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SOIL, LAND USE AND LAND CAPABILITY ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESSES FOR THE PROPOSED KUDUMANE MINE EXPANSION PROJECT NEAR HOTAZEL, NORTHERN CAPE

Prepared for

SRK Consulting (Pty) Ltd (South Africa)

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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

The Zimpande Research Collaborative (ZRC) was appointed to conduct a soil, land use and land capability assessment as part of the environmental assessment and authorisation process for the for the additional planned mining infrastructure at Kudumane Manganese Resources (KMR) near Hotazel, in the Northern Cape.

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, as per Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983).The proposed expansion project is partially located in soils which, based on their inherent characteristics may potentially support agriculture if appropriate water supply can be assured. Therefore, it is a requirement to understand the surrounding soils, land uses and land capability as well as the land potential to ensure that the proposed mining related development takes into consideration the high potential agricultural land

The Mean Annual Precipitation (MAP) within the Mining Right Area (MRA) 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.

Based on the information sourced from SLR (2014) the dominant land use within the MRA is mining related activities (infrastructure/servitudes, pipelines, powerlines open cast pits and etc), *ad-hoc* game and cattle farming and isolated residences/residential areas.

The dominant soils occurring within the footprint area are Hutton, Hutton/Clovelly, Mispah and Witbank forms (Paterson, 2014). These soils can be broadly classified as ideal for agricultural cultivation where the climate permits and under irrigation if the weather does not permit. The physical characteristics of the surrounding soil forms can largely be described as structureless, fine-grained, sandy soils. The deep soils were classified as Hutton/Clovelly, whereas the shallow soils with the occurrence of rock outcropping and calcrete layers were classified as Mispah soil forms. Disturbed soils due to current mining operations are also present and classified as Witbank soil forms.

Table A: Dominant soil forms within the footprint area and their respective land capability.

Soil Form	Land capability	Area (ha)	Percentage
Hutton	Arable (Class II)	25.60	2.01
Hutton/Clovelly	Arable (Class II)	800.84	63.04
Mispah	Grazing (Class VI)	33.98	2.67
Witbank	Wilderness (Class VIII)	409.97	32.27
Total Enclosed Area		**1270.39**	**100**

The loss of land capability is anticipated to be Medium before mitigation measures have been put in place, as the significant portion (826.44 ha out of 1270.39 (65%)) of the dominant soils are considered ideal for cultivation based on the available data land capability classification. However, the suitability 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. In addition, no large dams or irrigation schemes are available in the area thus limiting the soils in the area to grazing and wildlife landuses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced in this manner.

Large portions of potentially arable soils will be stripped and stockpiled and thus potentially reducing the fertility status of the soils. The proposed expansion activities will lead to a permanent change of land use if not properly mitigated. The cumulative loss from a soil and land capability point of view is anticipated to be Medium pre-mitigation and Low after mitigation. The loss of agricultural soils and the permanent change in land use will be limited to the footprint areas. 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.

Key mitigation measures to minimise impacts on the soil regime include but are not limited to:

- The project operations be kept within the demarcated footprint areas which must be well defined;
- 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; and
- The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible;
- Soil compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. If they have to be moved when wet, truck and shovel methods should be used as bowlscrapers create excessive compaction when moving wet soils;
- Usable topsoil from the construction of the surface infrastructure areas must be removed prior to construction and stockpiled separately within the demarcated areas with measures to protect this valuable resource from impacts such as chemical contamination as well as mixing with less valuable overburden types; and
- Revegetate with an indigenous grass mix, to re-establish a protective cover, in order to minimise soil erosion and dust emissions and aid in achieving the desired post closure land use in as short a period as possible following decommissioning and closure.

It is the opinion of the specialist that this study provides the relevant information required to guide the decision-making process by the relevant authorities to ensure that appropriate consideration of the agricultural resources in the footprint area is made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

DOCUMENT GUIDE

This report was compiled according to the following information guidelines for a specialist report in terms of the Environmental Impact Assessment (EIA) Regulation 326 of the National Environmental Management Act (NEMA), as summarised on the Table below.

Table 1: 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

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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
Witbank	Man-made soil deposit with no recognisable diagnostic soil horizons, including soil materials which have not undergone paedogenesis (soil formation) to an extent that would qualify them for inclusion in another diagnostic horizon

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

1. INTRODUCTION

The Zimpande Research Collaborative (ZRC) was appointed to conduct a soil, land use and land capability assessment as part of the environmental assessment and authorisation process for the for the additional planned mining infrastructure at Kudumane Manganese Resources (KMR) near Hotazel, in the Northern Cape. The Mining Right Area (MRA) is comprised of farm portions namely, Telele, Kipling, Hotazel, York and Devon where the footprint areas are located. For the purpose of this assessment the focus of this study will be on the footprint areas, as depicted from Figure 1 to 3.

