ZIMPANDE
RESEARCH COLLABORATIVE

Soil, Landuse and Land Capability Assessment

FOR THE PROPOSED BLACK ROCK SOLAR PHOTOVOLTAIC (PV) FACILITIES AND ASSOCIATED INFRASTRUCTURE NEAR HOTAZEL, NORTHERN CAPE.

Prepared for:	EScience Associates (Pty)
Report author:	T. Setsipane
Report reviewers:	S. van Staden (Pr.Sci.Nat)
	B. Mzila
Report Reference:	ZRC 22-4041
Date:	December 2022

Part of the SAS Environmental Group of Companies

Website: http://www.sasenvironmental.co.za

EXECUTIVE SUMMARY

The Zimpande Research Collaborative (ZRC) was appointed by EScience Associates (Pty) Ltd to conduct a soil, land use and land capability assessment for the proposed 100 MW Solar PV Facility and associated infrastructure hereafter referred to as the ''study area'' unless referring to individual infrastructure.

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 climatic conditions associated with the study area and surroundings are characterised by climatic limitations with the Mean Annual Precipitation ranging between 201 – 400 mm per annum. The surrounding areas under these climatic conditions have a severely restricted growing season due to high temperatures, frost and moisture stress. This results in limited suitable crops which frequently experience yield loss. Therefore, crops under rainfed conditions should be cultivated with caution, and management practices such as irrigation may be required to maximise the yield.

Based on the observations during the site assessment and on google earth imagery, the dominant land use in the vicinity of study area is predominantly open veld areas used for low density livestock grazing along the isolated farm properties. Towards the western portion of the study area mining related activities were observed. The Eskom overhead powerline traverses the study area from east to west through the study area and the proposed overhead powerline runs parallel to the Eskom powerline.

The majority of the soils within the study area are dominated by the soils of the Ermelo, Hutton, Coega and Witbank, with Ermelo soil form covering approximately 82.5% of the study area. The Hutton, Witbank and Coega soil forms cover the study area by 13%, 4.4% and 0.1% respectively.

The majority of the soils (Ermelo and Hutton) occurring within the study area can be broadly classified as soils ideal for agricultural cultivation practices (with minor limitations) were climate permits as well as grazing activities and wildlife/wilderness.

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 (%)
Ermelo	Arable (Class II)	Moderate Potential (L4)	480.9	82.5
Hutton			75.6	13
Coega	Grazing (Class VI)	Very Restricted Potential (L6)	0.8	0.1
Witbank	Wilderness (Class VIII)	Very Low Potential (L8)	25.7	4.4
Cumulative Total			**583.1**	**100**

Although the study area is dominated by arable soils (Class II), the suitability of the surrounding area for successful dry land agriculture is low due to the climatic constraints of the area and lack of irrigation options. This area experiences erratic and very low rainfall which is necessary for successful dryland agriculture. Therefore, without any irrigation scheme and robust fertilisation programme in place the study area will be limited to grazing and wildlife uses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced this way. Lastly, 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 Medium sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment this was found to be of a lesser impact significance than presented on the screening tool due to the soil and climatic constraints for commercialised agricultural production. In addition, the historical imagery on google earth revealed that no prior commercial cultivation was observed within the study area for the past 5 years and thus the proposed development is not likely to have an unacceptable impact on the agricultural production capability.

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:

- The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- The possibility for any agricultural (i.e., grazing) activity concurrently with solar generation should be further investigated;
- The solar project footprint should be vegetated with grass underneath the panels which can potentially be used to feed the livestock of the local community during the operational phase.
- 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.

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.

DOCUMENT GUIDE

Table B: Document guide according to the amended 2017 EIA Regulations (No. R. 326)

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix B
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix B
b)	A declaration that the specialist is independent	Appendix B
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of base data used for the specialist report	Section 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4 and 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative	Section 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.1
j)	A description of the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4 and 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5.2
l)	Any conditions for inclusion in the environmental authorisation	Section 4.1
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	None
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 5 and 6
(iA)	Regarding the acceptability of the proposed activity or activities	Section 6
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 4 and 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	None
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
q)	Any other information requested by the competent authority	None

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF TERMS

Albic	Grey colours, apedal to weak structure, few mottles (<10 %)
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.
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.
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.
Ferralic:	Having a ferralic horizon starting ≤150 cm of the soil surface.
Ferralic horizon:	A subsurface horizon resulting from long and intense weathering, with a clay fraction that is dominated by low-activity clays and contains various amounts of resistant minerals such as Fe, Al, and/or Mn hydroxides.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hard Plinthic	Accumulative of vesicular Fe/Mn mottles, cemented
Hydrophytes:	Plants that are adaptable to waterlogged soils
Lithic	Dominantly weathering rock material, some soil will be present.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Plinthic Catena	South African plinthic catena is characterised by a grading of soils from red through yellow to grey (bleached) soils down a slope. The colour sequence is ascribed to different Fe-minerals stable at increasing degrees of wetness
Red Apedal	Uniform red colouring, apedal to weak structure, no calcareous
Runoff	Surface runoff is defined as the water that finds its way into a surface stream channel without infiltration into the soil and may include overland flow, interflow and base flow.
Orthic	Maybe dark, chromic or bleached
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.
Soil Map Unit	A description that defines the soil composition of a land, identified by a symbol and a boundary on a map
Soft Plinthic	Accumulation of vesicular Fe/Mn mottles (>10%), grey colours in or below horizon, apedal to weak structure

ACRONYMS

AGIS	Agricultural Geo-Referenced Information Systems
°C	Degrees Celsius.
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ET	Evapotranspiration
IUSS	International Union of Soil Sciences
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GPS	Global Positioning System
m	Meter
MAP	Mean Annual Precipitation
NWA	National Water Act
PSD	Particle Size Distribution
SACNASP	South African Council for Natural Scientific Professions
SAS	Scientific Aquatic Services
SOTER	Soil and Terrain
ha	Hectares
DEAT	Department of Environmental Affairs and Tourism

1. INTRODUCTION

The Zimpande Research Collaborative (ZRC) was appointed by EScience Associates (Pty) Ltd to conduct a soil, land use and land capability assessment for the proposed 100 MW Solar PV Facility and associated infrastructure hereafter referred to as the ''study area'' unless referring to individual infrastructure.

The study area is located on the remaining extent of Farm Klipling 271 which is approximately 60 km north-west of the town of Kuruman and 12 kilometres north-west of the town of Hotazel, within the jurisdiction of the John Taolo Gaetsewe District Municipality, and the Joe Morolong Local Municipality (see Figures 1 and 2 below for locality of the study area).

The proposed solar facility and its associated infrastructure and services are located on soils, which may potentially support agricultural practices and food production on a regional scale. Thus, it is imperative to understand the surrounding soils, land uses and land capability as well as the land potential to ensure that the proposed solar facility and associated surface infrastructure components within the study area areas takes into consideration the high potential agricultural land, parallel with the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983). High agricultural potential land is a scarce non-renewable resource, which necessitates an Agricultural Potential assessment prior to land development, particularly for purposes other than agricultural land use.

1.1 Project Description

Black Rock Mine Operations (BRMO) proposes to construct and operate a solar power generation facility to supply its operations, with the primary aims of:

- Offsetting electricity grid supply risks and escalating costs.
- Reducing BRMO's carbon footprint with a long-term view to net carbon neutrality.

The proposed facility will provide power to BRMO's operations and will have a maximum generating capacity of 100MW. The project will be built in phases with the first phase being 44MW, which will include:

- A solar PV plant.
- 2 substations and electrical distribution infrastructure.
- Battery storage facilities.

Please refer to Figure 3 for the layout of the various project components described above.

Figure 1: Digital satellite imagery depicting the locality of the study area in relation to the surrounding area.

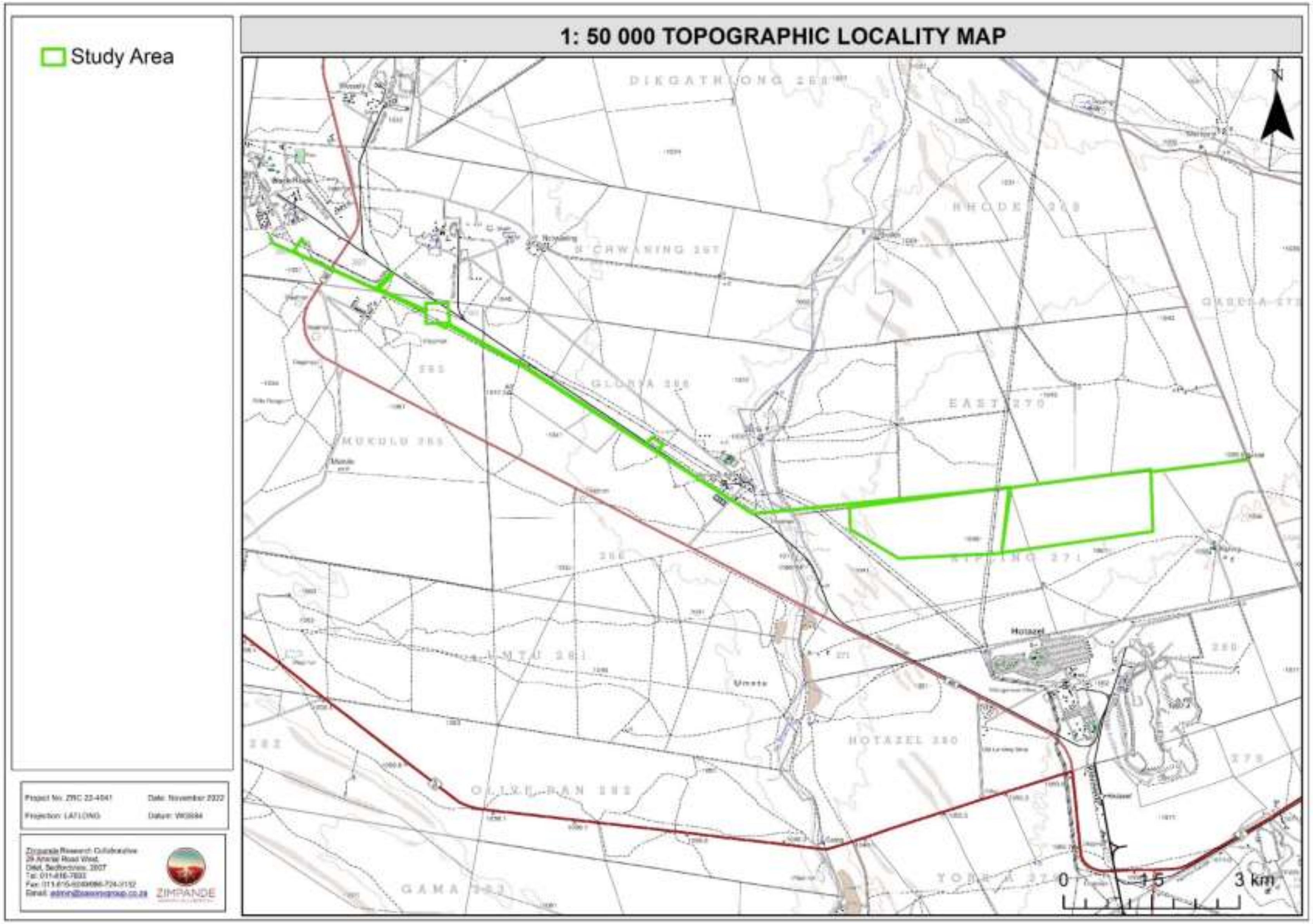


Figure 2: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.

