Appendix H.3

SOIL, LANDUSE AND LAND CAPABILITY ASSESSMENT

PUBLIC

ZIMPANDE
RESEARCH COLLABORATIVE

Soil, Landuse and Land Capability Assessment

REPORT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED TOURNEE 2 SOLAR PARK NEAR THUTHUKANI, MPUMALANGA PROVINCE.

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Part of the SAS Environmental Group of Companies

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EXECUTIVE SUMMARY

The Zimpande Research Collaborative (ZRC) was appointed to conduct a soil, land use and land capability assessment and hydropedological opinion as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the Tournee 2 Solar Park as proposed by Tournee 2 Solar (Pty) Ltd near Thuthukani and adjacent to the Eskom Tutuka Power Station, Mpumalanga Province.

The objective of this study was to evaluate:

- Climatic conditions within the context of agricultural productivity and constraints;
- Landscape setting and land use,
- Soil physical properties; and
- Other current limitations to various agricultural related land use purposes.

The development extent of the proposed solar PV includes areas functioning as wetlands. Thus, it is deemed necessary to investigate the recharge mechanism of the watercourses within and in close proximity to the study area to ensure that development planning takes cognisance of the hydropedologically important areas and hence enable informed decision making, construction design and support the principles of sustainable and water wise development.

The objective of the hydropedological study was to:

- Investigate the hydropedological drivers of the watercourse system near the development footprint;
- Determine the risk of the proposed activities on the watercourse system; and
- Define the developable areas from a hydropedological point of view taking into consideration the findings of other relevant studies;
- Develop a scientifically derived buffer; and
- Mitigation measures and recommendations to minimise the impact to acceptable levels in line with the mitigation hierarchy.

The Mean Annual Precipitation (MAP) within the study area is estimated to range between 601 – 800 mm per annum. These conditions have a moderate yield potential for a moderate range of adapted crops and planting date options may be limited for supporting rain fed agriculture, in some instances supplementary irrigation may be required if available.

According to observations made during the site assessment the Tournee 2 Solar PV Park largely comprises cultivated field with maize and soybeans as the crops of choice as well as grazing. The Tournee 2 Solar PV Park is traversed by watercourses which comprises instream dams as well other artificial impoundments in the immediate vicinity of these watercourses. The surroundings are characterised by cultivated lands as well as the Tutuka Power Station and ash dam located south of the Tournee 2 Solar PV Park.

The landscape largely resembles a Vertic and Melanic topo sequence where the soils are characterised by melanic, strongly to very strongly structured (topsoil and subsoil) of varying depths. These soils have high clay content, displaying a high water-holding capacity and mostly containing a high percentage of swelling clay minerals. Only a small patch to the south of the study area which comprises plinthic based soils which are characterised by an Orthic A horizon, a yellow brown apedal B horizon and the underlying hard plinthic layer.

The dominant soils which account for 74.6% (Arcadia and Mayo/Milkwood) are suitable for grazing (Class VI) and have a restricted potential cultivated agriculture due to the high clay content and susceptibility to water logging conditions. Only 21.3 % of the total study area is comprised of marginal arable soils and these are Darnall/Bonheim and Glencoe soil forms which also have limitations such as high clay content and layer of refusal of the Glencoe soil forms. It should be noted that the clay content of Darnall/Bonheim is such that tillage is more viable than that of the Arcadia and Mayo/Milkwood soil forms. The remaining soil is associated with the occurring freshwater features and this the Rensburg soil form which occupies 4.1% of the study area. Table A below indicates the dominant soils occurring within the study area, together with the associated land capability and the area covered in hectares (ha).

Table A: Dominant soil forms and their respective land capability.

Soil Form	Land Capability	Land Potential	Area (ha)	Percentage (%)
Darnall/Bonheim	Arable (Class IV)	Moderate Potential (L4)	70.4	21.3
Glencoe				
Rensburg	Watercourse (Class V)	Watercourse (L4)	13.5	4.1
Arcadia	Grazing (Class VI)	Restricted Potential (L5)	246.3	74.6
Mayo/Milkwood				
Total Enclosed			**330.2**	**100**

The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale.

According to the desk-based assessment the grazing capacity for this area is 4 Hectares per animal which is considered adequate for commercial farming. It was also evident during the site verification that the grazing land was utilised for fodder which means that these areas are actively used for commercial purposes. As such, this also presents a constraint for this project.

The agricultural sensitivity was based on the site verified results which considered the occurring soils as well as the current landuses particularly landuses contribution to the agricultural production spectrum. It is acknowledged that the DFFE screening sensitivity indicates the study areas as having a high agricultural sensitivity. Upon verification the site sensitivity ranged between low and high. The sensitivity classes were as follows:

- Cultivated land with Maize and Soybeans – Moderately High
- Grazing land – Intermediate
- Watercourses – Low

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a high sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment this was found to be of a less significance impact as presented on the screening tool due to the dominant soil forms which are not high potential agricultural soils due to various limitations which include high clay content and susceptibility to water logging.

Based on the precautionary principle the high sensitivity class can be considered valid on the basis that the study area is largely under active cultivation and grazing, however a more accurate sensitivity class would be “Moderately High”. The yield potential for maize and soybeans is considered adequate to contribute to the local and regional food production in a meaningful manner.

Hydropedological Considerations

The study area is largely dominated by Arcadia soil formation which are characterised by a quick response to rain events and typically generate overland flow owing to the clayey nature of the soils. The Arcadia soil form is characterised by low infiltration rates which induce saturation excess in the lower lying positions in the landscapes. A small patch to the south of the study area comprises interflow soils of Glencoe soil forms and are characterised by a fluctuating water table that manifest between the soils

and the semi-impermeable plinthic material which impedes vertical movement and promotes lateral flows.
The construction phase will only entail light excavation as part of infrastructure development. The post development scenario will not lead to any significant loss of hydropedological process, however a change in hydrological patterns is anticipated.

The project will likely lead to a limited loss of interflow recharge due to the BESS and Concrete Batching Plant. Mitigation measures should be carefully implemented during all phases of development to further minimise the impact. Although the pattern, timing and duration of the hydrograph would change to some degree, a change in the PES/EIS and functionality of the surrounding watercourse deemed unlikely provided that all mitigation measures are implemented. The development should ensure that the surface runoff is still delivered into the wetlands through stormwater management systems.

Following the assessment of the study area and the identified potential impacts as the result of the proposed development; the key mitigation and rehabilitation measures can be summarised as follows:

Pre-Construction and Planning Phase Mitigation:

- The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- Clean water with only biodegradable detergents should be used to clean the panels to limit any soil contamination that might occur;
- A stormwater and erosion management plan must be developed to prevent the loss of soil resources;
- The contractor(s) appointed for the removal of infrastructure during closure must commit to the disposal of materials at registered sites;
- Post-removal of the solar PV, the site must be rehabilitated (compacted areas ripped, topsoil re-instated and the area vegetated with indigenous seed mix); and
- Use of heavy machinery should be avoided as far as possible to minimise further soil compaction during final rehabilitation.

Construction Phase Mitigation

- Bare soils within the access roads can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast;
- All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission;
- Temporary erosion control measures should be used to protect the disturbed soils during the construction phase until adequate vegetation has established;
- Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented, always made available and accessible to the contractors and construction crew conducting the works on site for reference;
- Use of heavy machinery should be avoided as far as possible to minimise further soil compaction during final rehabilitation.
- A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works;
- An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and
- Burying of any waste including domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site;

- The proposed Solar Photovoltaic (PV) Facilities development within the study area should aim to minimise the impact on soils with used for cultivation and grazing activities;
- Revegetate the disturbed soils with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions; and
- The footprint areas should be lightly ripped to alleviate compaction.

Operational Phase Mitigation

- Maintenance vehicles should be checked for leakages of hydrocarbons prior to commencement of maintenance activities;
- Maintenance vehicles should stick to demarcated road as far as practically possible to minimise soil compaction on adjacent soils;
- The solar panels should be cleaned with clean water and use of chemicals should be avoided to minimise the likelihood of potential soil contamination; and
- Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil erosion.

It is the opinion of the specialist that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area will be made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

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GLOSSARY OF TERMS

AGIS	Agricultural Geo-Referenced Information Systems
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Chromic:	Having within ≤150 cm of the soil surface, a subsurface layer ≥30 cm thick, that has a Munsell colour hue redder than 7.5YR, moist.
Catena	A sequence of soils of similar age, derived from similar parent material, and occurring under similar macroclimatic condition, but having different characteristics due to variation in relief and drainage.
Catchment	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Chroma	The relative purity of the spectral colour which decreases with increasing greyness.
Evapotranspiration	The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants
IEM	Integrated Environmental Management
IUSS	International Union of Soil Sciences
Lithic	Having continuous rock or technic hard material starting ≤10 cm from the soil surface.
SACNASP	South African Council for Natural Scientific Professions
Salinity	High Sodium Adsorption Ratio (SAR) above 15% are indicative of saline soils. The dominance of Sodium (Na) cations in relation to other cations tends to cause soil dispersion (deflocculation), which increases susceptibility to erosion under intense rainfall events.
Sodicity	High exchangeable sodium Percentage (ESP) values above 15% are indicative of sodic soils. Similarly, the soil dispersion.
SOTER	Soil and Terrain
Watercourse	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks

ACRONYMS

°C	Degrees Celsius.
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Programme
ET	Evapotranspiration
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GPS	Global Positioning System
m	Meter
MAP	Mean Annual Precipitation
MPRDA	Minerals and Petroleum Resources Development Act, Act 28 of 2002
NEMA	National Environmental Management Act
NWA	National Water Act
SACNASP	South African Council for Natural Scientific Professions
WULA	Water Use Licence Application
ZRC	Zimpande Research Collaborative

1. INTRODUCTION

The Zimpande Research Collaborative (ZRC) was appointed to conduct a soil, land use and land capability assessment and hydropedological opinion as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the Tournee 2 Solar Park as proposed by Tournee 2 Solar (Pty) Ltd near Thuthukani and adjacent to the Eskom Tutuka Power Station, Mpumalanga Province.

1.1 Background and Project Description

The proposed Tournée 2 Solar PV Park will have a generating capacity of no more than 150 Megawatts (MW) and battery energy storage systems (BESS) of 600 megawatt-hours (MWh). Tier-1 bi-facial, single axis trackers are considered for the panels. The proposed Tournée 2 Solar PV Park will also include an on-site Independent Power Producer (IPP), which includes a substation. It is proposed that Lithium Battery Technologies such as Lithium-Ion Phosphate or Lithium Nickel Manganese Cobalt oxides will be considered as the preferred battery technology.

The purpose of the facility is to generate clean electricity from a renewable energy source (i.e., solar radiation) to contribute to the National Energy Grid.

The proponent provided preliminary development and exclusion areas for the Tournée 2 Solar PV Park (Figure 3), however, the layout will be finalised based on the results of all specialists and presented in the EIA report.

Table 1: Project details for the proposed Tournée 2 Solar PV Park.

Farm Potions Combined Extent	573.78 hectares (ha)
Buildable Area (subject to finalisation)	~297 ha
Contracted Capacity of PVSEF	Up to 150 MW/600MWh.
Associated Infrastructure	Internal Roads up to 4 m wide and 20km long.
	Independent Power Producer (IPP) site, (includes Back-to-back substation including IPP side and Eskom side)
	Battery Energy Storage System (BESS) (Including 132 kV feeder bays, transformers, control building and telecommunication infrastructure).
	Paved areas (m²) - 2 200.
	O&M building (m²) - 1 500.
	Construction phase: Construction camp area (m²) - 5,000 Laydown area (m²) - 20,000 Septic tanks, and portable toilets.
	PV Modules (229 Ha).
Technical Specifications	Tier 1 bi-facial, single axis trackers.

1.2 Terms of Reference and Scope of Work

The Environmental Authorisation process of the soil, land use and land capability assessment entailed the following aspects:

- As part of the desktop study various data sets were consulted which includes, but not limited to: Soil and Terrain dataset (SOTER), land type and capability maps and soil 2001, to establish broad baseline conditions and sensitivity of the study area both on environmental and agricultural perspective;
- Compile various maps depicting the on-site conditions based on desktop review of existing data;
- Classification of the climatic conditions occurring within the study area;
- Conduct a soil classification survey within the study area;
- Assess the spatial distribution of various soil types within the study area and classify the dominant soil types according to the South African Soil Classification System: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);
- Identify restrictive soil properties on land capability under prevailing conditions;
- Identify and assess the potential impacts in relation to the proposed development using impact assessment methodology; and
- Compile soil, land use and land capability brief report under current on-site conditions based on the field finding data to guide the decision-making process.

1.3 Assumptions and Limitations

For the purpose of this assessment, the following assumptions and limitations are applicable:

- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the investigation area at the scale required to inform an environmental process. However, this information is useful as background information to the study and, if desktop results are considered with the outcome of the soil and land capability assessment, sufficient decision making can take place;
- The soil survey conducted as part of the land capability assessment was confined within the study area outline. However, consideration of the immediately adjacent areas was given; and

- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. for this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa.

