Soil And Agricultural Assessment Report for the proposed Kiwano Battery Energy Storage System and Solar Photovoltaic Project

Upington, Northern Cape, South Africa

July 2022

CLIENTS

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Report Name	**Soil And Agricultural Assessment Report for the proposed Kiwano Battery Energy Storage System and Solar Photovoltaic Project**
Submitted to	ZITHOLELE CONSULTING
Report Writer	**Maletsatsi Mohapi**  Maletsatsi Mohapi is a Soil scientist in the field of Natural and Agricultural sciences. Maletsatsi is a soil and wetland specialist, with an experience in soil identification, soil classification, wetland delineation and wetland monitoring. Maletsatsi completed her MSc in Agriculture at the University of the Free State in 2021. Maletsatsi is also a member of the Soil Science Society of South Africa (SSSSA).
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 principles of science.

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Declaration

I, Maletsatsi Mohapi 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.

Maletsatsi Mohapi

Soil Scientist

The Biodiversity Company

August 2022

1 Introduction

The Biodiversity Company was commissioned to conduct a soil and agricultural assessment report for the proposed Kiwano Battery Energy Storage System (BESS) and Solar Photovoltaic (PV) project. The Kiwano BESS and PV project is part of phase 2, consisting of an envisaged PV capacity of 58 MW, and BESS capacity of 40 MW/ 200 MWh. The proposed project area is near Upington 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.

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, enabling informed decision making, as to the ecological viability of the proposed project.

1.1 Project

Infrastructure associated with the project will include the following:

- Build a 7 km single Twin-Tern Upington/ Kiwano 132kV line on a double circuit support structure;
- Build Kiwano 132kV substation with 5 feeder bays: 1 for the income line, 4 for the BESS and PV plants, and make provision for future expansion to accommodate 4 more bays;
- Build the 40MW/200MWh BESS plant equipped with 2x40MVA 132/22kV transformers and connect it at Kiwano substation; and
- Build a 58MW PV plant with 2x40MVA 132/22kV transformers and connect it at Kiwano substation.

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) 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 was required 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

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;
- 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 Maletsatsi Mohapi

Maletsatsi Mohapi is a Soil scientist in the field of Natural and Agricultural sciences. Maletsatsi is a soil and wetland specialist, with an experience in soil identification, soil classification, wetland delineation and wetland monitoring. Maletsatsi completed her MSc in Agriculture at the University of the Free State in 2021. Maletsatsi is also a member of the Soil Science Society of South Africa (SSSSA).

2 Project Area

The project area is located approximately 13 km south-west of Upington and approximately 2 km west of the Orange River, Northern-Cape Province. The project area is also found along the N14 national road and east of the Khi Solar one historical landmark (see Figure 2-1). The surrounding land use includes project agriculture (grazing) and renewable energy facilities. Two alternatives have been proposed, namely “Site A” and “Site B” (see Figure 2-2).