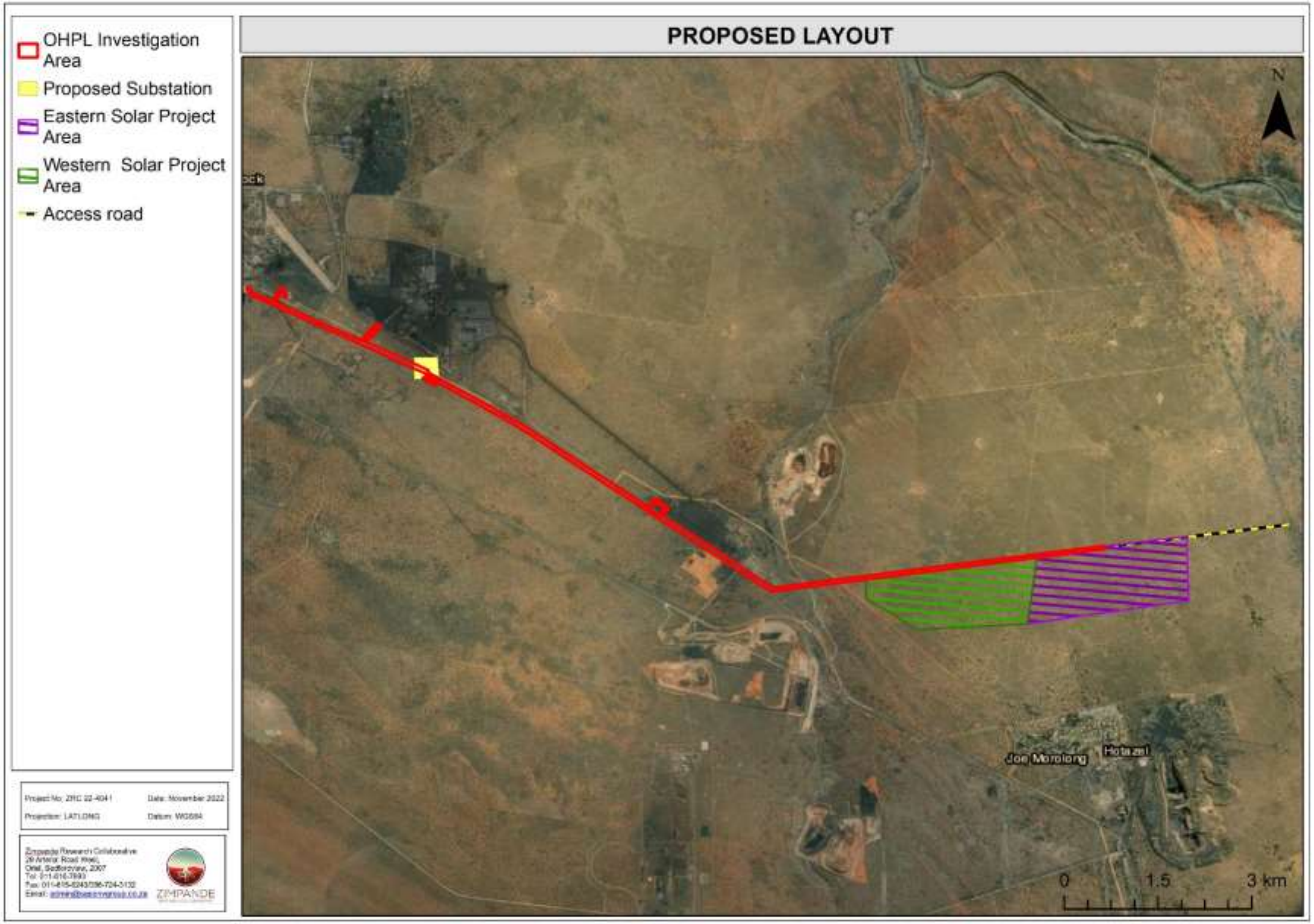


Figure 3: Proposed layout map.

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 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 pre-defined impact assessment methodology; and
- Compile soil, land use and land capability report under current on-site conditions based on the field finding data.

1.3 Assumptions and Limitations

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

- The soil, land use and land capability desktop assessment are confined to the Study area and does not include the neighbouring and adjacent properties;
- Land capability was classified according to the current soil restrictions, with respect to prevailing climatic conditions on site; however, it is virtually impossible to achieve 100% purity in soil mapping, the delineated soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute but rather form a continuum and gradually change from one type to another. Soil mapping and the findings of this assessment were therefore inferred from extrapolations from individual observation points; 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.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

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

2.2 Soil Classification and Sampling

A soil survey was conducted in October 2022, at which time the identified soils within the study area classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). This survey period is deemed appropriate since seasonality does not have an effect on the soil characteristics. 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.

2.3 Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table 1 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 2 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 1: 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 2: 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 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 3 below presents the land potential classes, whilst Table 4 presents a description thereof, according to Guy and Smith (1998).

Table 3: Table of 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 4: 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.

2.4 Consideration of DEA Screening Tool

The Agricultural Agro-Ecosystem Assessment protocol provides the criteria for the assessment and reporting of impacts on agricultural resources for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool which for agricultural resources is based on the most recent land capability evaluation values as provided by the Department of Agriculture, Forestry and Fisheries. The national web-based environmental screening tool can be accessed at: https://screening.environment.gov.za/screeningtool .

The main purpose of the Agricultural Agro-Ecosystem Assessment is to ensure that the sensitivity of the site to the proposed land use change (from potential agricultural land to the proposed solar photovoltaic (PV) facilities) is sufficiently considered. The information provided in this report aims to enable the Competent Authority to come to a sound conclusion on the impact of the proposed proposed solar photovoltaic (PV) facilities on the food production potential of the site.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool;
- It must contain proof (e.g., photographs) of the current land use and environmental sensitivity pertaining to the study area;
- All data and conclusions are submitted together with the main report for the proposed proposed solar photovoltaic (PV) facilities;
- It must indicate whether or not the proposed proposed solar photovoltaic (PV) facilities will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources; and
- The report is prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

The report is thus compiled in a manner that meets the minimum report content requirements for impacts on agricultural resources by the proposed proposed solar photovoltaic (PV) facilities.

3. DESKTOP ASSESSMENT RESULTS

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 5: 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 201 – 400 mm per annum. These conditions have a low 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 of the western portion of the study area is estimated at >2400 mm, whereas the eastern portion of the study area is estimated to range between 2201 – 2400 mm. The high evaporation rates pose risks to plant yield due possible plant permanent wilting resulting desiccation and lack of adequate soil moisture (Figure 4).
Geology	The Cretaceous to Tertiary Kalahari Formation and underlying Griqualand West Basin rocks, Transvaal Supergroup of Vaalian age dominate the entire study area. The youngest formation of the Kalahari group is the Gordonia Formation which is generally termed Kalahari sand and comprises of red or yellow aeolian sands that covers most of the Kalahari Group sediments.
Landform type	The Landform type occurring within the majority of the study area is classified as a Plain Landform, which means the terrain is suitable to allow agricultural activities. The remaining small portion on the midsection of the study area is classified as a high gradient hill and thus not suitable for agricultural activities (Figure 5).
Soil pH	According to the AGIS database, the pH of soil medium occurring within the study area is considered slightly acidic to acidic with pH ranging between 6.5 – 7.4. This means that some nutrients will not be available for plant uptake. This is however not considered a limitation as the soil's pH condition can be ameliorated.
Landtype data	The western portion of the study area is dominated by the Ah5 landtype, with the central portion by the Af28 landtype and the eastern portion by the Ah9 landtype. The Ah5 landtype is largely dominated by the deep soils of the Clovelly and Hutton formation and towards the valley bottom shallow soils of Mispah formation and endorheic pans. The Ah9 landtype largely consists of the aeolian sand deposits which can be in the form of deep (greater than 120 cm), very low mechanical limitations are anticipated on these soils. Lastly, the Af28 is characterised by more shallow soils with little to no leaching and occurrences of dunes in the landscape. (Figure 6)
The Soil and Terrain (SOTER) soil classification	The Soil and Terrain (SOTER) database indicates that the entire study area comprise Ferralic Arenosols. These soils consisting mainly of sand, with little humus or clay and thus may require additional inputs prior to cultivation.
Desktop land capability	The desktop land capability of the soils associated with the entire study area is of non-arable, grazing woodland or wildlife capability (Class VII).
Grazing Capacity	According to the AGIS database, the livestock grazing capacity potential is estimated to be approximately 13 hectares per large animal for the entire study area. The grazing capacity is considered low to marginally suitable for commercial livestock agriculture.
Desktop based Land use	Majority of the study area is characterised as vacant or unspecified landuses, with patches of mining land use from the central portion to the north western portions (Figure 7).
Alkalinity and Sodicity of the soils	The soils are neither alkaline nor sodic, this indicates soils are not affected by high concentration of salts.
Probability of soil loss	The predicted soil loss for the entire study area is considered very low. This can be attributed to the plain landform type which dominates the study area.
Soil Water Retaining Characteristics	Water retaining characteristics are scarce or absent within the entire study area. Water storage during the fallow period may not be possible in the absence of irrigated agriculture.
Clay Content	The clay content for most soils within the study area are characterised by clay contents of less than 15%. These soils are sandier in nature with little to no organic matter and some nutrients may potentially be leached out of the soils.
Department of Environmental Affairs (DEA) screening tool	The study area is characterised by very medium sensitivity to agriculture (Figure 8).

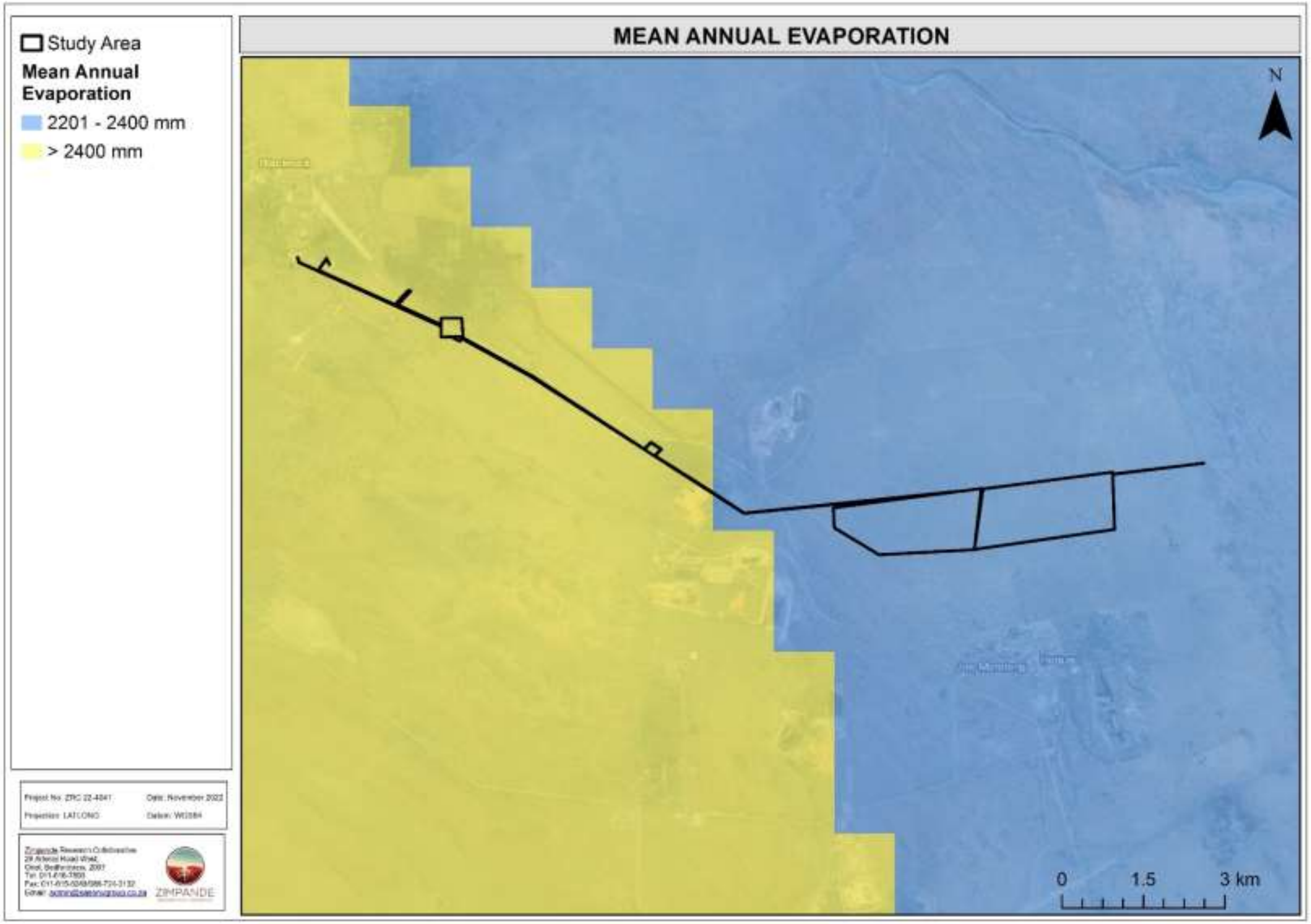


Figure 4: Mean Annual Evaporation associated with the study area.

