate to Moderate Sensitivity)

The baseline findings and the sensitivities as per the Department of Agriculture, Forestry and Fisheries (DAFF, 2017) national raster file concur with one another. The proposed Droogfontein 5 solar photovoltaic (PV) energy facility project is mostly characterised with "Low" to "Moderate" land capability sensitivities. Some portions in the assessment area fall within "Very Low to Low" sensitivities (see Figure 5-2). Some areas are also characterised with arable soils. 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" sensitivities (see Figure 5-2), which conforms to the requirements of an agricultural compliance statement only. The DEA screening tool, (2022) shows that there are no crop fields with "High" sensitivity within the assessment area (See **Error! Reference source not found.**). Hence, there is no segregation of crop fields with "High" sensitivity in the proposed project area that can limit crop production.

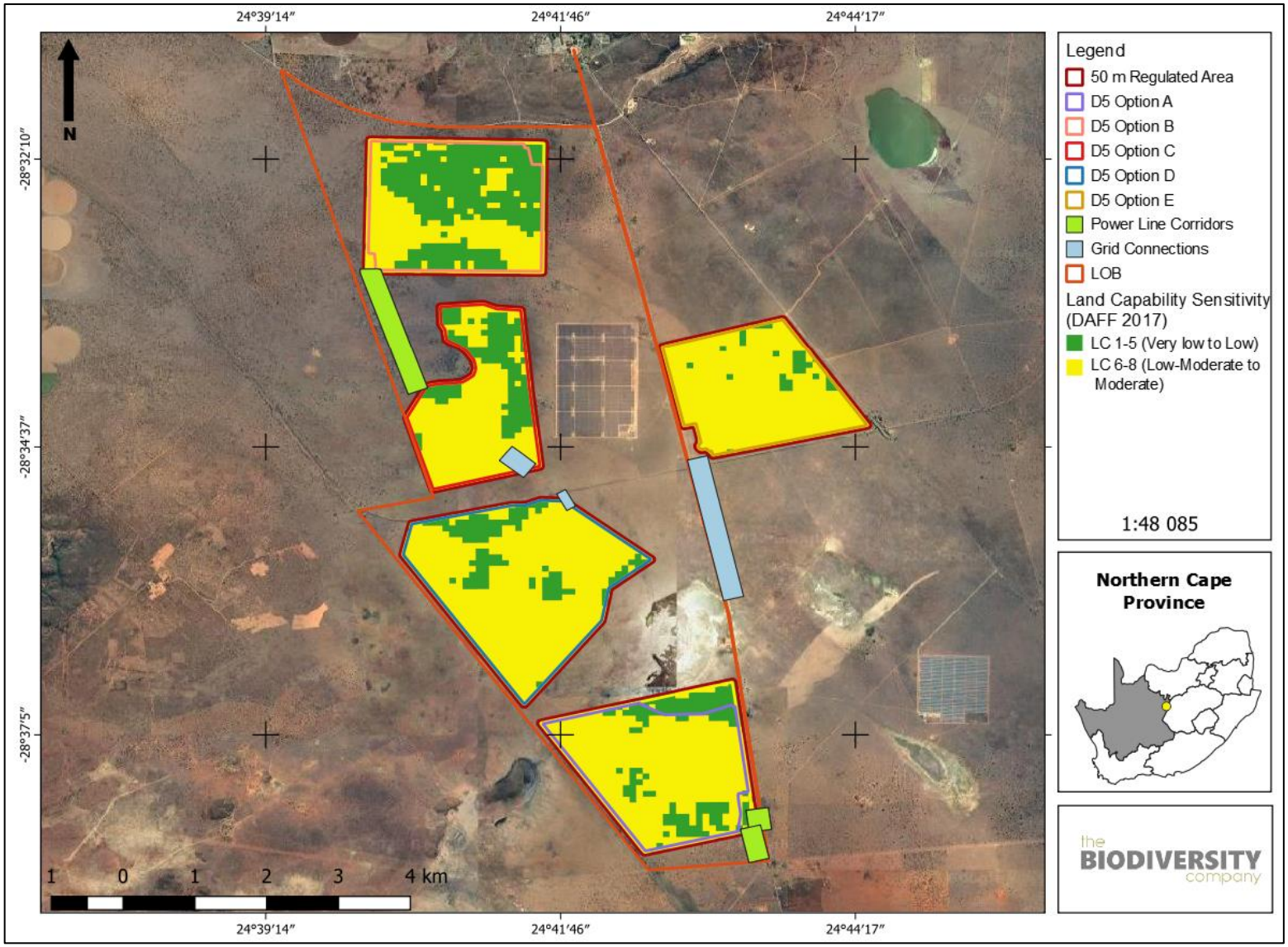

Figure 5-2 Land Capability Sensitivity (DAFF, 2017)

6 Conclusion

The most sensitive soil forms identified within the assessment area is the Ermelo, Hutton and Vaalbos soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Very low to Moderate” sensitivities, which correlates with the findings from the soil baseline assessment. The regulated footprint area is associated with non-arable and arable lands. The area is characterised with “Low” sensitivity for the land capabilities of the assessment footprint area.

The assessment area is associated with both non-arable and some arable soils. The available climate limits crop production considerably. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area. The area is not favourable for most cropping practices, which corresponds to the current livestock and game farming activities in the area.

It is the specialist’s opinion that the proposed Droogfontein solar project and associated infrastructure will have no impacts on the agricultural production ability of the land. There is no segregation of crop fields with “High” sensitivity in the proposed project area following the DEA screening tool, (2022). It is, therefore, the specialist`s recommendation that, the proposed Droogfontein 5 solar photovoltaic (PV) energy facility project and associate infrastructure may be favourably considered. The proposed project has limited impacts on the land capability of the resources in the assessment footprint, hence no mitigations required.

7 References

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.

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