PEDOLOGY BASELINE & IMPACT ASSESSMENT FOR THE PROPOSED MAINSTREAM STILFONTEIN SOLAR CLUSTER & GRID PROJECTS

Swift PV Facility

Stilfontein, North West Province

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CLIENT

srk consulting

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Acronyms and Abbreviations

BAR	Basic Assessment Report
BESS	Battery Energy Storage Systems
DEA	Department of Environmental Affairs (now known as the Department of Forestry and Fisheries and the Environment (DFFE))
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
GIS	Geographic Information Systems
LC	Land Capability
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential Evaporation
MASL	Metres Above Sea Level
MTS	Main Transmission Substation
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
PAOI	Project Area of Influence
PV	Photovoltaic
QDS	Quarter Degree Square
REDZ	Renewable Energy Development Zones
REIPPP	Renewable Independent Power Producer Programme
STC	Strategic Transmission Corridor
TBC	The Biodiversity Company
WMA	Water Management Area

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
Locality of the proposed activity	Section 4.1
Sensitivity verification	Section 6.9
Acceptability of impacts towards agricultural production capability associated with proposed activities	Section 8
Declaration of specialist(s)	Section 1.3
Project components with 50 m regulated area superimposed to that of the agricultural sensitivities of the screening tool	Section 6
Confirmation from specialist that mitigation to avoid fragmentation has been considered	Section 7.2
Statement from specialist regarding the acceptability and approval of proposed activities	Section 8.2
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 7.2
Assumptions and uncertainties	Section 5

1 Introduction

1.1 Background

The Biodiversity Company was commissioned to conduct a pedology assessment for the proposed Stilfontein Photovoltaic (PV) Cluster and grid development. South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) proposes the construction and operation of nine PV facilities with up to 150 MW generation capacity each, including grid connections, battery energy storage system (BESS) and associated infrastructure. The project is located in the JB Marks and City of Matlosana Local Municipalities and Dr Kenneth Kaunda District Municipality in the North-West Province (Figure 4-1). The project site is located approximately 13 km east of the town of Stilfontein along the N12 and forms part of the larger proposed Stilfontein PV Cluster.

The purpose of the proposed development is to generate and sell electricity to Eskom as part of the Renewable Independent Power Producer Procurement Programme (REIPPPP). Electricity will either be fed directly into the national grid or stored on site in a BESS and fed into the grid when needed.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017, including subsequent amendments) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and relevant Government Notices, as applicable. The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). The agricultural theme sensitivity for the area is predominantly rated as medium, with limited areas of both low and high sensitivity. One site visit was conducted from the 21st to the 25th of February 2022, this constitutes a wet season survey.

This report aims to present and discuss the soil resources identified on-site, their agricultural and land potential, the land uses within the project area as well as the anticipated impacts associated with the proposed renewable energy project.

1.2 Overview

1.2.1 Stilfontein Cluster

The project forms part of the larger proposed Stilfontein PV Cluster, which comprises nine PV facilities each generating up to 150 MW, including grid connections, BESS and associated infrastructure. ***Separate Environmental Authorisations (EA) applications will be submitted for the individual PV facilities and grid connections through separate BA processes*** (see below). The Stilfontein Cluster is briefly described here.

The Stilfontein Cluster is entirely located within the Klerksdorp Renewable Energy Development Zones (REDZ) and the Central Strategic Transmission Corridor (STC).

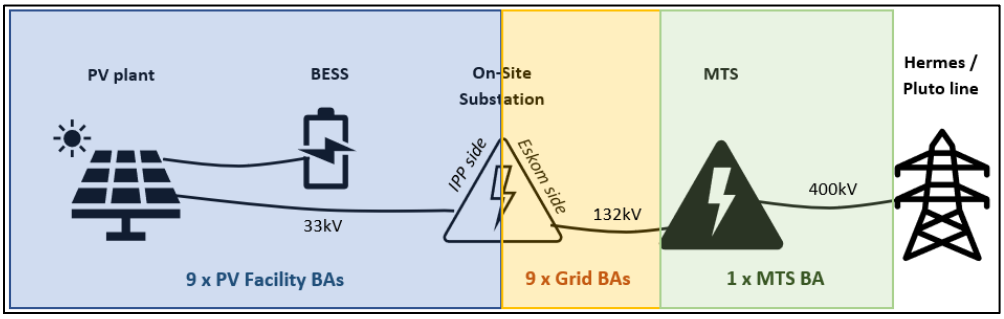

Figure 1-1 Components included in individual BA processes for the Stilfontein Cluster

1.2.2 PV Facilities

The Stilfontein Cluster comprises nine proposed PV facilities, each with a development area of ~220-405 ha: Spoonbill (Project 1), Sunbird (Project 2), Swallow (Project 3), Snipe (Project 4), Shrike (Project 5), Stilfontein (Project 6), Sparrow (Project 7), Starling (Project 8) and Swift (Project 9) (see Figure 1-2).

Each PV facility comprises the following key components:

- PV single axis tracking arrays with a maximum export capacity of up to 150 MW and a maximum height of 5 m. Panel technology will be either monofacial or bifacial;
- Internal gravel roads with a maximum width of up to 12 m;
- Power transformers;
- Fencing and lighting;
- Material laydown areas;
- Stormwater infrastructure;
- Water supply and water storage infrastructure;
- Offices, including ablutions with septic / conservancy tank sewage treatment infrastructure;
- Operational control centre and maintenance area;
- Lithium-Ion BESS;
- IPP-side of the 11-33/132kV on-site substation, each serving one PV facility. The proposed step-up substation facility will have a development footprint of up to 4 ha, with a 100 m wide buffer around each on-site substation to accommodate powerline tie-ins at any point of the substation and other associated activities. Two alternative locations are identified for each substation;
- Medium voltage 11-33kV underground cabling and / or overhead power lines between the PV facilities and on-site substation33kV underground cabling and overhead power lines between the PV facilities and collector substations; and
- IPP-side of 33/132kV collector substation.

1.3 Report Structure

The entire proposed development area of the Stilfontein Cluster was collectively assessed and forms the Project Area of Influence (PAOI) referred to as ‘project area’ from hereon. All baseline findings are presented for the project area, with a supporting Impact Assessment and EMPr for the project area. The following structure is applicable for this report:

- Project-specific baseline aspects;
- Project-specific baseline / sensitivity map;
- Project-specific impact rating; and
- Project-specific mitigation measures.
- Project-specific conclusion / specialist opinion.

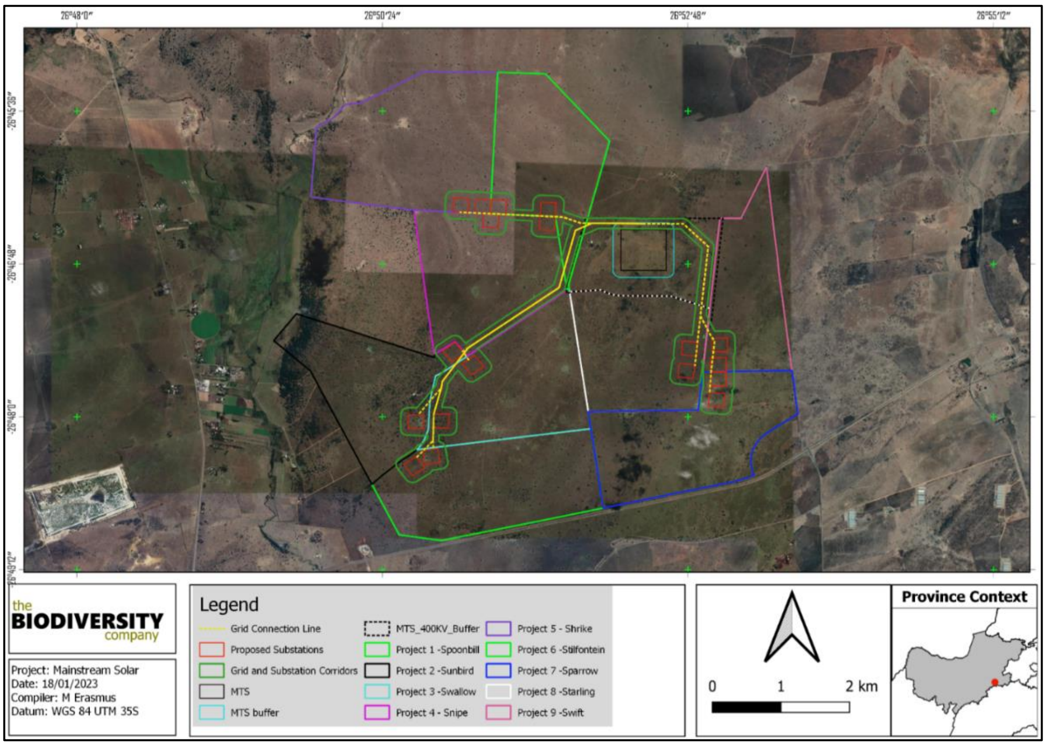

Figure 1-2 Layout of the different aspects of the Mainstream solar project

Note: Two alternative substation sites and two corresponding powerline corridors are considered per PV project.

1.4 Specialist Details

Report Name	**PEDOLOGY BASELINE & IMPACT ASSESSMENT FOR THE PROPOSED MAINSTREAM STILFONTEIN SOLAR CLUSTER & GRID PROJECTS**	
Reference	**Mainstream Stilfontein Solar Projects**	
Submitted to	srk consulting	
Fieldwork	**Michael Douglas**	
	Michael Douglas is a soil scientist with experience in soil classification. Michael completed his BSc Honours in environmental science and geological science at the North-West University of Potchefstroom. Michael has been part of various agricultural potential, land capability and pedology studies as part of Environmental Impact Assessments and Basic Assessments.	
Report Writer	**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.	
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.	