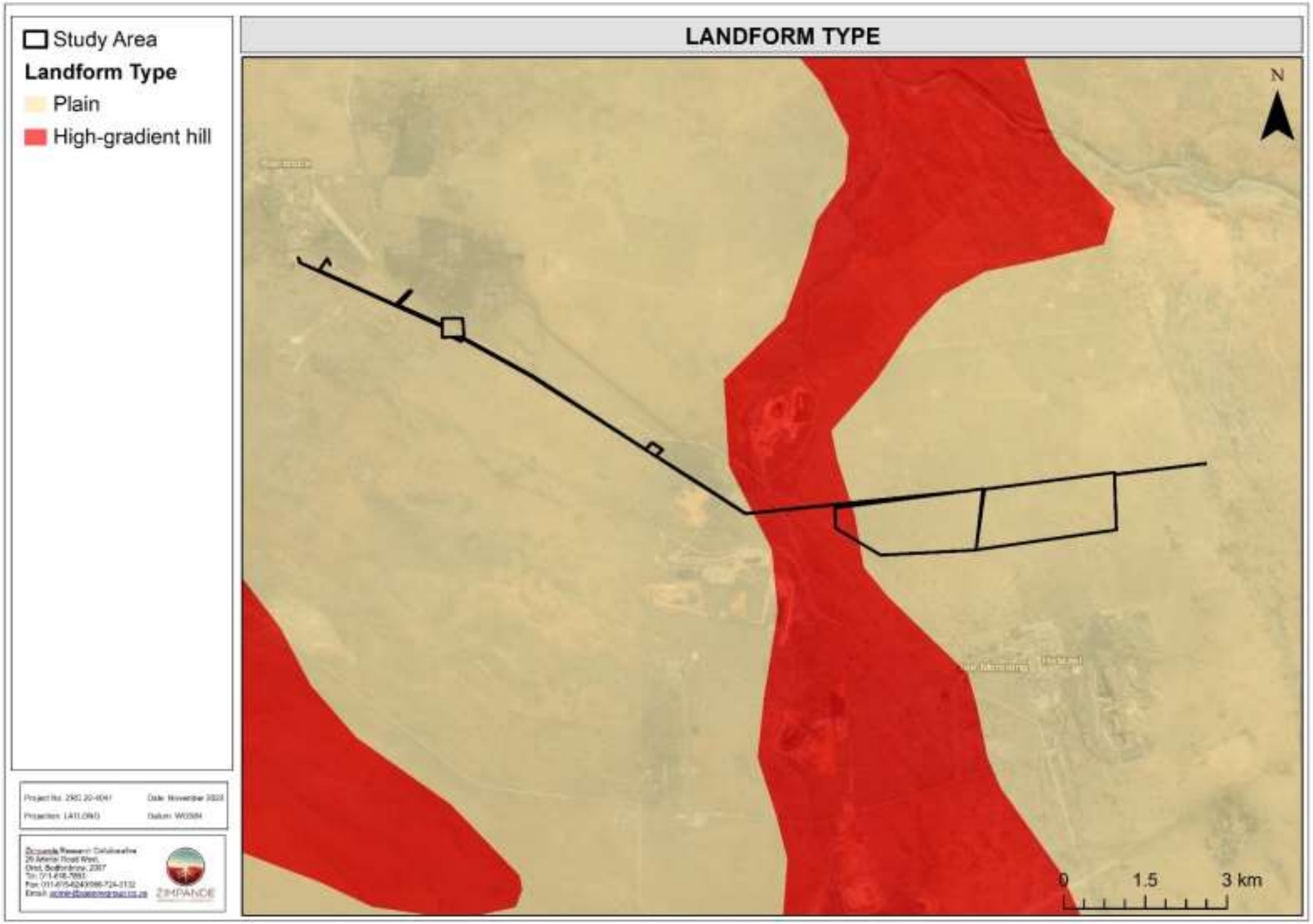


Figure 5: Landform types associated with the study area.

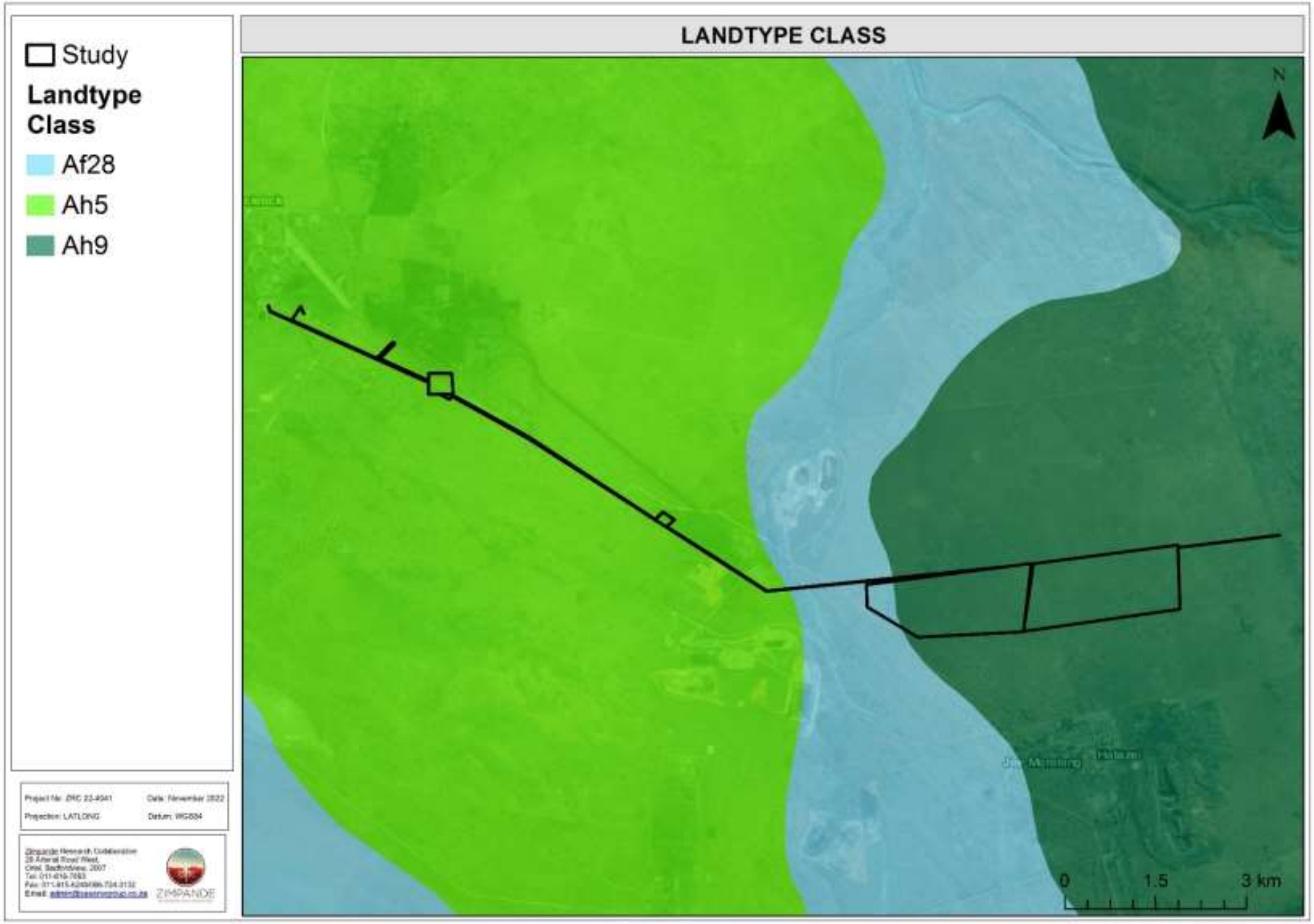


Figure 6: Landtype classes associated wit the study area.