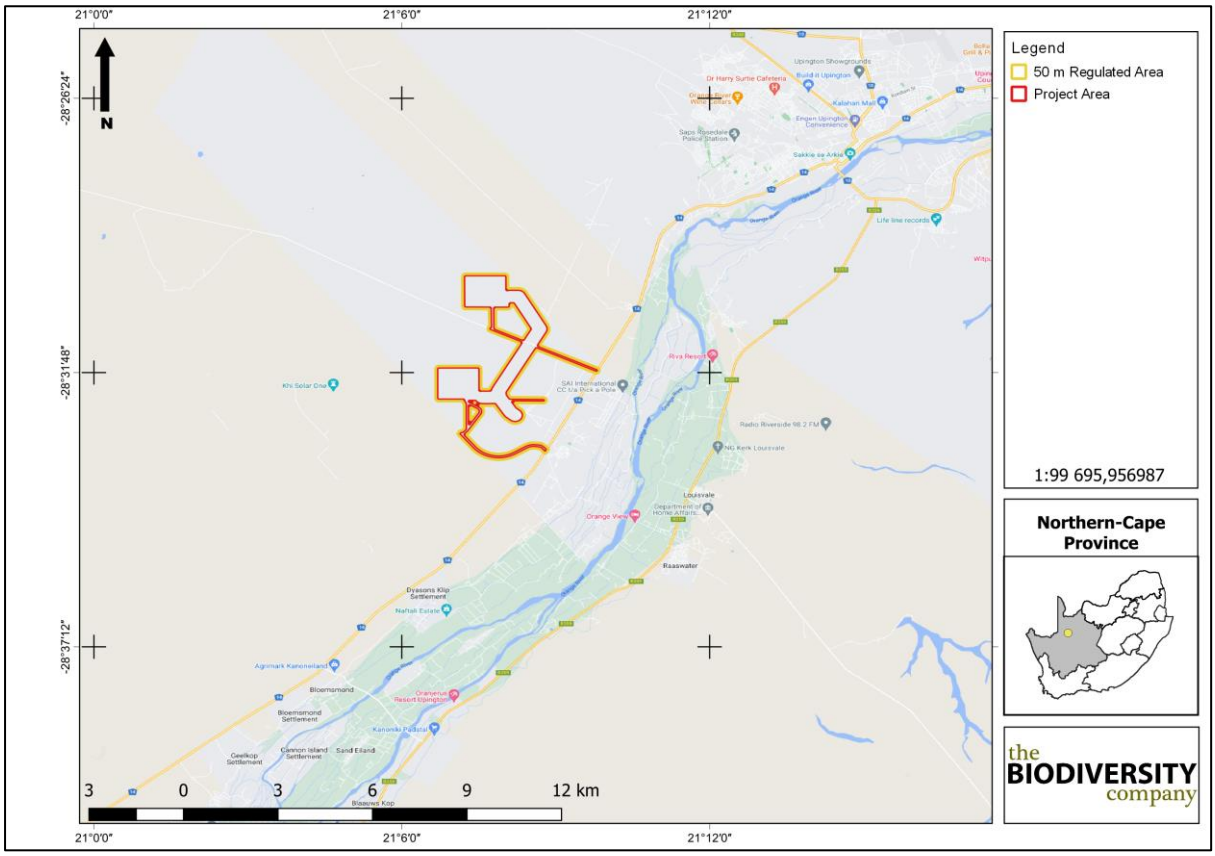

Figure 2-1 Locality map of the project area

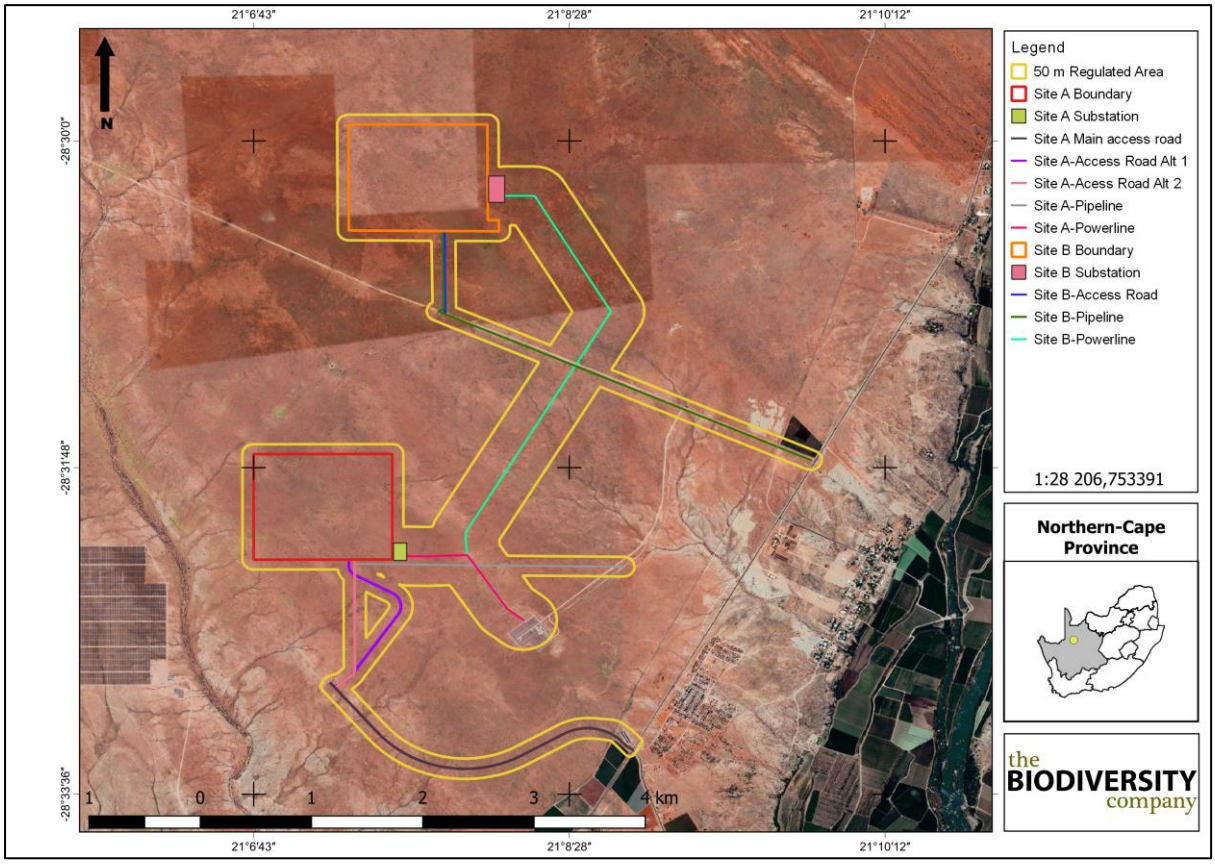

Figure 2-2 Proposed layouts (Alternative A and B)

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 the field survey in April 2022, concurrently with the wetlands survey. The site was traversed on foot. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 0.5 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 nor fertility 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 10 and Ag 1 land types. The Ae 10 and Ag 1 land types are mostly predominated by Hutton and Mispah soil forms with also the occurrence of bare rocks and other soils occurring throughout the terrains, following the South African soil classification working group (1990). The Ae land type is characterised by shallow profiles and occurrence of rocky areas. Furthermore, they consist of the freely drained red to yellow-brown apedal soils. The soils have a high base status with profiles deeper than 300 mm