2 Scope of Work

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- To conduct a soil assessment which includes a description of the physical properties which characterise the soil within the proposed area of development of the relevant portions of the property;
- Using the findings from the soil assessment to determine the existing land capability/potential and current land use of the entire surface area of the relevant portions of the project area;
- To determine the sensitivity of the baseline findings;
- The soil classification was done according to the Taxonomic Soil Classification System for South Africa, 1991. The following attributes must be included at each observation:
    - Soil form and family (Taxonomic Soil Classification System for South Africa, 1991);
    - Soil depth;
    - Estimated soil texture;
    - Soil structure, coarse fragments, calcareousness;
    - Buffer capacities;
    - Underlying material;
    - Current land use; and
    - Land capability.
- Compile an impact assessment to indicate the significance of the expected impacts;
- Discussing the feasibility of the proposed activities;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation; and
- Recommend relevant mitigation measures to limit all associated impacts.

3 Key Legislative Requirements

Currently, various pieces of legislation and related policies exist that guide and direct the land user in terms of land use planning both on a national and provincial level. This legislation includes, but is not limited to:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- Sub-division of Agricultural Land Act (Act 70 of 1970);
- Municipal Structures Act (Act 117 of 1998);
- Municipal Systems Act (Act 32 of 2000); and
- Spatial Planning and Land Use Management Act, 16 of 2013 (not yet implemented).

The above mentioned are supported by additional legislation that aims to manage the impact of development on the environment and the natural resource base of the country. Related legislation to this effect includes:

- Conservation of Agricultural Resources Act (Act 43 of 1983);
- National Environmental Management Act (Act 107 of 1998); and
- National Water Act (Act 36 of 1998).

The legislation, policies and guidelines listed in Table 3-1 are applicable to the current project, an accompanying comment has been provided to express the relevance to the project. The list, although extensive, may not be complete and other legislation, policies and guidelines may apply as well.

Table 3-1 A list of key legislative requirements relevant to biodiversity and conservation in the North West Province

Region	Legislation / Guideline	Comment
National	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)	Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017), Appendix 6 requirements
	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, GNR 320 of Government Gazette 43310 (March 2020)	The minimum criteria for reporting.
	National Water Act (NWA) (Act No. 36 of 1998)	The regulation of water uses.
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)	To provide for control over the utilization of the natural agricultural resources including the vegetation and the combating of weeds and invader plants.
	Government Notice No. 113 in Government Gazette No. 41445 and Government Notice No. 383 in Government Gazette No. 44504. Government Notice No. 2313 of Government Gazette No. 47095 of 27 July 2022	Strategic Transmission Corridors (STC) important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.
	Government Notice No. 114 in Government Gazette No. 41445 and Government Notice No. 142, 144 and 145 in Government Gazette No. 44191	The procedure to be followed when applying for environmental authorisation for electricity transmission or distribution infrastructure or large scale wind and solar photovoltaic energy facilities in these REDZs

4 Methodology

4.1 Project Area

The proposed solar projects are located approximately 22 km south-west of Potchefstroom and approximately 13 km north-east of Stilfontein, North-West Province. The project area is situated in the C24A quaternary catchment within the Vaal Water Management Area (WMA) (see Figure 4-1).

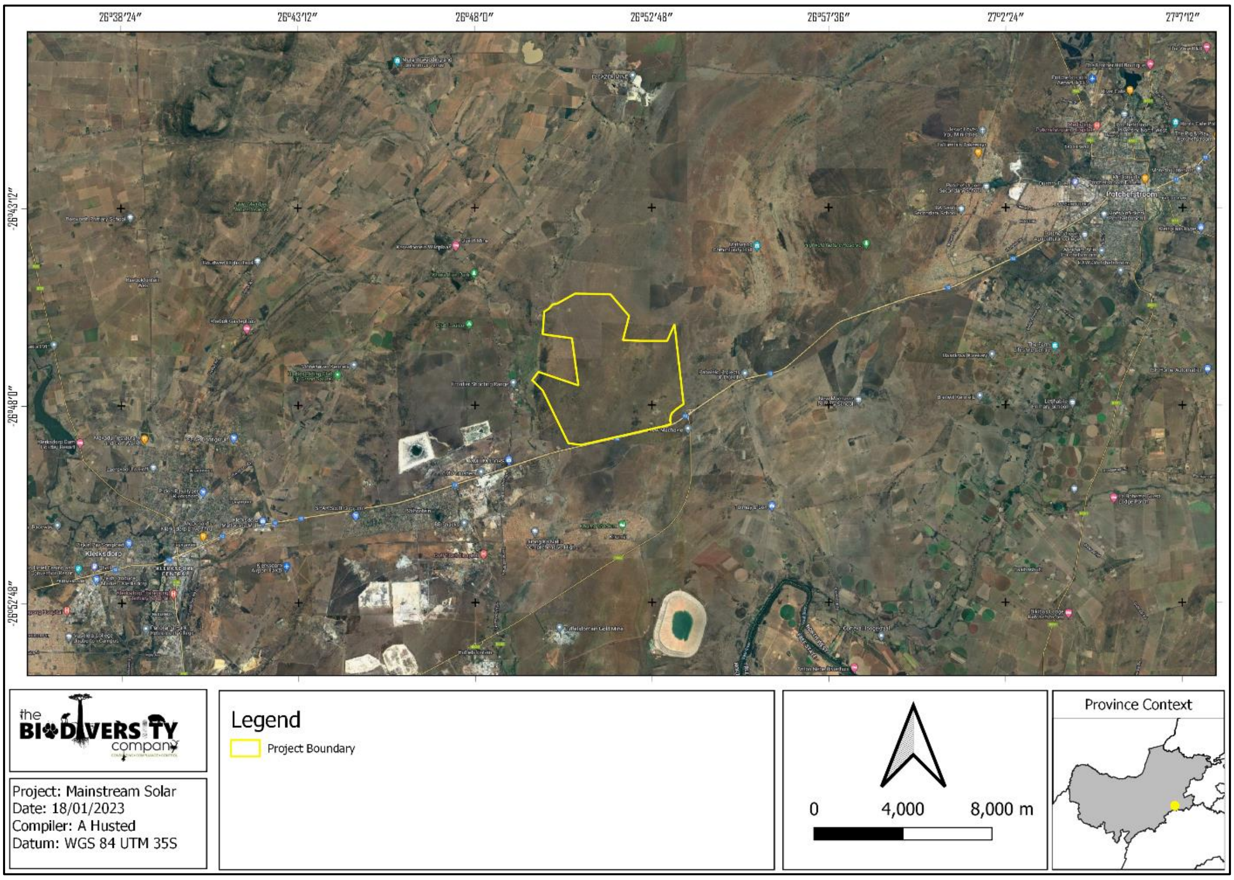

Figure 4-1 Location of the project area

4.2 Land Capability

Given 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 (DALRRD, 2017). The land capability and land potential took into consideration the National Land Capability Evaluation Raster Data Layer (DAFF, 2017). Where applicable, the necessary category adjustments were made to provide a representative land capability description for the area.

The assessment was broken into two phases. Phase 1 was a desktop assessment to determine the following:

- Historic climatic conditions;
- The terrain features using 5 m contours;
- The base soils information from the land type database (Land Type Survey Staff, 1972 - 2006); and
- The geology for the proposed project site.

Phase 2 was a soil survey to determine the actual agricultural potential. During this phase the current land use was also surveyed.

4.2.1 Agricultural Potential Assessment

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

Land capability is divided into eight classes, and these may be divided into three capability groups. Table 4-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use and sensitivity increases from class I to class VIII (Smith, 2006).

Table 4-1 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 4-2. The final land potential results are then described in Table 4-2. These land potential classes are regarded as the final baseline results associated with sensitivity.

The main contributors to the climatic conditions as per Smith (2006) are Mean Annual Precipitation (MAP), Mean Annual Potential Evaporation (MAPE), mean September temperatures, mean June temperatures and mean annual temperatures. These parameters will be derived from Mucina and Rutherford (2006) for each vegetation type located within the project area. This will give the specialist the opportunity to consider micro-climate, aspect, topography etc.

Table 4-2 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 4-3 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

4.2.2 Climate Capability

According to Smith (2006), climatic capability is determined by considering temperature, rainfall and Class A-pan[1] of a region. The first step is to determine the MAP to Class A-pan ratio.

Table 4-4 Climatic capability (step 1) (Scotney et al., 1987)

Climatic Capability Class	Limitation Rating	Description	MAP: Class A pan Class
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

In the event that the MAP: Class A-pan ratio is within C7 or C8, no further analysis is required to refine climatic capability. In cases where the ratio falls within C1-C6, steps 2 to 3 are required to further refine the climatic capability.

Step 2

Determine mean September temperatures to adjust C1 to C6 classes accordingly:

- <10℃ = C6

[1] Evapotranspiration, which is the combined process of water surface evaporation, soil moisture evaporation, and plant transpiration

- 10 - 11℃ = C5
- 11 - 12℃ = C4
- 12 - 13℃ = C3
- >13℃ = C1

Step 3

Determine mean June temperatures to adjust C1 to C6 classes accordingly:

- <9℃ = C5
- 9 - 10℃ = C4
- 10 - 11℃ = C3
- 11 - 12℃ = C2

4.2.3 Current Land Use

A generalised land-use will be derived for the larger project area considering agricultural productivity.

- Mining;
- Bare areas;
- Agriculture crops;
- Natural veld;
- Grazing lands;
- Forest;
- Plantation;
- Urban;
- Built-up;
- Waterbodies; and
- Wetlands.

The land capability of the proposed footprint was compared to the National Land Capability which was refined in 2014- 2016. The National Land Capability methodology is based on a spatial evaluation modelling approach and a raster spatial data layer consisting of fifteen (15) land capability evaluation values (

Table ***4-5***), usable on a scale of 1:50 000 – 1:100 000 (DAFF, 2017). The previous system is based on a classification approach, with 8 classes (Table 4-1).