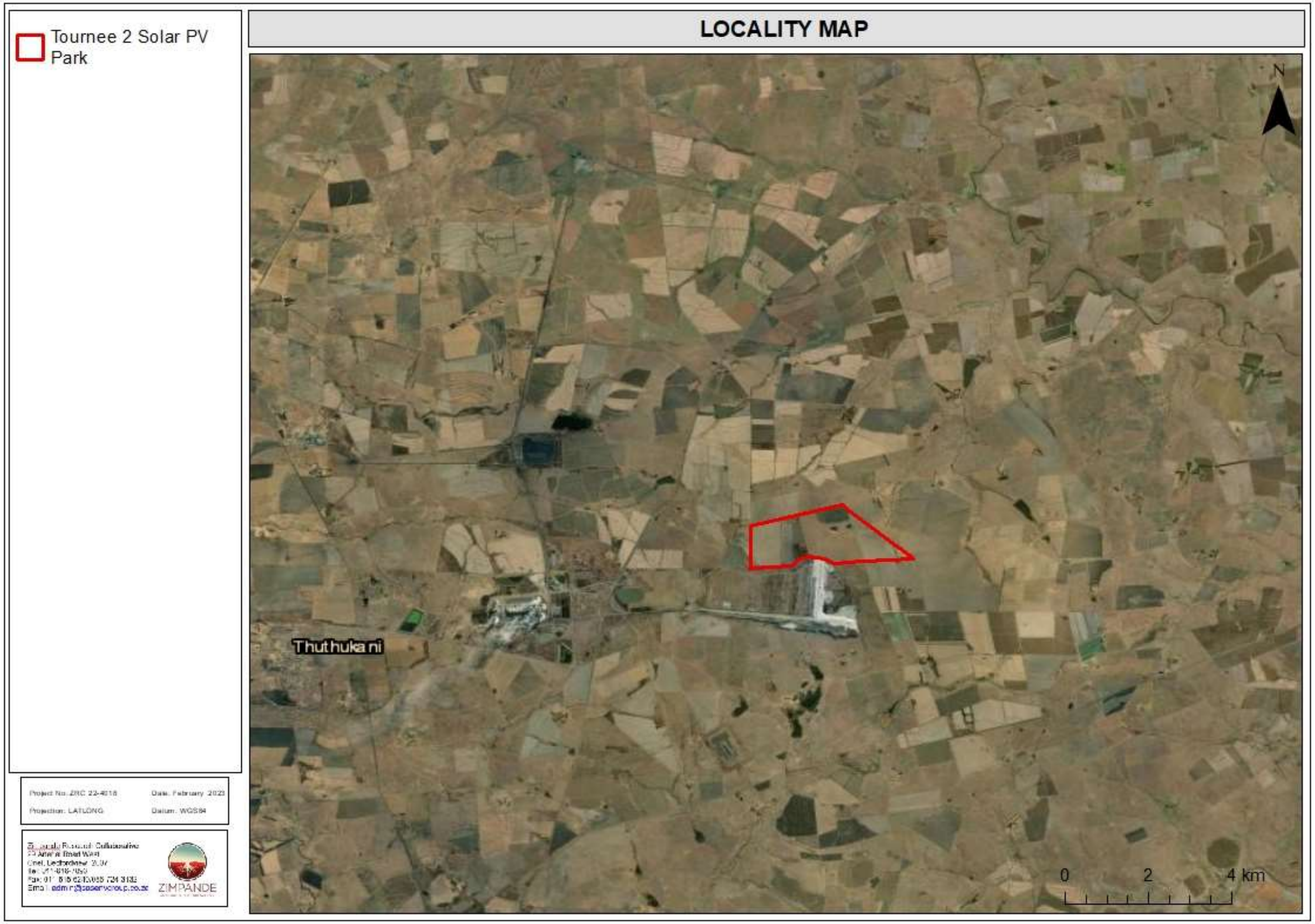


Figure 1: Digital satellite imagery depicting the locality of the Tournee 2 Sola PV Park in relation to the surrounding areas.

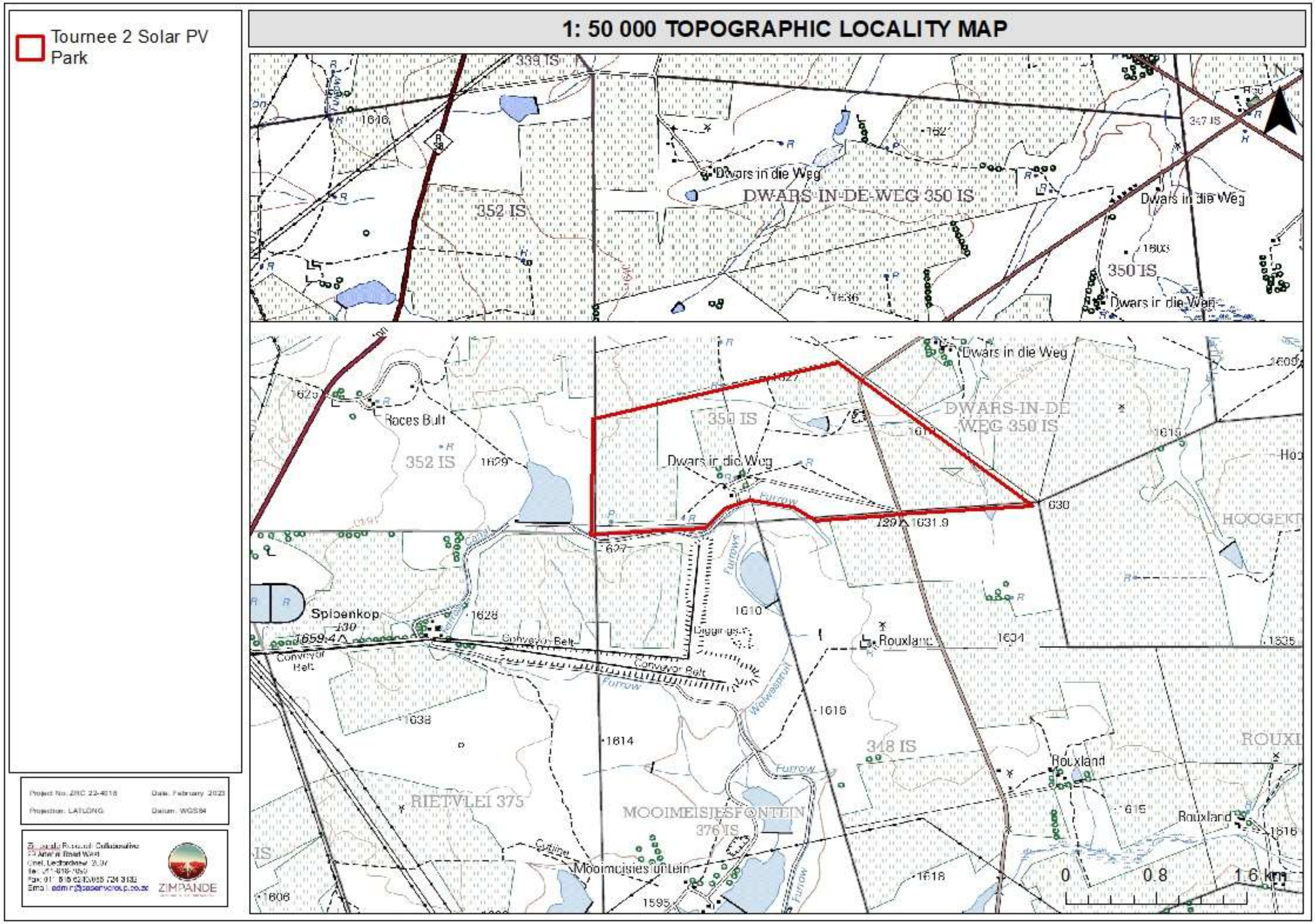


Figure 2: Location of the Tournee 2 Solar PV Park depicted on a 1:50 000 topographical map in relation to surrounding area.

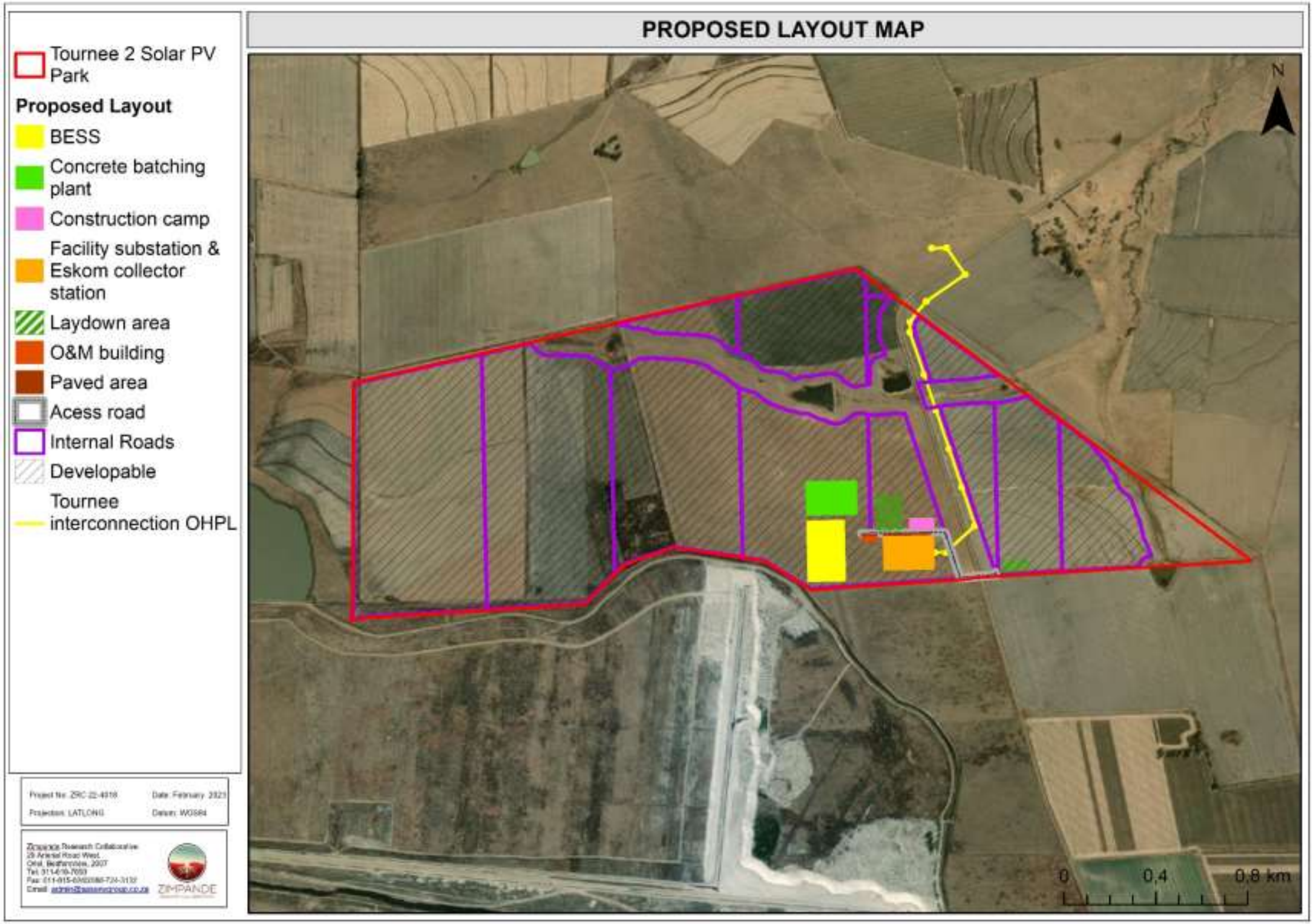


Figure 3: Presentation of the Tournee 2 Solar PV Park proposed layout.

1.4 Legislative Requirements

The bullets points below summarise the legislative requirements which will guide the scope of this study:

- The National Water Act (NWA) and in particular GN R 704, which acknowledges the principle of co-operative governance between the three key ministries (DME, DEAT, DWAF) that legislate key aspects of mining activity,
- The Mineral and Petroleum Resources Development (MPRDA) Act No. 28 of 2002
- The National Forests Act (NFA),
- The Conservation of Agricultural Resources Act (CARA), and
- The Disaster Management Act, 2002.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

A desktop study was conducted to determine the soil, land use and land capability properties. Further to this, literature review and other database such as the Agricultural Geo-Referenced Information System (AGIS) and Agricultural Research Council Institute for Soil Climate and Water (ARC-ISCW), in order to collect the pre-development soil and land capability data.

2.2 Consideration of the Department Environmental Affairs (DEA) Screening Tool

The information provided in this section aims to understand the sensitivity of the agricultural resources and how the proposed solar facility may impact on the food production potential of the site. The results of the screening tool are contained in Figure 5.

2.3 Soil Classification and Sampling

A soil survey was conducted in February 2023 at which time the identified soils within the study area were classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). The soil survey was restricted to the study area. Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles, which will entail evaluation of physical soil properties and prevailing limitations to various land uses.

2.4 Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table 2 below; with Classes I to III classified as prime agricultural land that is well suited for annual cultivated crops, whereas Class IV soils may be cultivated under certain circumstances and specific or intensive management practices, and Land Classes V to VIII are not suitable to cultivation. Furthermore, the climate capability is also measured on a scale of C1 to C8, as illustrated in Table 3 below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed to inform the necessary mitigation measures.

Table 2: Land Capability Classification (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups	Limitations
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable land**	No or few limitations
II	W	F	LG	MG	IG	LC	MC	IC			Slight limitations
III	W	F	LG	MG	IG	LC	MC	IC			Moderate limitations
IV	W	F	LG	MG	IG	LC					Severe limitations
V	W	F	LG	MG						**Grazing land**	Water course and land with wetness limitations
VI	W	F	LG	MG							Limitations preclude cultivation. Suitable for perennial vegetation
VII	W	F	LG								Very severe limitations. Suitable only for natural vegetation
VIII	W									**Wildlife**	Extremely severe limitations. Not suitable for grazing or afforestation.
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	

Table 3: Climate Capability Classification (Scotney et al., 1987)

Climate Capability Class	Limitation Rating	Description
C1	None to slight	Local climate is favorable for good yield for a wide range of adapted crops throughout the year.
C2	Slight	Local climate is favorable for good yield for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1.
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.
C4	Moderate	Moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.
C5	Moderate to severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss.
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops for which frequently experience yield loss.
C7	Severe to very severe	Severely restricted choice of crops due to heat, cold and/or moisture stress.
C8	Very severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.

The land potential assessment entails the combination of climatic, slope and soil condition characteristics to determine the agricultural land potential of the investigated study area. The classification of agricultural land potential and knowledge of the geographical distribution of agricultural viable land within an area of interest. This is of importance for making an informed decision about land use. Table 4 below presents the land potential classes, whilst Table 5 presents a description thereof, according to Guy and Smith (1998).

Table 4: Table of Land Potential Classes (Adapted from Guy and Smith, 1998)

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	(L3) Wetland	(L3) Wetland	(L4) Wetland	(L4) Wetland	(L5) Wetland	(L5) Wetland	(L6) Wetland	(L6) Wetland
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 5: The Land Capability Classes Description (Guy and Smith, 1998)

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, temperature or rainfall. Appropriate permission is required before ploughing virgin land.
L5	**Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperature or rainfall.
L6	**Very restricted potential:** Regular and/or severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L7	**Low potential:** Severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L8	**Very low potential:** Very severe limitations due to soil, slope, temperature or rainfall. Non-arable.