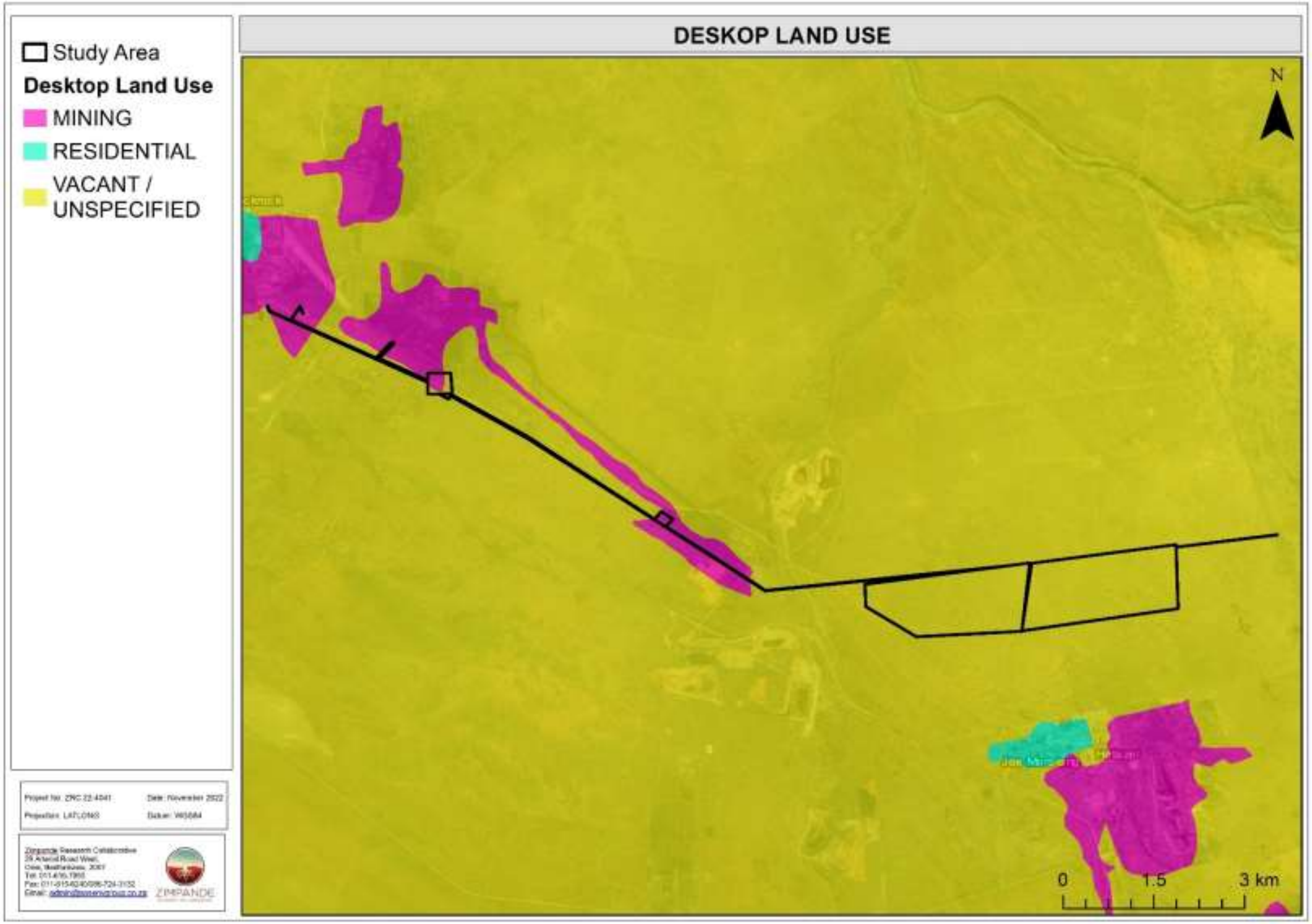
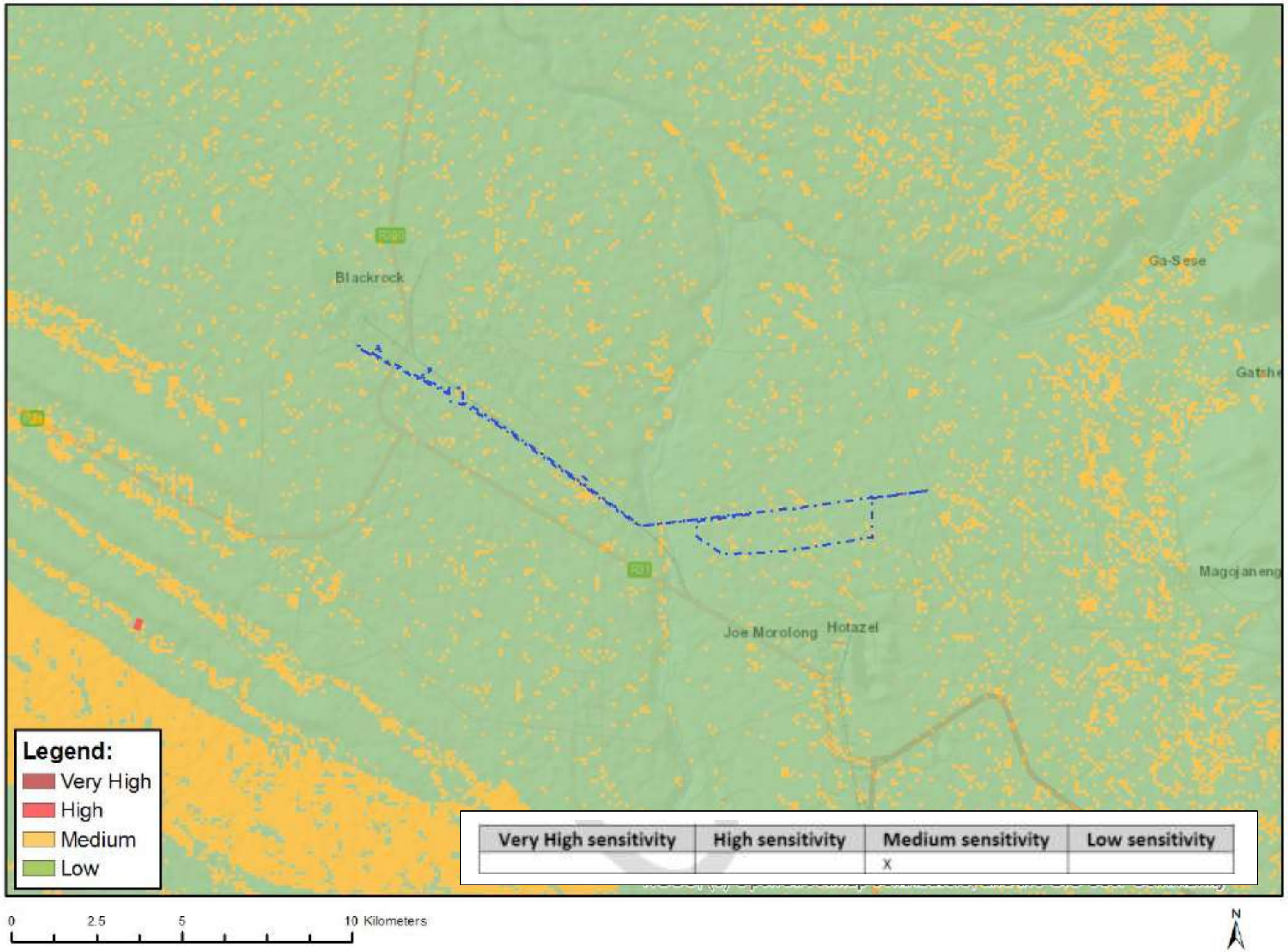


Figure 7: Desktop land uses associated with the study area.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Figure 8: Screening tool analysis for agricultural sensitivity.

4. ASSESSMENT RESULTS

4.1 Current Land Use

Based on the observations during the site assessment and on google earth imagery, the dominant land use in the vicinity of study area is predominantly open veld areas used for low density livestock grazing along the isolated farm properties. Towards the western portion of the study area mining related activities were observed. The Eskom overhead powerline traverses the study area from east to west through the study area and the proposed overhead powerline runs parallel to the Eskom powerline.

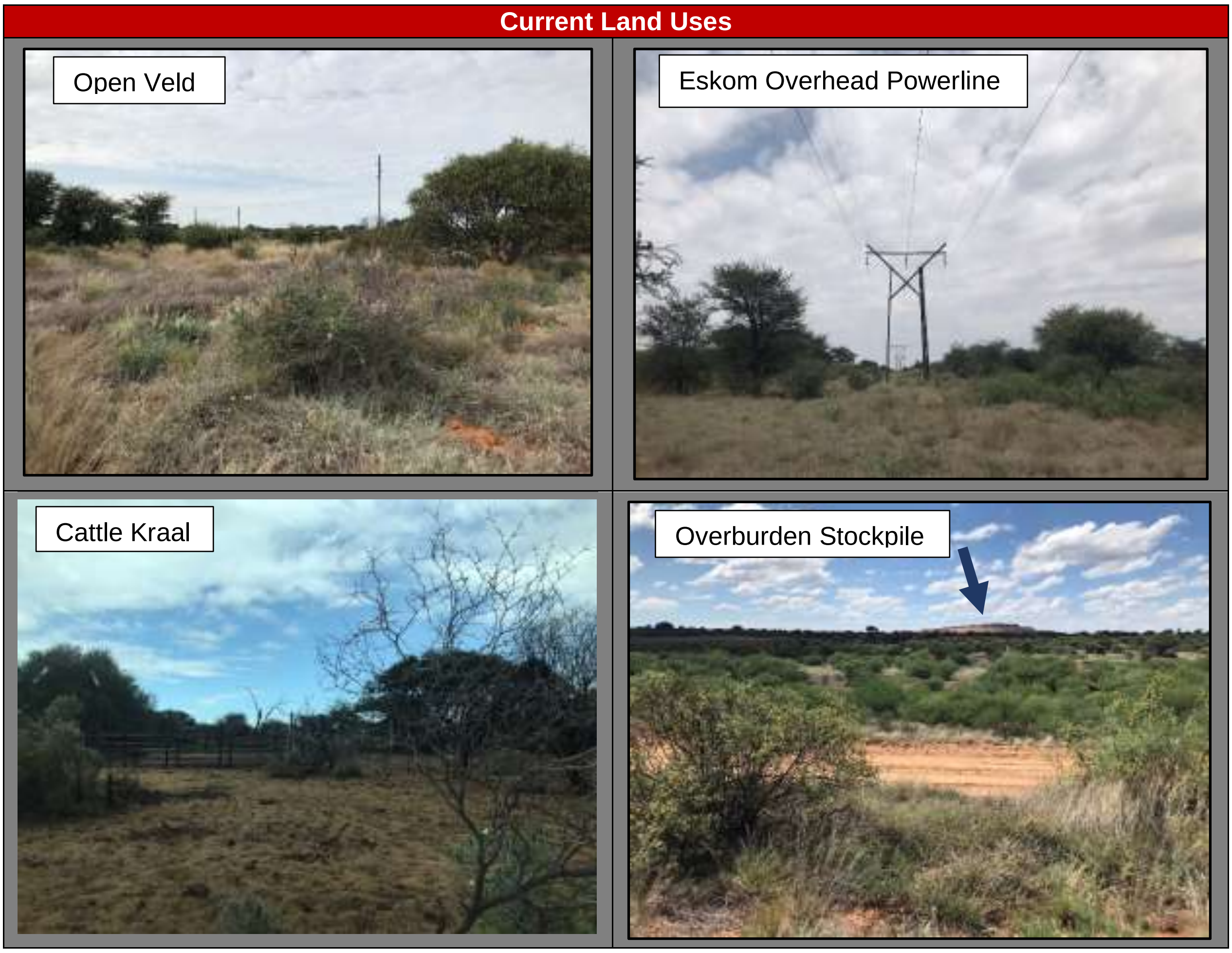


Figure 9: Photographs illustrating the dominant land use within the study area.

4.2 Dominant Soil Forms

The majority of the soils within the study area are dominated by the soils of the Ermelo, Hutton, Coega and Witbank, with Ermelo soil form covering approximately 82.5% of the study area. The Hutton, Witbank and Coega soil forms cover the study area by 13%, 4.4% and 0.1% respectively.

The majority of the soils (Ermelo and Hutton) occurring within the study area can be broadly classified as soils ideal for agricultural cultivation practices (with minor limitations) were climate permits as well as grazing activities and wildlife/wilderness.

The Ermelo and Hutton soil form share similar characteristics as such they have a B horizon that is uniformly coloured with yellow and red oxides of iron respectively. These soils are characterised by weak apedal structure, sandy textural class due to aeolian deposits of sand and thus allows for effective rooting depth, well drained characteristics and limited mechanical limitations relating to tillage practices. However, these soils are prone to leaching thus causing deficiencies in plant required nutrients and subsoil acidity.

The Coega soil forms are typically shallow in nature, with the presence of a hard carbonate material below the topsoil. The use of these soils is limited by climatic condition in which they occur in addition to other factors such as high pH, high concentration of salts (salinity) and nutrients deficiencies. This thus limits these soils to grazing and wildlife uses in the absence of irrigation.

The Witbank (Anthrosols) soil forms are soils which have been subjected to physical disturbance because of human interventions. Such interventions include transportation and deposition of the earth material containing soil. As a result, these soils are not ideal for agricultural cultivation.

Table 6 below show the dominant soils forms within the study area and their respective diagnostic horizons and Figures 10-12 below depicts a map of the soil forms.

Table 6: Dominant soil forms within the Study area.