without any occurrence of dunes. The Ag land type is characterised by freely drained red or yellow-brown apedal soils, with red apedal soils being dominant. These soils have a high base status and are likely to be less than 300 mm deep. The geology of Ae 10 land type includes migmatite, gneiss and ultrametamorphic rocks of the Namaqualand Metamorphic Complex. Moreover, the geology of Ag 1 land type includes granite, migmatite and gneiss of the Namaqualand Metamorphic Complex. The terrain units and expected soils for the Ae 10 and Ag 1 land types are presented in Figure 4-1 to Figure 4-2 and Table 4-1 to Table 4-2, respectively.

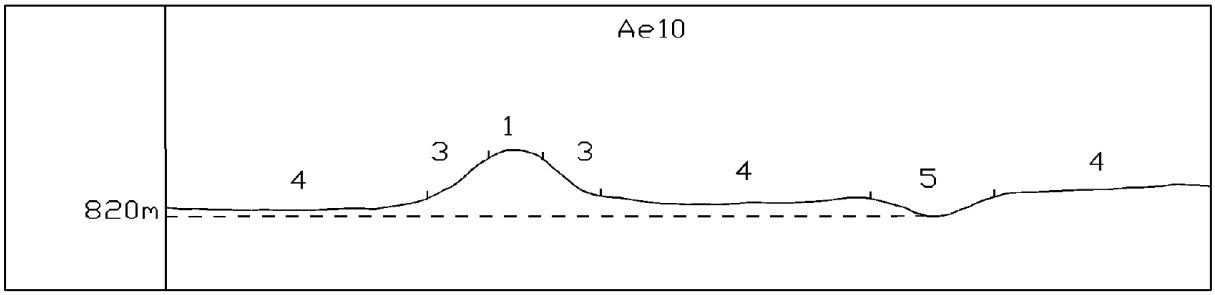

Figure 4-1 Illustration of land type Ae 10 terrain units (Land Type Survey Staff, 1972 – 2006)

Table 4-1 Soils expected at the respective terrain units within the Ae 10 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (1%)		3 (2%)		4 (94%)		5 (3%)	
Bare rock	80%	Bare rock	80%	Hutton	60%	Mispah	90%
Mispah	20%	Mispah	20%	Mispah	40%	Hutton	10%