Kudumane Manganese Resources (Pty) Ltd (KMR) is situated approximately 3 km south-west of the town of Hotazel within the John Taolo Gaetsewe District Municipality in the Northern Cape. KMR currently holds to Mining Rights; Mining Right NC/30/5/1/2/2/0268 MR covering the farms York A 279 and Telele 312 and Mining Right NC/ 30/5/1/2/2/10053 MR over the farms Devon 277, Hotazel 280 and Kipling 271. See Figure 1 and Figure 2 for the locality of the MRA.

The proposed expansion project traverse soils which may potentially support agriculture; 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 mining related development 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, as per Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983).

1.1 Project Description

Kudumane Manganese Resources (Pty) Ltd (Kudumane) intends to expand its current operations to extend the life of its operation and improve production capacity, through the inclusion of key mining related activities and infrastructure within their approved MRA (Figure 1).

The infrastructure and activities associated with the proposed KMR Expansion Project requires a new Environmental Authorisation (EA), the amendment of the mine's existing Environmental Management Programmes (EMPrs), a Waste Management Licence (WML) and a Water Use Licence Application (WULA) to authorise the below listed **key infrastructure**:

- A new Opencast Pit mine on Kipling;
- Expansion of the Hotazel and York Opencast Pits to allow for the mining of KMRs boundary pillar associated with each pit; and

- Two attenuation dams on the Ga-Mogara River, to allow for the expansion of the York and Hotazel Opencast Pits.

An Options Analysis was undertaken by SRK to determine the best approach for KMR to extend the open pit mining operations in a westerly direction beyond the 1:100-year floodline (The extension of the pits is restricted by a drainage channel of the Ga-Mogara River on the western side). Option-1/Scenario 1 was determined to be the best and most cost-effective option and includes the construction of dams along the river course to attenuate the flow before reaching the open pit areas. In this option, there are no diversion channels. The report states: "*The capture and attenuation of the flowing upstream ponds is technically a good option and if the ponds overflow, the open pit operation can be suspended until the storm has abated. The mitigation measure will be to monitor upstream flows and give sufficient time to evacuate the pit. If the water flows into the pit, then the pit can be pumped dry and mining can commence*."

The above key infrastructure will have **secondary infrastructure** and activities associated with them, which includes:

- Establishment of an addition water storage tank near the proposed Kipling opencast pit operation, including a pipeline for the transfer of water between the proposed Kipling water storage tank and the existing Hotazel and York water storage tanks;
- Development and expansion of waste rock dumps at the proposed Kipling operation and the existing Hotazel operation;
- Establishment and expansion of ore stockpiles dumps at the proposed Kipling operation and the existing Hotazel and York operations;
- New haul road between the proposed Kipling operation and the existing Hotazel operation and upgrading of the existing haul roads between the Hotazel and York operations;
- Development and expansion of sewerage treatment plants at Kipling (new), Hotazel and York (Expansion);
- Supporting infrastructure such as admin offices ancillary infrastructure on the farm Kipling;
- Waste and fuel storage areas;
- Relocation and development of new pollution control dams at York and Kipling operations;
- Upgrading the intersection along the R380 before the R31 – intersection used by KMR as haul truck transport entrance;
- Establishment of a Contractor's camp; and
- Extension of existing mine powerlines.

