Soil Assessment Report for the Mutsho Solar PV 1 Power Project

Makhado, Limpopo Province

May 2022

CLIENT

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Report Name	**Soil Assessment Report for the Mutsho Solar PV 1 Power Project**
Reference	**Mutsho PV 1**
Submitted to	savannah environmental
Report Writer	**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).
Report Writer / Reviewer	**Andrew Husted**  Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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DECLARATION

I, Matthew Mamera, declare that:

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

Matthew Mamera

Soil Pedologist

The Biodiversity Company

May 2022

1 Introduction

The Biodiversity Company was appointed by Savannah Environmental (Pty) Ltd (Savannah) to undertake a basic soil and agricultural potential assessment for the Mutsho Power Project. The project area is located in the magisterial district of Vhembe, in the Limpopo Province, approximately 39 km north of the town Makhado (Louis Trichardt) and 8 km south-west of Mopane Town.

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

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities and enable informed decision making. This report aims to also present and discuss the findings from the soil resources identified within the regulated 50 m, the soil suitability and land potential of these soils, the land uses within the regulated area and also the risk associated with the proposed project. This report focus on the proposed development of the Mutsho Solar PV1 Facility.

1.1 Project description

The following is as per the project description provided by Savanna environmental:

Mutsho Power (Pty) Ltd is proposing the construction and operation of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure on the Farm Vrienden 589, located approximately 8km south-west of Mopane and 39km south-west of Musina, within the Musina Local Municipality and the Vhembe District Municipality in the Limpopo Province. The facility will have a contracted capacity of up to 100MW and will be known as Mutsho Solar PV1. The project is planned as part of a cluster of Solar PV Facilities with a total capacity of up to 400MW, and will be connected to the electricity grid via a 132kV Collector Station and 132kV double circuit overhead power line to the Nzhelele Substation. The grid connection infrastructure is the subject of a separate Basic Assessment process.

A preferred project site with an extent of ~1237ha and a development area of ~277ha within the project site has been identified by Mutsho Power (Pty) Ltd as a technically suitable area for the development of the Mutsho Solar PV1 Facility.

Infrastructure associated with the Solar PV Facility, which will enable the facility to supply a contracted capacity of up to 100MW, will include:

» Solar PV array comprising PV modules and mounting structures.

» Inverters and transformers.

» Cabling between the panels.

» 33/132kV onsite facility substation, including associated equipment and infrastructure.

» Electrical and auxiliary equipment required at the Collection Station that serves the solar energy facility, including a switchyard/bay, control building, fences, etc.

» Cabling from the onsite substation to the Collection Station (either underground or overhead).

» Site offices, warehouses, and guardhouses.

» Water storage tanks at admin block for human consumption.

» Laydown areas.

» Internal gravel distribution roads.

The Solar PV Facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Mutsho Solar PV1 Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, or a similar programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with Mutsho Solar PV1 set to inject up to 100MW into the national grid.

1.2 Scope of Work

According to the National Web based Environmental Screening Tool, the proposed development is located within a "Medium" 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:

- 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;

[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).

- 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 12 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, 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).

2 Project Area

The proposed Mutsho Power Project area is located in the magisterial district of Vhembe, in the Limpopo Province, approximately 40 km north of the town Makhado (Louis Trichardt) and 7 km south-west of Mopane Town (see Figure 2-1 and Figure 2-2). The broad project area is located approximately 6 km west of the N1 road and 43 km south-west of Musina. The proposed power project is found within the Vrienden 589MS farm, the area is 10 km towards the Mopane road and 30 km along the Waterpoort road. The surrounding land use includes agricultural activities (crop and animals), mining and predominantly nature and wildlife reserves.