Soil Form	Code	Diagnostic Horizon Sequence
Ermelo	Er	Orthic/Yellow Brown
Hutton	Hu	Orthic/Red apedal B
Coega	Cg	Orthic A/ Hard Carbonate
Witbank	Wb	Anthropogenic disturbed soils

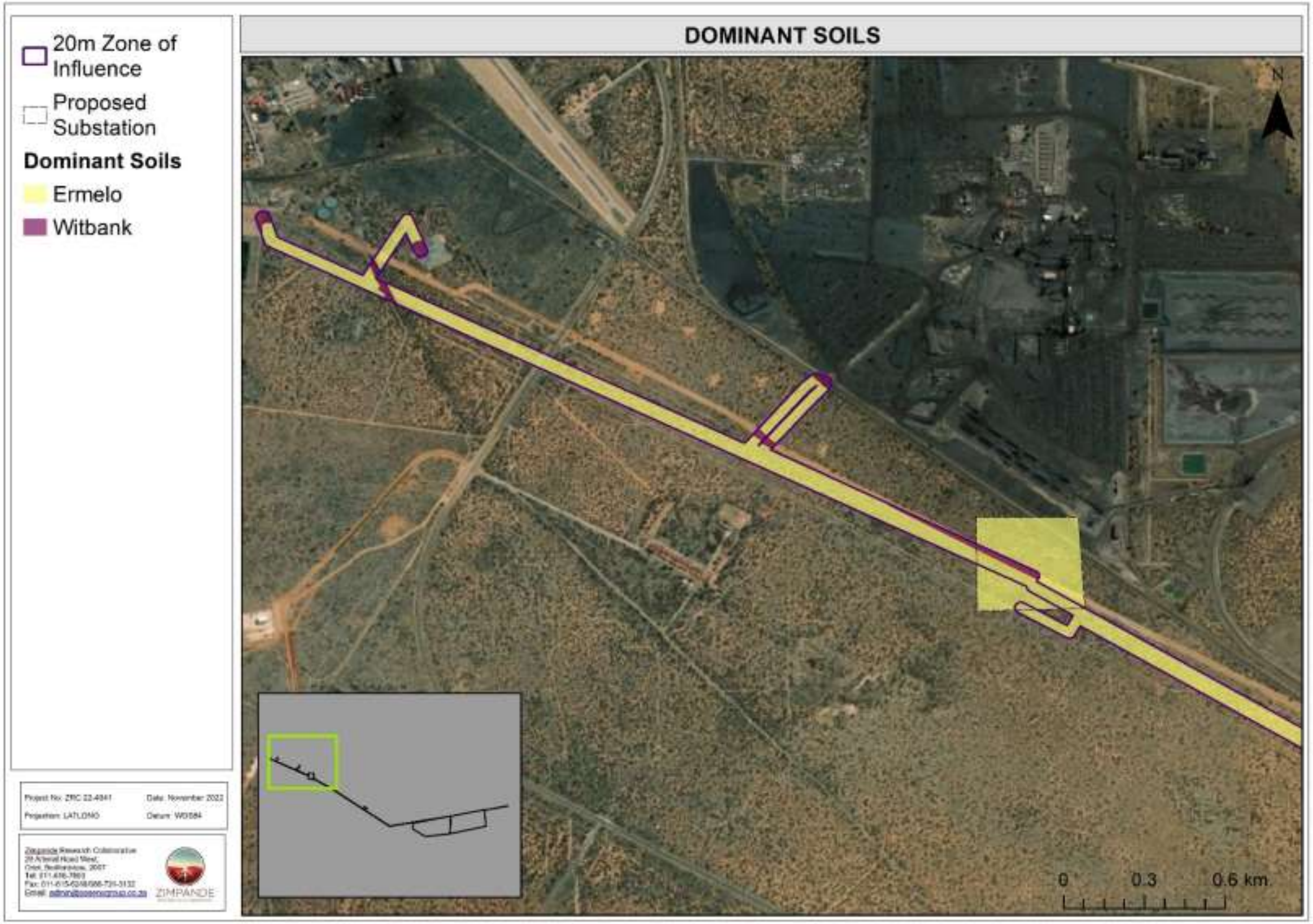


Figure 10: Dominant soil forms identified within the western portion of the study area during the field verification.

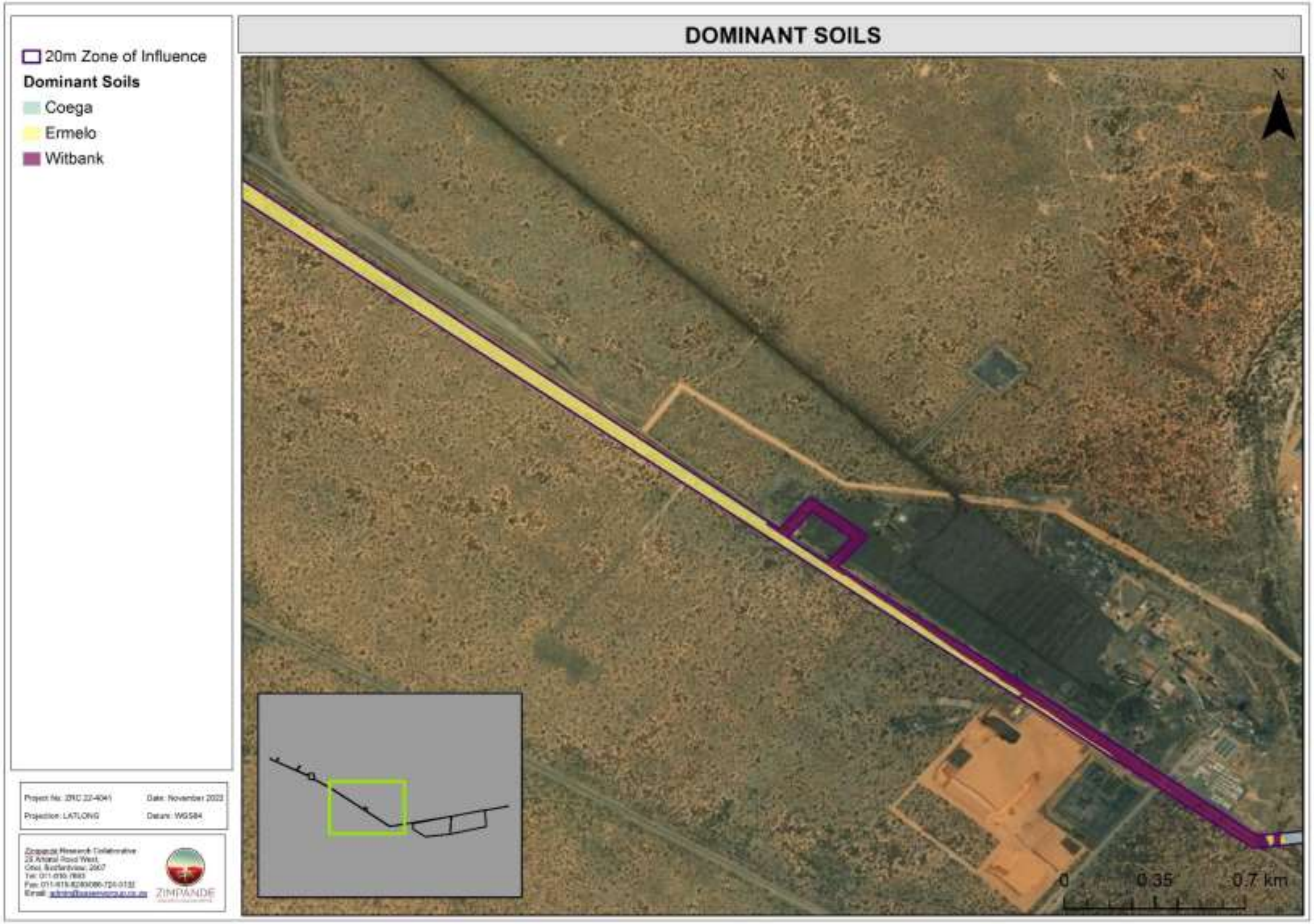


Figure 11: Dominant soil forms identified within the central portion of the study area during the field verification.

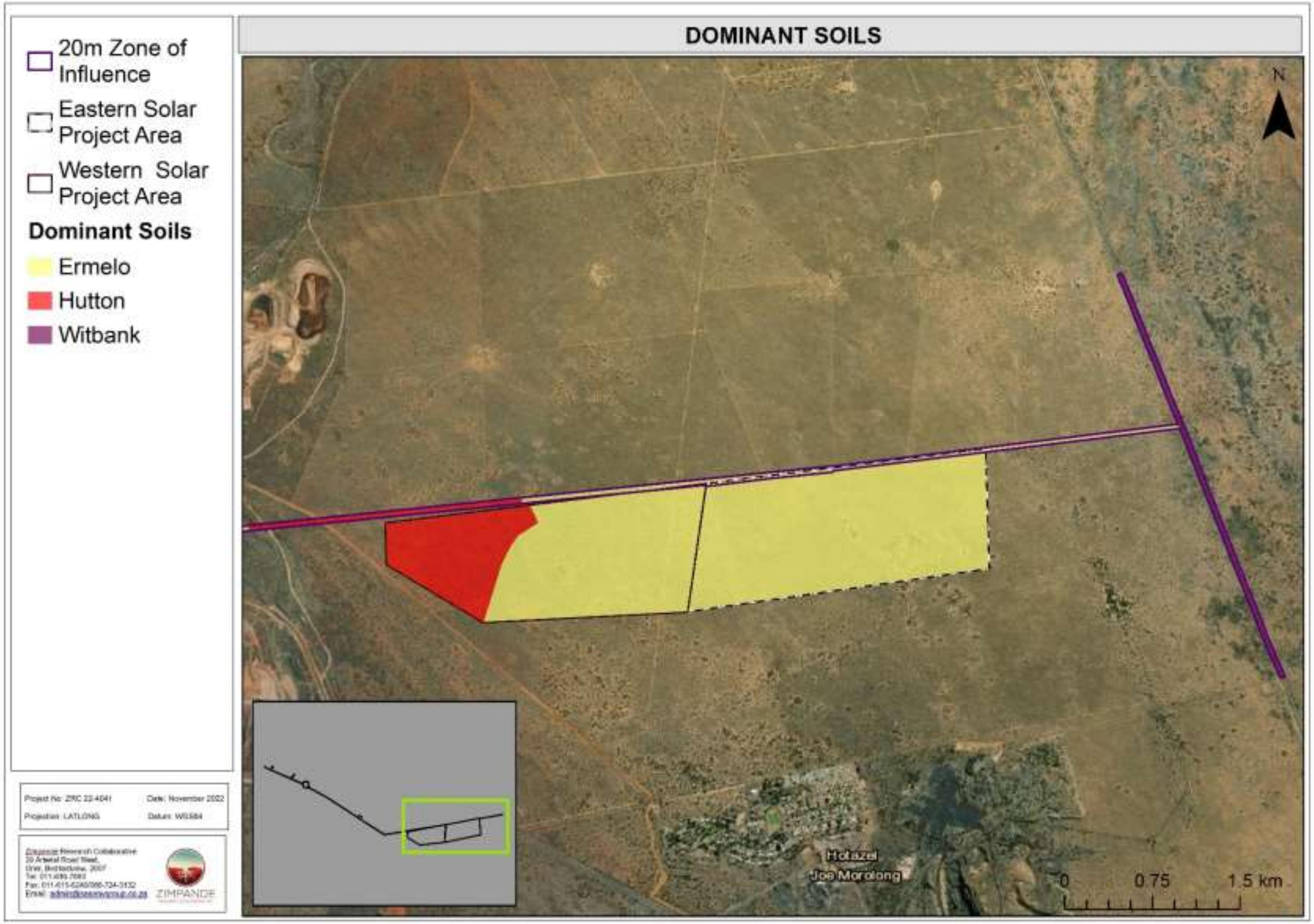


Figure 12: Dominant soil forms identified within the eastern portion of the study area during the field verification.

4.3 Land Capability Classification

Agricultural land capability in South Africa is generally restricted by climatic conditions, with specific mention to water availability (Rainfall). Even within similar climatic zones, different soil types typically have different land use capabilities attributed to their inherent characteristics. High potential agricultural land is defined as having the soil and terrain quality, growing season and adequate available moisture supply needed to produce sustained economically high crops yields when treated and managed according to best possible farming practices (Scotney *et al*., 1987).

For the purpose of 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 7 due to the severely restricted choice of crops due to heat, cold and/or moisture stress.

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 Figures **13 to 15;** while Figures **16 to 18** illustrates the Land Potential associated with the study area when incorporating other factors such as climate, slope and soil conditions together. The identified land capability limitations for the identified soils are discussed in comprehensive “dashboard style” summary tables presented from Tables **8** to **10** below. The dashboard reports aim to present all the pertinent information in a concise and visually appealing fashion. **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: Identified soil forms within the study area and their respective land capability.