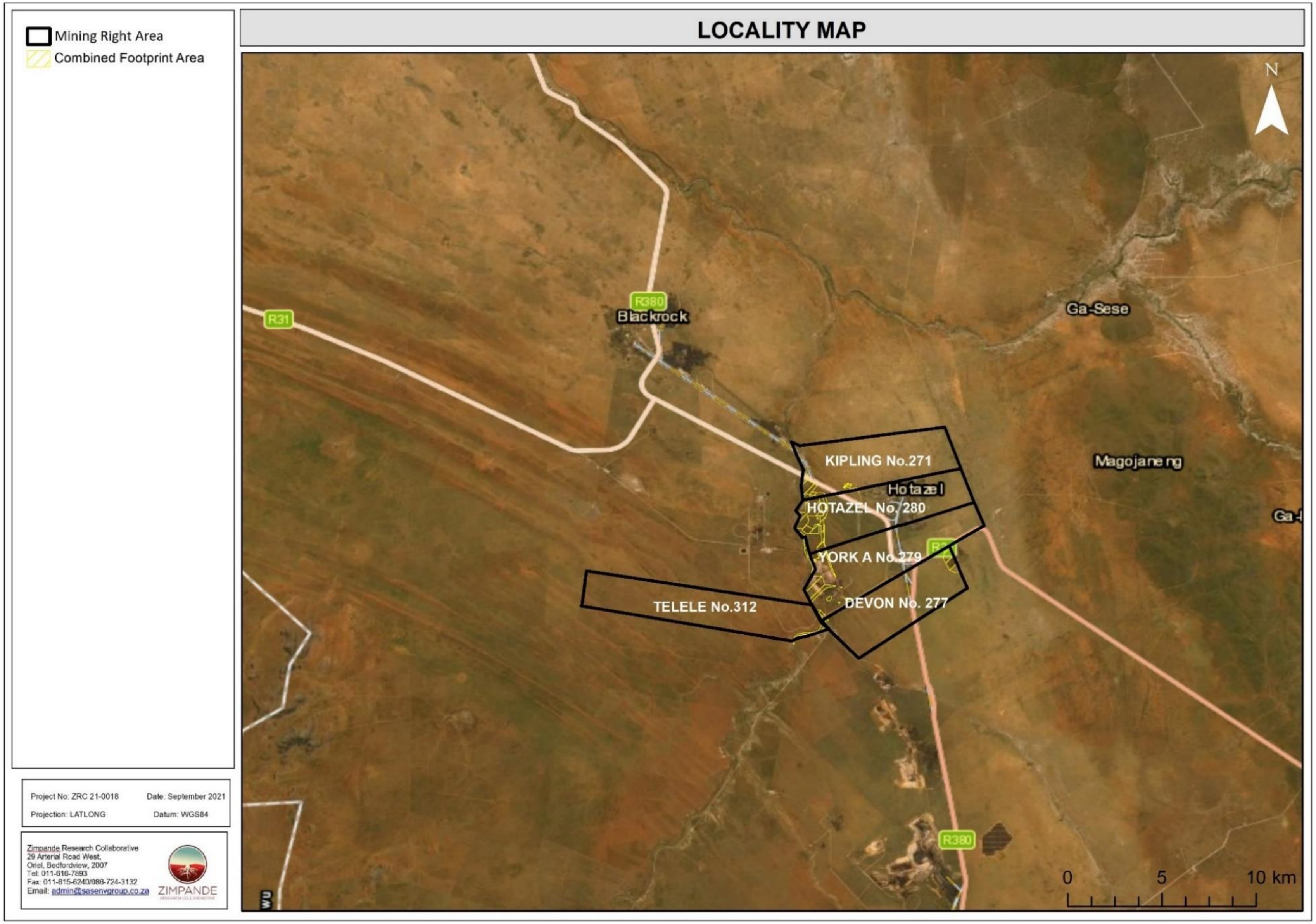

Figure 1: Digital satellite imagery depicting the locality of the MRA in relation to the surrounding areas.