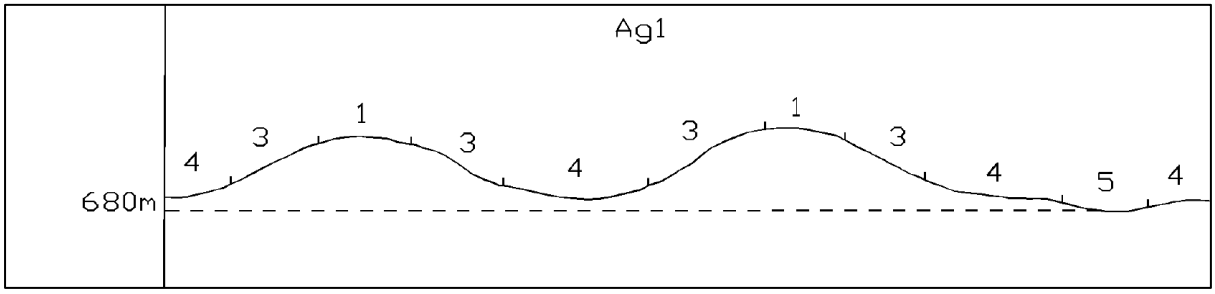

Figure 4-2 Illustration of land type Ag 1 terrain units (Land Type Survey Staff, 1972 – 2006)

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

Terrain Units							
1 (8%)		3 (22%)		4 (50%)		5 (20%)	
Bare rock	60%	Hutton	40%	Hutton	55%	Hutton	65%
Hutton	20%	Mispah	30%	Mispah	35%	Mispah	15%
Mispah	20%	Bare rock	30%	Bare rock	10%	Stream beds	20%

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 4% with some irregularities in areas with slopes reaching 7%. 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 813 to 859 Metres Above Sea Level (MASL).