Soil Form	Land Capability	Land Potential	Area (ha)	Percentage (%)
Ermelo	Arable (Class II)	Moderate Potential (L4)	480.9	82.5
Hutton			75.6	13
Coega	Grazing (Class VI)	Very Restricted Potential (L6)	0.8	0.1
Witbank	Wilderness (Class VIII)	Very Low Potential (L8)	25.7	4.4
Cumulative Total			**583.1**	**100**

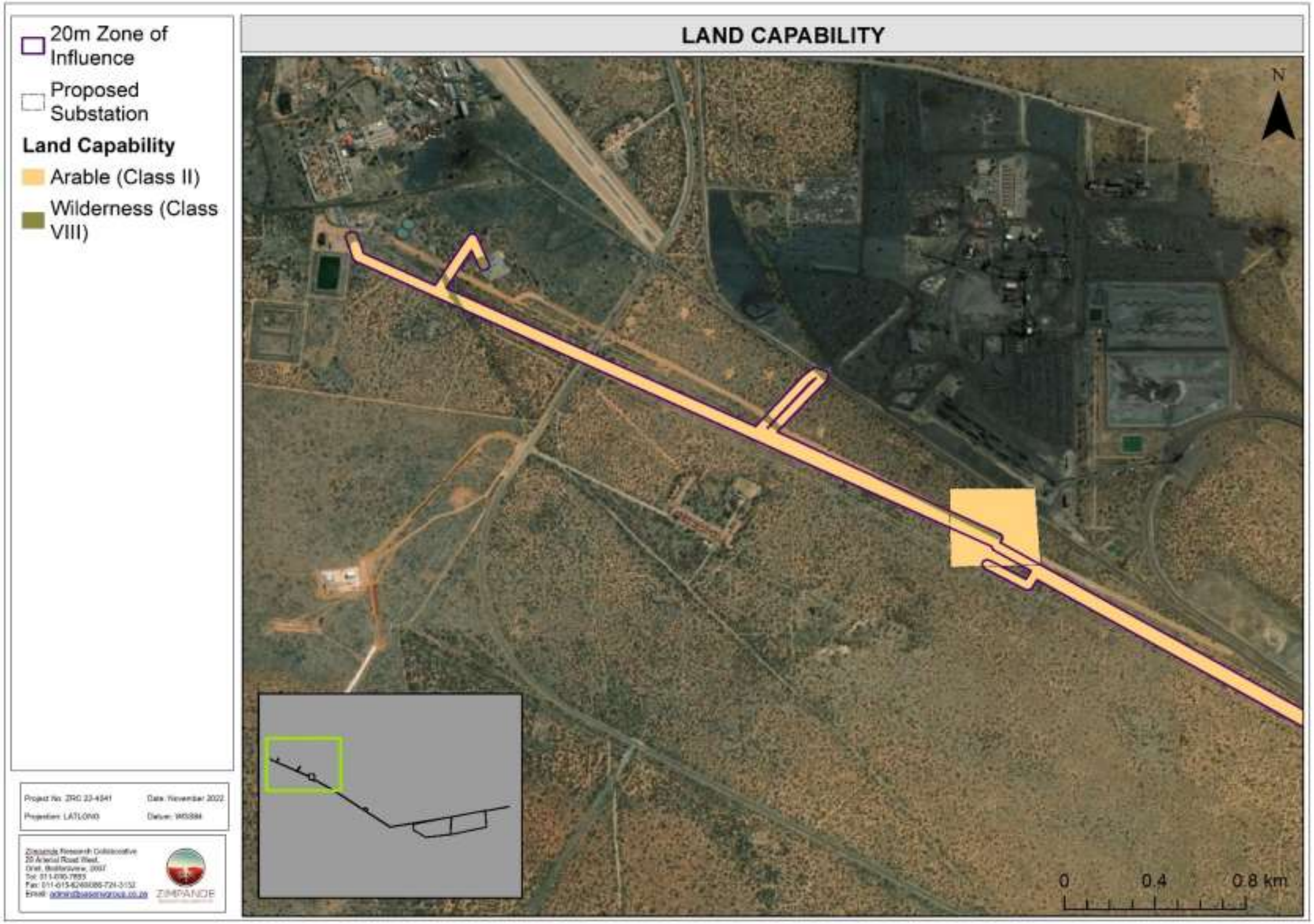


Figure 13: Map depicting Land capability of soils occurring within the study area.

Figure 14: Map depicting Land capability of soils occurring within the study area.

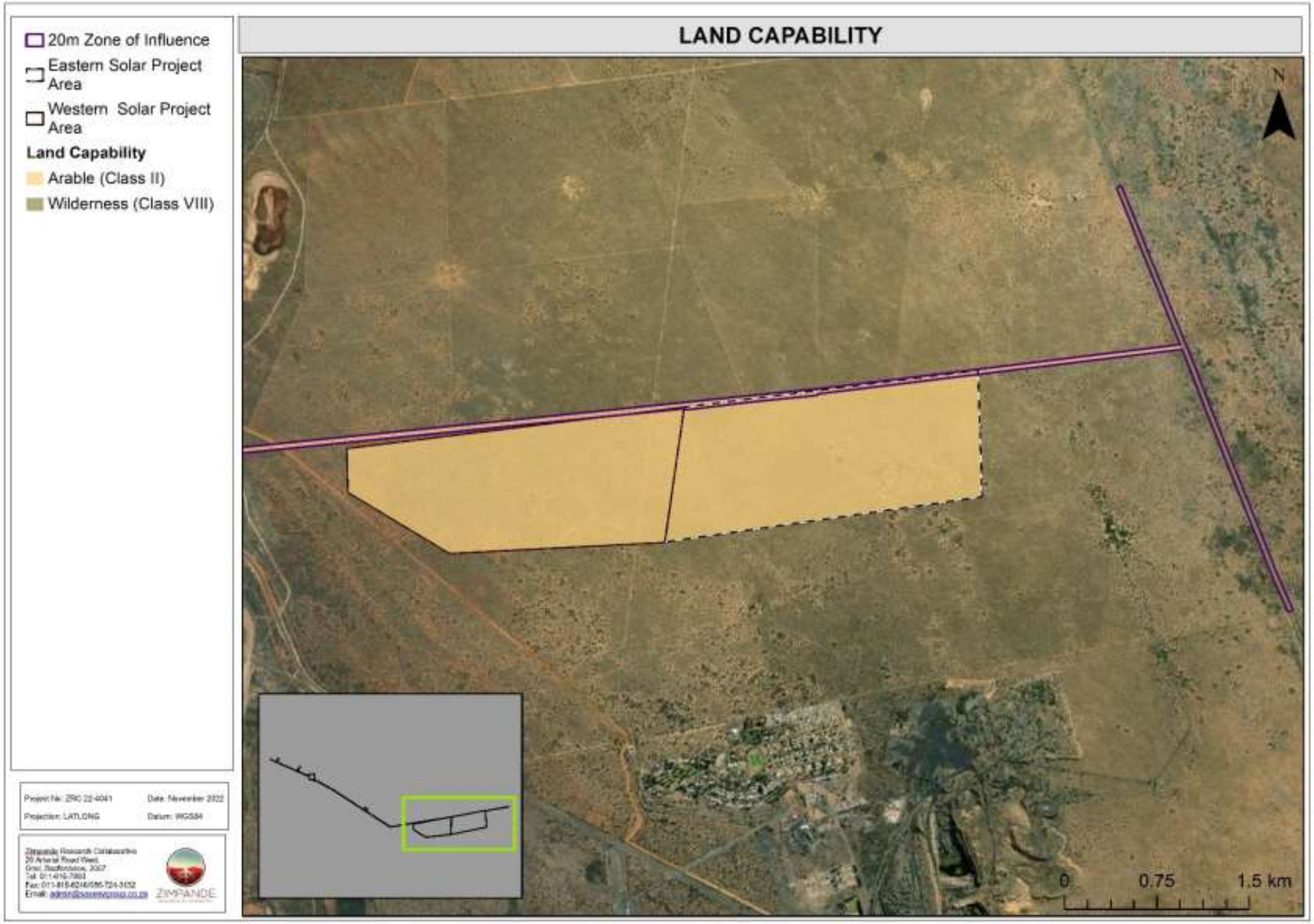


Figure 15: Map depicting Land capability of soils occurring within the study area.

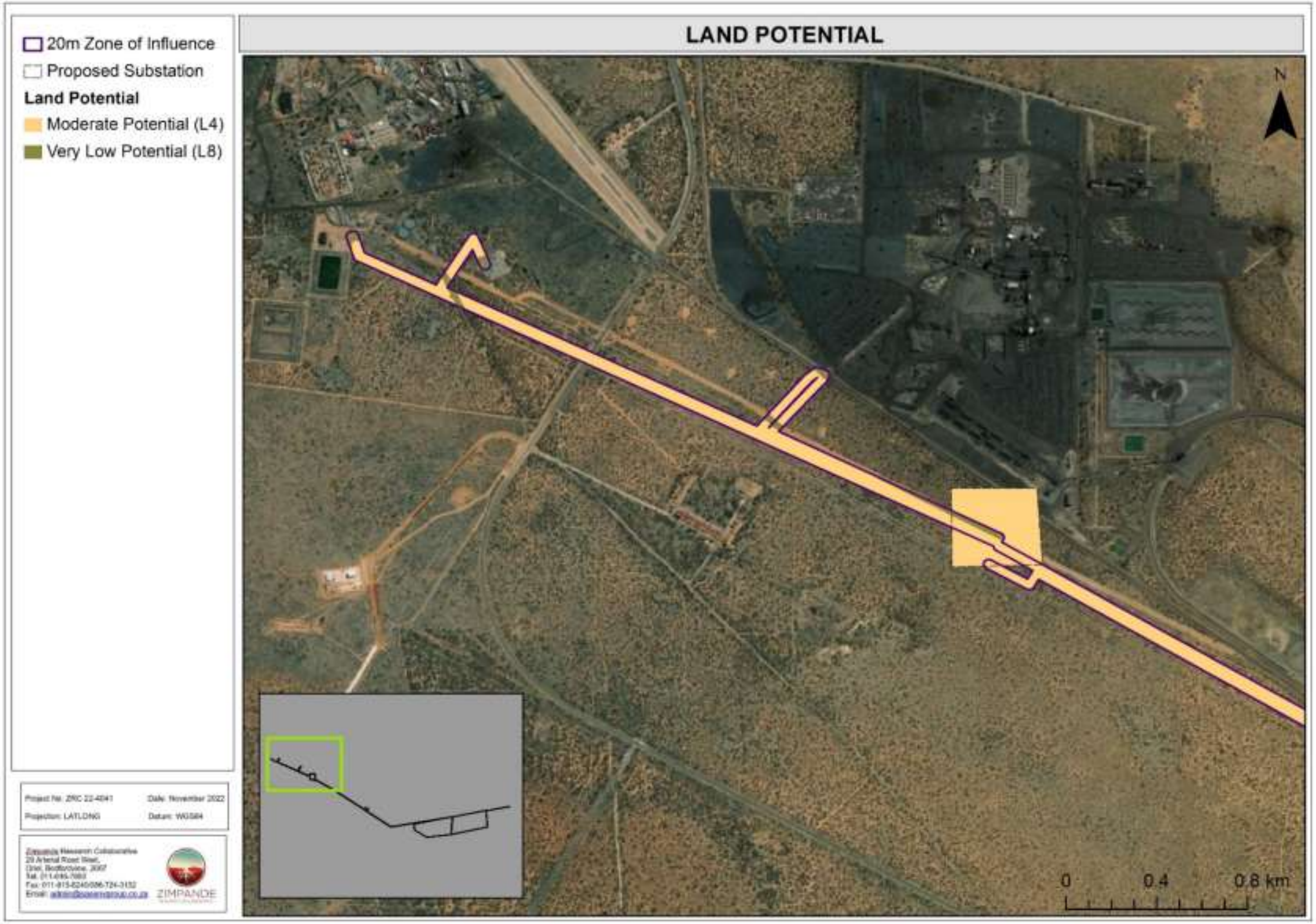


Figure 16: Land Potential associated with the study area.