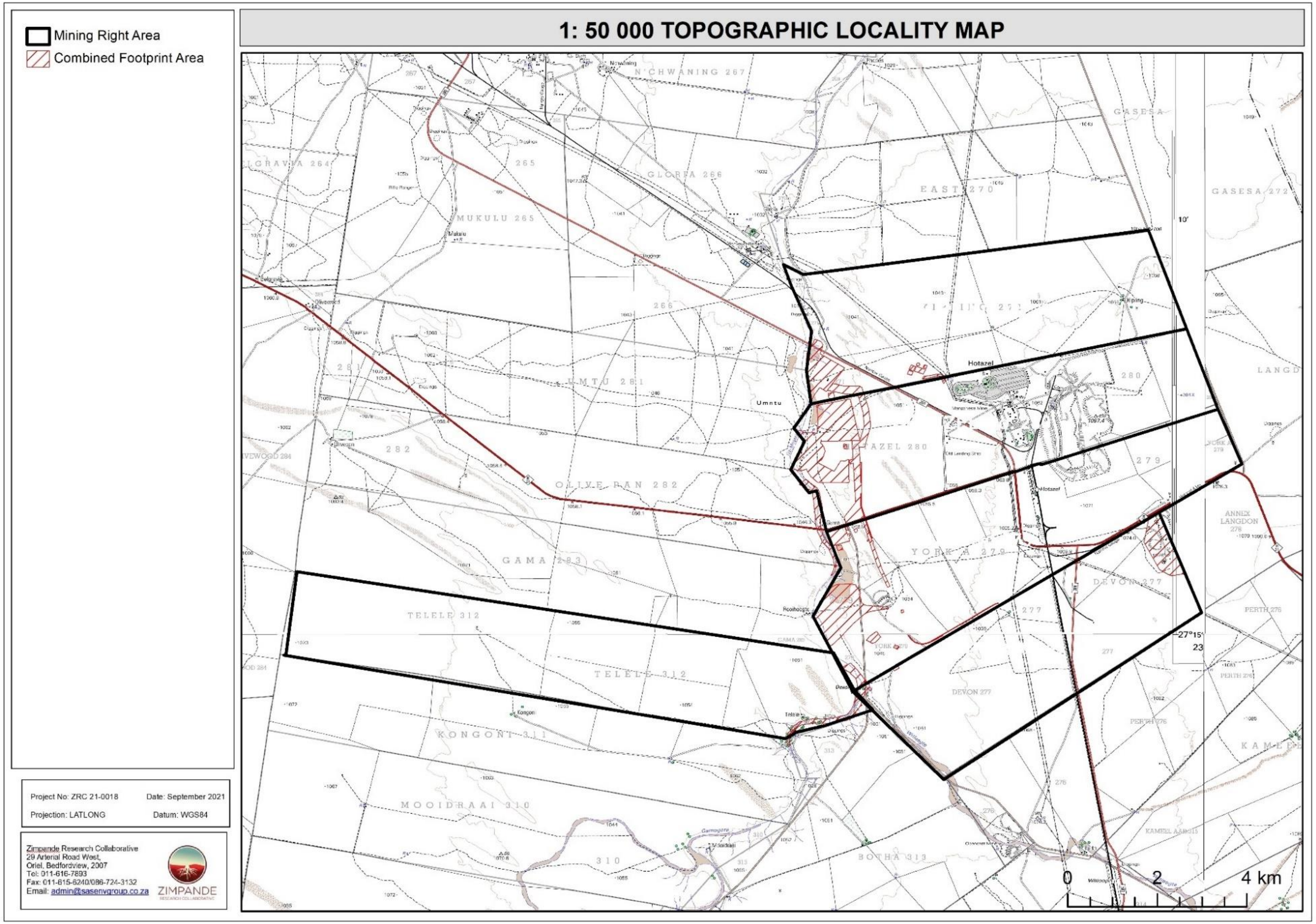

Figure 2: Location of the MRA depicted on a 1:50 000 topographical map in relation to surrounding areas.

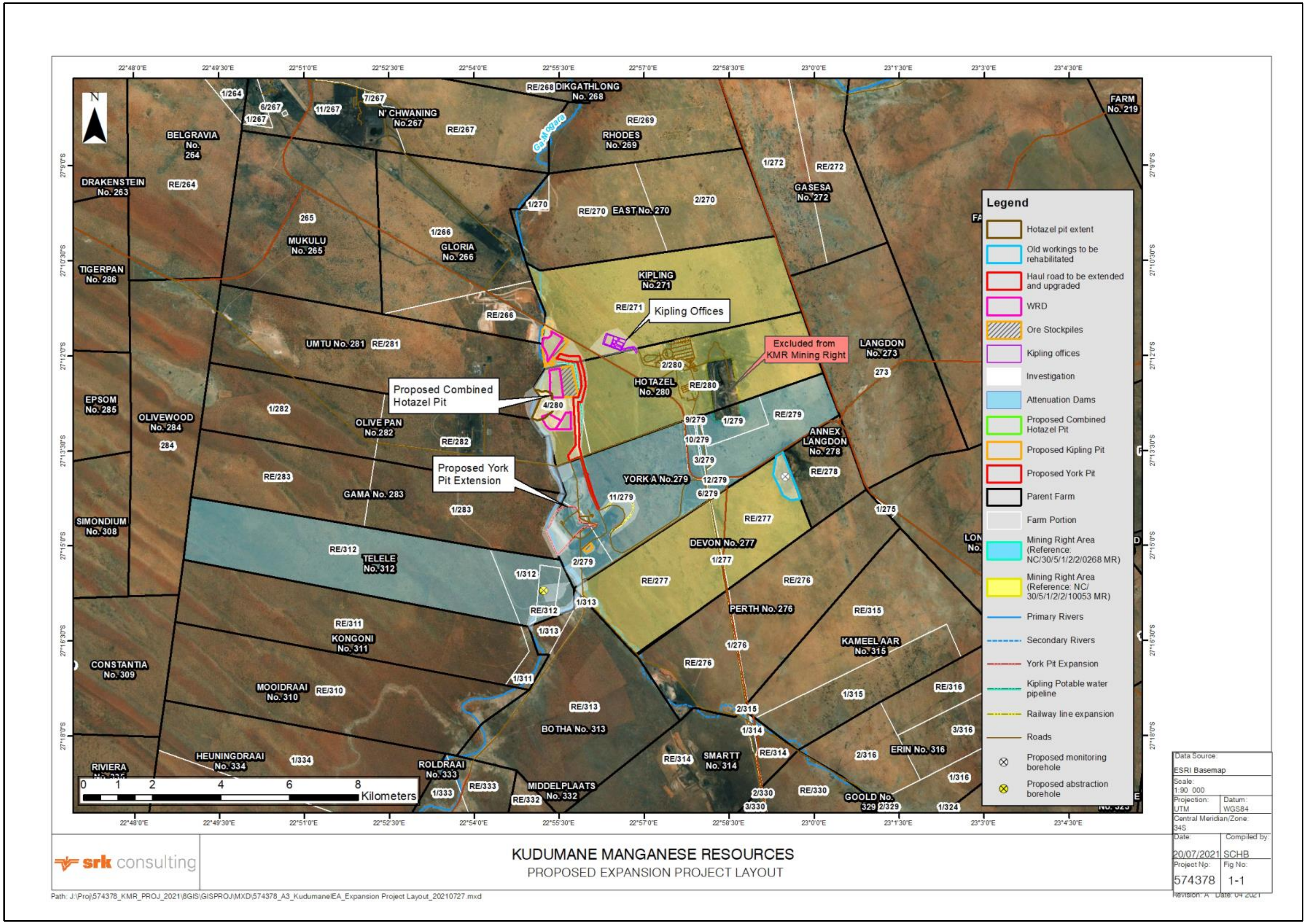

Figure 3: The proposed projects of the KMR expansion situated on the MRA.