3. DESKTOP ASSESSMENT RESULTS FROM VARIOUS DATABASES

The following data is applicable to the study area, according to various data sources including but not limited to the Agricultural Geo-referenced Information System (AGIS):
**It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the investigation area at the scale required to inform an environmental process. However, this information is useful as background information to the study and, if desktop results are considered with the outcome of the soil and land capability assessment, sufficient decision making can take place.*

Table 6 below presents the summary of the desktop exercise.

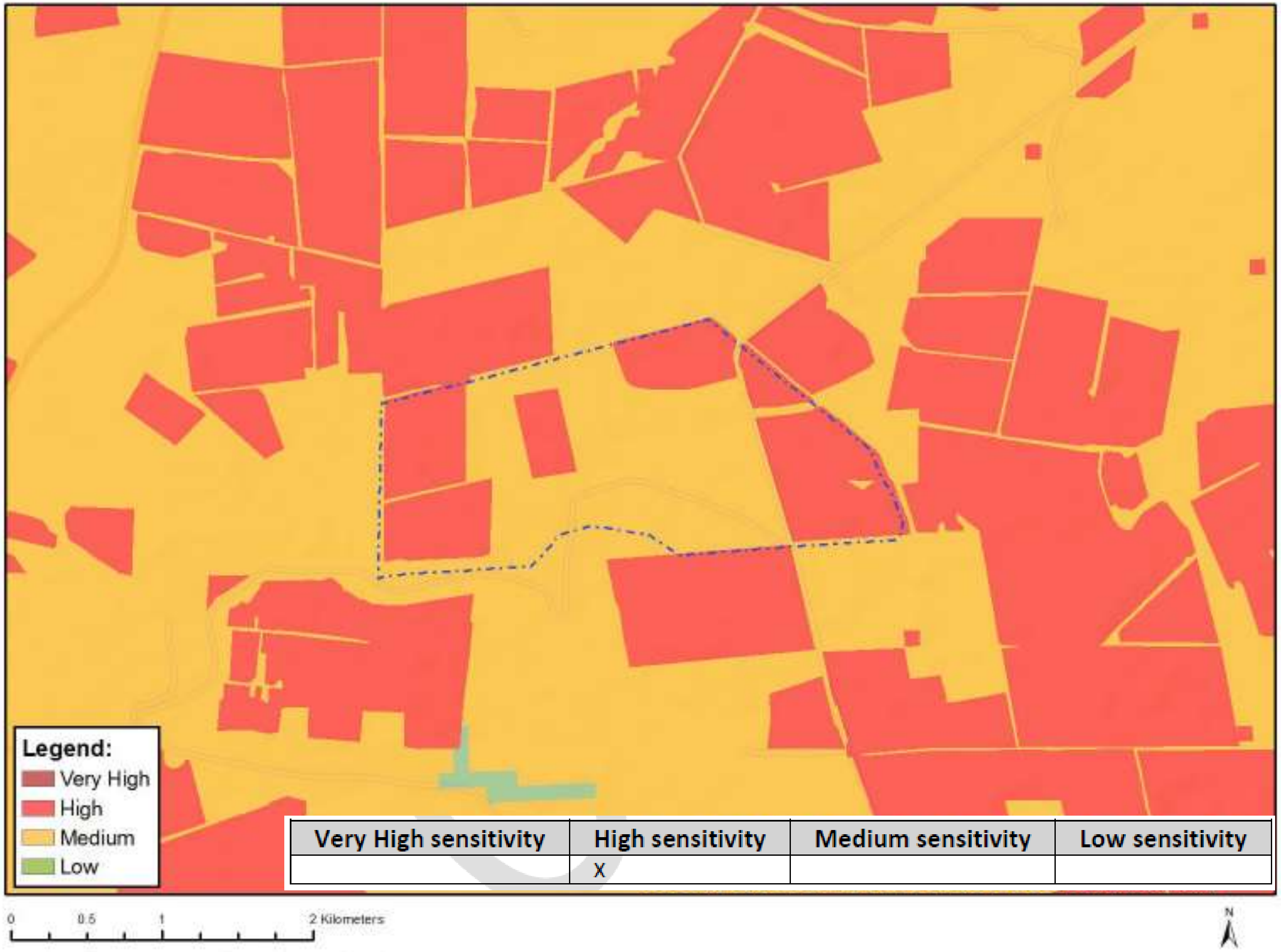
Table 6: Desktop based soil background information sourced from various databases.

Parameters	Description
Mean Annual precipitation (MAP)	The Mean Annual Precipitation (MAP) within the study area is estimated to range between 601 – 800 mm per annum. These conditions have a moderate yield potential for a moderate range of adapted crops and planting date options may be limited for supporting rain fed agriculture, in some instances supplementary irrigation may be required if available.
Mean Annual Evaporation (MAE)	The mean annual evaporation (MAE) of the majority of the Tournee 2 Solar PV Park is estimated to be between 1601 – 1800 mm. The high evaporation rates pose risks to plant yield due possible plant permanent wilting resulting desiccation and lack of adequate soil moisture.
Geology	The entire Tournee 2 Solar PV Park is underlain by the Suurberg, Drakensberg, Lebombo geological formation. This geological formation is known to yield soils with finer particles and high clayey content with high water holding capacity.
Landform type	The Plain Landform type dominates the entire Tournee 2 Solar PV Park, which means the terrain is suitable to allow agricultural activities.

Parameters	Description
Soil pH	According to the AGIS database, the pH of soil medium occurring within the Tournee 2 Solar PV Park is considered alkaline with pH ranging between .65 – 7.4. In slightly alkaline soil. Some micronutrients become less available. This is however not considered a limitation as the soil's pH condition can be ameliorated.
Landtype data	The entire Tournee 2 Solar PV Park is dominated by the Ea17 landtype. The Ea17 land type represent areas with clayey soils.
The Soil and Terrain (SOTER) soil classification	The Soil and Terrain (SOTER) database indicates that the entire Tournee 2 Solar PV Park is underlain by Eutric Vertisols. These soils are black coloured, strongly to very strongly structured (topsoil and subsoil) of varying depths.
Desktop land capability	The desktop land capability of the soils associated with Tournee 2 Solar PV Park is Arable capability (Class III).
Grazing Capacity	The livestock grazing capacity potential based on the AGIS database is estimated to be approximately 4 hectares per large animal. This is considered adequate for commercial livestock grazing.
Desktop based Land use	The majority of the Tournee 2 Solar PV Park is characterised by vacant or unspecified landuses, while the remaining portions are under cultivation. Refer to Figure 4.
Alkalinity and Sodicity of the soils	The soils within the Tournee 2 Solar PV Park are slightly saline which means that they are affected by salts.
Probability of soil loss	The predicted soil loss for the entire Tournee2 Solar PV Park is considered low, which means the soils are not susceptible to wind and water erosion attributed to the high clay content.
Soil Water Retaining Characteristics	Water retaining characteristics are scarce or absent within the entire Tournee 2 Solar PV Park. Water storage during the fallow period may not be possible in the absence of irrigated agriculture.
Clay Content	The clay content for the soils within the study area are characterised by clay contents greater than 35%.
Soil Depth	The soil depth for the entire Tournee 2 Solar PV Park ranges between 450 - 750 mm. This indicates a limited choice of crops for cultivation for majority of the area due to shallower depths.
Department of Environmental Affairs (DEA) screening tool	The entire Tournee 2 Solar PV Park is characterised by high sensitivity to agriculture (Figure 4).

Figure 4: Desk-based landuses associated with the Tournee 2 Solar PV Park and surroundings.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Figure 5: Screening tool agricultural them for the Tournee 2 Solar PV Park and surroundings.

4. FIELD ASSESSMENT FINDINGS

4.1 Current Land Use

This section aims to provide an overview of the current landuses associated the Tournee 2 Solar PV Park based on:

- Field verified data;
- Through the scrutiny of the satellite imagery; and
- The South African Land Cover (SANLC) data of 2020.

According to observations made during the site assessment the Tournee 2 Solar PV Park largely comprises cultivated fields with maize and soybeans as the crops of choice as well as grazing. The Tournee 2 Solar PV Park is traversed by watercourses which comprises instream dams as well other artificial impoundments in the immediate vicinity of these watercourses. The surroundings are characterised by cultivated lands as well as the Tutuka Power Station and ash dam located south of the Tournee 2 Solar PV Park. Figure 6 below depicts the associated land use within the study area.

DOMINANT LAND USES

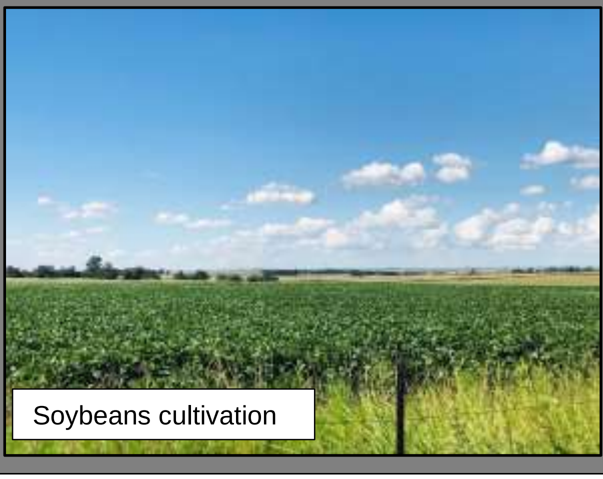


Figure 6: Land uses associated with the Tournee 2 Solar PV Park.

4.1 Dominant Soil Forms

The catena of the landscape in which the wetland is situated largely resembles a Vertic and Melanic topo sequence where the soils are characterised by black coloured, strongly to very strongly structured (topsoil and subsoil) of varying depths. These soils have high clay content, displaying a high water-holding capacity and mostly containing a high percentage of swelling clay minerals.

Vertic and Melanic soils associated with the study area can be classified as Arcadia, Rustenburg and Rensburg soil forms, where the Vertic/Melanic A horizon grades directly into a Hard Rock material (Milkwood/Mayo) or a Gleyed horizon which indicates signs of prolonged saturation. These soils can also be moderately deep where the Vertic/Melanic grades into a pedocutanic horizon, underlain by gleyed material. Figure 7 below depicts the locality of the identified soil forms within the study area. Thus, these soils are generally restricted to intensive grazing and wildlife.

The portions to the east are characterised by Darnall/Bonheim soil forms which are also of melanic (dark clayey) character underlined by pedocutanic horizons as well as lithic/hard rock material. Although these soils resemble the Milkwood/Mayo soils these soils have adequate root depth for most crops and can be cultivated and produce good yield if intensive management practices are implemented.

The remaining portion to the south is comprised of Glencoe soil forms which are characterised by Orthic A horizon, underlain by yellow brown apedal B horizon over hard plinthic material.

These are considered arable soils with wetness limitation due to the occurrence of semi-impermeable plinthic material which impedes vertical movement and promotes lateral flows.

The spatial distribution of all identified soil forms within the study area is presented in soil map in Figure 5 below. Table 6 below presents the dominant soil forms and their respective diagnostic horizon sequence.

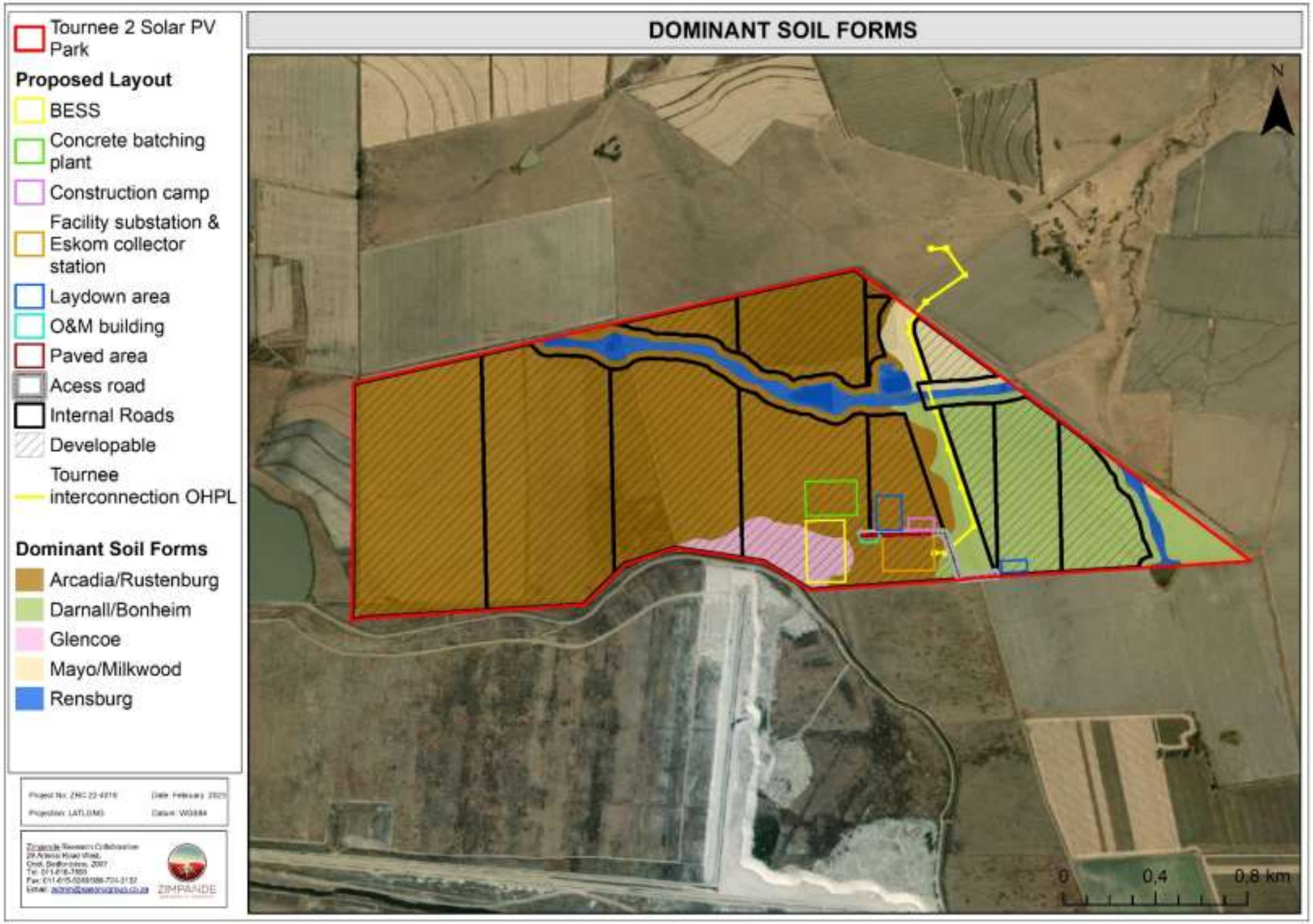


Figure 7: Dominant soil forms associated with the Tournee 2 Solar PV Park.