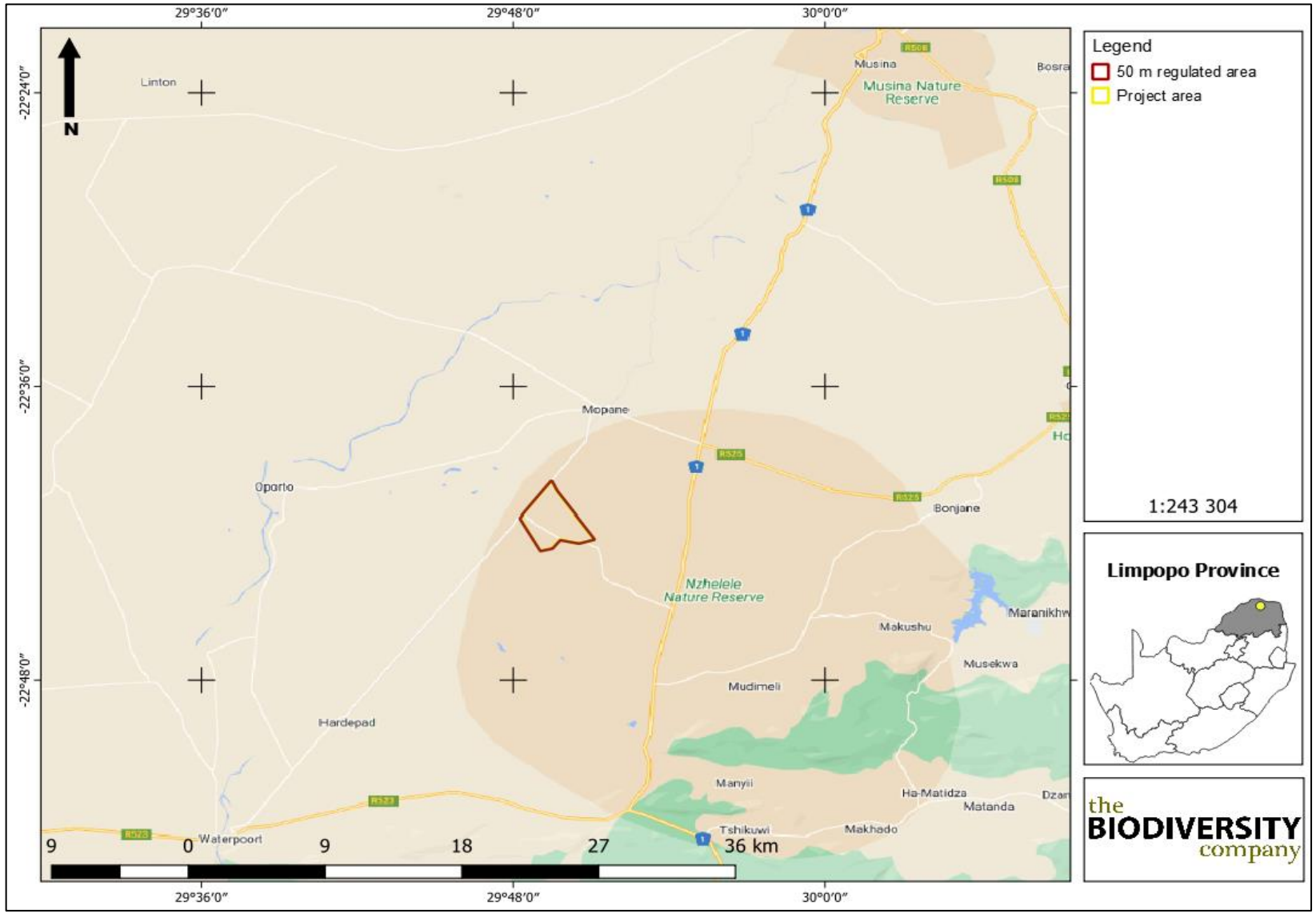

Figure 2-1 The location of the project area

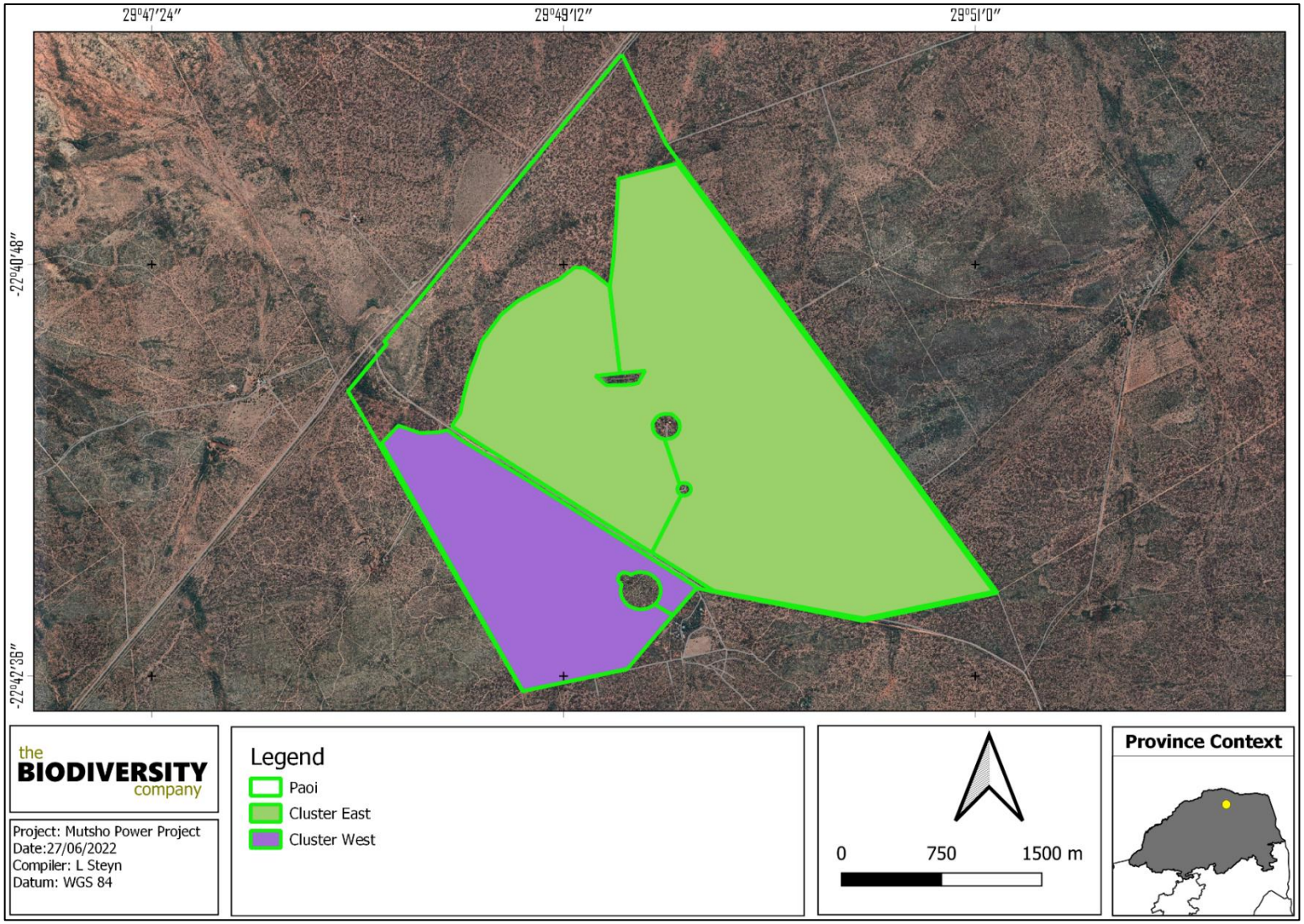

Figure 2-2 The various components of the project

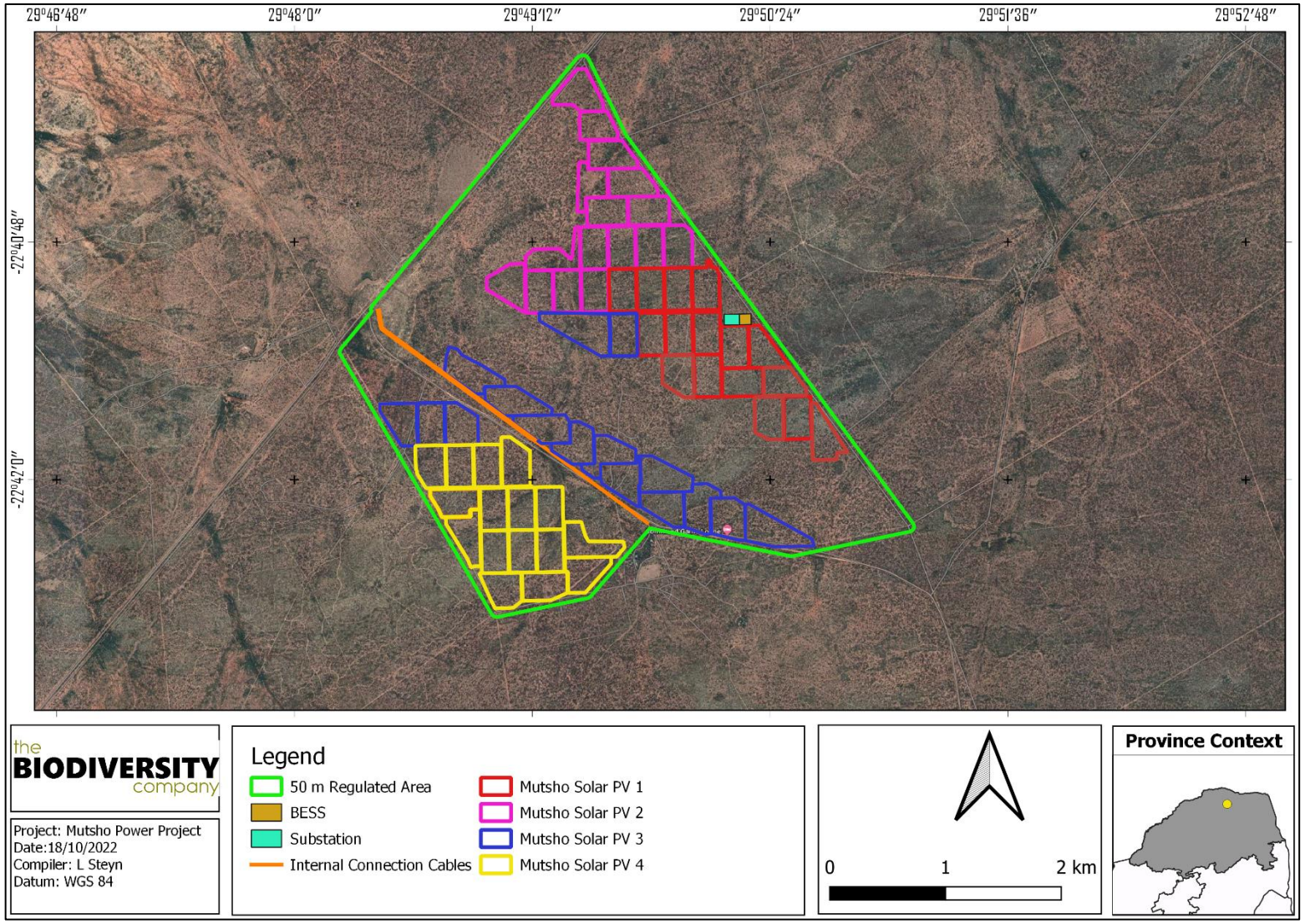

Figure 2-3 The Mutsho Solar PV Project layout.

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 May 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 Limitation