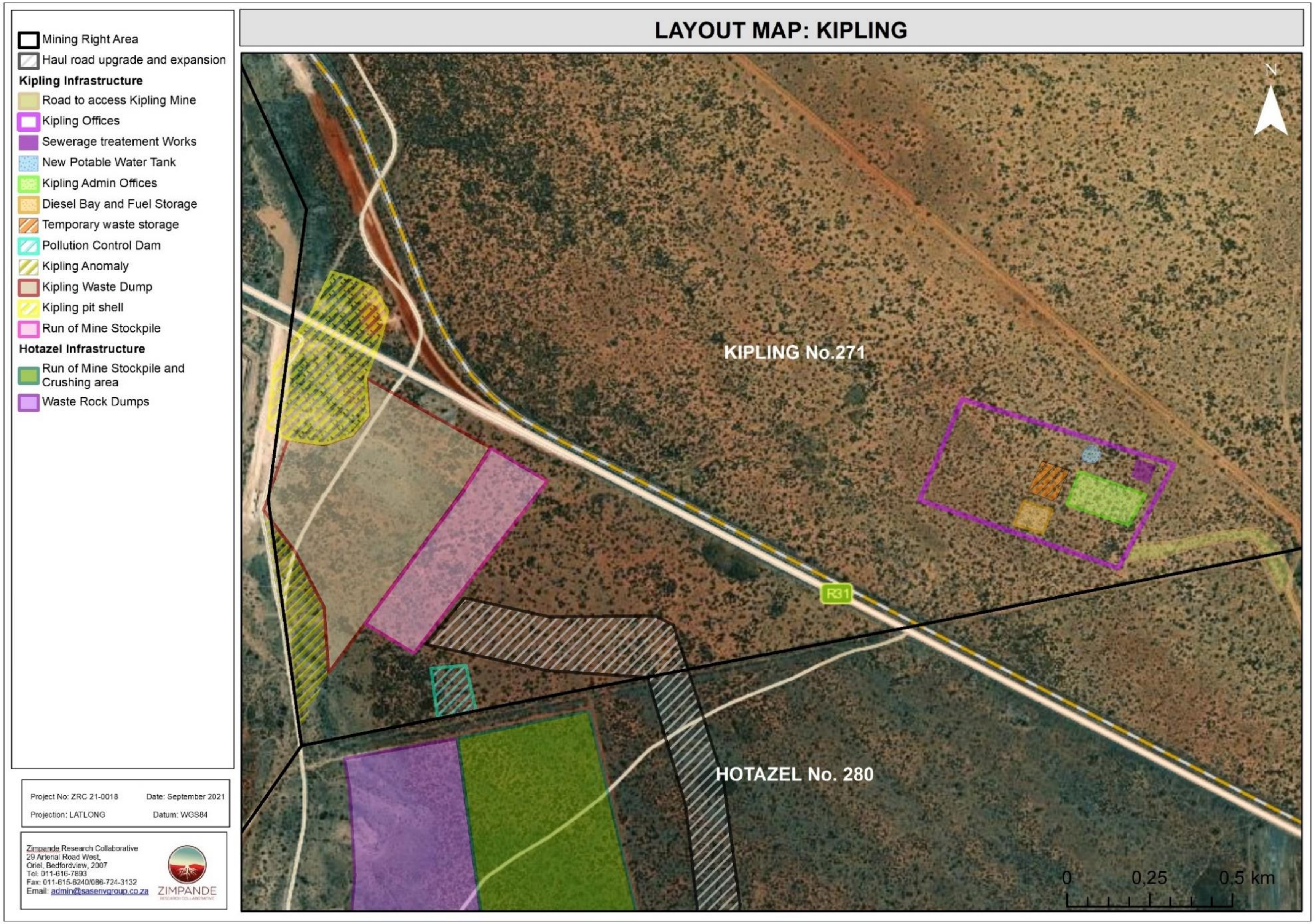

Figure 4: Layout map depicting the Kipling farm portion and its associated activities and infrastructure.