4.2 Land Capability Classification

For this assessment, land capability was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Climate Capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification. The study area falls into Climate Capability Class 4 due a moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops.

The identified soils were classified into land capability and land potential classes using the Camp *et. al*, and Guy and Smith Classification system (Camp *et al.,* 1987; Guy and Smith, 1998), as presented on Figure **8;** while Figure **9** illustrates the Land Potential associated with the study area when incorporating other factors such as climate, slope and soil conditions together. **Table 7** below presents the dominant soil forms and their respective land capability, agricultural potential as well as areal extent expressed as hectares as well as percentages.

Table 7: Land capability and land potential associated with the soils occurring within the study area.

Soil Form	Land Capability	Land Potential	Area (ha)	Percentage (%)
Darnall/Bonheim	Arable (Class IV)	Moderate Potential (L4)	70.4	21.3
Glencoe				
Rensburg	Watercourse (Class V)	Watercourse (L4)	13.5	4.1
Arcadia	Grazing (Class VI)	Restricted Potential (L5)	246.3	74.6
Mayo/Milkwood				
Total Enclosed			**330.2**	**100**

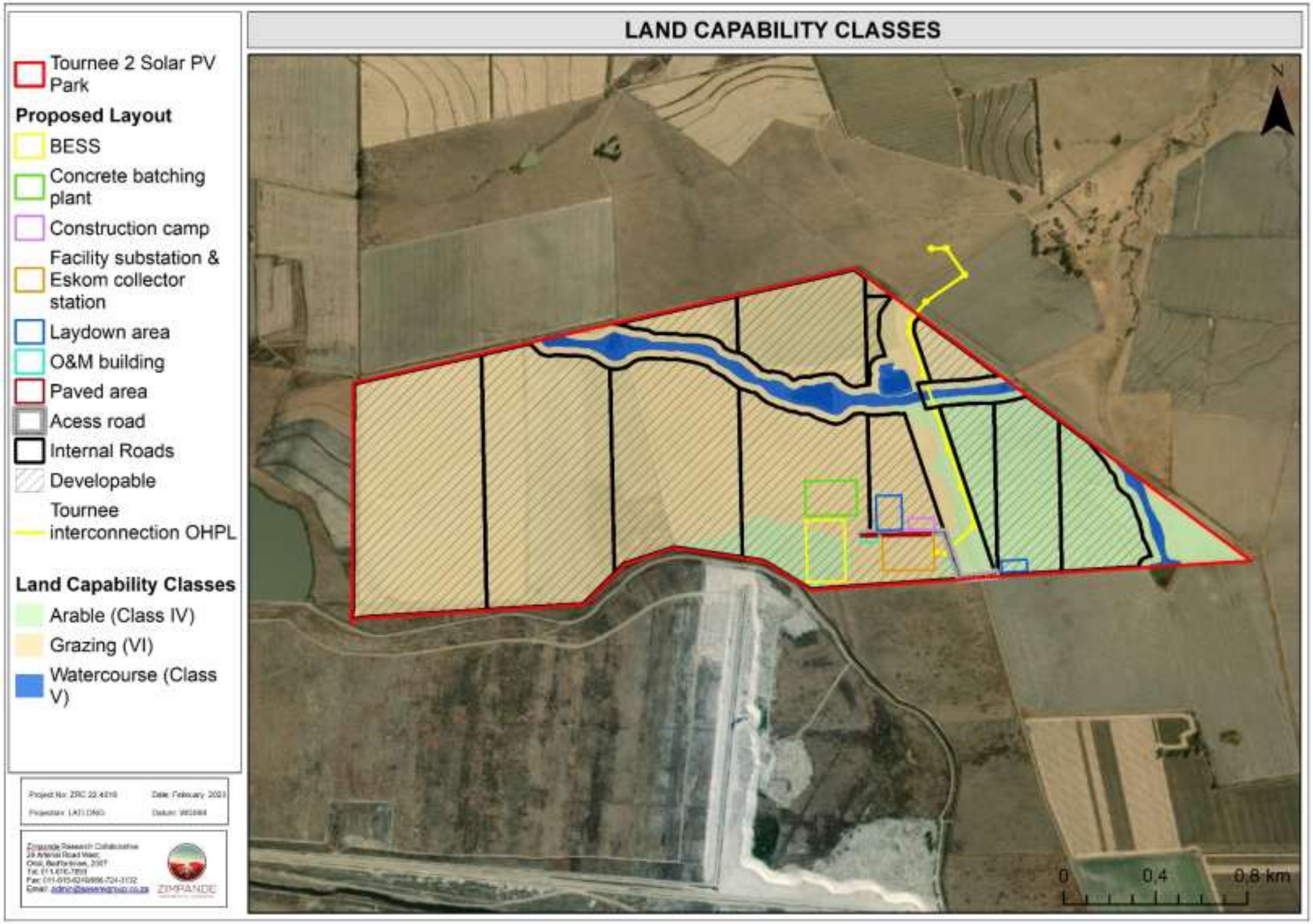


Figure 8: Land Capability of the soil forms associated with the Tournee 2 Solar PV Park.

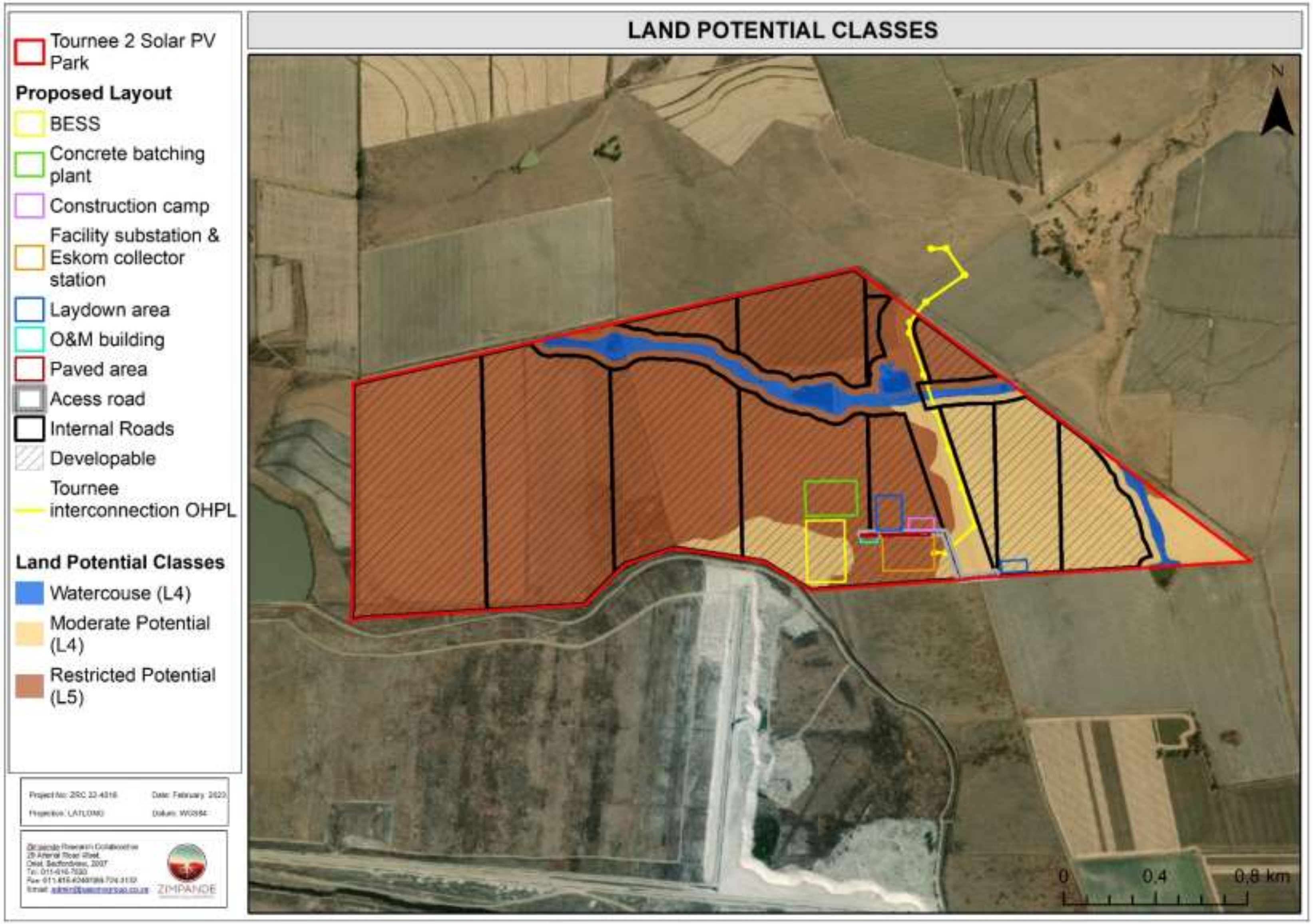


Figure 9: Land potential associated with the Tournee 2 Solar PV Park.

Table 8: Summary discussion of the Arable (Class IV) land capability class.

Land Capability: Arable (Class IV) and Moderate potential land			
 			
Terrain Morphological Unit (TMU)	Gently sloping land of >1% slope	**Photograph notes**	View of the identified with the Darnall/Bonheim soil horizons.
Soil Form(s)	Darnall/Bonheim and Glencoe	**Area Extent**	70.4 ha 21.3%
Physical Limitations	High clay content.	**Land Capability and Land Potential** The identified soil forms are of moderate (Class IV) land capability, and suitable for arable agricultural land use with restrictions. Therefore, these soils are considered to potentially make a moderate contribution to agricultural productivity on a regional and national scale.	
Land Potential	**Restricted Potential (L5)**: Regular and/or moderate to severe limitations due to soil, temperature, or rainfall.	**Consideration of Integrated Environmental Management and Sustainable Development principles:** Even though these soils are of arable agricultural significance the suitability for crop production is limited by the high clay content which may be detrimental to root growth and nutrient uptake by plants. The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded important from an agricultural point of view. There is an opportunity for the proposed solar project co-exist with the ongoing cultivation provided that natural grassland areas are target as far as practically possible. These soils should be afforded the necessary protection according to the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) wherever possible.	

Table 9: Summary discussion of the Grazing (Class VI) land capability class.

Land Capability: Grazing (Class VI)			
  			
Terrain Morphological Unit (TMU)	Typically associated with the crest (TMU 1) and scarp (TMU 2), very steep terrain.	**Photograph notes**	View of the topsoil horizons, hard rock and hard carbonate horizons associated with the Arcadia/Rustenburg soil forms.
Soil Form(s)	Arcadia and Milkwood/Mayo	**Areal Extent**	246.3 ha 74.6%
Physical Limitations	Shallow effective rooting depth is the primary limitation of the land capability which is due to the high clay content which hinders penetration of plant roots.	**Land Capability** The identified Arcadia and Milkwood/Mayo soil forms are of poor (Class VI) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suitable for natural pastures for light grazing. Therefore, these soils are not considered to make a substantial contribution to extensive subsistence farming on a local scale.	
Land Potential	**Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperature, or rainfall.	**Consideration of Integrated Environmental Management and Sustainable Development principles:** The identified soil forms are, at best, suited for grazing and/or wilderness practices. These soils are generally not considered to be of significant agricultural but in this instance, these are under active cultivation with a significantly high yield potential (8 and 3 tons per hectare for maize and soybeans respectively). Therefore, mitigation measures should this put in place to minimise disruption of these soils as far as practically possible, and areas under natural grassland should be targeted to ensure that the proposed development co exists with cultivated agriculture.	

Table 10: Summary discussion of the Watercourse (Class V) land capability class

<table>
<tr><th colspan="4">Land Capability: Grazing Class V</th></tr>
<tr><td colspan="4"> </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Relatively flat to gently sloping landscape of < 2% slope gradient</td><td>Photograph notes</td><td>View of the morphology of the identified Rensburg soil forms.</td></tr>
<tr><td>Soil Form(s)</td><td>Rensburg</td><td>Area Extent</td><td>13.5 ha 4.1%</td></tr>
<tr><td>Physical Limitations</td><td>These soils were found to be associated with a watercourse features. The land capability class in which these soils were assigned to is associated with water course or land with wetness limitations during the rainy season.</td><td colspan="2">Land Capability
The identified Rensburg soil forms are of limited watercourse (class V) land capability and are not considered as prime agricultural soils. Theses soils, at best, are associated with seasonal wetlands as well as livestock grazing. Therefore, these soils are considered to make a substantial contribution to extensive commercial cattle farming.</td></tr>
<tr><td>Land Potential</td><td>Restricted potential: Regular and/or moderate to severe limitations due to soil, slope, temperature, or rainfall.</td><td colspan="2">Consideration of Integrated Environmental Management and Sustainable Development principles:

These soils have a limited contribution to the agricultural resources due to wetness limitation and low yield potential. However, the watercourses can be important in an irrigated agricultural practise since they serve as water sources for irrigation. In addition, watercourse areas should be excluded since these areas are prone to flooding which may cause damage to infrastructure, and because watercourses enjoy protection from the National Water Act No. 36 of 1996 and the National Environmental Management Act No. 36 of 1996.</td></tr>
</table>

5 IMPACT ASSESSMENT AND MITIGATION MEASURES

The proposed activities as part of the Tournee 2 solar PV establishment will entail light excavation as part of surface infrastructure preparations. The occurring soils are anticipated to be exposed to erosion, dust emission, and potential soil contamination impacts during the construction phase of the proposed development; and these impacts may persist for the duration of the operational phase if not mitigated adequately. The significance of the impacts is summarised on Tables presented below for the proposed development.