- All the proposed four PV sites were assessed in the same way for the field survey and the reporting.

4 Project Area

4.1 Soil and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ah 89 land type (see Figure 4-1). The Ah land type is commonly characterised with Mispah, Oakleaf and Hutton soil forms according to the Soil Classification Working Group, (1991) with the possibility of other soils also occurring. Red-yellow apedal mesotrophic and eutrophic soils also occur in the area with high base status, associated with shallow and rocky profiles in the upper terrains. Lime is mostly absent in the upper areas and can occur in the lower areas. The land terrain units for the featured Ah 89 land type are illustrated in Figure 4-1 with the expected soils listed in Table 4-1.

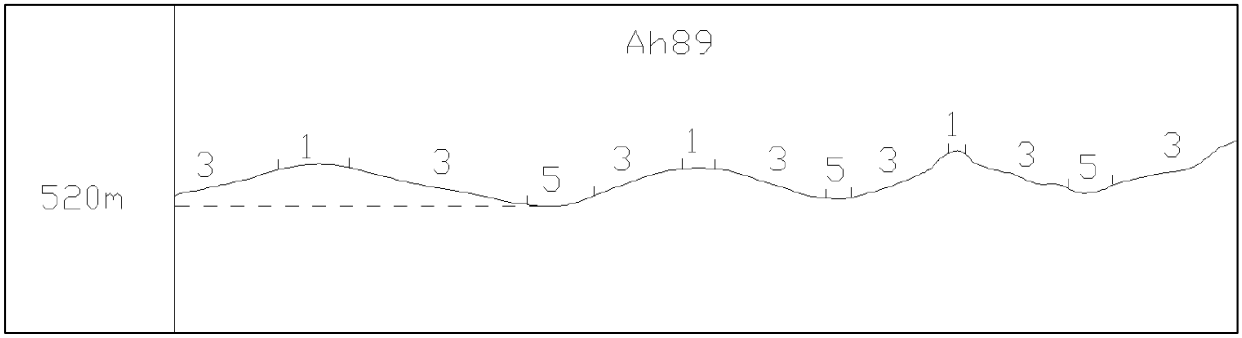

Figure 4-1 ***Illustration of land type Ah 89 terrain unit (Land Type Survey Staff, 1972 - 2006)***