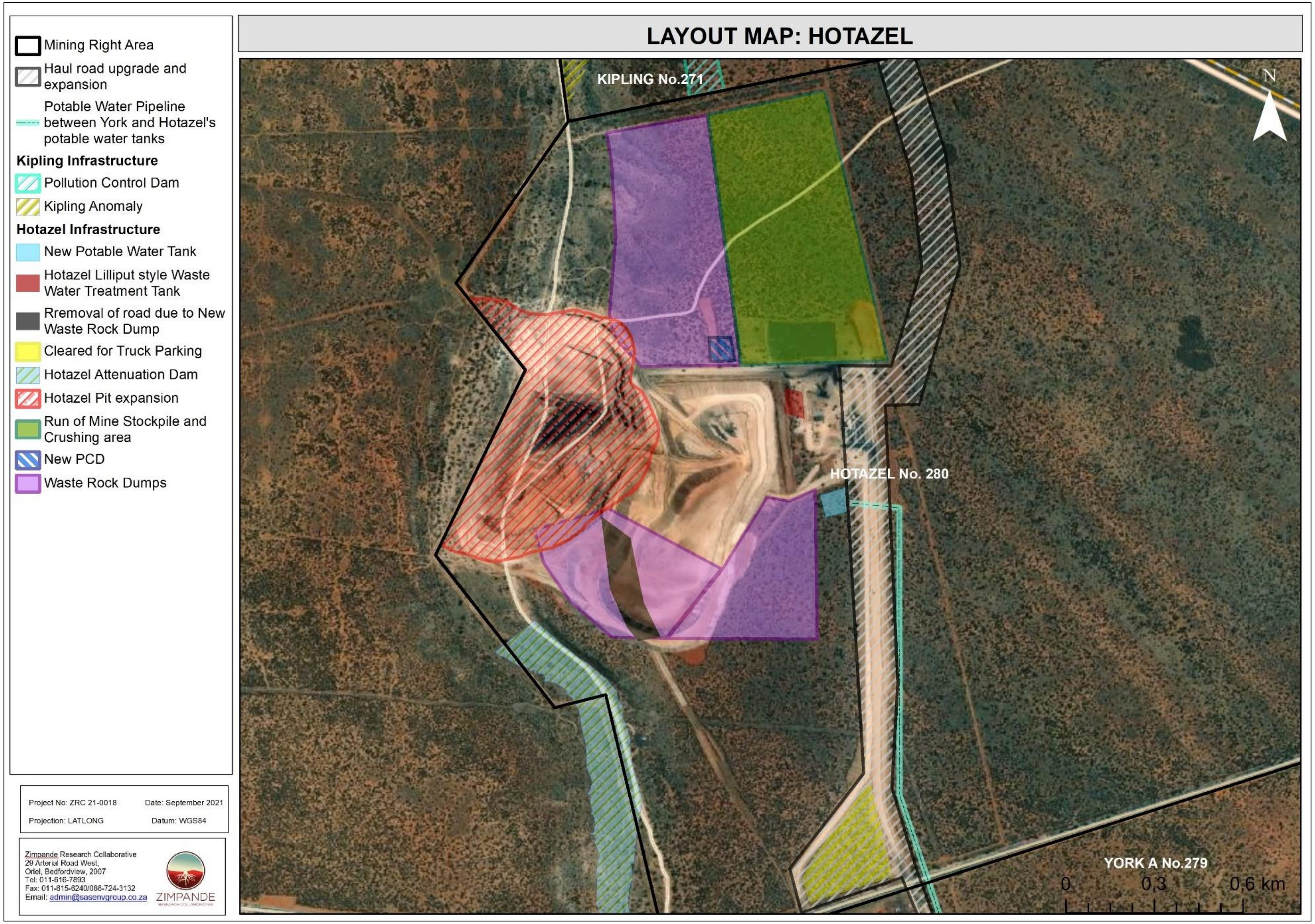

Figure 5: Layout map depicting the Hotazel farm portion and its associated activities and infrastructure.