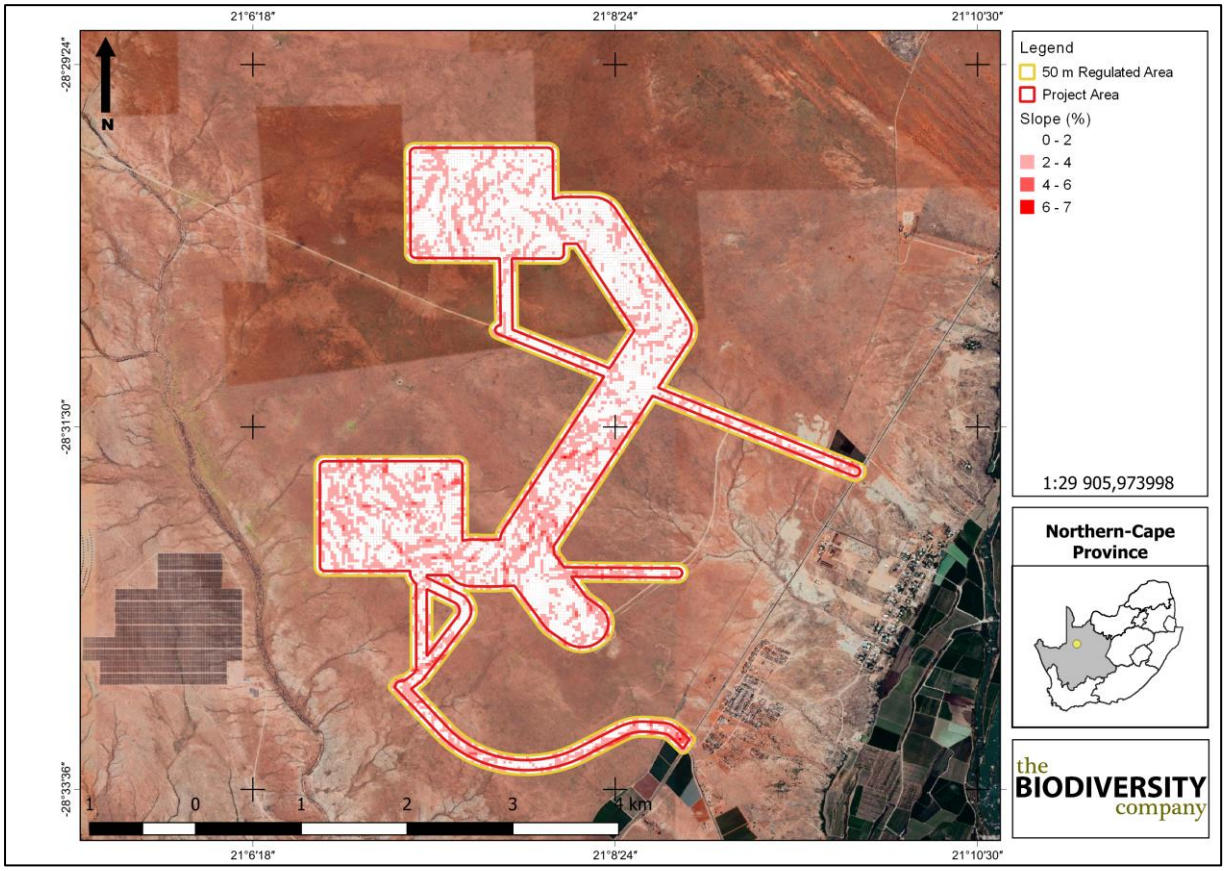

Figure 4-3 Slope percentage map for the project area

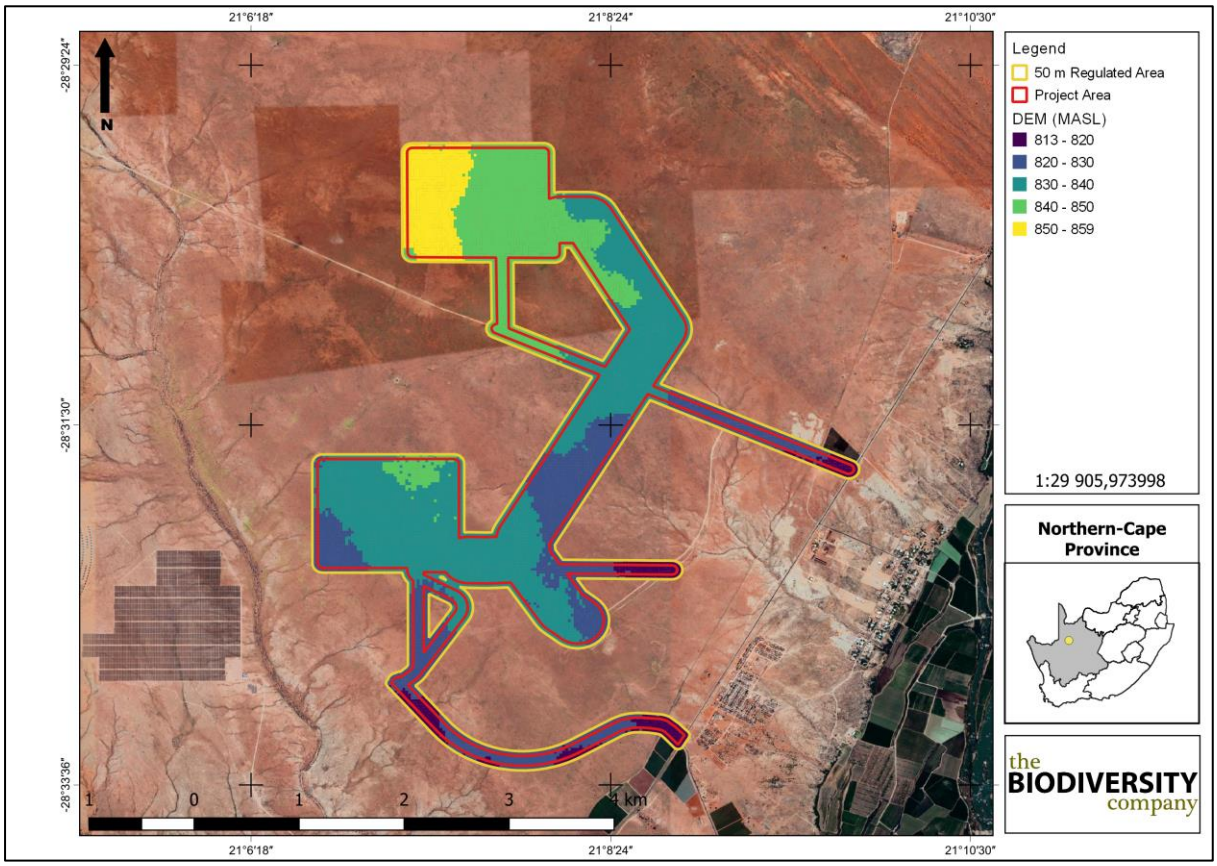

Figure 4-4 Digital Elevation Model of the project area (Metres Above Sea Level)

5 Results and Discussion

5.1 Baseline finding

The most sensitive soil forms identified within the assessment area are Hutton and Dundee soil forms, with other associated soils also occurring. The Hutton soil form consists of an orthic topsoil on top of a thick red apedal subsoil horizon. Dundee soil form consists of an orthic topsoil on top of a thick alluvial subsoil horizon (see Figure 5-1).