Table 4-1 ***Soils expected at the respective terrain units within the Ah 89 land type (Land Type Survey Staff, 1972 - 2006)***

Terrain Units					
1 (10%)		**3 (75%)**		**4 (15%)**	
Mispah	80%	Hutton	63%	Oakleaf	70%
Bare rocks	20%	Clovelly	20%	Streambed	15%
		Bare rocks	5%	Hutton	5%
		Mispah	5%	Clovelly	5%
		Glenrosa	5%	Bainsvlei	5%
		Bainsvlei	2%		

4.2 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 4-2. Most of the project area is characterised by a slope percentage between 0 and 5%, with some smaller patches within the project area characterised by a slope percentage ranging from 5 to 15%. This illustration indicates a non-uniform topography in scattered areas with the majority of the area being characterised by a gentle slope. The DEM of the project area (Figure 4-3) indicates an elevation of 689 to 746 Metres Above Sea Level (MASL).

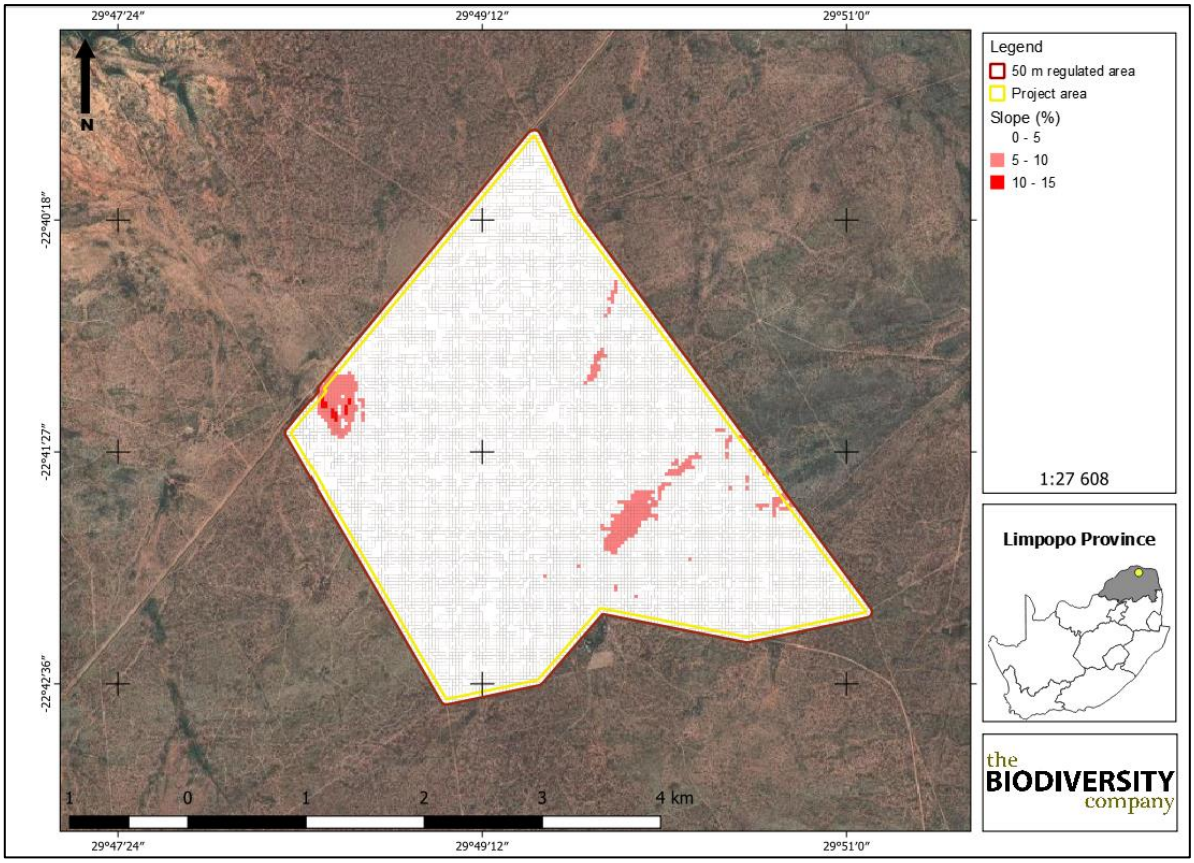

Figure 4-2 The slope percentage calculated for the project area

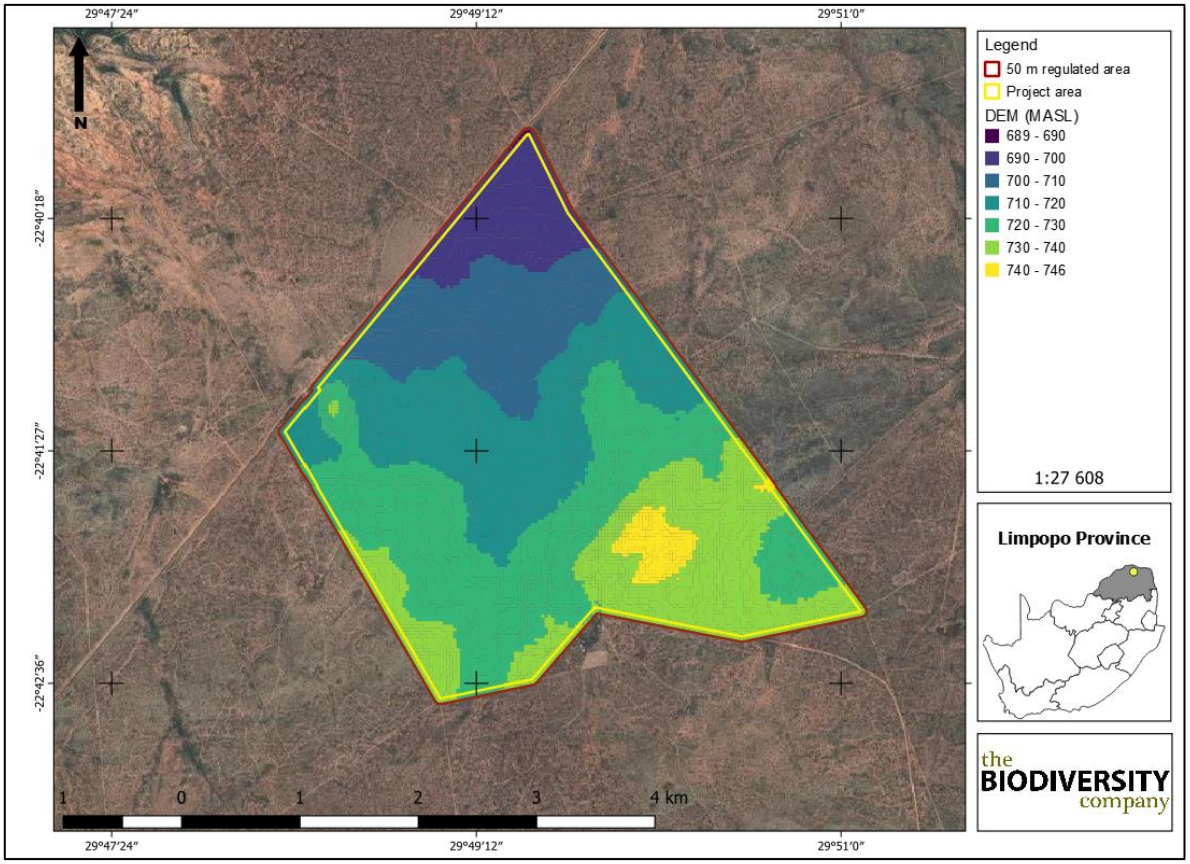

Figure 4-3 The DEM generated for the project area

5 Results and Discussion

5.1 Baseline Findings

The most sensitive soil forms identified within the area was the Hutton and Nkonkoni soil forms, with other associated soils also occurring. The Hutton soil form consist of an orthic topsoil on top of a thick red apedal horizon. The Nkonkoni soil form is characterized with an orthic top soil on top of a red apedal horizon underlain with a lithic diagnostic subsurface horizon below (see Figure 5-1).