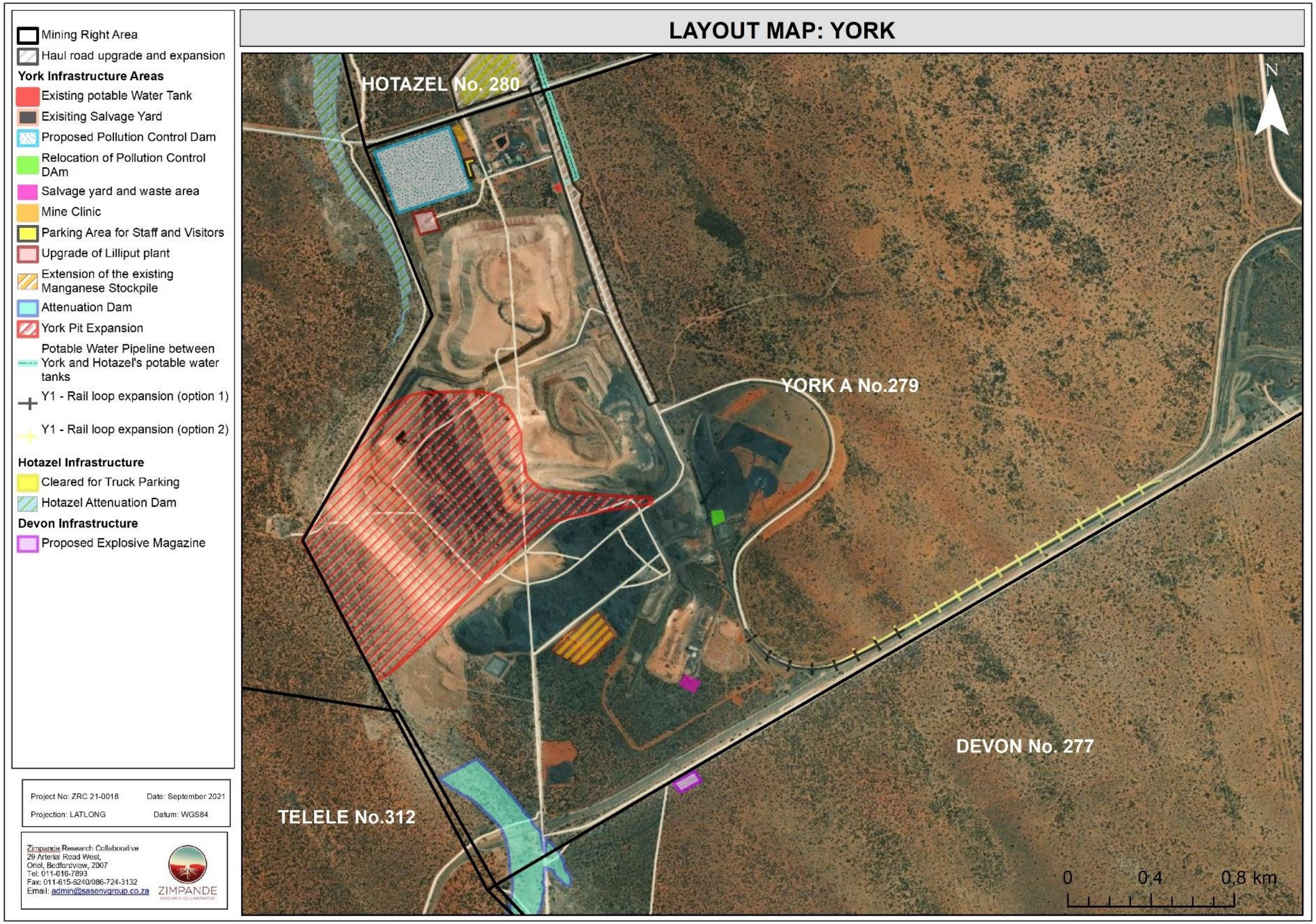

Figure 6: Layout map depicting the York farm portion and its associated activities and infrastructure.