The land capability of the above-mentioned soil forms has been determined to have land capacity classes of “IV” and “VI” with a climate capacity 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 “L6” and “L7”. The “L6” land potential level is characterised by a *very restricted potential. Regular and/or severe limitations that occurs due to soil, slope, temperatures or rainfall*. The “L7” land potential level is characterised by low potential. Severe limitations due to soil, slope, temperature or rainfall. These areas are non-arable. The “L6” and “L7” land potentials are characterised with a “Low to Moderate” sensitivity.

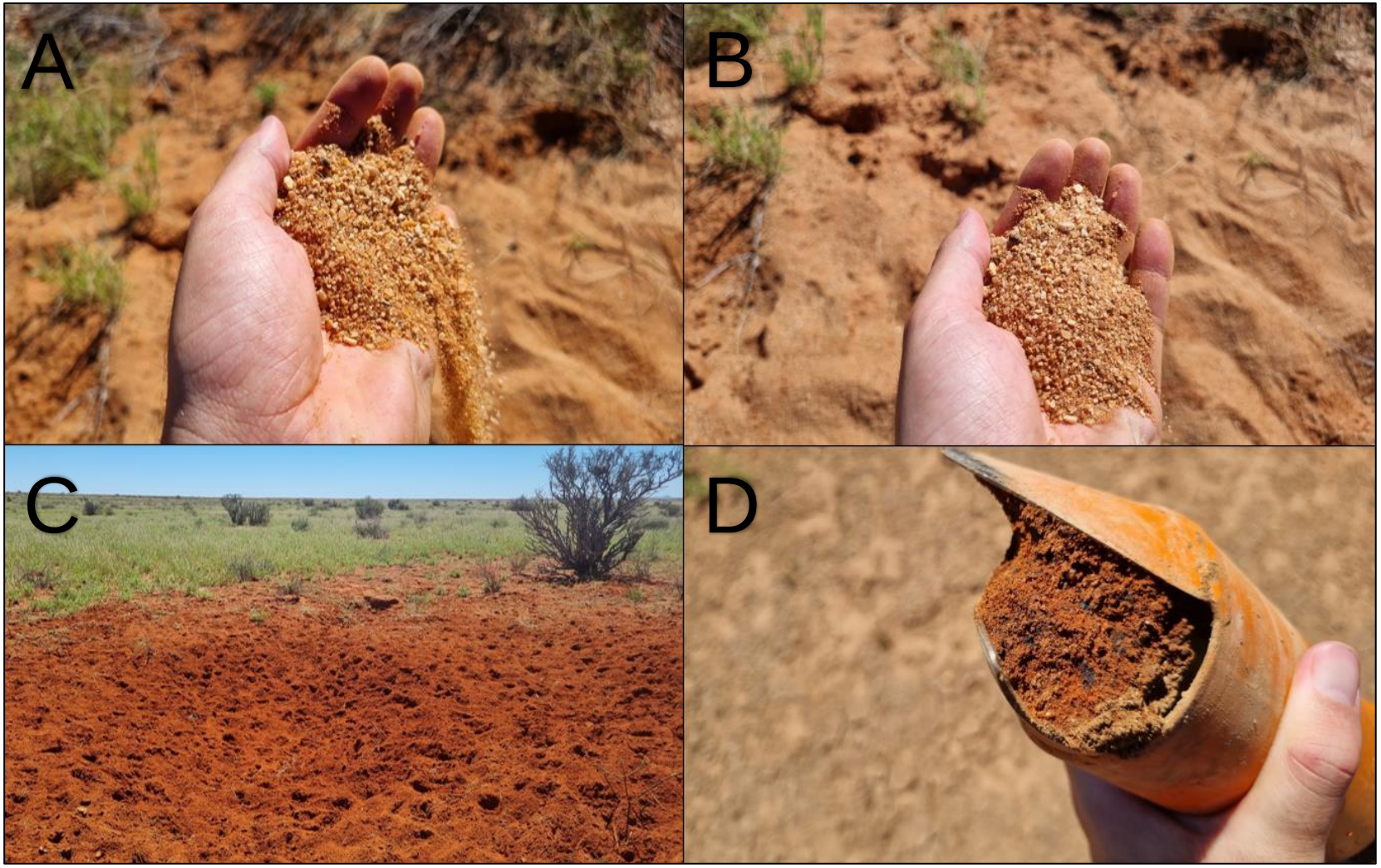

Figure 5-1 A and B) Alluvial material (unconsolidated fluvial), C) Chromic (red) orthic topsoil, and D) red apedal subsoil horizon with limited occurrence of black mottles

5.2 Sensitivity Verification

The following land potential levels have been determined;

- Land potential level 6 (this land potential is characterised by a very restrictive potential. Regular and/or severe limitation due to soil, slope, temperature, or rainfall. Non arable); and
- Land potential level 7 (this land potential is characterised by a low potential. Severe limitations due to soil, slope, temperatures, or rainfall. Non arable).