5.1 Activities and Aspect Register

The impact assessment rating is applicable to the following activities:

ACTIVITIES AND ASPECTS REGISTER
Pre-Construction Phase
- Planning and design of the solar facility with specific mention of the solar Arrays that extend over large areas of agriculturally productive land. - Preparation for the construction activities. - **Impact:** Vegetation clearance within the study area leading to soil erosion. Soil Compaction leading to disruption of soil physical characteristics (i.e., structure, porosity) Soil Contamination leading to alteration of the soil chemical characteristics and subsequent impact on fertility
Construction Phase
- Land and footprint clearing as well as light soil stripping. - **Impact:** Increased soil erosion and subsequent soil loss. Loss of organic matter Soil Compaction leading to disruption of soil physical characteristics (i.e., Structure, porosity) Soil Contamination leading to alteration of the soil chemical characteristics and subsequent impact on fertility
- Establishment of surface infrastructure (Solar facility). - **Impact:** Spillage of hydrocarbons leading to soil contamination. Increased run-off (and erosion) in compacted areas and modification of natural infiltration.
Operational and Maintenance Phases
- Operation of the surface infrastructure. - **Impact:** Increased soil erosion, compaction and spillage of hydrocarbons

5.1.1 Loss of Agricultural Land Capability

The dominant soils which account for 74.6% (Arcadia and Mayo/Milkwood) are suitable for grazing (Class VI) and have a restricted potential cultivated agriculture due to the high clay content and susceptibility to water logging conditions. Only 21.3 % of the total study area is comprised of marginal arable soils and these are Darnall/Bonheim and Glencoe soil forms which also have similar limitations due to high clay content although the clay content is such that tillage is more viable than that of the Arcadia and Mayo/Milkwood soil forms. The remaining soil is associated with the occurring freshwater features and this the Rensburg soil form which occupies 4.1% of the study area.

5.1.2 Soil Erosion

Soil erosion is largely dependent on land use and soil management and is generally accelerated by anthropogenic activities. In the absence of detailed South African guidelines on erosion classification, the erosion potential and interpretation are based on field observations as well as observed soil profile characteristics. In general, soils with high clay content have a high-water retention capacity, thus less prone to erosion in comparison to sandy textured soils, which in contrast are more susceptible to erosion.

The proposed development footprint is located on a gradually sloping terrain. Soils which were vegetated prior to the proposed activities will be more susceptible to erosion during the construction phase if left bare or if not vegetated before the rainy season; thus, exposed to wind and storm water. The impact significance with appropriate mitigation measures put in place Low due to the high clay content of the surrounding soils.

5.1.3 Soil compaction

Heavy equipment traffic during construction activities is anticipated to cause soil compaction. The soils within the study area will be subjected to compaction as there will be a significant increase in the use of vehicle and heavy machinery during the construction phase and if work is done when the soil is wet this may increase the soils susceptibility to compaction. However, the significance of the impact is Moderate if unmanaged and Low if managed, given that the effect will be localized and restricted to access roads, vehicle hardstand areas and equipment and machinery laydown areas. Soil compaction may potentially lead to:

- Increased bulk density and soil strength, reduced aeration, and lower infiltration rate;
- Consequently, it lowers crop performance via stunted aboveground growth coupled with reduced root growth;
- Destroyed soil structure, causing it to become more massive with fewer natural voids with a high possibility of soil crusting. This situation can lead to stunted, drought-stressed plants because of restricted water and nutrient uptake, which results in reduced crop yields; and
- Soil biodiversity is also influenced by reduced soil aeration. Severe soil compaction may cause reduced microbial biomass. Soil compaction may not influence the quantity, but the distribution of macro fauna that is vital for soil structure including earthworms due to reduction in large pores.

5.1.4 Potential Soil Contamination

Contamination sources are mostly unpredictable and often occur as incidental spills or leaks during both the construction and operational phase. Thus, all the identified soils are considered equally predisposed to potential contamination. The significance of soil contamination is Moderate for all identified soils without mitigation and Low with mitigation, largely depending on the nature, volume and/or concentration of the contaminant of concern as well as the rate at which contaminants are transported by water in the soil. If the management protocols are not well managed this will more likely lead to:

- Contaminants leaching into the soil and thus potentially rendering the soil sterile. reducing the yield potential of soils.
- Potential reduction of water quality used for irrigation and for livestock use.

5.1.5 Cumulative Impacts and Screening tool Verification

The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded important from an agricultural point of view and as such this is deemed to be a constraint for this project.

According to the desk-based assessment the grazing capacity for this area is 4 Hectares per animal which is considered adequate for commercial farming. It was also evident during the site verification that the grazing land was utilised for fodder which means that these areas are actively used for commercial purposes. As such, this also presents a constraint for this project.

The loss of agricultural soils and the permanent change in land use will be localised to within the study area. The integrated mitigation measures must be implemented accordingly, with the aim of minimising the potential loss of these valuable soils considering the need for sustainable development.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a high sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment this was found to be of a less significance impact as presented on the screening tool due to the dominant soil forms which are not high potential agricultural soils due to various limitations which include high clay content and susceptibility to water logging.

The high sensitivity class can be considered valid on the basis that the study area is largely under active cultivation and the yield potential for maize and soybeans is considered adequate to contribute to the local and regional food production grid.

The Tables below present the impact significance ratings for the proposed solar PV various phases namely the pre-construction/planning phase, the construction, and operational phases.

Table 11: Summary of the soil and land capability Impact Assessment of the Pre-Construction & Planning Phase of the proposed Tournee 2 Solar PV.

IMPACT NATURE		Impact –Soil, land capability and agricultural potential.			STATUS	NEGATIVE
Impact Description		Loss of Land Capability				
Impact Source(s)		• Vegetation clearing and partial topsoil stripping as part of surface preparation; • Placement of infrastructure on soil suitable for cultivation and grazing; and • Movement of Construction vehicles of good potential agricultural soils.				
Receptor(s)		Agricultural Resources				
Soil Impact	**Driver / Activity**	**PARAMETER**	**WITHOUT MITIGATION**	**SCORE**	**WITH MITIGATION**	**SCORE**
Loss of Land Capability	Potential poor planning leading to placement of stripped and stockpiled soils outside the demarcated areas.	EXTENT (A)	PV2:	2	PV2:	1
		DURATION (B)	PV2:	4	PV2:	2
		PROBABILITY (C)	PV2:	4	PV2:	3
		INTENSITY OR MAGNITUDE (D)	PV2:	-2	PV2:	-2
		SIGNIFICANCE RATING (F) = (A*B*D)*C	PV2:	**-64**	PV2:	**-12**
Soil Erosion	Potential poor planning leading to placement of the solar PV and associated infrastructure on moderate potential agricultural soils utilised for grazing.	EXTENT (A)	PV2:	2	PV2:	1
		DURATION (B)	PV2:	3	PV2:	2
		PROBABILITY (C)	PV2:	4	PV2:	3
		INTENSITY OR MAGNITUDE (D)	PV2:	-2	PV2:	-2
		SIGNIFICANCE RATING (F) = (A*B*D)*C	PV2:	**-48**	PV2:	**-12**
Soil Contamination	Potential poor planning leading to spillage of petroleum hydrocarbons on moderate potential agricultural soils utilised for grazing.	EXTENT (A)	PV2:	1	PV2:	1
		DURATION (B)	PV2:	3	PV2:	2
		PROBABILITY (C)	PV2:	4	PV2:	2
		INTENSITY OR MAGNITUDE (D)	PV2:	-2	PV2:	-2
		SIGNIFICANCE RATING (F) = (A*B*D)*C	PV2:	**-24**	PV2:	**-8**
Soil Compaction	Potential poor planning leading to placement of the solar pv and associated	EXTENT (A)	PV2:	1	PV2:	1
		DURATION (B)	PV2:	4	PV2:	2
		PROBABILITY (C)	PV2:	4	PV2:	2

	infrastructure on soils susceptible to compaction.	**INTENSITY OR MAGNITUDE (D)**	PV2:	-2	PV2:	-2
		SIGNIFICANCE RATING (F) = (A*B*D)*C	PV2:	**-32**	PV2:	**-8**
CUMULATIVE IMPACTS		The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale. The cumulative impact on the local and regional scale is considered moderate without mitigation and low with mitigatory measures in place as the dominant soils are not sensitive from a soil and land capability point of view.				
CONFIDENCE		High				
MITIGATION MEASURES		• Infrastructure footprint area should be clearly demarcated to avoid unnecessary disturbance of adjacent soils; • Access road should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance; • Construction vehicle movement should be limited to within the project perimeter fence to avoid unnecessary compaction of adjacent soils; • Revegetate adjacent areas with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions; and • Always strip a suitable time before the placement or construction of the solar PV facilities, to avoid soil loss and contamination.				

Table 12: Summary of the soil and land capability Impact Assessment of the Pre-Construction & Planning Phase of the proposed Tournee PV 2.

IMPACT NATURE	Impact –Soil, land capability and agricultural potential.	STATUS	NEGATIVE
Impact Description	Loss of Land Capability		
Impact Source(s)	• Vegetation clearing and partial topsoil stripping as part of surface preparation; • Placement of infrastructure on soil suitable for cultivation and grazing; and • Movement of Construction vehicles of good potential agricultural soils.		
Receptor(s)	Agricultural Resources		

Soil Impact	Driver / Activity	PARAMETER	Pre - mitigation (Score)	Post - mitigation (Score)
Loss of Land Capability	Potential poor planning leading to placement of stripped and stockpiled soils outside the demarcated areas.	Impact Magnitude (M)	4	1
		Impact Extent (E)	3	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	3
		Probability of Occurrence (P)	5	3
		Significance (S)	(-) 70	(-) 24
		Environmental Significance Rating	High	Low
Soil Erosion	Potential poor planning leading to placement of the solar PV and associated infrastructure on moderate potential agricultural soils utilised for grazing.	Impact Magnitude (M)	2	2
		Impact Extent (E)	2	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	2	2
		Probability of Occurrence (P)	3	2
		Significance (S)	(-) 27	(-) 16
		Environmental Significance Rating	Low	Low
Soil Contamination	Potential poor planning leading to spillage of petroleum hydrocarbons on moderate potential agricultural soils utilised for grazing.	Impact Magnitude (M)	3	2
		Impact Extent (E)	2	2
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	4
		Probability of Occurrence (P)	4	2
		Significance (S)	(-) 48	(-) 22
		Environmental Significance Rating	Moderate	Low
Soil Compaction	Potential poor planning leading to placement of the solar pv and associated	Impact Magnitude (M)	2	2
		Impact Extent (E)	2	1
		Impact Reversibility (R)	3	3

	infrastructure on soils susceptible to compaction.	**Impact Duration (D)**	**4**	**4**
		Probability of Occurrence (P)	**5**	**3**
		Significance (S)	(-) 55	(-) 30
		Environmental Significance Rating	**Moderate**	**Low**
CUMULATIVE IMPACTS		The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale. The cumulative impact on the local and regional scale is considered moderate without mitigation and low with mitigatory measures in place as the dominant soils are not sensitive from a soil and land capability point of view.		
CONFIDENCE		High		
MITIGATION MEASURES		• Infrastructure footprint area should be clearly demarcated to avoid unnecessary disturbance of adjacent soils; • Access road should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance; • Construction vehicle movement should be limited to within the project perimeter fence to avoid unnecessary compaction of adjacent soils; • Revegetate adjacent areas with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions; and • Always strip a suitable time before the placement or construction of the solar PV facilities, to avoid soil loss and contamination.		

Table 13: Summary of the soil and land capability Impact Assessment of the Construction Phase of the proposed Tournee 2 Solar PV.

IMPACT NATURE	Impact –Soil, land capability and agricultural potential.		STATUS	NEGATIVE
Impact Description	Loss of Land Capability			
Impact Source(s)	• Vegetation clearing and partial topsoil stripping as part of surface preparation; • Placement of infrastructure on soil suitable for cultivation and grazing; and • Movement of Construction vehicles of good potential agricultural soils.			
Receptor(s)	Agricultural Resources			
Soil Impact	**Driver / Activity**	**PARAMETER**	**Pre - mitigation (Score)**	**Post - mitigation (Score)**
Loss of Land Capability	*Soil stripping/excavation and removal of soil as a growth medium and loss of grazing land.	Impact Magnitude (M)	5	1
		Impact Extent (E)	3	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	5	3
		Probability of Occurrence (P)	5	3
		Significance (S)	(-) 80	(-) 24
		Environmental Significance Rating	High	Low
Soil Erosion	*Site clearing, removal of vegetation, and associated disturbances to soils, leading to increased runoff, erosion, and consequent loss of land capability in cleared areas and subsequent loss of soils utilised for grazing. *Potential frequent movement of earth moving machinery within lose and exposed soils, leading to excessive erosion.	Impact Magnitude (M)	2	2
		Impact Extent (E)	2	2
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	4
		Probability of Occurrence (P)	3	2
		Significance (S)	(-) 33	(-) 22
		Environmental Significance Rating	Moderate	Low
Soil Contamination	*Spillage of petroleum hydrocarbons during construction of the proposed solar facilities and the associated access road. *Potential disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Impact Magnitude (M)	2	2
		Impact Extent (E)	2	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	4
		Probability of Occurrence (P)	5	3
		Significance (S)	(-) 55	(-) 30
		Environmental Significance Rating	Moderate	Low
Soil Compaction	*Site clearing, removal of vegetation, and associated disturbances to soils, leading to, increased runoff, soil compaction and	Impact Magnitude (M)	4	2
		Impact Extent (E)	2	1
		Impact Reversibility (R)	3	3

	consequent loss of land capability in cleared areas.	**Impact Duration (D)**	**4**	2
		Probability of Occurrence (P)	**3**	2
		Significance (S)	(-) 39	(-) 16
		Environmental Significance Rating	**Moderate**	**Low**
CUMULATIVE IMPACTS	The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale. The cumulative impact on the local and regional scale is considered moderate without mitigation and low with mitigatory measures in place as the dominant soils are not sensitive from a soil and land capability point of view.			
CONFIDENCE	High			
MITIGATION MEASURES	• Bare soils within the access roads can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast; • All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission; • Although the soils have a high clay content, temporary erosion control measures in sloping areas should be used to protect the disturbed soils during the construction phase until adequate vegetation has established; • Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented, always made available and accessible to the contractors and construction crew conducting the works on site for reference; • A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works; • An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and • Burying of any waste including domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site; • The proposed Solar Photovoltaic (PV) Facilities development within the study area should aim to minimise the impact on soils with used for grazing activities; • Revegetate the disturbed soils with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions; and • The footprint areas should be lightly ripped to alleviate compaction.			

Table 14: Summary of the soil and land capability Impact Assessment of the operational and maintenance phase of the proposed Tournee 2 Solar PV.