Table 4-5 National Land Capability Values (DAFF, 2017)

Land Capability Evaluation Value	Land Capability Description
1	Very low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

5 Knowledge Gaps

The following aspects were considered as limitations:

- It has been assumed that the extent of the project area provided to the specialist is accurate for this update. Fieldwork was only completed for the previous project extent, and findings have been extrapolated for this update;
- Due to time constraints, only selected areas could be accessed and ground-truthed, with the remaining areas primarily assessed at a desktop level. This is deemed acceptable and won't affect the report findings; and
- The GPS used for delineations is accurate to within five meters.

6 Results & Discussion

The following sections include findings from the desktop analysis and the processing of results from field observations that are relevant to the agricultural potential of the project area.

6.1 Desktop Assessment

6.1.1 Vegetation Types

According to Mucina & Rutherford (2006), the project site is located within the Carletonville Dolomite Grassland (Gh 15) and the Vaal Reefs Dolomite Sinkhole Woodland (Gh 12) vegetation types.

6.1.1.1 Carletonville Dolomite Grassland (Gh 15)

The Carletonville Dolomite Grassland (Gh 15) vegetation type is distributed predominantly in the North-West and Gauteng province with a small portion being distributed within the Free State. This vegetation type ranges from Ventersdorp in the west to as far east as Centurion and Bapsfontein. The altitude of this vegetation type ranges between 1 360 meters above sea level to 1 620 meters above sea level (Mucina & Rutherford, 2006).

The vegetation within the Gh 15 vegetation type occurs in slightly undulating plains which are dissected by rocky ridges consisting of chert. This vegetation is associated with species-rich grasslands which form complex patterns dominated by a variety of species (Mucina & Rutherford, 2006).

The conservation status of the Gh 15 vegetation type has been determined to be Vulnerable with a target percentage of 24. A small extent of this vegetation type is conserved in conservation areas which include the Sterkfontein Caves and Cradle of Humankind in general, the Oog Van Malmanie, Boskop Dam, Abe Bailey, Krugersdorp, Schoonspruit, Olifantsvlei and other private conservation areas. Approximately a quarter of this vegetation type has been transformed into cultivated lands, mining areas or built-up areas (Mucina & Rutherford, 2006).

6.1.1.2 Vaal Reefs Dolomite Sinkhole Woodland (Gh 12)

The distribution of this vegetation type predominately is in the North-West and Free State Provinces with small areas located in and around Stilfontein and Orkney. The Vaal River acts as the southern boundary of this vegetation type. Vaal reefs Dolomite Sinkhole Woodlands are found at an altitude ranging from 1 280 to 1 380 Metres Above Sea Level (MASL) (Mucina & Rutherford, 2006).

The vegetation within the Gh 12 vegetation type occurs in slightly undulating plains which are dissected by rocky ridges consisting of chert. This vegetation is associated with woodland clumps occurring around sinkholes (Mucina & Rutherford, 2006).

The conservation status of the Gh 12 vegetation type has been determined to be Vulnerable with a target percentage of 24. A small extent of this vegetation type is conserved in conservation areas which include the Sterkfontein Caves and Cradle of Humankind in general, the proposed Highveld National Park is supposed to conserve large areas of this vegetation unit. Approximately a quarter of this vegetation type has been transformed into cultivated lands, mining areas or built-up areas (Mucina & Rutherford, 2006).

6.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Fa 14 and Fa 13 land types. The Fa land type is characterised by Glenrosa and/or Mispah soil forms which are common in this area, however, other soils may occur. Lime is rare or absent throughout the entire landscape.

The surrounding areas are underlain by Archaean gneiss and granite which is partially covered by Karoo Supergroup sediments and is intruded by sills and dykes from the Karoo Dolerite Suite. Yellow apedal soils are dominant on sedimentary parent material and is well drained, has more than 35% clay and is deeper than 800 mm. Hutton, Griffin and Clovelly soils are widely spread. Shortland soil forms are dominant on dolerite. The expected terrain units and corresponding soil forms are illustrated in Figure 6-1 and Table 6-1 respectively. It is worth noting that the Fa13 and 14 land types are identical in this regard. The numbers illustrated on the relevant figures indicate the terrain units.

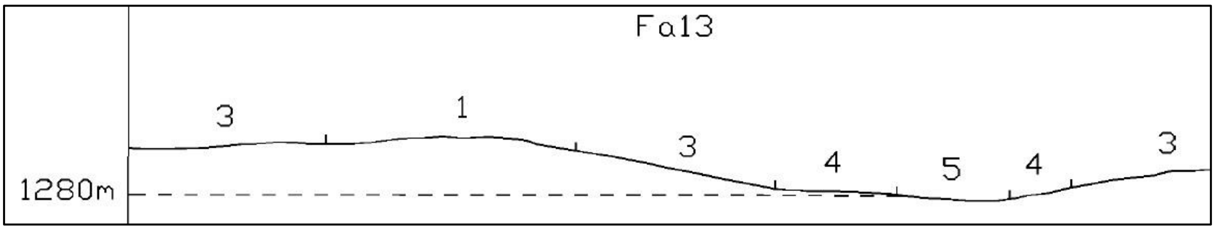

Figure 6-1 Illustration of land type Fa 13 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 6-1 ***Soils expected at the respective terrain units within the Fa 13 land type (Land Type Survey Staff, 1972 - 2006)***

Terrain Units							
1 (25%)		**2 (60%)**		**4 (10%)**		**5 (5%)**	
Glenrosa	72%	Hutton	47%	Hutton	50%	Hutton	40%
Bare Rock	16%	Glenrosa	46%	Glenrosa	33%	Willowbrook	40%
Hutton	12%	Bare Rock	7%	Bare Rock	17%	Glenrosa	14%
						Bare Rock	6%

6.3 Climate

The project area is characterised by a warm-temperate summer rainfall with an overall mean annual precipitation of approximately 593 mm (Mucina & Rutherford, 2006). Frost frequently occurs in winter months and high temperatures occur in the summer months (see Figure 6-2).

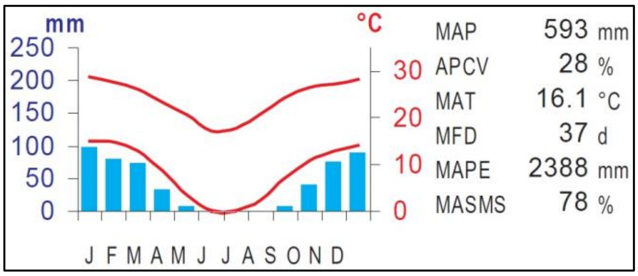

Figure 6-2 ***Climate diagram for the region (Mucina & Rutherford, 2006)***

6.4 Terrain Analysis

The slope percentage of the project area has been calculated and is illustrated in Figure 6-3. 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 up to 17.5%. This illustration indicates a non-uniform topography throughout the project area. The elevation of the project area (Figure 6-4) indicates an elevation of 1339 to 1401 Metres Above Sea Level (MASL).