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which five 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).

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 Kiwano BESS and PV project is characterised with "Very Low" to "Low" land capability sensitivities (DEA screening tool, 2022; Figure 5-2). It is also the specialist's opinion that the land capability and land potential of the resources in the regulated area is characterised by "Very Low" to "Low" sensitivities, which conforms to the requirements of an agricultural compliance statement only. However, the DEA screening tool, (2022) shows that there are some crop fields with "High" sensitivity within the assessment area for Site B (see Figure 5-3). This may require the project area to be adjusted to avoid these crop fields or to negotiate with the landowners to utilise the high crop field sensitivity areas while applying mitigation measures.

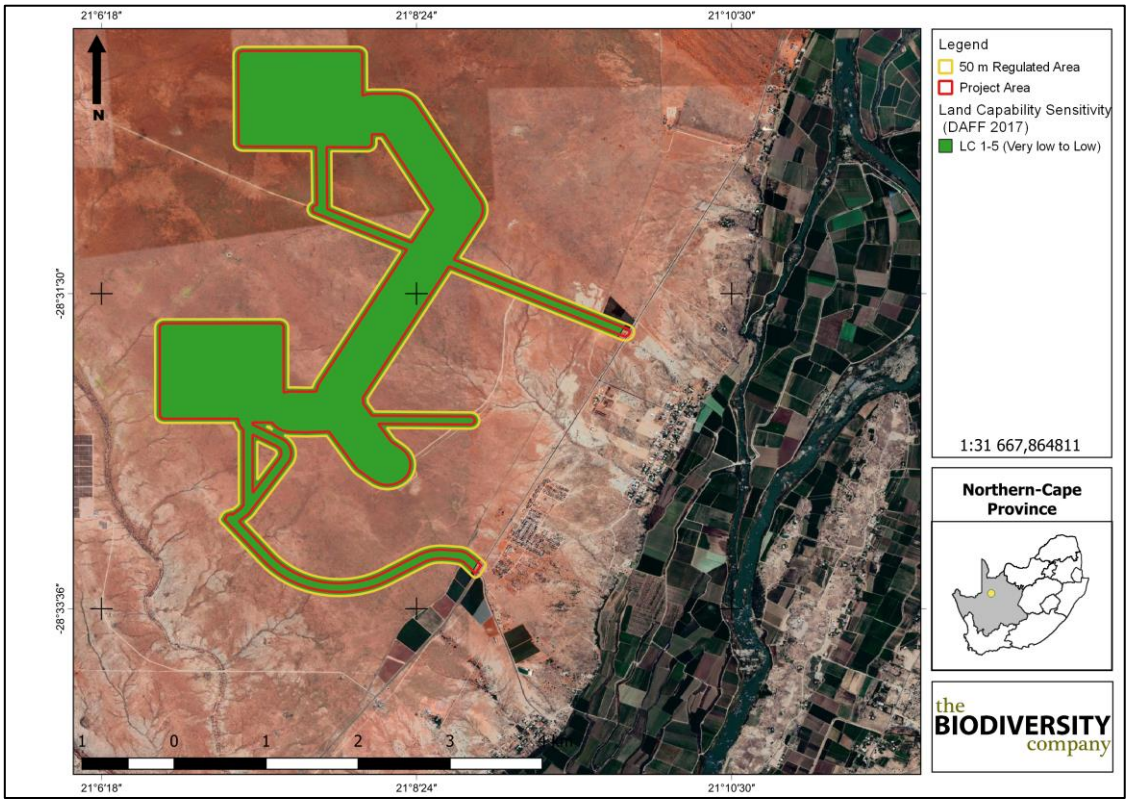

Figure 5-2 The land capability sensitivity for Kiwano (DAFF, 2017)