IMPACT NATURE	Impact –Soil, land capability and agricultural potential.		STATUS	NEGATIVE
Impact Description	Loss of Land Capability			
Impact Source(s)	• Movement of maintenance equipment and vehicles of good potential agricultural soils.			
Receptor(s)	Agricultural Resources			

Soil Impact	Driver / Activity	PARAMETER	Pre - mitigation (Score)	Post - mitigation (Score)
Loss of Land Capability	*Frequent disturbances of soils, resulting in risk of reduced soil quality.	Impact Magnitude (M)	3	2
		Impact Extent (E)	2	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	2
		Probability of Occurrence (P)	4	2
		Significance (S)	(-) 48	(-) 16
		Environmental Significance Rating	Moderate	Low
Soil Erosion	*Frequent disturbances of soils during the maintenance of the solar PV, resulting in risk of erosion.	Impact Magnitude (M)	2	1
		Impact Extent (E)	1	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	2
		Probability of Occurrence (P)	3	2
		Significance (S)	(-) 30	(-) 14
		Environmental Significance Rating	Low	Low
Soil Contamination	*Leaching of hydrocarbons chemicals into the soils from maintenance equipment, leading to alteration of the soil chemical status as well as contamination of ground water.	Impact Magnitude (M)	2	1
		Impact Extent (E)	1	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	2
		Probability of Occurrence (P)	3	2
		Significance (S)	(-) 30	(-) 14
		Environmental Significance Rating	Low	Low
Soil Compaction	*Frequent disturbances of soils during the maintenance of the solar PV, resulting in risk of compaction.	Impact Magnitude (M)	2	1
		Impact Extent (E)	1	1
		Impact Reversibility (R)	3	3
		Impact Duration (D)	4	2
		Probability of Occurrence (P)	3	2

		Significance (S)	(-) 30	(-) 14
		Environmental Significance Rating	Low	Low
CUMULATIVE IMPACTS		The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale. The cumulative impact on the local and regional scale is considered moderate without mitigation and low with mitigatory measures in place as the dominant soils are not sensitive from a soil and land capability point of view.		
CONFIDENCE		High		
MITIGATION MEASURES		• Maintenance vehicles should be checked for leakages of hydrocarbons prior to commencement of maintenance activities; • Maintenance vehicles should stick to demarcated road as far as practically possible to minimise soil compaction on adjacent soils; • The solar panels should be cleaned with clean water and use of chemicals should be avoided to minimise the likelihood of potential soil contamination; and • Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil erosion.		

Table 15: Summary table of overall significance.

DESCRIPTION OF IMPACT	Soil Impact	Driver / Activity	Overall Significance – Without Mitigation	Overall Significance – With Mitigation
Pre-Construction & Planning Phase				
Loss of Agricultural resources	Soil erosion	Poor planning leading to placement of the solar PV and associated infrastructure on moderate potential agricultural soils utilised for cultivation and grazing.	Low	Low
	Soil compaction	Poor planning leading to placement of the solar PV and associated infrastructure on soils susceptible to compaction due to high clay content.	Moderate	Low
	Soil contamination	Poor planning leading to spillage of petroleum hydrocarbons on moderate potential agricultural soils utilised for cultivation and grazing.	Moderate	Low
	Loss of land capability and grazing potential	Poor planning leading to placement of stripped and stockpiled soils outside the demarcated areas.	High	Low
Construction Phase				
DESCRIPTION OF IMPACT	**Soil Impact**	**Driver / Activity**	**Overall Significance – Without Mitigation**	**Overall Significance – With Mitigation**
Loss of Agricultural resources	Soil erosion	*Site clearing, removal of vegetation, and associated disturbances to soils, leading to increased runoff, erosion, and consequent loss of land capability in cleared areas and subsequent loss of soils utilised for grazing. *Potential frequent movement of earth moving machinery within lose and exposed soils, leading to excessive erosion.	Moderate	Low
	Soil compaction	*Site clearing, removal of vegetation, and associated disturbances to soils, leading to, increased runoff, soil compaction and consequent loss of land capability in cleared areas.	Moderate	Low
	Soil contamination	*Spillage of petroleum hydrocarbons during construction of the proposed solar facilities and the associated access road. *Potential disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Moderate	Low
	Loss of land capability and grazing potential	*Soil stripping/excavation and removal of soil as a growth medium and loss of grazing.	High	Low

Operational and Maintenance Phases				
DESCRIPTION OF IMPACT	Soil Impact	Driver / Activity	Overall Significance	
			Without Mitigation	With Mitigation
Loss of Agricultural resources	Soil erosion	*Frequent disturbances of soils during the maintenance of the solar PV, resulting in risk of erosion.	Low	Low
	Soil compaction	*Frequent disturbances of soils during the maintenance of the solar PV, resulting in risk of compaction.	Low	Low
	Soil contamination	*Leaching of hydrocarbons chemicals into the soils from maintenance equipment, leading to alteration of the soil chemical status as well as contamination of ground water.	Low	Low
	Loss of land capability and grazing potential	*Frequent disturbances of soils, resulting in risk of reduced soil quality.	Moderate	Low

5. AGRICULTURAL SENSITIVITY

The agricultural sensitivity was based on the site verified results which considered the occurring soils as well as the current landuses particularly landuses contribution to the agricultural production spectrum. It is acknowledged that the DFFE screening sensitivity indicates the study areas as having a high agricultural sensitivity. Upon verification the site sensitivity ranged between low and high. The sensitivity classes were as follows:

- Cultivated land with Maize and Soybeans – Moderately High
- Grazing land – Intermediate
- Watercourses – Low

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a high sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment this was found to be of a less significance impact as presented on the screening tool due to the dominant soil forms which are not high potential agricultural soils due to various limitations which include high clay content and susceptibility to water logging.

Based on the precautionary principle the high sensitivity class can be considered valid on the basis that the study area is largely under active cultivation and grazing, however a more accurate sensitivity class would be “Moderately High”. The yield potential for maize and soybeans is considered adequate to contribute to the local and regional food production in a meaningful manner. Figure 10 below depicts the agricultural sensitivity.

Figure 10: Agricultural sensitivity associated with the Tournee 2 Solar PV Park.

6. HYDROPEDOLOGICAL OPINION

The footprint area for the proposed solar PV comprises wetlands. Thus, it is deemed necessary to investigate the recharge mechanism of the watercourse within and in close proximity to the study area to ensure that development planning takes cognisance of the hydropedologically important areas and hence enable informed decision making, construction design and support the principles of sustainable development.

The objective of the hydropedological study is to:

- Investigate the hydropedological drivers of the watercourse system near the development footprint;
- Determine the risk of the proposed activities on the watercourse system; and
- Define the developable areas from a hydropedological point of view taking into consideration the findings of other relevant studies;
- Develop a scientifically derived buffer; and
- Mitigation measures and recommendations to minimise the impact to acceptable levels in line with the mitigation hierarchy.

6.1 *Ecological Significance*

The proposed study area is associated with wetlands, thus it is deemed important to understand the status of the affected wetland in terms of their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) to ensure that the necessary protection is afforded.

According to the freshwater study conducted by SAS (2023), a channelled valley bottom (CVB) wetland and a depression wetland was identified to be associated with the proposed Tournée 2 Solar PV Park and investigation areas (defined as a 500m radius around the proposed Tournée 2 Solar PV Park). As the depression wetland is exclusively associated with the investigation area, and unlikely to be directly impacted by the proposed Tournée 2 Solar PV Park, only the CVB wetland was assessed further. The results of the field assessment are summarised in the table below while the locality of the identified freshwater features is depicted on Figure 11 below.

Table 16: Summary table of overall significance.

Freshwater ecosystems	PES	Ecoservices importance	EIS	REC / RMO / BAS
CVB wetland	D (largely modified)	Moderate – Very Low	Moderate	D/ Maintain/ D

6.2 Hydropedological Recharge Mechanisms

The catena of the landscape in which the wetland is situated largely resembles a Vertic and Melanic topo sequence where the soils are characterised by black coloured, strongly to very strongly structured (topsoil and subsoil) of varying depths. These soils have high clay content, displaying a high water-holding capacity and mostly containing a high percentage of swelling clay minerals. The recharge mechanism of the occurring soils is classified as responsive shallow. The high clay content of these soils leads to surface sealing once the soils become saturated, resulting in the generation of overland flow after rain events. Shallow responsive soils lead to a rapid runoff response time during intense rainfall events attributed to their clayey nature which inhibits infiltration. The table below presents a summary of the identified dominant soil forms and the associated hydropedological grouping.

Table 17: Summary table of the identified dominant soil forms and the associated hydropedological grouping.

Dominant Soil forms	Hydropedological Groupings
Arcadia	Responsive (Shallow)
Mayo/Milkwood	
Darnall/Bonheim	Recharge (Deep)
Rensburg	Responsive (Saturated)
Glencoe	Interflow (Soil/Bedrock)

6.2.1 Responsive (Shallow) Soils

The soils of Arcadia formation are characterised by a quick response to rain events and typically generate overland flow owing to the clayey nature of the soils. The Arcadia soil form is characterised by low infiltration rates which induce saturation excess in the lower lying positions in the landscapes. It must be noted that these are not wetland soils as these soils lack signs of hydromorphy in the subsurface to qualify them as a wetland soil (i.e., Rensburg soil form).

6.2.2 Recharge (Deep)Soils

Recharge soils are characterised by absence of any morphological indication of saturation and are typically associated with deep freely drained soils. The dominant hydrological pathway for these soils is vertical through and out the profile into the underlying bedrock. These soils are termed recharge soils, as they are likely to recharge groundwater, or lower lying positions in the regolith via bedrock.

6.2.2 Interflow (Soil/Bedrock) Soils

These soils are characterised by Orthic A horizon, underlain by yellow brown apedal B horizon over hard plinthic material. These are considered interflow soils due to the fluctuating water table that manifest between the soils and the semi-impermeable plinthic material which impedes vertical movement and promotes lateral flows. These soils are deemed important for recharging the wetlands, however in their extent within the study area is limited and are not directly connected to the occurring watercourses in the landscape.

6.2.3 Responsive (saturated) Soils

Responsive soils include clayey Katspruit (Ka) soil form which depict prominent signs of prolonged wetness (Gleying) occurring within the valley bottom wetland (refer to Table 4) the morphological characteristics of the soils signify long periods of saturation (Le Roux, et. al., 2015) and are essentially water receptors from the surrounding catchment since they largely occur in the valley bottom terrain unit in the landscape setting. The high clay content of these soils prolongs the inundation (hydroperiod) of the wetland by reducing the rate of lateral seepage while vertical movement of water in the soils does not occur.

Figure 11 below depicts the locality of the identified freshwater features, while Figure 12 presents the hydropedological soil types associated with the development.

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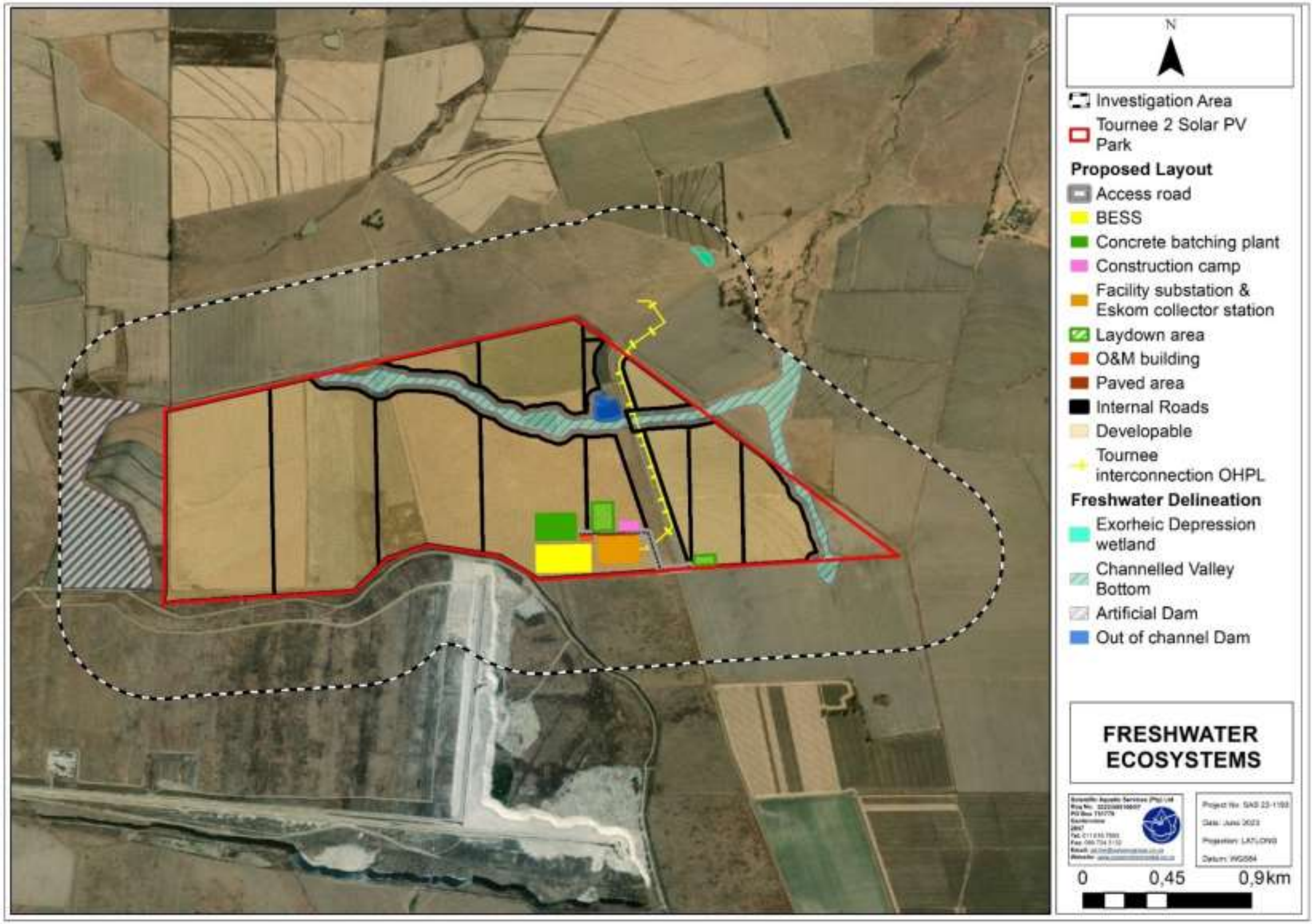

Figure 11: Location of the freshwater ecosystems associated with the proposed Tournée 2 Solar PV Park and investigation area.