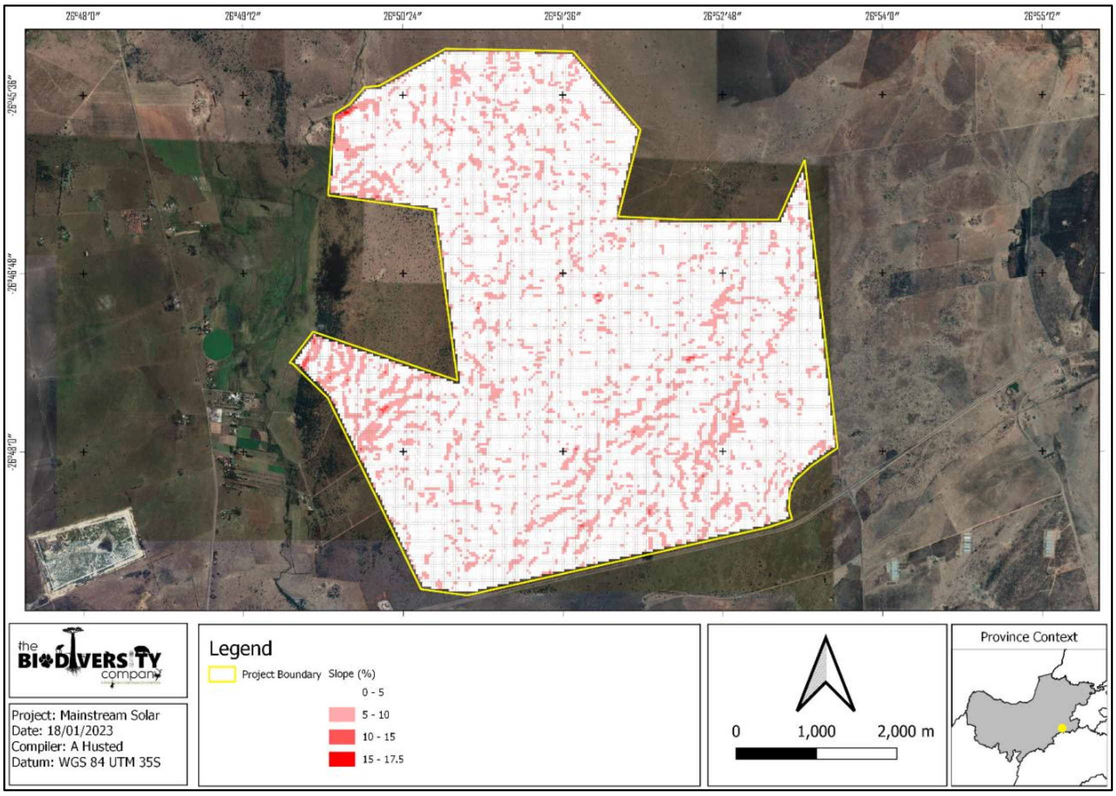

Figure 6-3 Slope percentage map for the project area

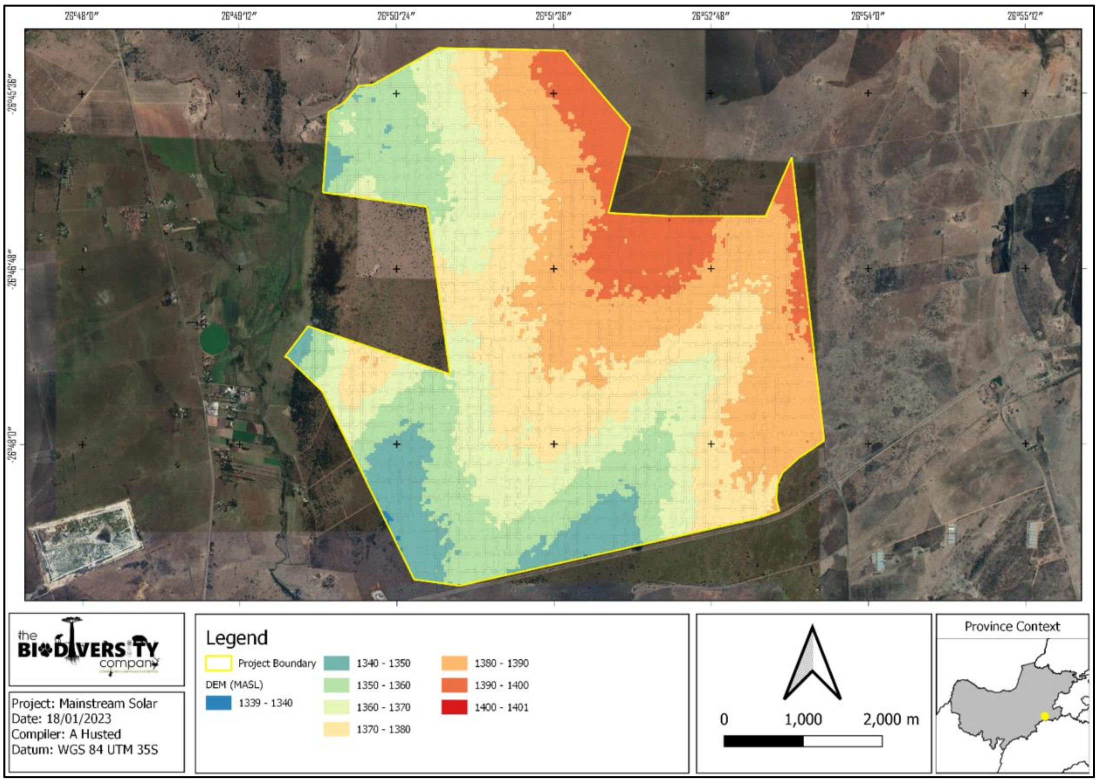

Figure 6-4 Elevation of the project area (metres above sea level)

6.5 Description of Identified 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. The following diagnostic horizons were identified during the site assessment:

- Orthic topsoil;
- Gley horizon;
- Lithocutanic horizon; and
- Red apedal horizon.

6.5.1 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).

6.5.2 Lithocutanic Horizon

For the Lithocutanic horizon, *in 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.

6.5.3 Red Aepdal 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).

6.5.4 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) are 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).

6.6 Description of Soil Forms and Soil Families

Based on soil profiles and diagnostic horizons identified, three soil forms were identified, namely the Katspruit, Vaalbos and Glenrosa soil form, of which the latter comprises approximately 90% of the project area. The Vaalbos soil form is scattered throughout and takes up small pockets of deeper red apedal soil. These pockets however are few and small in extent and could not be delineated. Therefore, only the Glenrosa and Katspruit soil forms have been delineated as shown in Figure 6-5 and described in Table 6-2, according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage of 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 6-3.

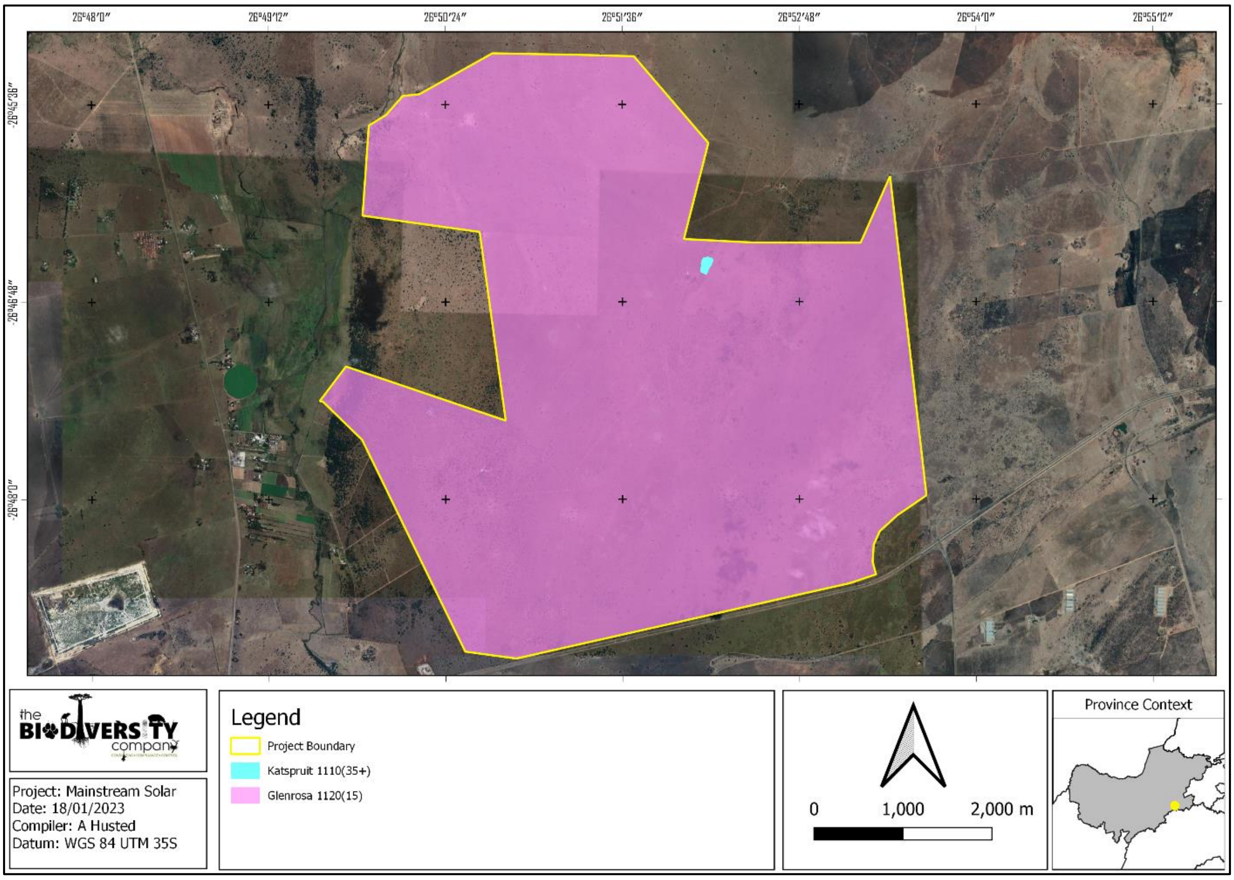

Figure 6-5 Soil delineations within the project area

Table 6-2 Summary of soils delineated within the project area

	Topsoil					Subsoil A			
	Depth (mm)	**Clay (%)**	**Signs of wetness**	**Rock %**	**Surface crusting**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**
Glenrosa 1120(15)	0-300	0-15	None	>30	None	N/A[2]			
Katspruit 1110(35+)	0-300	15-35	None	0	None	300 to 800	>35	None	0

Table 6-3 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Consistence of Gley	Occurrence of Lime	Extent of Lithic Weathering
Glenrosa 1120(15)	Dark	N/A	Lime Absent	Geolithic
Katspruit 1110(35+)	Dark/Chromic Topsoil	Friable and/or sand/loamy sand texture in gley	None	N/A

[2] Glenrosa soil form is located on a Lithic (rock) horizon, and subsoil characteristics are not applicable. Katspruit soil forms were recorded outside the project area.

6.7 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.

6.7.1 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).

Table 6-4 Climate capability of the project area (step 1) (Scotney et al., 1987)

Central Sandy Bushveld region				
Climatic Capability Class	Limitation Rating	Description	MAP: Class A pan Class	Applicability to site
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	✔

The MAP has been determined to be 593 mm with the Class A-pan being 2388 mm. Therefore, the MAP to Class A-pan ratio has been calculated to be 0,25, which constitutes a climate capability of C8. Given the fact that the climatic capability has been determined to be "C8" during the first step, no further refinements will be made.

6.7.2 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 (0-4%, 4-8%, 8-12% and >12%) to determine the land capability of each soil form. These land capabilities were then grouped together in two different land capability classes (land capability 5 and 6).

It is however worth noting that, even though the slope percentage of an area plays a considerable role in the formation and morphology of soil forms, the slope class is not the only parameter used to determine land capability. All parameters listed in

Table 6-3 are also used to calculate land capability together with slope percentage. Key parameters used to determine the land capability include topsoil texture, depth and the permeability class of a soil form. The land capabilities for the project area are described in Table 6-5 and illustrated in Figure 6-7.