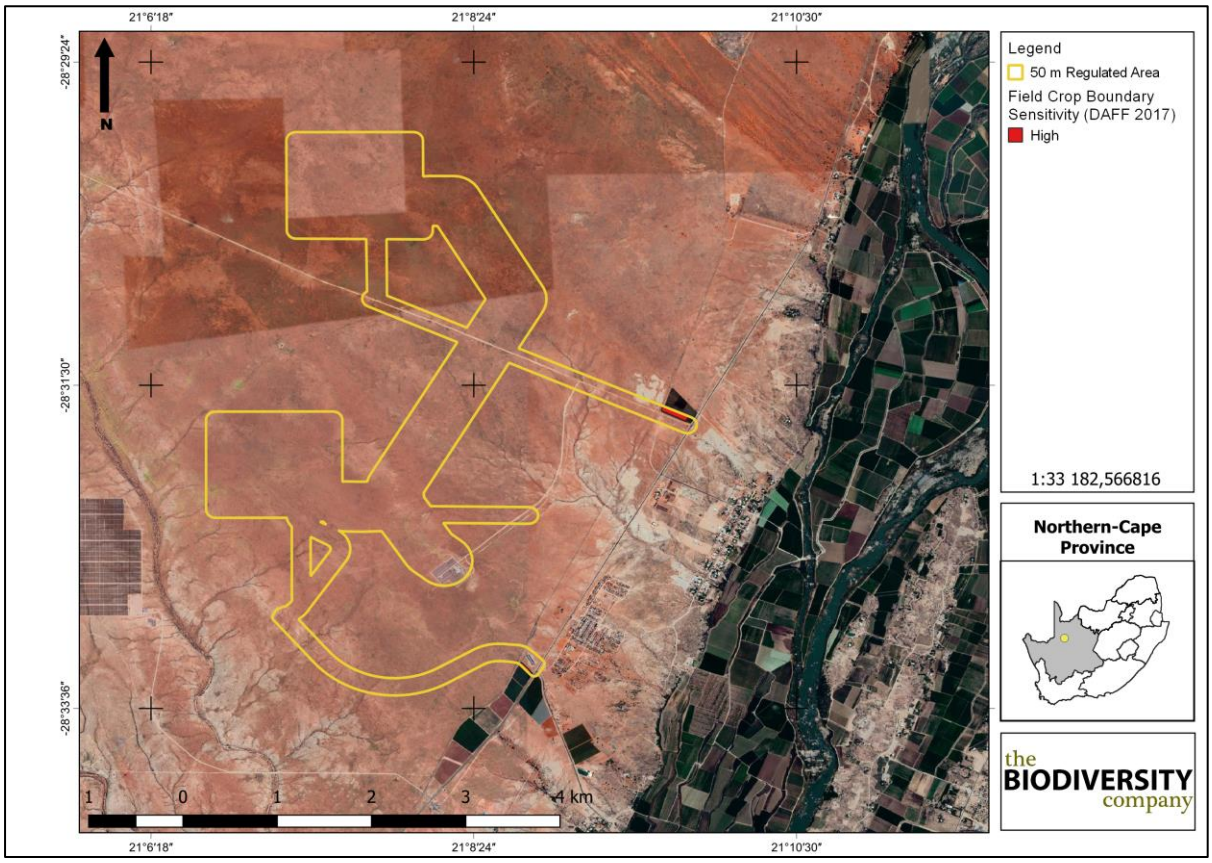

Figure 5-3 The crop boundary sensitivity for Kiwano (DAFF, 2017)

6 Conclusion

The most sensitive soil forms identified within the assessment area are the Hutton and Dundee soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Very low to Low” sensitivities, which correlates with the findings from the baseline assessment.

The assessment area is associated with non-arable lands, due to the type of soils in the area. The available climate limits crop production significantly. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area, which consequently result into a very restricted choice of crops due to the heat and moisture stress. The area is not favourable for most cropping practices, which corresponds to the current agriculture (grazing) and renewable energy facilities activities.

It is the specialist’s opinion that the proposed project and associated infrastructure will have no impacts on the agricultural ability of the land. Site B exhibited small patches of high crop boundary sensitivity, along the 50 m buffer. However, the proposed water pipeline will be located within the existing road reserve and for that reason, any existing crop filed will most certainly be avoided. Therefore, the proposed development will have no impact on the high crop boundary sensitivity areas.

Either of the two alternatives may be chosen as both are associated with land capabilities with “Very Low to Low” sensitivities. Site A is preferred to Site B due to the presence of “High” sensitivity crop fields within the Site B pipeline corridor. Both pipeline alternatives will avoid placement within crop fields, and will be aligned within existing linear reserves. It is the specialist`s recommendation that, the proposed project and associate infrastructure may be favourably considered.

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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