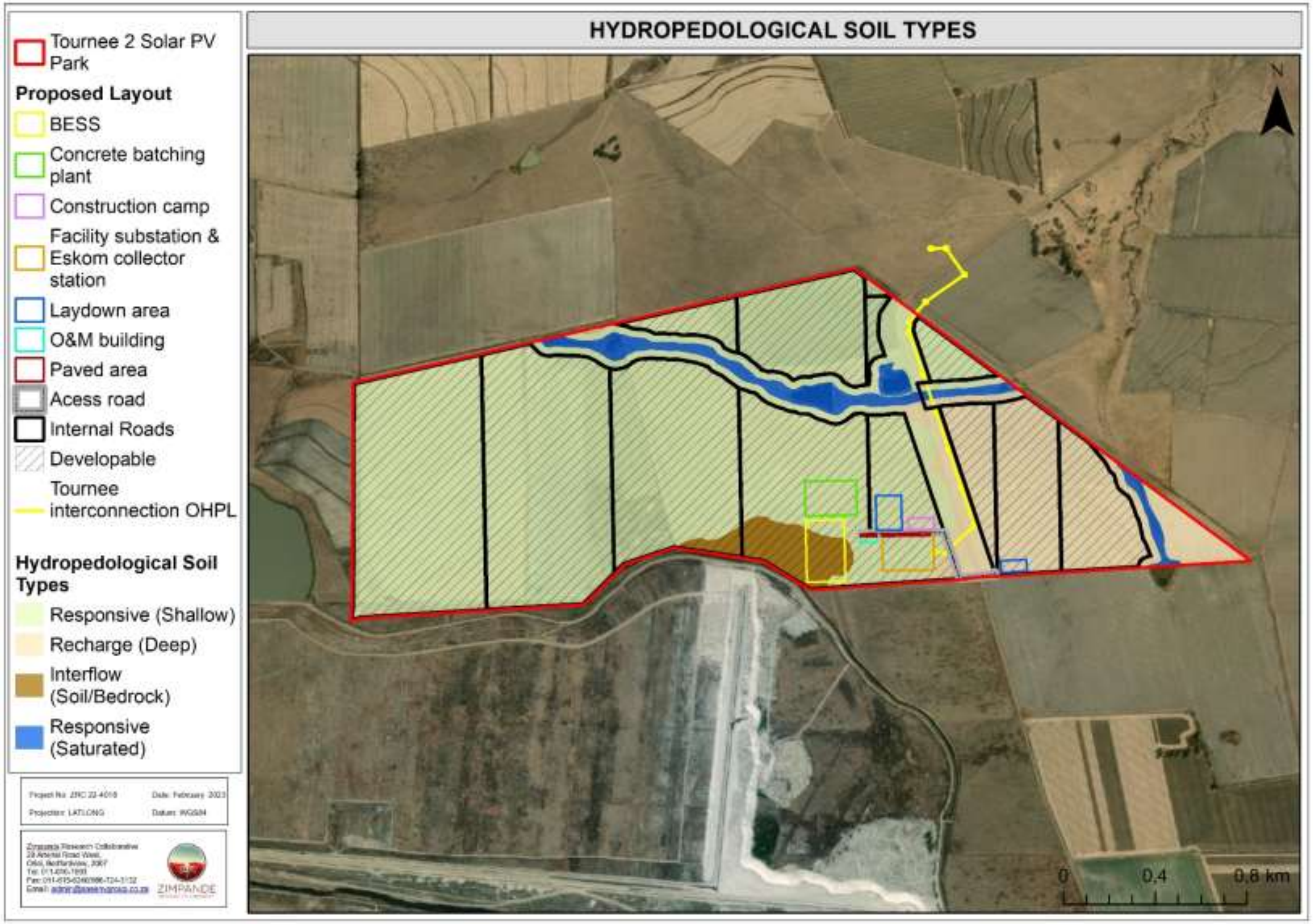

Figure 12: Map depicting hydrological soil types associated with the study area.

Figure 13 depicts the location of the transects whereas Figures 14 presents conceptual cross sections depicting the hillslope processes associated with the watercourse within the study area for pre- and post-development scenarios.

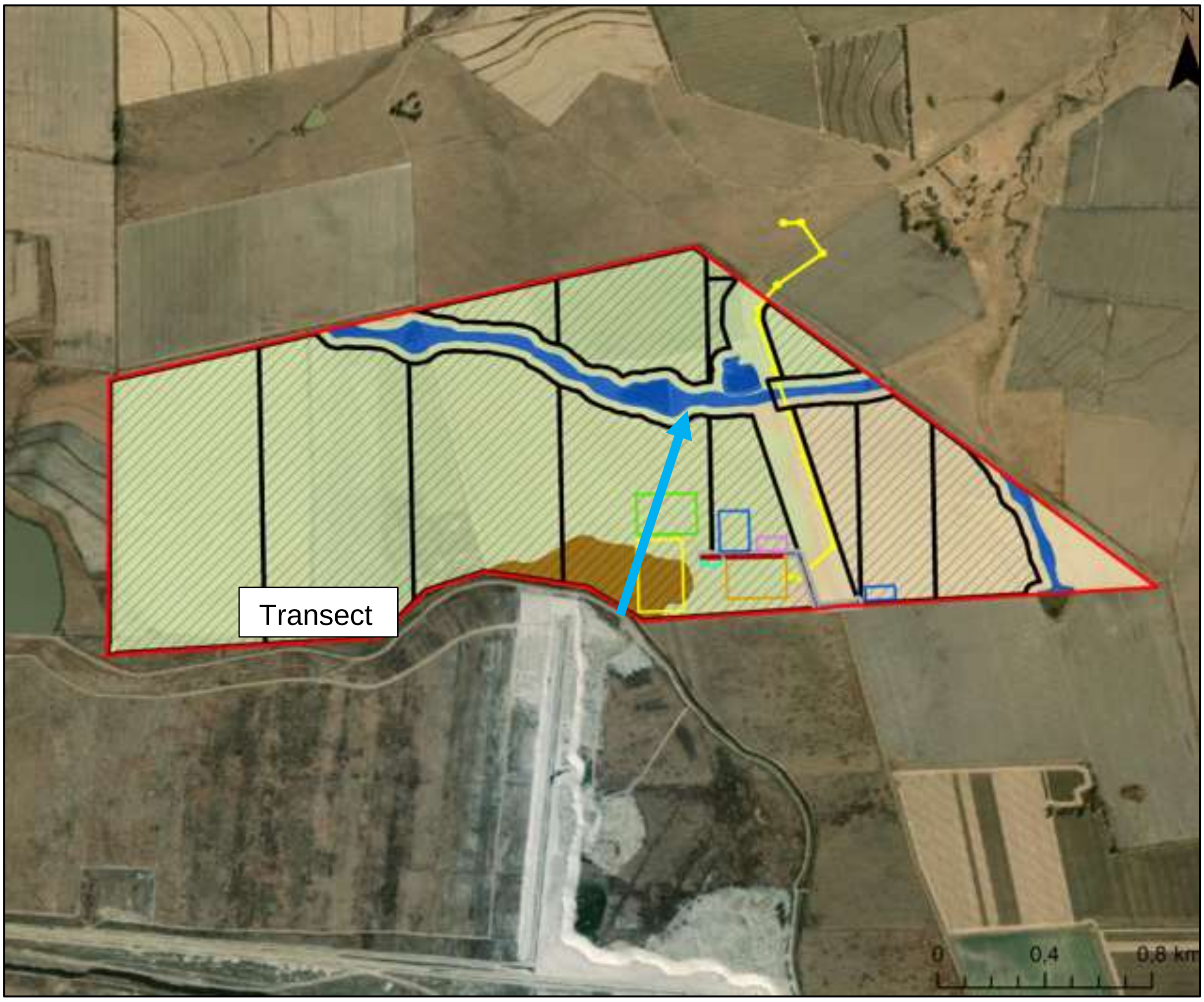

Figure 13: Depiction of the location of the investigated transect.

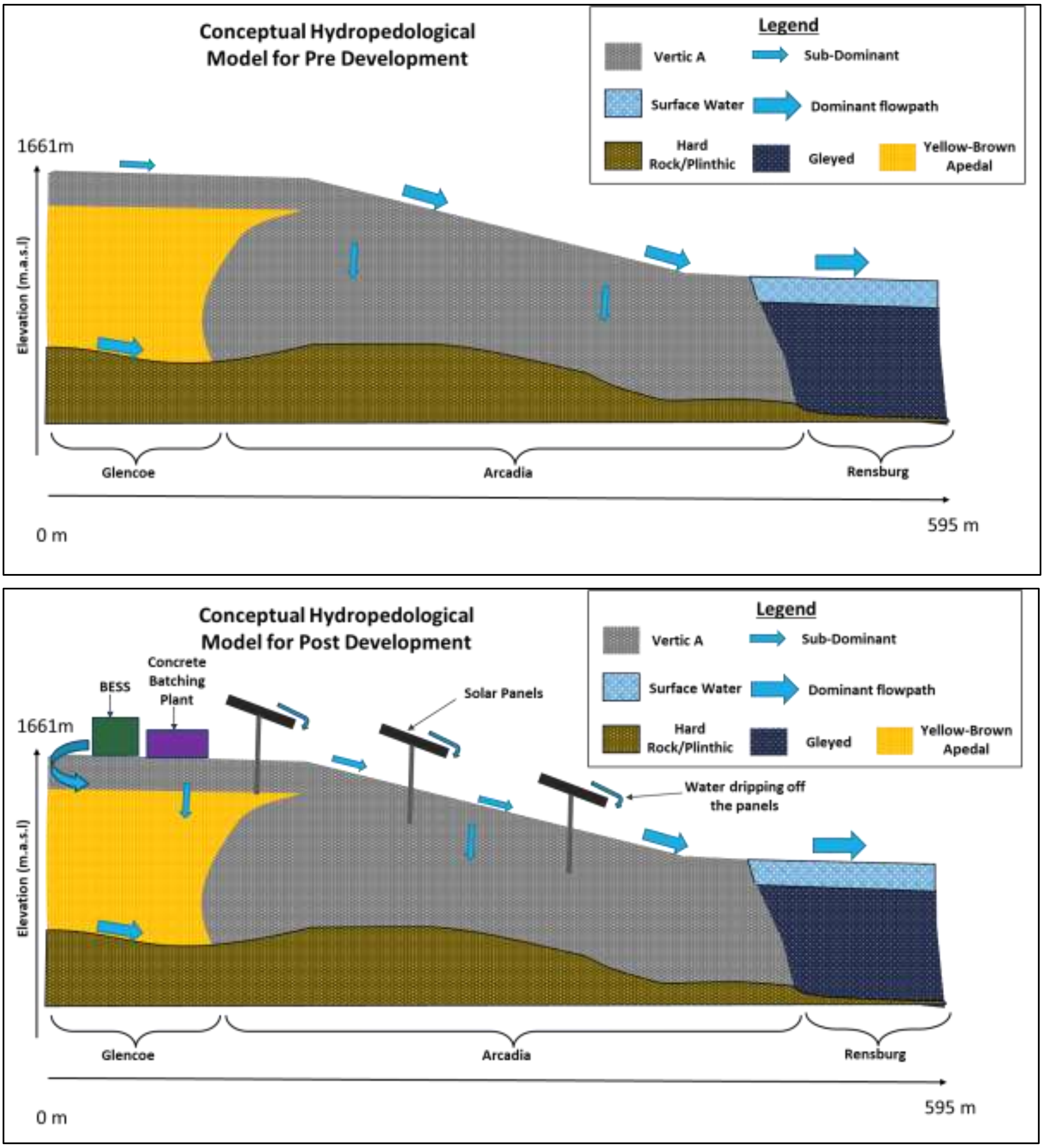

Figure 14: Depiction of conceptual hydropedological models for the pre and post development scenarios for the proposed solar PV development.

The study area is largely dominated by Arcadia soil formation which are characterised by a quick response to rain events and typically generate overland flow owing to the clayey nature of the soils. The Arcadia soil form is characterised by low infiltration rates which induce saturation excess in the lower lying positions in the landscapes. A small patch to the south of the study area comprises interflow soils of Glencoe soil forms and are characterised by a fluctuating water table that manifest between the soils and the semi-impermeable plinthic material which impedes vertical movement and promotes lateral flows.

The construction phase will only entail light excavation as part of infrastructure development. The post development scenario will not lead to any significant loss of hydropedological process, however a change in hydrological patterns is anticipated.

The project will likely lead to a limited loss of interflow recharge due to the BESS and Concrete Batching Plant. Mitigation measures should be carefully implemented during all phases of development to further minimise the impact. Although the pattern, timing and duration of the hydrograph would change to some degree, a change in the PES/EIS and functionality of the surrounding watercourse deemed unlikely provided that all mitigation measures are implemented. The development should ensure that the surface runoff is still delivered into the wetlands through stormwater management systems.

6.2 Scientific Buffer Consideration

The scientific buffer development as required by the Department of Water and Sanitation (DWS) was considered for this development to provide protection of the important watercourse recharge mechanisms to ensure that the status quo of the watercourse systems does not deteriorate during all phases of development.

Given the absence of hydropedologically important soils and the dominance of the overland flow mechanism following initial saturation of the swelling clay rich soils within the study area, a 32m NEMA Zone of Regulation is deemed sufficient to limit the potential edge effects on the freshwater features in the immediate vicinity of the proposed development. The 32m ZOR should be adhered to during all phases of development and the project must ensure that the stormwater is discharged back into the freshwater ecosystems in an attenuated manner.

7. CONCLUSIONS AND RECOMMENDATIONS

The Zimpande Research Collaborative (ZRC) was appointed to conduct a soil, land use and land capability assessment and hydropedological opinion as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the Tournee 2 Solar Park as proposed by Tournee 2 Solar (Pty) Ltd near Thuthukani and adjacent to the Eskom Tutuka Power Station, Mpumalanga Province.

The objective of this study was to evaluate:

- Climatic conditions within the context of agricultural productivity and constraints;
- Landscape setting and land use,
- Soil physical properties; and
- Other current limitations to various agricultural related land use purposes.