The land capability of the above-mentioned soil has been determined to have a land capability class of “II” with arable soils and 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 a land potential “L5” class. 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 “L5” land potential class has “low sensitivity”.

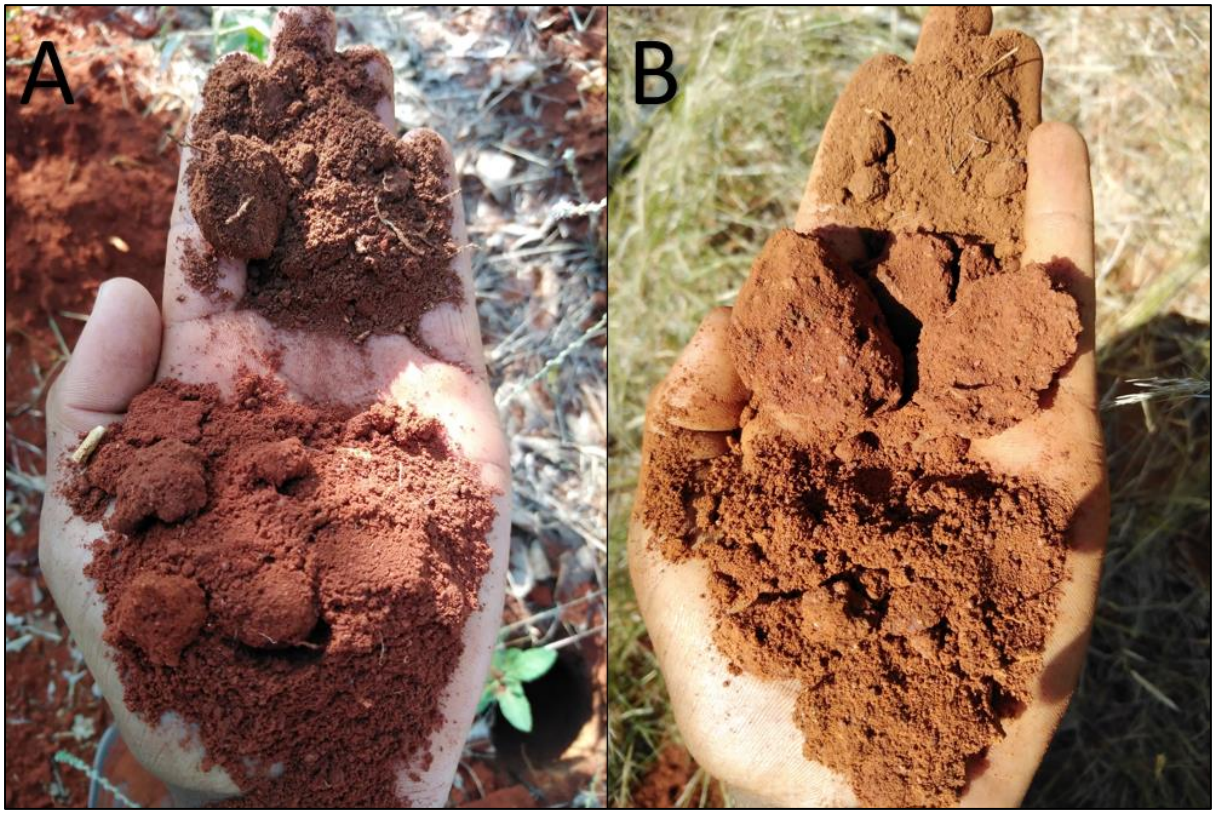

Figure 5-1 Hutton and Nkonkoni soil forms with red apedal subsurface horizons (A and B respectively).

5.2 Sensitivity Verification

The following land potential level has been determined;

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

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 Sensitivity);
- Land Capability 6 to 8 (Low to Moderate Sensitivity) and;

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project focus area, which predominantly covers "Low" to "Moderate" sensitivities. Small patches are characterised by "Very Low" sensitivities (Figure 5-2). In the assessment area there is no segregation of agricultural lands or crop fields with high potentials. The land capability and land potential in the assessed area concur. The "Very Low to Moderate" sensitivities also falls within the DAFF, (2017) requirements for a compliance statement report only. It is the specialist`s recommendation that the proposed solar power project and the associated infrastructure may be favourably considered.