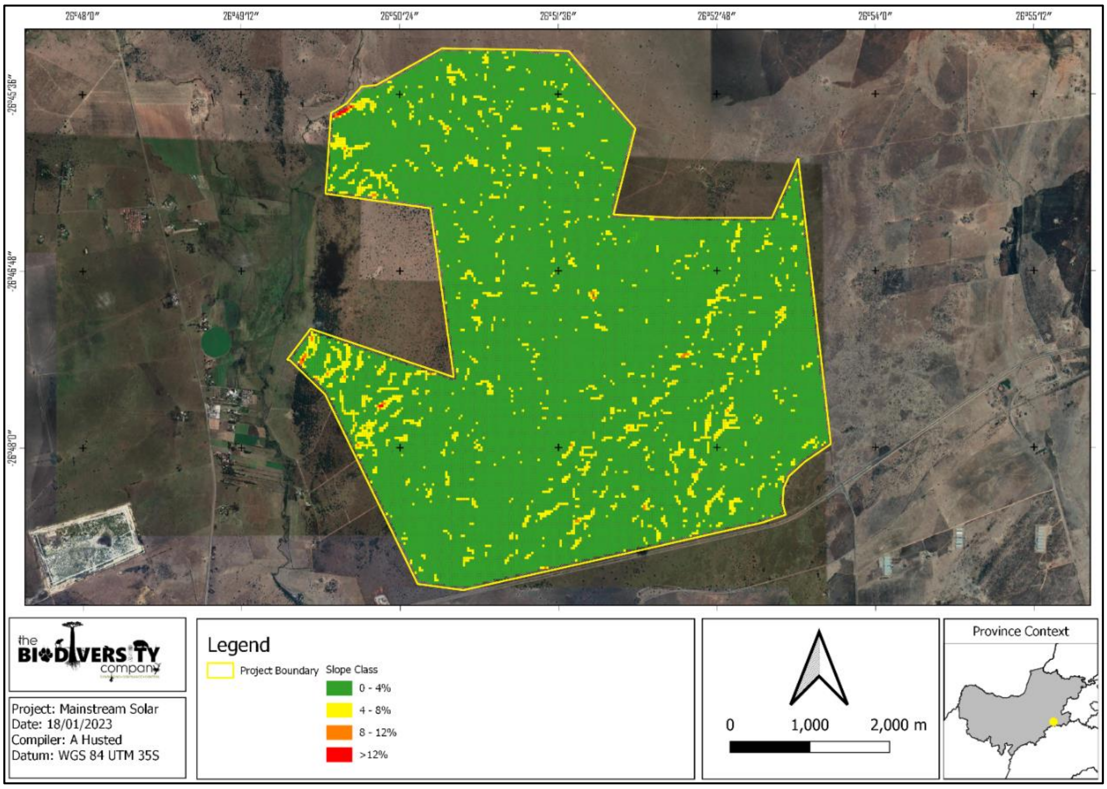

Figure 6-6 Four slope classes relevant to the land capability calculation methodology

Table 6-5 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage Within Project Area	Land Capability Group	Sensitivity
V	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	0.1	Grazing	Low
VI	Limitations preclude cultivation. Suitable for perennial vegetation	Protection measures for establishment, e.g., sod-seeding	Veld, pastures and afforestation	99.9	Grazing	Low

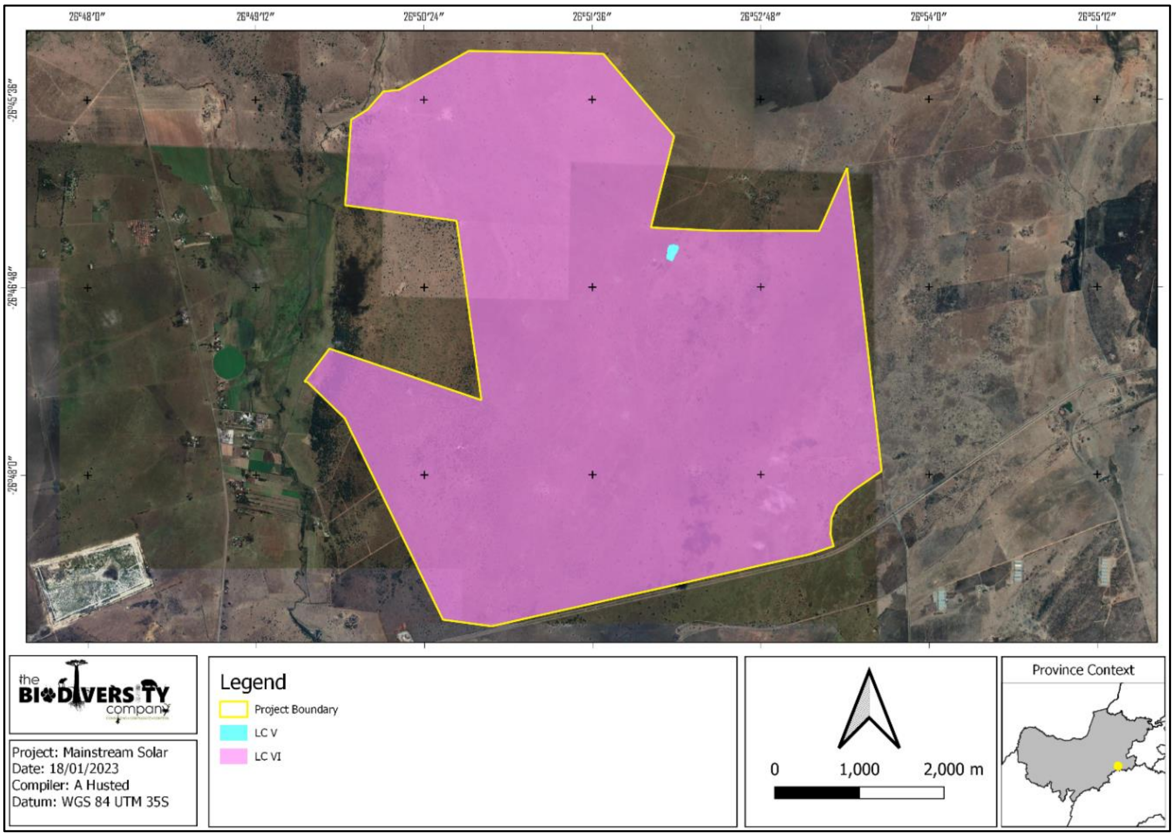

Figure 6-7 Land capability classes for the project area (LCV – Land Capability Class 5, CLVI - Land Capability Class 6)

6.7.3 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in

Table 6-6 and Table 6-7. From the two land capability classes, two land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability VI has been reduced to a land potential level L7. The land capability V is characterised by a "Vlei" land potential level (see Figure 6-8).

Table 6-6 ***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
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L2	L2	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

*Land potential level applicable to project site

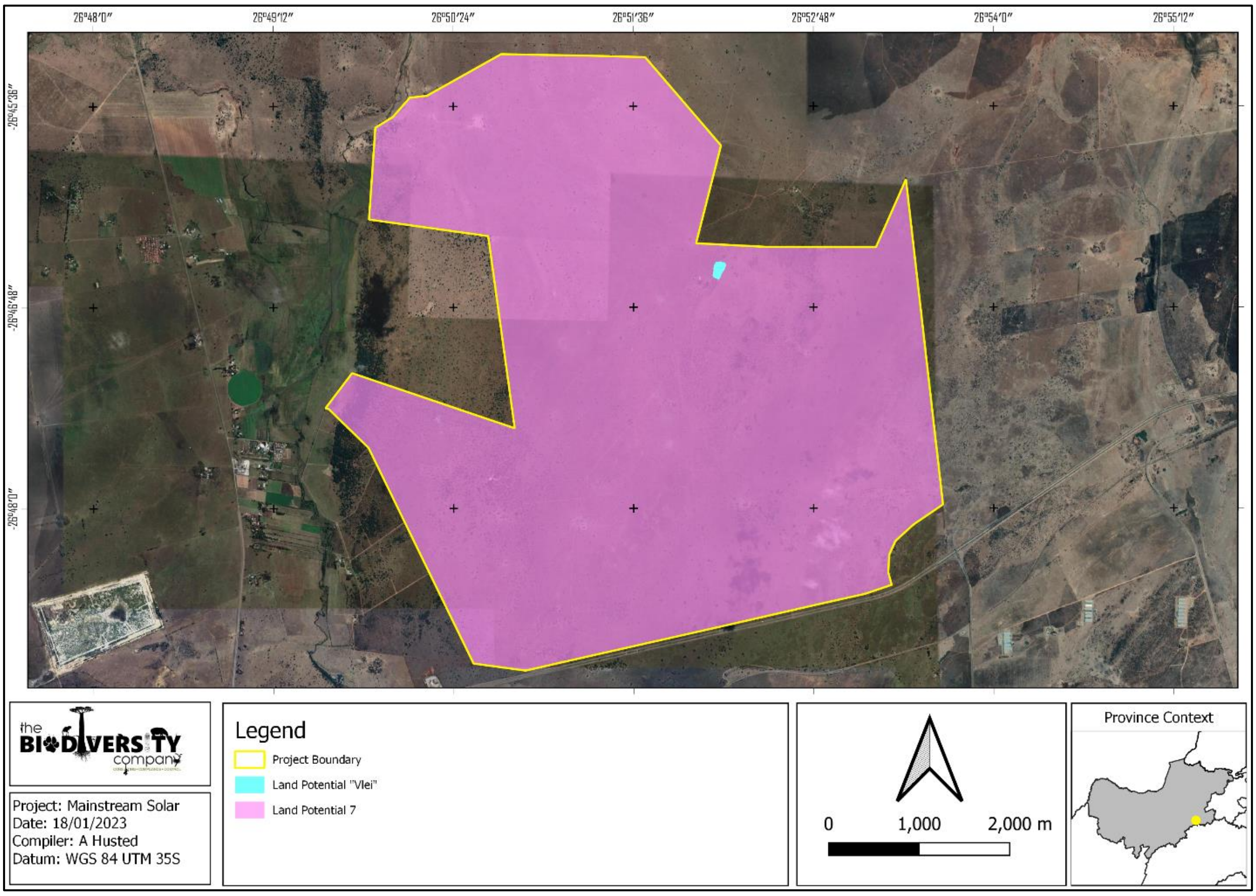

Figure 6-8 ***Land potential determined for the project area***

Table 6-7 ***Land potential for the soils within the project area (Guy and Smith, 1998)***

Land Potential	Percentage	Description of Land Potential Class	Sensitivity
Vlei	0.1	Wetland (grazing and wildlife)	Low
L7	99.9	**Low potential**. Severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Very Low

6.8 Current Land Use

Three different land uses have been identified within the proposed project area, namely “Built-Up Areas”, “Grazing/Wildlife” and “Wetland” (Figure 6-9). The fact that the majority of the project area is comprised of “Grazing/Wildlife” emphasises the fact that the land capability/potential is only suitable for grazing, rather than arable land.