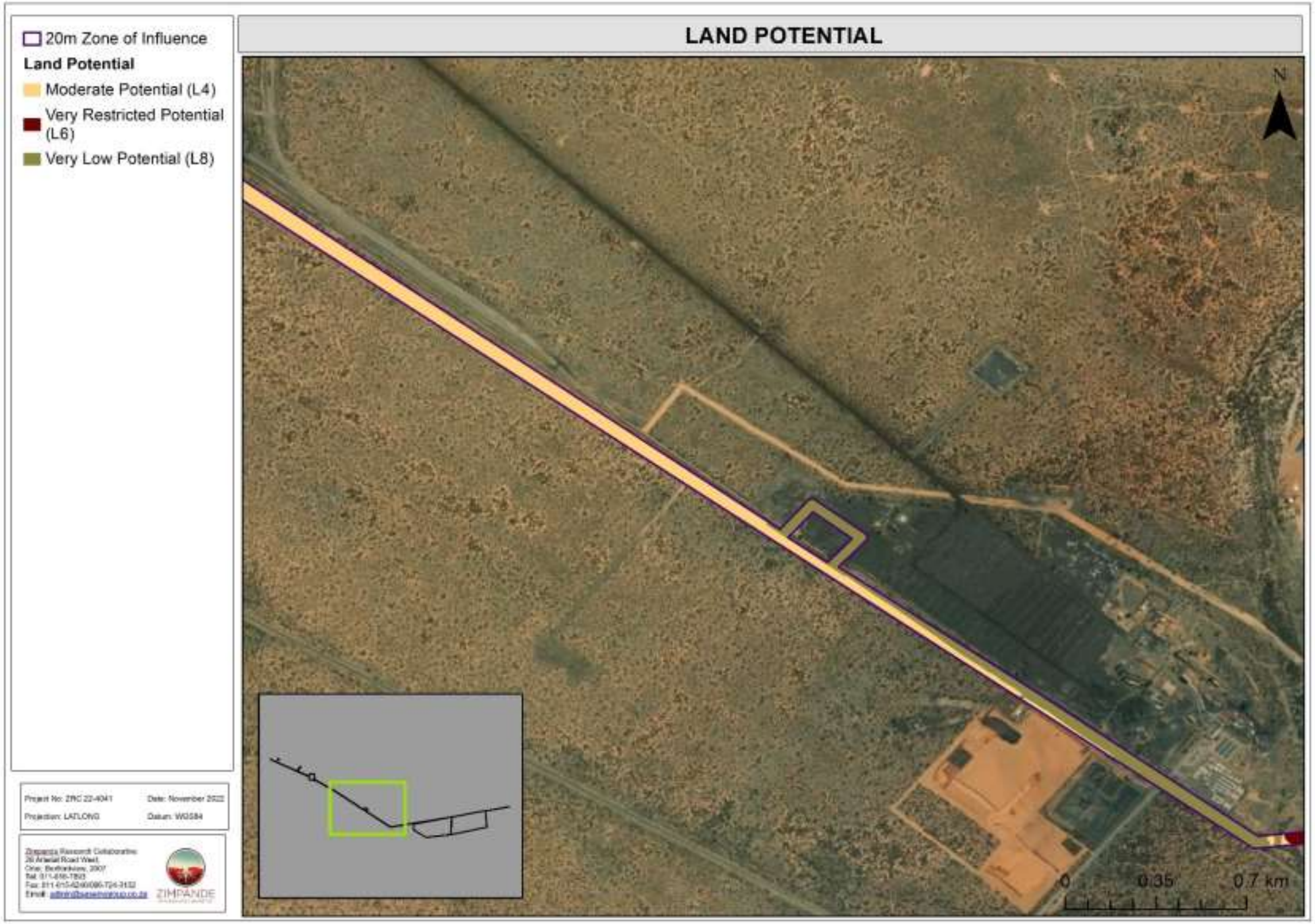


Figure 17: Land Potential associated with the study area.

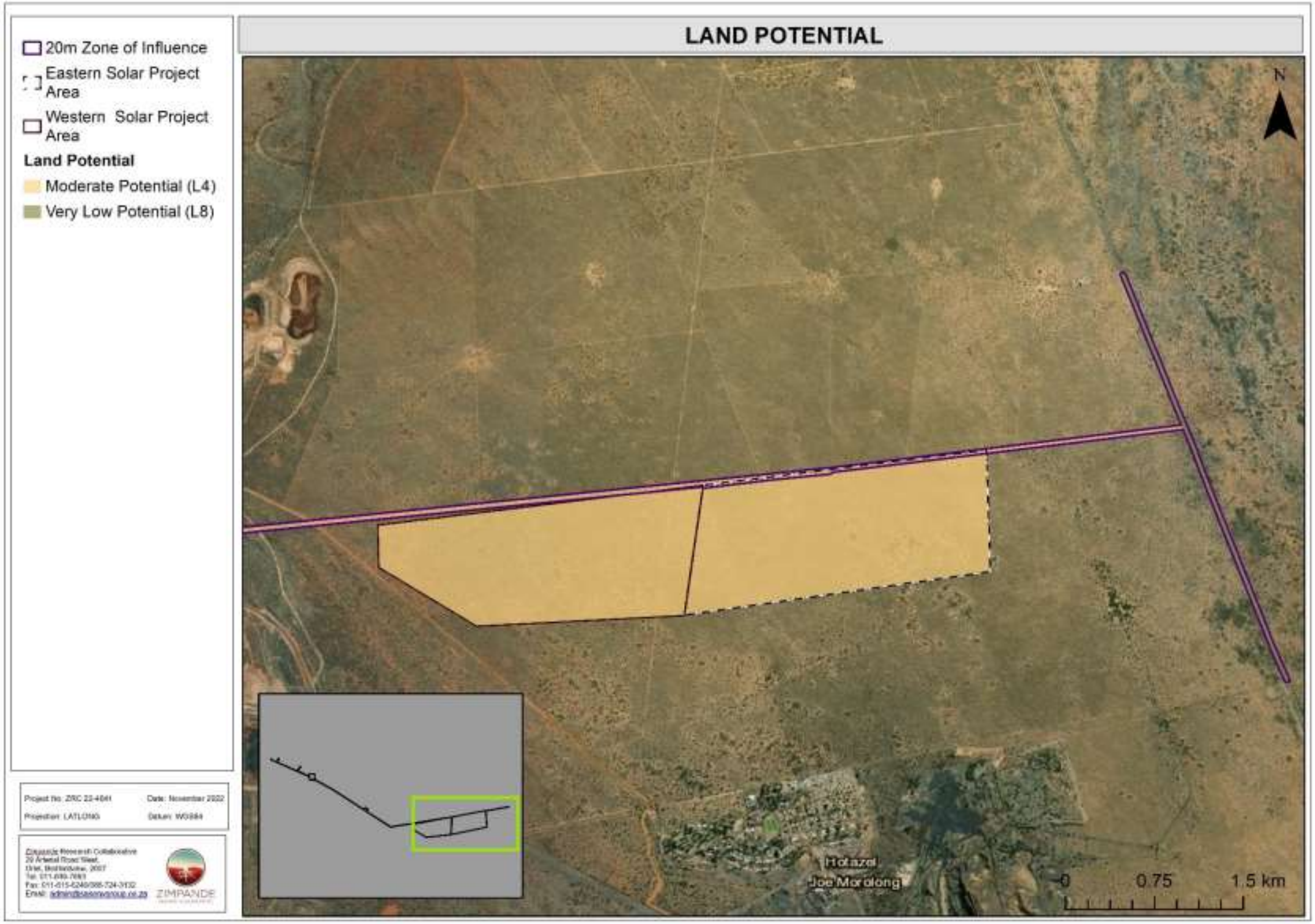


Figure 18: Land Potential associated with the study area.

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

<table>
<tr><th colspan="5">Land Capability: Arable (Class II) and High potential with minor limitations</th></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2"><0.5% Relatively flat</td><td>Photograph notes</td><td>View of the yellow brown and red apedal soil horizons associated with the Ermelo and Red apedal soil forms occurring within the study area.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Ermelo and Hutton</td><td>Area Extent</td><td>556.6 ha (95.5% of the Study area)</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">None. These soils have enough depth for most cultivated crops and good drainage characteristics.</td><td colspan="2" rowspan="2">Land Capability and Land Potential
These soil forms are considered high potential agricultural soils with high (Class II) land capability, suitable for arable agricultural land use with minimal management interventions. Therefore, these soils are considered suitable for use for crop cultivation, and are also well-suited for other less intensive land uses such as grazing, forestry, etc. However, emphasis is directed to their agricultural crop productivity due to the scarcity of such soil resources on a national scale and food security concerns</td></tr>
<tr><td>Land Potential</td><td colspan="2">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.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>M</td><td rowspan="2">The overall impact of the proposed solar pv and associated infrastructure on land capability and land potential is anticipated to be Moderate (M) prior to mitigation measures and Low (L) post mitigation, due to the inherently high land capability of the identified dominant soil form. The proposed developments will result in a localised long term permanent change of land use. Thus, the loss of agricultural soils and agriculturally productive land will be somewhat significant considering that arable soils are a non-renewable resource.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
Although these are sensitive soils for potential agricultural use, the suitability for crop production is limited by the climate. This area experiences erratic and very low rainfall which is necessary for successful dryland agriculture. In addition, no large dams or irrigation schemes are available in the area thus limiting the soils in the area to grazing and wildlife uses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced this way. However, the integrated mitigation measures must be implemented accordingly, with the aim of minimizing the potential loss of these valuable soils.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>L</td></tr>
</table>

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

<table>
<tr><th colspan="5">Land Capability: Grazing (Class VI)</th></tr>
<tr><td colspan="5"> </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">Gently sloping land of <1% slope</td><td>Photograph notes</td><td>View of the identified shallow soils of the Coega formation with hard carbonate material.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Coega</td><td>Areal Extent</td><td>0.8 ha (0.1%)</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">These soils have limitations in terms of water storage, depth and nutrient holding capacity due to the presence of a hard carbonate at a shallow depth.</td><td colspan="2" rowspan="2">Land Capability
The identified soils are of poor (Class VI) land capability because of the soil depth of this class is very shallow and moderately sloping. These limitations generally make these soils unsuited to cultivation and limit their use largely to pastures or wood land.</td></tr>
<tr><td>Land Potential</td><td colspan="2">Restricted potential: Regular and/or moderate to severe limitations due to soil, slope, temperature or rainfall.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>L</td><td rowspan="2">The overall impact of the proposed solar pv and associated infrastructure land capability and land potential is anticipated to be Low (L) both with and without mitigation measures in place, due to the inherently poor land capability of the identified dominant soil forms. The proposed solar pv and associated infrastructure in this instance will not impact on high potential soils and will be somewhat significant considering the scarcity of arable soils in South Africa.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
While these soils are not considered prime agricultural production soils. Some soils in class VI can be safely used for the common crops, provided unusually intensive management is used.</td></tr>
<tr><td>Overall impact significance post to mitigation</td><td>L</td></tr>
</table>

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

<table>
<tr><th colspan="5">Land Capability: Wildlife/Wilderness - Class VIII</th></tr>
<tr><td colspan="5">  </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">Not applicable; highly disturbed areas</td><td>Photograph notes</td><td>View of the identified Witbank soil forms</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Witbank (Anthrosols)</td><td>Area Extent</td><td>25.7 ha (4.4%)</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">Not applicable; highly disturbed soils</td><td colspan="2" rowspan="2">Land Capability
These identified Witbank soils have very poor (class VIII) land capability due to the significant disturbance that has occurred because of mining activities. This has led to the long-term alteration of the soil physical chemical properties such that these soils are no longer viable for agriculture. These soils are therefore not considered to make a significant contribution to agricultural productivity even on a local scale.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">Comprises of significantly disturbed areas due from anthropogenic activities (mining and related activities), to an extent that no recognisable diagnostic soil horizon properties could be identified. These soils are characterised by various limitations, primarily the absence of appropriate soil to provide a growth medium.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>L</td><td rowspan="2">The overall impact of the proposed solar pv and associated infrastructure on the land capability of these soils is anticipated to be low due to their very poor land capability.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
The current state of these soils requires significant rehabilitation already. These areas should be targeted for development to avoid disturbance of natural soils and landscapes. These areas can be rehabilitated holistically at closure of the surrounding mines.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>L</td></tr>
</table>

5 IMPACT ASSESSMENT AND MITIGATION MEASURES

In addition to the loss of growth medium (stripped soils), the 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 current life of mine is expected to exceed 25 years. The PV installations are anticipated to have an operational life of at least 25 years before panels may need to be replaced. After 25 years of operational life the solar panels will be removed and transported to a recycling facility.