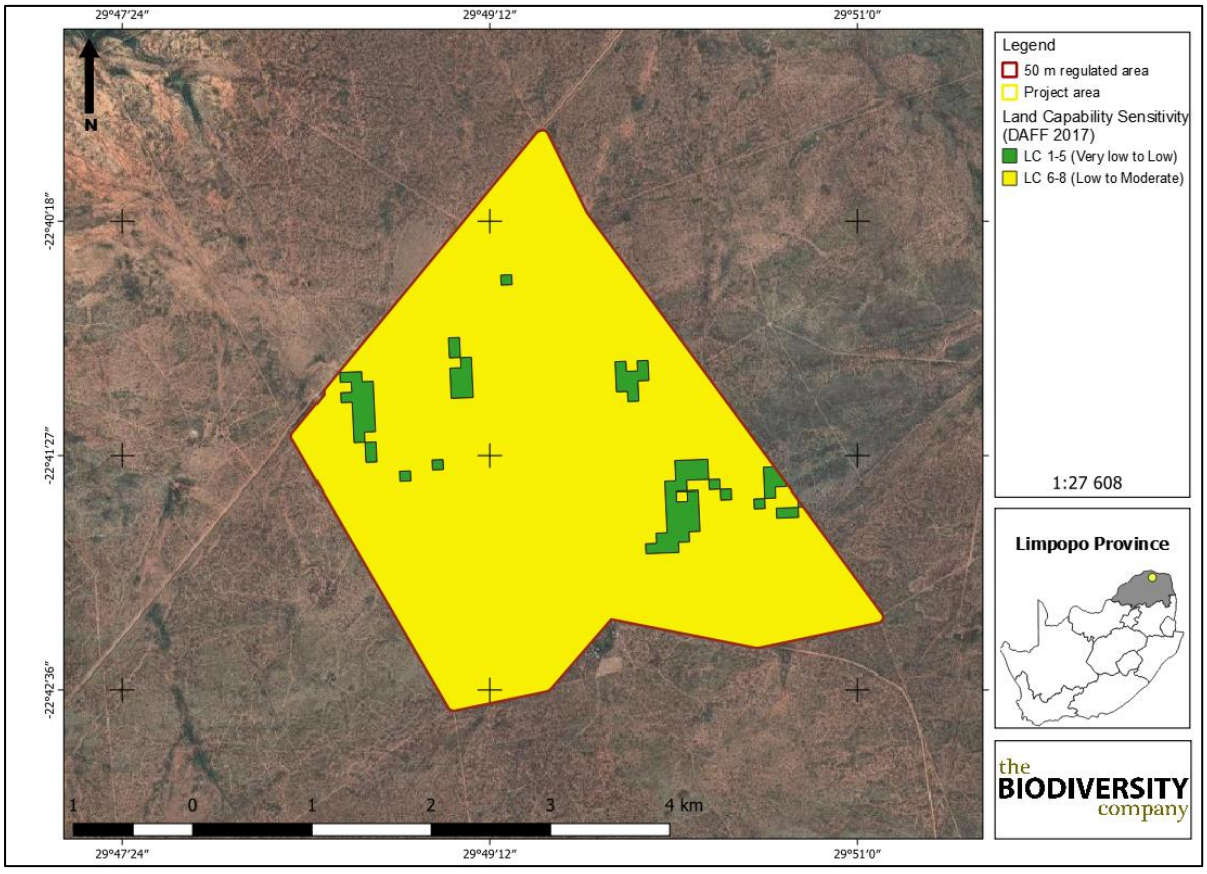

Figure 5-2 The land capability sensitivity (DAFF, 2017)

6 Conclusion

The most sensitive soil forms identified within the assessment corridor is the Hutton and Nkonkoni soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Very Low to Moderate” sensitivities, which correlates with the findings from the baseline assessment. The regulated area has arable soils.

The assessment area is associated with arable soils, due to some of the type of soils available. However, the climate limits crop production significantly. 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.

It is the specialist’s opinion that the proposed solar power project will have limited impact on the agricultural production ability of the land. Additionally, the proposed activities will not result in the segregation of any high production agricultural land. Therefore, the proposed solar power project may be favourably considered.

7 References

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