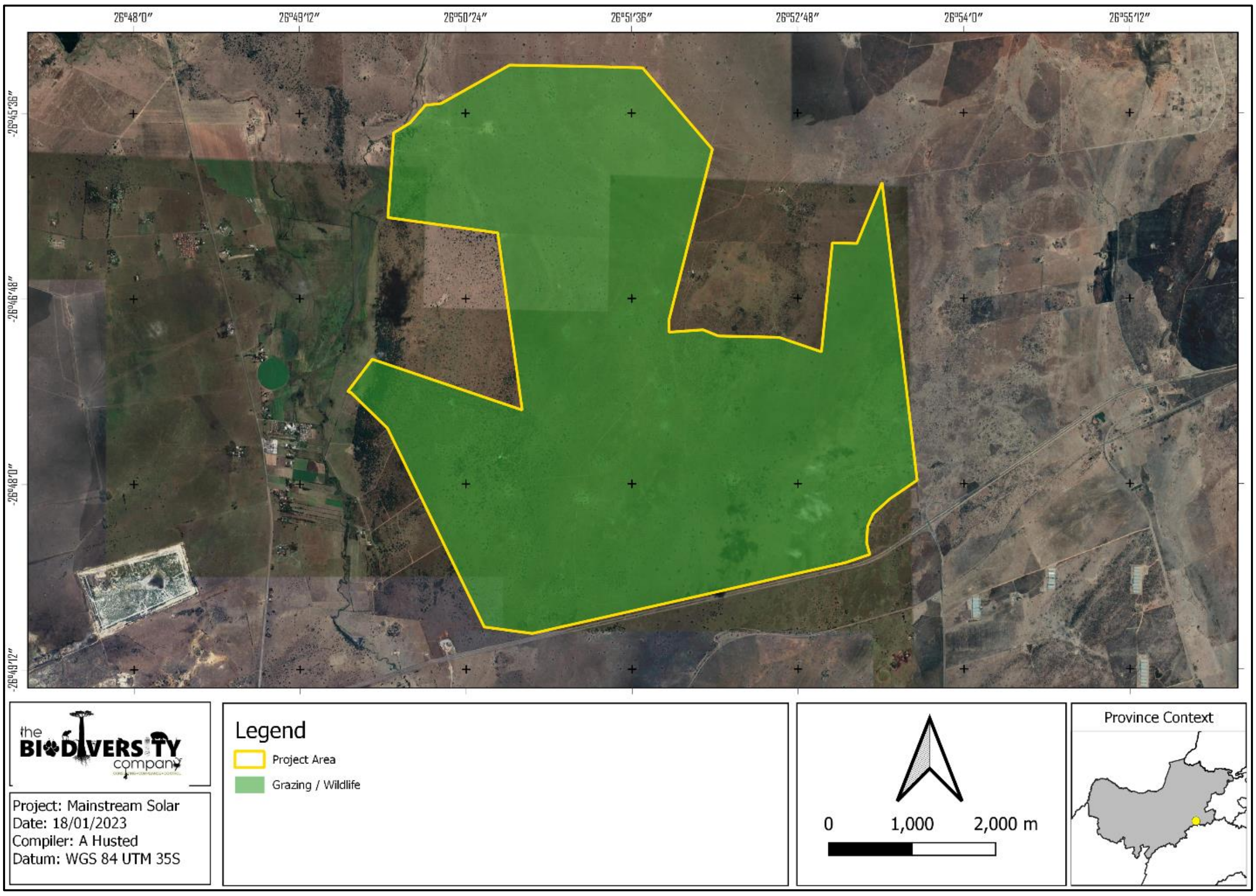

Figure 6-9 Different land uses within the proposed project area

6.9 Sensitivity Assessment

The land capability sensitivity (DAFF, 2017) indicates three groups of land capability classes, namely Land Capability (LC) 1-5 (very low to low sensitivity), LC 6-8 (moderately low to moderate sensitivity) and LC 9-10 (moderately high sensitivity) (Figure 6-10).

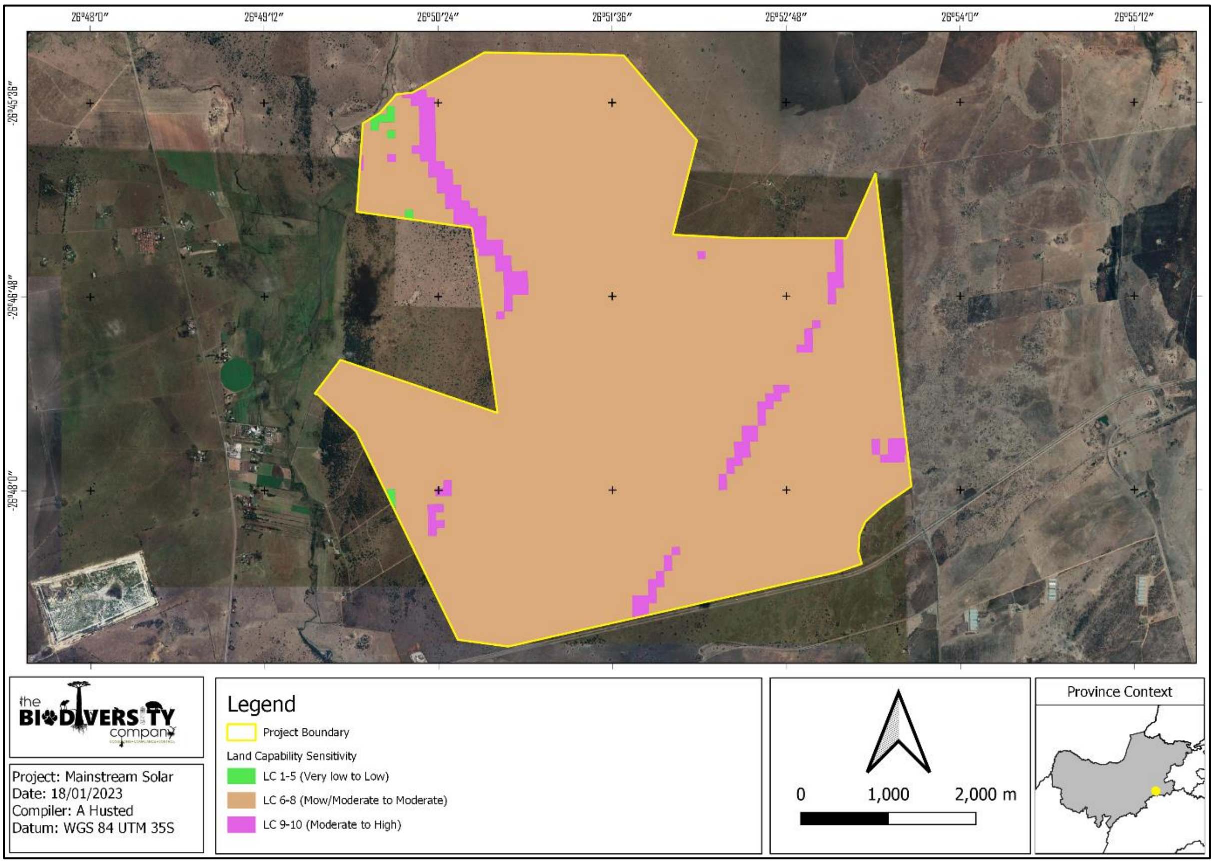

Figure 6-10 Land Capability Sensitivity (DAFF, 2017)

As per the terms of reference for the project, GIS sensitivity maps are required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area. The sensitivity scores identified during the field survey for the identified land potential levels are illustrated in Figure 6-11. The baseline conditions indicate "Very Low" and "Low" sensitivities only, which emphasises the fact that the DAFF (2017) modelled land capabilities are inaccurate to some extent.