The development extent of the proposed solar PV includes areas functioning as wetlands. Thus, it is deemed necessary to investigate the recharge mechanism of the watercourses within and in close proximity to the study area to ensure that development planning takes cognisance of the hydropedologically important areas and hence enable informed decision making, construction design and support the principles of sustainable and water wise development.

The objective of the hydropedological study was to:

- Investigate the hydropedological drivers of the watercourse system near the development footprint;
- Determine the risk of the proposed activities on the watercourse system; and
- Define the developable areas from a hydropedological point of view taking into consideration the findings of other relevant studies;
- Develop a scientifically derived buffer; and
- Mitigation measures and recommendations to minimise the impact to acceptable levels in line with the mitigation hierarchy.

The landscape largely resembles a Vertic and Melanic topo sequence where the soils are characterised by melanic, strongly to very strongly structured (topsoil and subsoil) of varying depths. These soils have high clay content, displaying a high water-holding capacity and mostly containing a high percentage of swelling clay minerals. Only a small patch to the south of the study area which comprises plinthic based soils which are characterised by an Orthic A horizon, a yellow brown apedal B horizon and the underlying hard plinthic layer.

The dominant soils which account for 74.6% (Arcadia and Mayo/Milkwood) are suitable for grazing (Class VI) and have a restricted potential cultivated agriculture due to the high clay content and susceptibility to water logging conditions. Only 21.3 % of the total study area is comprised of marginal arable soils and these are Darnall/Bonheim and Glencoe soil forms which also have limitations such as high clay content and layer of refusal of the Glencoe soil forms. It should be noted that the clay content of Darnall/Bonheim is such that tillage is more viable than that of the Arcadia and Mayo/Milkwood soil forms. The remaining soil is associated with the occurring freshwater features and this the Rensburg soil form which occupies 4.1% of the study area. Table A below indicates the dominant soils occurring within the study area, together with the associated land capability and the area covered in hectares (ha).

Table A: Dominant soil forms and their respective land capability.

Soil Form	Land Capability	Land Potential	Area (ha)	Percentage (%)
Darnall/Bonheim	Arable (Class IV)	Moderate Potential (L4)	70.4	21.3
Glencoe				
Rensburg	Watercourse (Class V)	Watercourse (L4)	13.5	4.1
Arcadia	Grazing (Class VI)	Restricted Potential (L5)	246.3	74.6
Mayo/Milkwood				
Total Enclosed			**330.2**	**100**

The development footprint presents areas of active cultivation where maize and soybeans are currently cultivated. The yield potential for maize is approximately 8 tons per hectare while the soybeans is 3 tons per hectare. The cultivated areas are therefore regarded as productive and economically viable from an agricultural point of view and as such development in these lands will impact on food production from the land parcel and contribute to losses of food production on a broader scale.

According to the desk-based assessment the grazing capacity for this area is 4 Hectares per animal which is considered adequate for commercial farming. It was also evident during the site verification that the grazing land was utilised for fodder which means that these areas are actively used for commercial purposes.

The agricultural sensitivity was based on the site verified results which considered the occurring soils as well as the current landuses particularly landuses contribution to the agricultural production spectrum. It is acknowledged that the DFFE screening sensitivity indicates the study areas as having a high agricultural sensitivity. Upon verification the site sensitivity ranged between low and high. The sensitivity classes were as follows:

- Cultivated land with Maize and Soybeans – Moderately High
- Grazing land – Intermediate
- Watercourses – Low

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a high sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment this was found to be of a less significance impact as presented on the screening tool due to the dominant soil forms which are not high potential agricultural soils due to various limitations which include high clay content and susceptibility to water logging.

Based on the precautionary principle the high sensitivity class can be considered valid on the basis that the study area is largely under active cultivation and grazing, however a more accurate sensitivity class would be “Moderately High”. The yield potential for maize and soybeans is considered adequate to contribute to the local and regional food production in a meaningful manner.

Hydropedological Considerations

The catena of the landscape in which the wetland is situated largely resembles a Vertic and Melanic topo sequence where the soils are characterised by melanic, strongly to very strongly structured (topsoil and subsoil) of varying depths. These soils have high clay content, displaying a high water-holding capacity and mostly containing a high percentage of swelling clay minerals. The recharge mechanism of the occurring soils is classified as responsive shallow. The high clay content of these soils lead to surface sealing once the soil becomes saturated which can occur after limited rainfall, resulting in the generation of overland flow after rain events. Shallow responsive soils lead to a rapid runoff response time during intense rainfall events attributed to their clayey nature which inhibits infiltration.

The construction phase will only entail light excavation as part of infrastructure development. The post development scenario will not lead to any significant loss of hydropedological process, however a change in hydrological patterns is anticipated. The project will likely lead to a No-Net Loss of interflow recharge if mitigation measures are carefully implemented. The surface runoff would still be delivered into the wetlands through stormwater management systems, although the pattern, timing and duration of the hydrograph would change to some degree. A change in the Present Ecological State (PES) category is however not deemed likely, provided that all mitigation measures contained in this report and the freshwater ecological report are implemented.

Following the assessment of the study area and the identified potential impacts as the result of the proposed development; the key mitigation and rehabilitation measures can be summarised as follows:

Pre-Construction and Planning Phase Mitigation:

- The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- Clean water with only biodegradable detergents should be used to clean the panels to limit any soil contamination that might occur;
- A stormwater and erosion management plan must be developed to prevent the loss of soil resources;
- The contractor(s) appointed for the removal of infrastructure during closure must commit to the disposal of materials at registered sites;
- Post-removal of the solar PV, the site must be rehabilitated (compacted areas ripped, topsoil re-instated and the area vegetated with indigenous seed mix); and
- Use of heavy machinery should be avoided as far as possible to minimise further soil compaction during final rehabilitation.

Construction Phase Mitigation

- Bare soils within the access roads can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast;
- All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission;
- Temporary erosion control measures should be used to protect the disturbed soils during the construction phase until adequate vegetation has established;
- Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented, always made available and accessible to the contractors and construction crew conducting the works on site for reference;
- Use of heavy machinery should be avoided as far as possible to minimise further soil compaction during final rehabilitation.
- A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works;
- An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and
- Burying of any waste including domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site;

- The proposed Solar Photovoltaic (PV) Facilities development within the study area should aim to minimise the impact on soils with used for cultivation and grazing activities;
- Revegetate the disturbed soils with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions; and
- The footprint areas should be lightly ripped to alleviate compaction.

Operational Phase Mitigation

- Maintenance vehicles should be checked for leakages of hydrocarbons prior to commencement of maintenance activities;
- Maintenance vehicles should stick to demarcated road as far as practically possible to minimise soil compaction on adjacent soils;
- The solar panels should be cleaned with clean water and use of chemicals should be avoided to minimise the likelihood of potential soil contamination; and
- Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil erosion.

It is the opinion of the specialist that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area will be made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

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APPENDIX A: METHOD OF ASSESSMENT

Desktop Screening

Prior to commencement of the field assessment, a background study, including a literature review, was conducted in order to collect the pre-determined soil and land capability data in the vicinity of the investigated area Various data sources including but not limited to the Agricultural Geo-Referenced Information System (AGIS) and other sources as listed under references were used for the assessment.

Soil Classification and Sampling

A soil survey was conducted by a qualified soil specialist, at which time the identified soils within the infrastructure areas and associated access roads were classified into soil forms according to the Soil Classification Working Group for South Africa (2018). Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles, which entailed evaluating physical soil properties and prevailing limitations to various land uses.

Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table **A1** below; with Classes I to III classified as prime agricultural land that is well suitable for annual cultivated crops. Whereas, Class IV soils may be cultivated under certain circumstances and management practices, whereas Land Classes V to VIII are not suitable to cultivation. Furthermore, the climate capability is also measured on a scale of 1 to 8, as illustrated in Table **A2** below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed in order to inform the necessary mitigation measures.

Table A1: Land Capability Classification (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	IC		
IV	W	F	LG	MG	IG	LC				
V	W		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

Table A2: Climate Capability Classification (Scotney et al., 1987)

Climate Capability Class	Limitation Rating	Description
C1	None to slight	Local climate is favourable for good yield for a wide range of adapted crops throughout the year.
C2	Slight	Local climate is favourable for good yield for a wide range of adapted crops and a year round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1.
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.
C4	Moderate	Moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.
C5	Moderate to severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss.
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops for which frequently experience yield loss.
C7	Severe to very severe	Severely restricted choice of crops due to heat, cold and/or moisture stress.
C8	Very severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.

The land potential assessment entails the combination of climatic, slope and soil condition characteristics to determine the agricultural land potential of the investigated area. The classification of land potential and knowledge of the geographical distribution within an area of interest. This is of importance for making an informed decision about land use. **Table A3** below presents the land potential classes, whilst Table 4 presents description thereof, according to Guy and Smith (1998).

Table A3: Land Potential Classes (Guy and Smith, 1998)

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	(L3) Wetland	(L3) Wetland	(L4) Wetland	(L4) Wetland	(L5) Wetland	(L5) Wetland	(L6) Wetland	(L6) Wetland
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 A4: The Land Capability Classes Description (Guy and Smith, 1998)

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, temperature or rainfall. Appropriate permission is required before ploughing virgin land.
L5	**Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperature or rainfall.
L6	**Very restricted potential:** Regular and/or severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L7	**Low potential:** Severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L8	**Very low potential:** Very severe limitations due to soil, slope, temperature or rainfall. Non-arable.

APPENDIX B – IMPACT ASSESSMENT METHODOLOGY

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e., residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented below.

Table C1: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Table C2: impact significance rating

TOTAL SCORE	4 TO 15	16 TO 30	31 TO 60	61 TO 80	81 TO 100
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High

Impact Mitigation

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure B1 below.

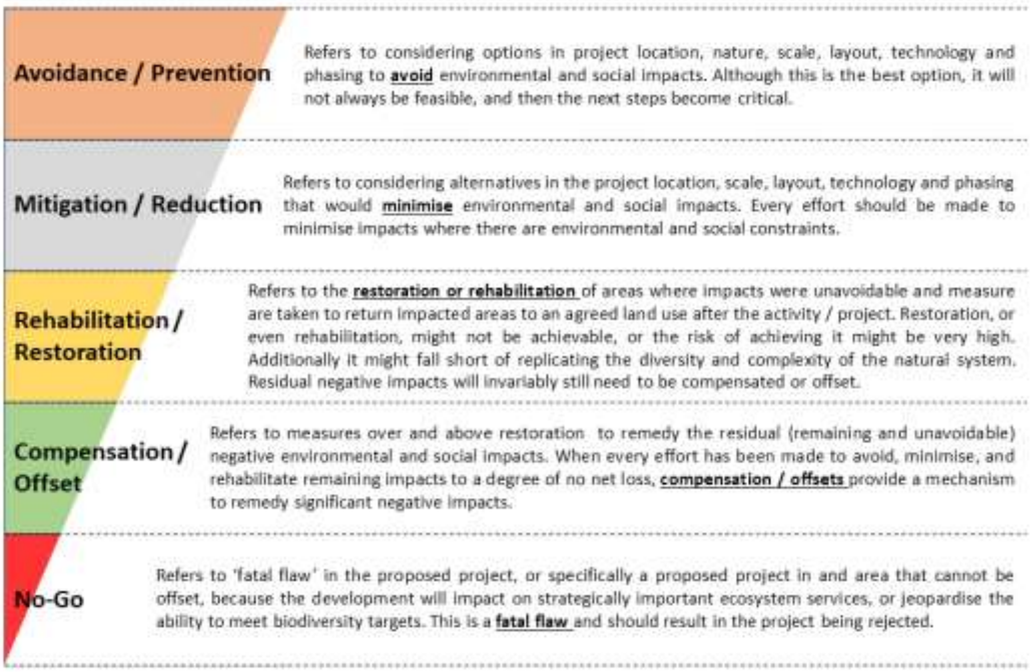

Figure B1:Mitigation Sequence/Hierarchy

APPENDIX C: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Tshiamo Setsipane MSc (Agric.) (Soil Science) (University of Free State)

Braveman Mzila BSc (Hons) Environmental Hydrology (University of KwaZulu-Natal)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Zimpande Research Collaborative		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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

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Signature of the Specialist

1.(b) A declaration that the specialist is independent in a form as may be specified by the competent authority

I, Braveman Mzila, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource discipline lead, Managing member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland assessment short course Rhodes University	2016
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2013

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

SAS ENVIRONMENTAL GROUP OF COMPANIES (SEGC) – SPECIALIST CONSULTANT INFORMATION CURRICULUM VITAE OF TSHIAMO SETSIPANE

PERSONAL DETAILS

Position in Company	Soil Scientist/ Hydropedologist
Joined SAS Environmental Group of Companies	2020

MEMBERSHIP IN PROFESSIONAL SOCIETIES

South African Council for Natural Scientist Professions (SACNASP)

EDUCATION

Qualifications

M.Sc. (Agric) Soil Science (*Cum Laude*)	(University of the Free State)	2019
BSc. (Agric) Honours Soil Science	(University of the Free State)	2014
BSc. (Agric) Soil Science & Agrometeorology	(University of the Free State)	2013

COUNTRIES OF WORK EXPERIENCE

South Africa – Kwa-Zulu Natal, Mpumalanga and Free State

KEY SPECIALIST DISCIPLINES

Hydropedological Assessments:

- Soil Survey
- Soil Delineation
- Hydrological hillslope classification
- Hydropedological loss Quantification
- Hydropedological impact assessment
- Scientific buffer determination

Soil, Land use, Land Capability and Agricultural Potential Studies

- Soil Desktop assessment
- Soil classification
- Agricultural potential
- Agricultural Impact Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF BRAVEMAN MZILA

PERSONAL DETAILS

Position in Company	Wetland Ecologist and Soil Scientist
Joined SAS Environmental Group of Companies	2017

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Soil Science Society (SASSO)

Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications	
BSc (Hons) Environmental Hydrology (University of Kwazulu-Natal)	2013
BSc Hydrology and Soil Science (University of Kwazulu-Natal)	2012

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape, KwaZulu-Natal

KEY SPECIALIST DISCIPLINES

Hydropedological Assessments:

- Soil Survey
- Soil Delineation
- Hydrological hillslope classification
- Hydropedological loss Quantification
- Hydropedological impact assessment
- Scientific buffer determination

Soil, Land use, Land Capability and Agricultural Potential Studies

- Soil Desktop assessment
- Soil classification
- Agricultural potential
- Agricultural Impact Assessments