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
- 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 and 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
Decommissioning and Closure Phases
- Dismantling and decommissioning of the solar PV infrastructure. - Revegetation of the solar PV areas with indigenous vegetation - **Impact:** Soil erosion, compaction, and soil contamination - Loss of land capability

5.1.1 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 relatively flat terrain. The soils of Ermelo, Hutton and Witbank formation occurring within the study area are susceptible to soil erosion due to their sandy nature. 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 when in stockpile areas before the rainy season; thus, exposed to wind and storm water. The severity of this impact is anticipated to be Moderate for most of the soils and with the appropriate mitigation measures the significance of this impact may be Low. Soil erosion is likely to have some negative impacts on soil and this will most likely lead to:

- Removal of organic matter and important soil nutrients essential for vegetation growth and thus reduced yield potential;
- Possible pollution and sedimentation of nearby water sources consequently affecting the water quality for livestock and
- Limited water availability essential for vegetation growth.

Tables 11 below presents the impact assessment for soil erosion for the proposed developments.

Pre-Construction	Construction	Operational
Potential poor planning leading to placement of waste management sites and infrastructure on high potential agricultural soils.	Site clearing, removal of vegetation, and associated disturbances to soils, leading to, increased runoff, erosion and consequent loss of land capability in cleared areas.	Frequent disturbances during maintenance of the solar PV, resulting in risk of erosion
	Potential frequent movement of earth moving machinery within lose and exposed soils, leading to excessive erosion	

Table 11: Summary of the impact significance on potential soil erosion for the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	5	4	3	3	2	9	8	72 (Medium-Low)
Construction phase	4	3	3	3	3	7	9	63 (Medium-Low)
Operational phase	3	3	3	3	4	6	10	60 (Medium-Low)
Managed								

	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	4	3	2	3	2	7	7	49 (Low)
Construction phase	3	3	2	3	3	6	8	48 (Low)
Operational phase	3	2	2	3	4	5	9	45 (Low)

5.1.2 Soil compaction

Heavy equipment traffic during construction and activities is anticipated to cause soil compaction. The study area is more prone 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 considered to be Medium 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 as a result of restricted water and nutrient uptake, which results in reduced crop yields;
- 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.

Tables 12 below presents the impact assessment for soil compaction for the proposed developments.

Pre-Construction	Construction	Operational
Potential poor planning leading to placement of waste management sites and infrastructure on high potential agricultural soils.	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.	Frequent disturbances during maintenance of the solar PV, resulting in risk of erosion
	Potential frequent movement of construction machinery within the project footprint, leading to excessive soil compaction.	

Table 12: Summary of the impact significance on soil compaction for the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	4	4	4	3	2	8	9	72 (Medium-Low)
Construction phase	4	3	3	3	3	7	9	63 (Medium-Low)
Operational phase	3	3	2	3	3	6	8	48 (Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	4	3	3	3	3	7	9	63 (Medium Low)
Construction phase	3	2	3	3	3	5	9	45 (Low)
Operational phase	3	2	2	3	4	5	9	45 (Low)

5.1.3 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 Medium 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. Therefore, strict waste management protocols as well as product stockpile management and activity specific Environmental Management Programme (EMPr) and monitoring guidelines should be adhered to during the construction and operational activities. 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.

Tables 13 below presents the impact assessment for soil contamination for the proposed developments.

Pre-Construction	Construction	Operational
Potential poor planning leading to placement of waste management sites and infrastructure on high potential agricultural soils.	Spillage of petroleum hydrocarbons during construction of associated infrastructure	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
	Potential disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Potential disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.

Table 13: Summary of the impact significance on soil contamination for the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	5	3	3	3	3	8	9	72 (Medium-Low)
Construction phase	4	3	3	3	4	7	10	70 (Medium-Low)
Operational phase	4	3	3	3	3	7	9	63 (Medium-Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	4	3	3	3	2	7	8	56 (Medium Low)
Construction phase	3	2	2	3	4	5	9	45 (Low)
Operational phase	3	2	2	3	4	5	8	40 (Low)

5.1.4 Loss of Agricultural Land Capability

The soils associated with the study area can be broadly classified as soils suitable for cultivation based on their inherent characteristics. However, the environmental conditions such as climatic constraints and lack of water resources thus renders the loss of land capability to be Medium without mitigation measures and Low with mitigation in place under the condition that the integrated mitigation measures are implemented accordingly, with the aim of minimising the potential loss of high potential soils. This is due to stripping of topsoil and site clearing that will potentially result in loss of fertile topsoil and soil erosion.

Table 14: Summary of the impact significance on loss of agricultural capability for the study area.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	4	4	3	3	3	8	9	72 (Medium-Low)
Construction phase	4	4	4	3	3	8	10	80 (Medium-High)
Operational phase	3	3	4	3	4	6	11	66 (Medium-Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Pre-Construction phase	3	3	3	3	3	6	9	54 (Medium-Low)
Construction phase	3	3	3	3	2	6	8	48 (Low)
Operational phase	3	2	3	3	2	5	8	40 (Low)

5.1.5 Cumulative Impacts and Screening tool Verification

Although the study area is dominated by arable soils (Class II), the suitability of the surrounding area for successful dry land agriculture is low due to the climatic constraints of the area and lack of irrigation options. This area experiences erratic and very low rainfall which is necessary for successful dryland agriculture. Therefore, without any access to an irrigation scheme and a robust fertilisation programme in place the study area will be limited to grazing and wildlife uses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced this way. Lastly, 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 minimizing 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 Medium 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 soil and climatic constraints for commercialised agricultural production. In addition, the historical imagery on google earth revealed that no prior commercial cultivation was observed within the study area for the past 5 years and thus the proposed development is not likely to have an unacceptable impact on the agricultural production capability.

5.2 Integrated Mitigation Measures

Based on the findings of the soil, land use and land capability assessment, mitigation measures have been developed to minimise the impact on the soil resources of the area, should the proposed project proceed:

5.2.1 Soil Erosion and Dust Emission Management

- 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.

5.2.2 Soil Contamination Management

- Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented, made available and accessible at all times 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.

5.2.3 Loss of Land Capability Management

- 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.

From a soil, land use and land capability point of view the proposed Solar Photovoltaic (PV) Facilities can be considered provided under the that the integrated mitigation measures must be implemented accordingly, with the aim of minimizing the potential loss of high potential agricultural soils.

6 CONCLUSION

The Zimpande Research Collaborative (ZRC) was appointed by EScience Associates (Pty) Ltd to conduct a soil, land use and land capability assessment for the proposed proposed 100 MW Solar PV Facility and associated infrastructure hereafter referred to as the ‘’study area’’ unless referring to individual infrastructure.

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 climatic conditions associated with the study area and surroundings are characterised by climatic limitations with the Mean Annual Precipitation ranging between 201 – 400 mm per annum. The surrounding areas under these climatic conditions have a severely restricted growing season due to high temperatures, frost and/or moisture stress. This results in limited suitable crops which frequently experience yield loss. Therefore, crops under rainfed conditions should be cultivated with caution, and management practices such as irrigation may be required to maximise the yield.

Based on the observations during the site assessment and on google earth imagery, the dominant land use in the vicinity of study area is predominantly open veld areas used for low density livestock grazing along the isolated farm properties. Towards the western portion of the study area mining related activities were observed. The Eskom overhead powerline traverses the study area from north to south through the study area.

The majority of the soils within the study area are dominated by the soils of the Ermelo, Hutton, Coega and Witbank, with the Ermelo soil form covering approximately 90.7% of the study area. The Hutton, Witbank and Coega soil forms cover the study area by 4.8%, 4.4% and 0.1% respectively.

The majority of the soils (Ermelo and Hutton) occurring within the study area can be broadly classified as soils ideal for agricultural cultivation practices (with minor limitations) were climate permits as well as grazing activities and wildlife/wilderness.

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 (%)
Ermelo	Arable (Class II)	Moderate Potential (L4)	480.9	82.5
Hutton			75.6	13
Coega	Grazing (Class VI)	Very Restricted Potential (L6)	0.8	0.1
Witbank	Wilderness (Class VIII)	Very Low Potential (L8)	25.7	4.4
Cumulative Total			**583.1**	**100**

Although the study area is dominated by arable soils (Class II), the suitability of the surrounding area for successful dry land agriculture is low due to the climatic conditions of the area. This area experiences erratic and very low rainfall which is necessary for successful dryland agriculture. Therefore, without any irrigation scheme and robust fertilisation programme in place the study area will be limited to grazing and wildlife uses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced this way. Lastly, the loss of agricultural soils and the permanent change in land use will be localized to within the Study area. The integrated mitigation measures must be implemented accordingly, with the aim of minimizing 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 Medium 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 soil and climatic constraints for commercialised agricultural production. In addition, the historical imagery on google earth revealed that no prior commercial cultivation was observed within the study area for the past 5 years and thus the proposed development is not likely to have an unacceptable impact on the agricultural production capability.

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:

- ➢ The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- ➢ The possibility for any agricultural (i.e., grazing) activity concurrently with solar generation should be further investigated;
- ➢ The solar project footprint should be vegetated with grass underneath the panels which can potentially be used to feed the livestock of the local community during the operational phase.
- ➢ 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.

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.

7 REFERENCES

Agricultural Geo-referenced Information System (AGIS) database. www.agis.agric.za .Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983).

DEAT. 2004. Overview of Integrated Environmental Management, Integrated Environmental Management, Information Series 0, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

Department of Agriculture, Forestry and Fisheries. Agricultural Geo-referenced Information system (AGIS). Grazing Capacity Maps (1993).

Department of Mines. 1970. 1:250 000 Geological Map Series (sheet no. 2730) of the Republic of South Africa (RSA) and the Kingdoms of Lesotho and Swaziland. Department of Mines (1970).

International Union of Soil Sciences (IUSS) Working Group. 2014. World Reference Base (WRB) for Soil Resources 2014. International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Rome

Land Type Survey Staff, 1976-2006. Land type Survey Database. ARC-ISCW, Pretoria.

Morgenthal, T.L., Newby, T., Smith, H.J.C., and Pretorius, D.J. 2004. Developing and refinement of a grazing capacity map for South Africa using NOAA (AVHRR) satellite derived data. Report GW/A/2004/66. ARC Institute for Soil, Climate and Water, Pretoria.

National Department of Agriculture. 2002. Development and Application of a Land Capability Classification System for South Africa

National Department of Agriculture. 2002. Development and Application of a Land Capability Classification System for South Africa

Scotney, D.M., Ellis, F., Nott, R.W., Taylor, K.P., Van Niekerk, B.J., Verster, E. & Wood, P.C. 1987. A system of soil and land capability classification for agriculture in the SA TBVC states. Dept. Agric., Pretoria.

Soil Classification Working Group, 2018. Soil classification. A Natural and Anthropogenic System for South Africa. Mem. agric. nat. Resource. S. Afr. No. 15. Dept. Agric. Dev., Pretoria.

Tanner, P. 2007. Guideline for rehabilitation of mined land. Chamber of Mines of South Africa, Johannesburg.

TerraAfrica Consult. 2015. Soil, Land Use and Land Capability Report for The Proposed Mokala Manganese Mine.

APPENDIX A: ASSESSMENT METHODOLOGY

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 (February 2021), 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	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 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.

Impact Assessment Methodology

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable according to the defined criteria. Refer to the Table A1. The purpose of the rating is to develop a clear understanding of influences and

[1] The definition has been aligned with that used in the ISO 14001 Standard.

processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary[2].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act 1998 (Act No. 108 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table A1: Criteria and definitions for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected < 100m	2

[2] Some risks/impacts that have low significance will however still require mitigation.

Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table C2: Significance Rating Matrix.

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table C3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	3Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.
- If applicable, transboundary or global effects were assessed.
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[3] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[3] *Mitigation measures should address both positive and negative impacts*

APPENDIX B: 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)

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

----

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

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

I, Tshiamo Setsipane, 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
B.Sc. (Agric) Honours Soil Science	(University of the Free State)	2014
B.Sc. (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