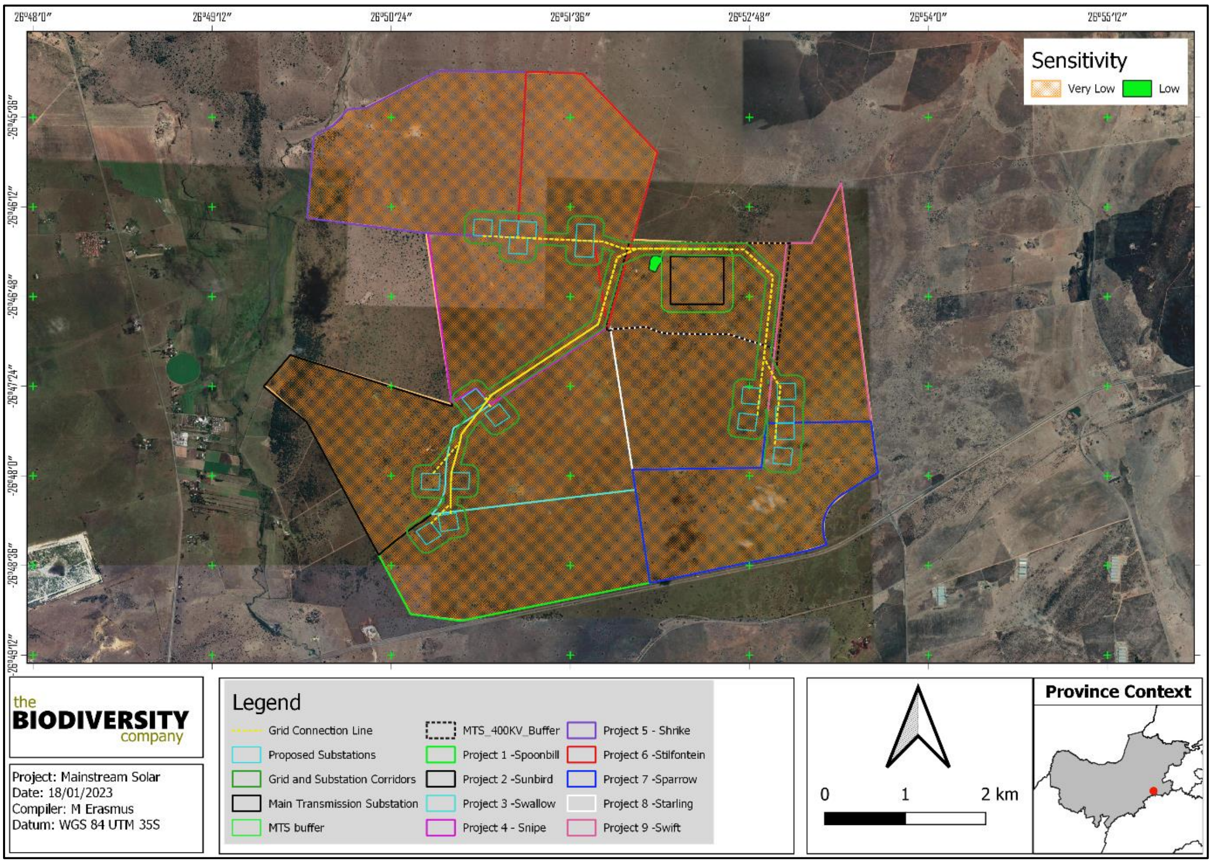

Figure 6-11 Agriculture sensitivity of the project area

Note: Two alternative substation sites and associated powerline corridors are considered per PV project.

7 Impact Assessment

7.1 Impacts on Land Capability Resources

The impact assessment considered both direct and indirect impacts to the delineated land capability by the proposed activities. Considering the low sensitivity of the project area in respect to land potential, very few impacts are expected, regardless of the activity. The below impact assessment applies to each individual project of the Stilfontein Solar and Grid Cluster.

7.1.1 Construction

The following impacts on land capability are expected in respect to the proposed construction phase of the entire renewable energy facility, comprising the solar facilities and grid solutions (on-site substation, MTS Substation, 132kv & 400kv powerlines etc) (Table 7-1):

- Soil compaction;
- Decrease in land capability; and
- Increased erosion.

During the construction phase, servitudes will be cleared for powerlines and roads, foundations will be demarcated and cleared for the on-site substations. the MTS, the BESS, offices and the PV area. Furthermore, a significant increase in traffic is expected which will further contribute to compaction. Laydown yards will be established and used for storage of building material as well as the PV components. Thereafter, the physical construction of all components will take place. Even though the intensity of this phase will be noticed, it is worth noting that the duration of this phase is short with the probability of impacts towards land capability being unlikely due to the low sensitivity of soil resources. The final significance of this phase is calculated to be "Very Low" before and after mitigation.

Table 7-1 Assessment of significance of potential impacts on the land capability associated with the construction phase of the project

Loss of Land Capability								
	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Local	Medium	Short-term	**Very Low**	Probable	**Very Low**	– ve	High
	1	2	1	**4**				
Essential mitigation measures:								
The impacts associated with the construction of the proposed renewable energy facility (including ancillary infrastructure and all components) are expected to pose very low threats before and after mitigation. Therefore, very little mitigation will be required. General mitigation strategies have however been mentioned in Section 7.2.1								
With mitigation	Local	Medium	Short-term	**Very Low**	Probable	**Very Low**	– ve	High
	1	2	1	**4**				

7.1.2 Operational Phase

The following impacts on land capability are expected in respect to the proposed operation phase of the entire renewable energy facility, comprising the solar facilities and grid solutions (on-site substation, MTS Substation, 132kv & 400kv powerlines etc.), (Table 7-2):

- Soil Compaction; and
- Increased erosion.

During the operational phase, all of the constructed components will be in operation. The developed area will constantly be monitored and maintained to ensure that erosion doesn't take place and that vegetation and alien invasive infestation does not rapidly take over the area. All access roads and grid routes will also be maintained together with other infrastructure components like substations. Traffic will commonly impact upon land capability in areas already disturbed during the construction phase, which decreases the intensity score of this phase.

Table 7-2 Assessment of significance of potential impacts on the land capability associated with the operational phase of the project

Loss of Land Capability								
	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Local	Low	Long-term	**Low**	Possible	**Very Low**	– ve	High
	1	1	3	**5**				
Essential mitigation measures:								
The impacts associated with the construction of the proposed renewable energy facility (including ancillary infrastructure and all components) are expected to pose very low threats before and after mitigation. Therefore, very little mitigation will be required. General mitigation strategies have however been mentioned in Section 7.2.1								
With mitigation	Local	Low	Long-term	**Low**	Possible	**Very Low**	– ve	High
	1	1	3	**5**				

7.1.3 Cumulative Impacts

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the area; and general land capability loss and transformation resulting from other activities in the area.

The expected post-mitigation risk significance for the project in isolation is expected to be very low, but in consideration of the larger Stilfontein area, the overall cumulative impact is expected to be low (Table 7-2). This is expected owing to the fact that the larger area comprises of other renewable energy projects that have either already been approved or are currently being assessed (see Figure 7-1).

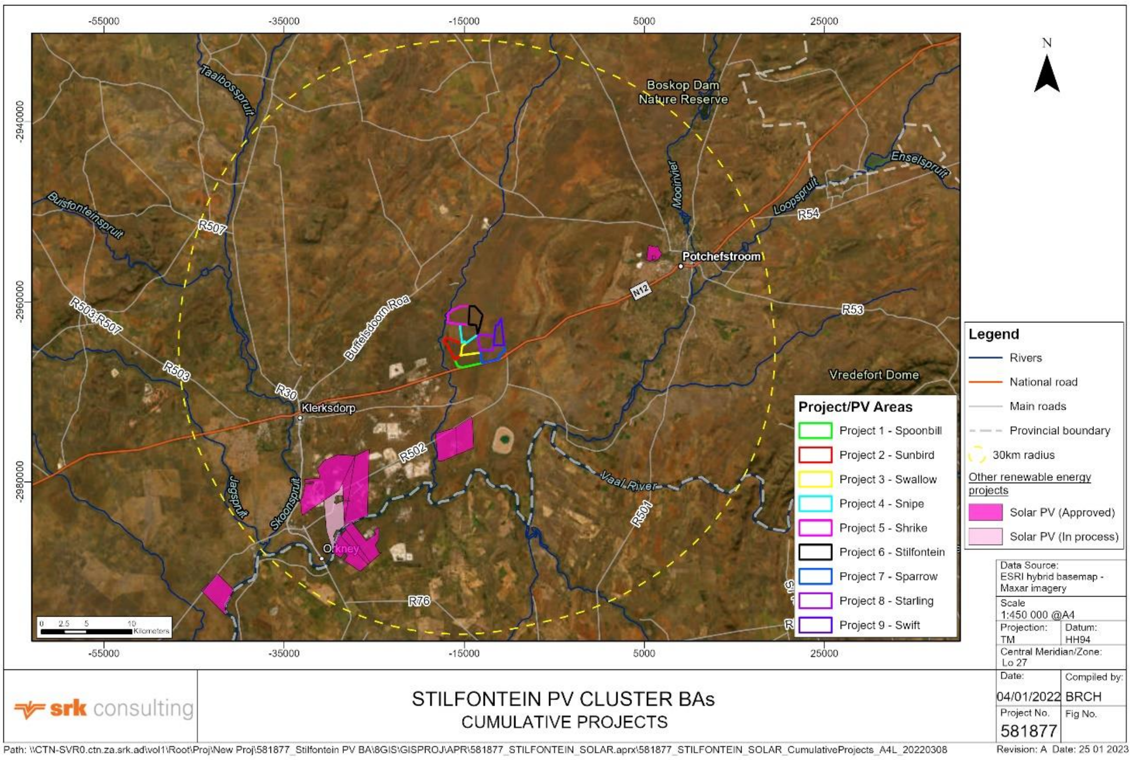

Figure 7-1 Map indicating Stilfontein Solar Facilities Cluster - cumulative projects (Source: DFFE Q3 2022 REEA database)

Table 7-3 Assessment of significance of potential cumulative impacts on the land capability

Loss of Land Capability								
	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Regional	Low	Long-term	**Medium**	Possible	**Low**	– ve	High
	2	1	3	**6**				
Essential mitigation measures:								
The cumulative impacts associated with surrounding activities are expected to pose low threats before and after mitigation. Therefore, limited mitigation will be required. General mitigation strategies have however been mentioned in Section 7.1.3.								
With mitigation	Regional	Low	Long-term	**Medium**	Possible	**Low**	– ve	High

7.2 Mitigation Measures

7.2.1 General Mitigation

General mitigations will ensure the conservation of all soil resources, regardless of the sensitivity of resources and the intensity of impacts.

- Ensure that proper stormwater management designs are put in place;
- Only the proposed access roads are to be used to reduce any unnecessary compaction;
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks;
- Proper invasive plant control must be undertaken quarterly;
- All excess soil (soil that is stripped and stockpiled to make way for foundations) must be stored, continuously rehabilitated to be used for rehabilitation of eroded areas; and
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.

7.2.2 Restoration of Vegetation Cover

Implement a comprehensive restoration programme guided by a botanical specialist. Restoring vegetation cover is the first step to successful rehabilitation. Vegetation cover decreases flow velocities and minimises erosion. There are two general goals for vegetation restoration, namely:

- Ecological Restoration: To restore the degraded sites ecosystem to one that is resilient and self-sustaining with regards to its species composition, function and structure; or
- Agricultural Restoration: To enable the ecosystems to have a productive agricultural potential which can sustainably support livestock and/or wildlife or other uses such as crops/animal feed.

To achieve the goals that the landowner has set through continuous discourse, monitoring and evaluation to deem the restoration successful, guidelines need to be developed, which will then aid in the establishment of the success criteria.

7.2.3 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). Soil moisture is also critical to the success of ripping to mitigate the effects of compaction, which must take place within 1-3 days after seeding and 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, as far as practically possible).

7.2.4 Revegetate Degraded Areas

Implement a comprehensive restoration programme guided by a botanical specialist. Revegetating degraded areas is vital in mitigating erosion and loss of soil (see section 7.2.2).

8 Conclusion and Recommendation

8.1 Baseline Conditions

One dominant soil form has been identified throughout the project area, namely the Glenrosa soil form. This soil form is associated with a poor land capability class (land capability class VI) which is associated with grazing only. The poor climatic conditions (C8) further decrease the land potential of the area. These findings concur well with the land uses currently associated with the project area, namely "Grazing/Wildlife".

8.2 Specialist Recommendation

All aspects considered during the impact assessment have been determined to have "Very Low" pre- and post-mitigation significance ratings. The worst-case impact scenario includes "Very Low" final significance ratings associated with all the phases of the proposed renewable energy facility and associated infrastructure.

Considering the low significance ratings due to the poor land capability relevant to the baseline conditions, it is the specialist's opinion that the proposed project will not result in the loss of high production arable land or the segregation of such land uses. Therefore, it is recommended that the proposed activities proceed as proposed for both the solar facilities as well as the proposed substation and associated grid connections.

Both substation alternatives and the corresponding powerline corridors are equally acceptable from a soil and agricultural perspective.

9 References

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The Biodiversity Company. 2022. Terrestrial Biodiversity Impact Assessment for the Mainstream Solar Project

Appendix 1

Specialist Declaration of Independence

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed development the Stilfontein Cluster, North West Province, with separate EA applications for:

- Nine Photovoltaic (PV) facilities and associated infrastructure: Spoonbill, Sunbird, Swallow, Snipe, Shrike, Stilfontein, Sparrow, Starling and Swift;
- Three collector substations and associated infrastructure: Voelnessie A, Voelnessie B, Voelnessie C; and
- One Main Transmission Substation and associated infrastructure.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	The Biodiversity Company			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Andrew Husted			
Specialist Qualifications:	MSc			
Professional affiliation/registration:	SACNASP Pr Sci Nat 400213/11			
Physical address:	777 Peridot Street, Jukskei Park, 2158			
Postal address:	As above			
Postal code:	2158	Cell:	0813191225	
Telephone:		Fax:		
E-mail:	Info@thebiodiversitycompany.com			

2. DECLARATION BY THE SPECIALIST

I, Andrew Husted, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

The Biodiversity Company

Name of Company:

16/05/2022

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Andrew Husted, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

16/5/2022

Date

Signature of the Commissioner of Oaths

16/05/2022

Date

Stamp

Certified as a true copy of original

Farai Shadreck Mbirimi BD52805

Minister of Religion / Commissioner of Oaths

391 11th Road, Erand, Midrand 1685

Date 16/05/2022

Details of Specialist, Declaration and Undertaking Under Oath

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Appendix 2
Specialist Curriculum Vitae

Andrew Husted

M.Sc Aquatic Health (*Pr Sci Nat*)

Cell: +27 81 319 1225

Email: andrew@thebiodiversitycompany.com

Identity Number: 7904195054081

Date of birth: 19 April 1979

Profile Summary

Working experience throughout South Africa, West and Central Africa and also Armenia & Serbia.

Specialist experience in exploration, mining, engineering, hydropower, private sector and renewable energy.

Experience with project management for national and international multi-disciplinary projects.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise include Instream Flow and Ecological Water Requirements, Freshwater Ecology, Terrestrial Ecology and also Ecosystem Services.

Areas of Interest

Sustainability and Conservation.

Instream Flow and Ecological Water Requirements.

Publication of scientific journals and articles.

Key Experience

- Familiar with World Bank, Equator Principles and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Fish population structure assessments
- The use of macroinvertebrates to determine water quality
- Aquatic Ecological Assessments
- Aquaculture

Country Experience

Botswana, Cameroon

Democratic Republic of Congo

Ghana, Ivory Coast, Lesotho

Liberia, Mali, Mozambique

Nigeria, Republic of Armenia,

Senegal, Serbia, Sierra Leone, South Africa

Tanzania

Nationality

South African

Languages

English – Proficient

Afrikaans – Conversational

German - Basic

Qualifications

- MSc (University of Johannesburg) – Aquatic Health.
- BSc Honours (Rand Afrikaans University) – Aquatic Health
- BSc Natural Science
- Pr Sci Nat (400213/11)
- Certificate of Competence: Mondi Wetland Assessments
- Certificate of Competence: Wetland WET-Management
- SASS 5 (Expired) – Department of Water Affairs and Forestry for the River Health Programme
- EcoStatus application for rivers and streams

OVERVIEW

An overview of the specialist technical expertise include the following:

- Aquatic ecological state and functional assessments of rivers and dams.
- Instream Flow Requirement or Ecological Water Requirement using PROBFLO studies for river systems.
- Ecological wetland assessment studies, including the integrity (health) and functioning of the wetland systems.
- Wetland offset strategy designs.
- Wetland rehabilitation plans.
- Monitoring plans for rivers and other wetland systems.
- Toxicity and metal analysis of water, sediment and biota.
- Bioaccumulation assessment of fish communities.
- Fish telemetry assessment that included the translocation of fish as well as the monitoring of fish in order to determine the suitability of the hosting system.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- The design, compilation and implementation of Biodiversity and Land Management Plans and strategies.

TRAINING

Some of the more pertinent training undergone includes the following:

- Wetland and Riparian Delineation Course for Consultants (Certificate of Competence) – DWAF 2008
- The threats and impacts posed on wetlands by infrastructure and development: Mitigation and rehabilitation thereof – Gauteng Wetland Forum 2010
- Ecological State Assessment of Lentic Systems using Fish Population Dynamics – University of Johannesburg/Rivers of Life 2010
- Soil Classification and Wetland Delineation – Terra Soil Science 2010
- Wetland Rehabilitation Methods and Techniques - Gauteng Wetland Forum 2011
- Application of the Fish Response Assessment Index (FRAI) and Macroinvertebrate Response Assessment Index (MIRAI) for the River Health Programme 2011
- Tools for a Wetland Assessment (Certificate of Competence) – Rhodes University 2011
- PROBFLO for conducting Ecological Flow Assessments – 2018/19

EMPLOYMENT EXPERIENCE

The Biodiversity Company (January 2015 – Present)

Director / Ecologist.

Digby Wells Environmental (August 2008 – December 2014)

Freshwater & Terrestrial Ecologist

PREVIOUS EMPLOYMENT: Econ@UJ (University of Johannesburg)

Freshwater Ecologist

ACADEMIC QUALIFICATIONS

University of Johannesburg, Johannesburg, South Africa (2009): MAGISTER SCIENTIAE (MSc) - Aquatic Health:

Title: *Aspects of the biology of the Bushveld Smallscale Yellowfish (Labeobarbus polylepis): Feeding biology and metal bioaccumulation in five populations.*

Rand Afrikaans University (RAU), Johannesburg, South Africa (2004): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Rand Afrikaans University (RAU), Johannesburg, South Africa (2001 - 2004): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

PUBLICATIONS

Desai M., Husted A., Fry C., Downs C.T., & O'Brien G.C. 2019. Spatial shifts and habitat partitioning of ichthyofauna within the middle–lower region of the Pungwe Basin, Mozambique. *Journal of Freshwater Ecology*, 34(1), 685–702. doi: 10.1080/02705060.2019.1673221

Tate R.B. and Husted, A. 2015. Aquatic Biomonitoring in the upper reaches of the Boesmanspruit, Carolina, Mpumalanga, South Africa. African Journal of Aquatic Science.

Tate R.B. and Husted A. 2013. Bioaccumulation of metals in *Tilapia zillii* (Gervai, 1848) from an impoundment on the Badeni River, Cote D'Iviore. African Journal of Aquatic Science.

O'Brien G.C., Bulfin J.B., Husted A. and Smit N.J. 2012. Comparative behavioural assessment of an established and new Tigerfish (*Hydrocynus vittatus*) population in two manmade lakes in the Limpopo catchment, Southern Africa. African Journal of Aquatic Science.

Tomschi H., Husted A., O'Brien G.C., Cloete Y., Van Dyk C., Pieterse G.M., Wepener V., Nel A. and Reisinger U. 2009. Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam near Selebi Phikwe, Botswana. EC Multiple Framework Contract Beneficiaries.8 ACP BT 13 – Mining Sector (EDMS). Specific Contract N° 2008/166788. Beneficiary Country: Botswana. By: HPC HARRESS PICKEL CONSULT AG

Husted A. 2009. Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations. The University of Johannesburg (Thesis).