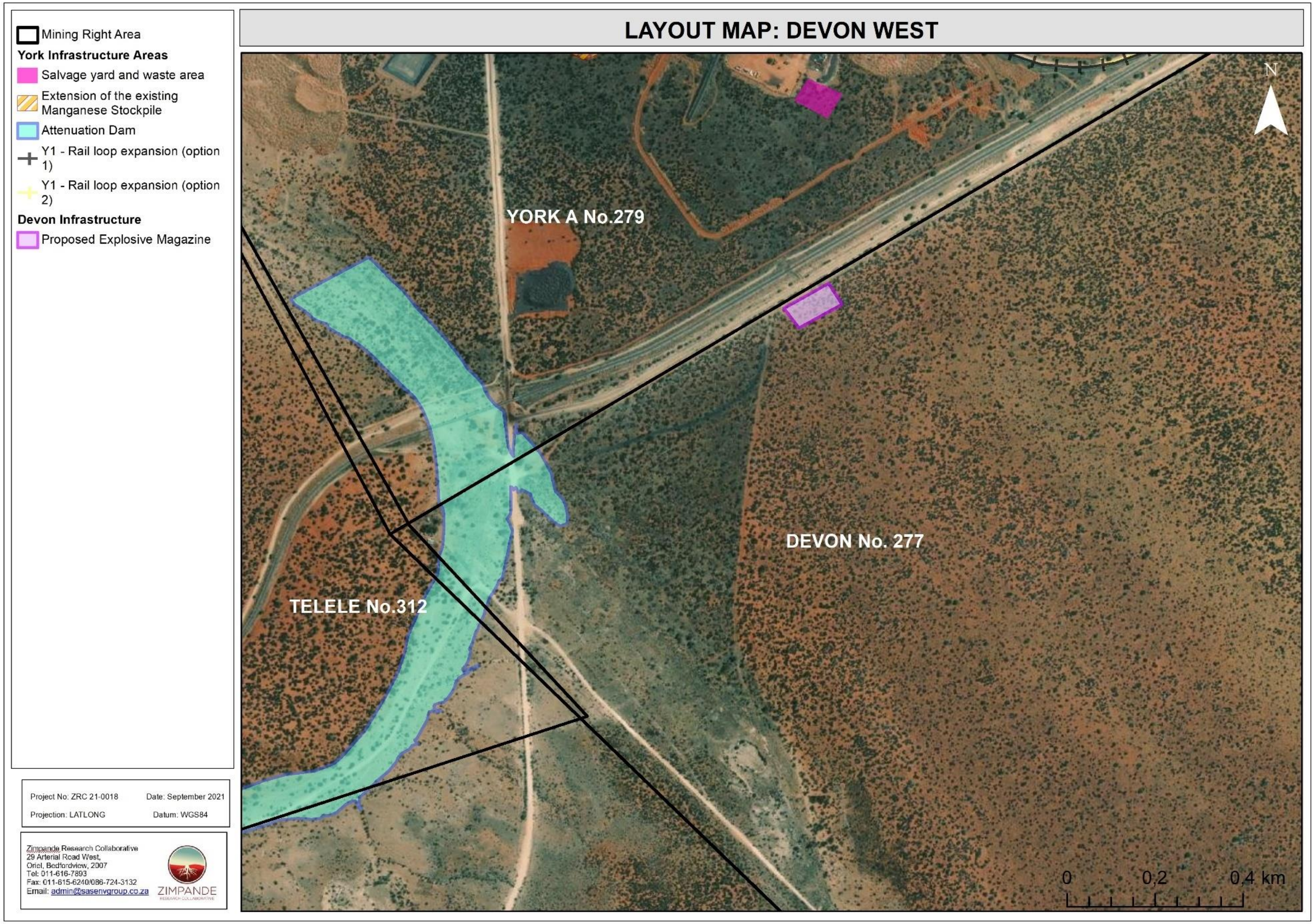

Figure 7: Layout map depicting the Devon West farm portion and its associated activities and infrastructure.

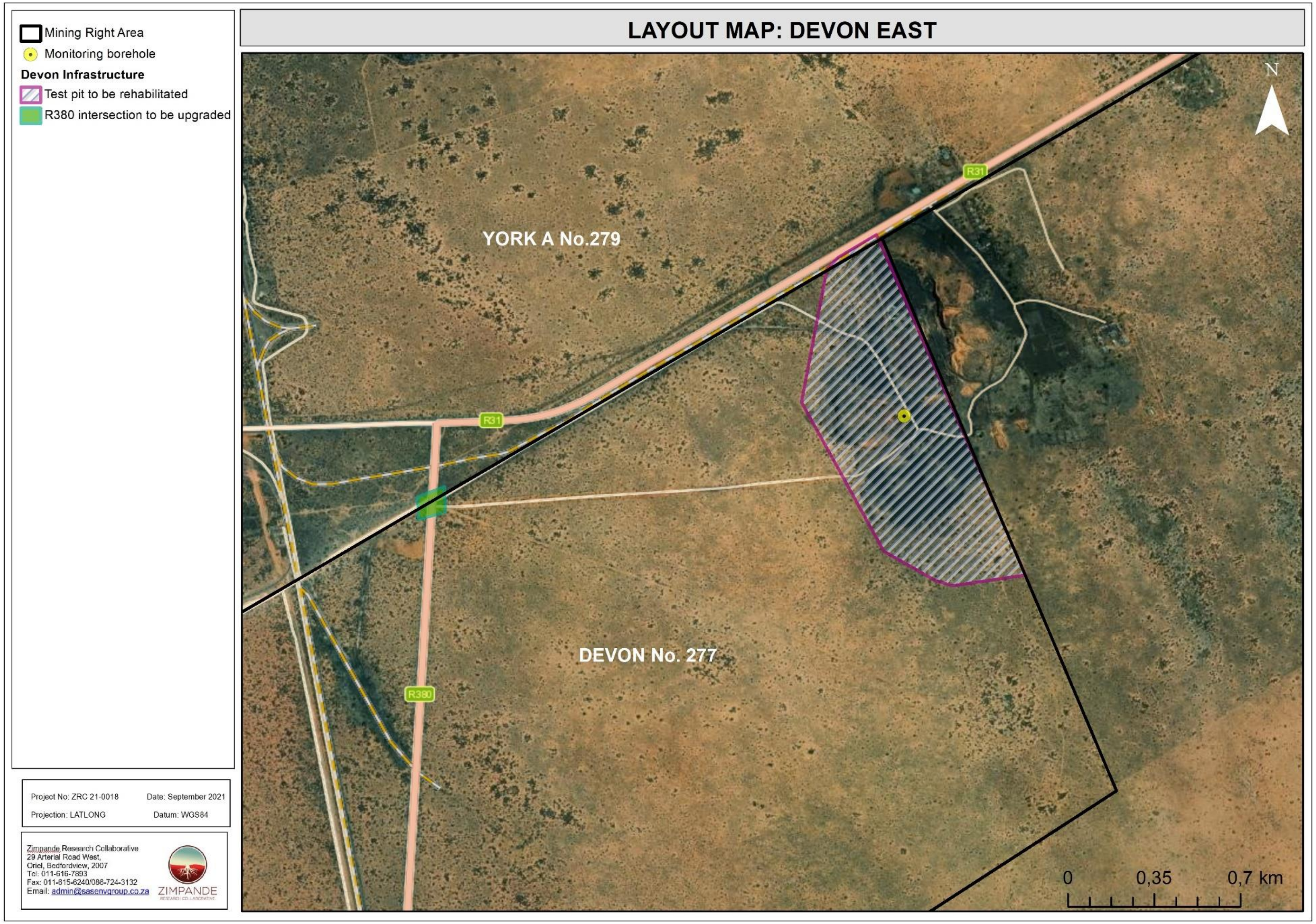

Figure 8: Layout map depicting the Devon East farm portion and its associated activities and infrastructure.

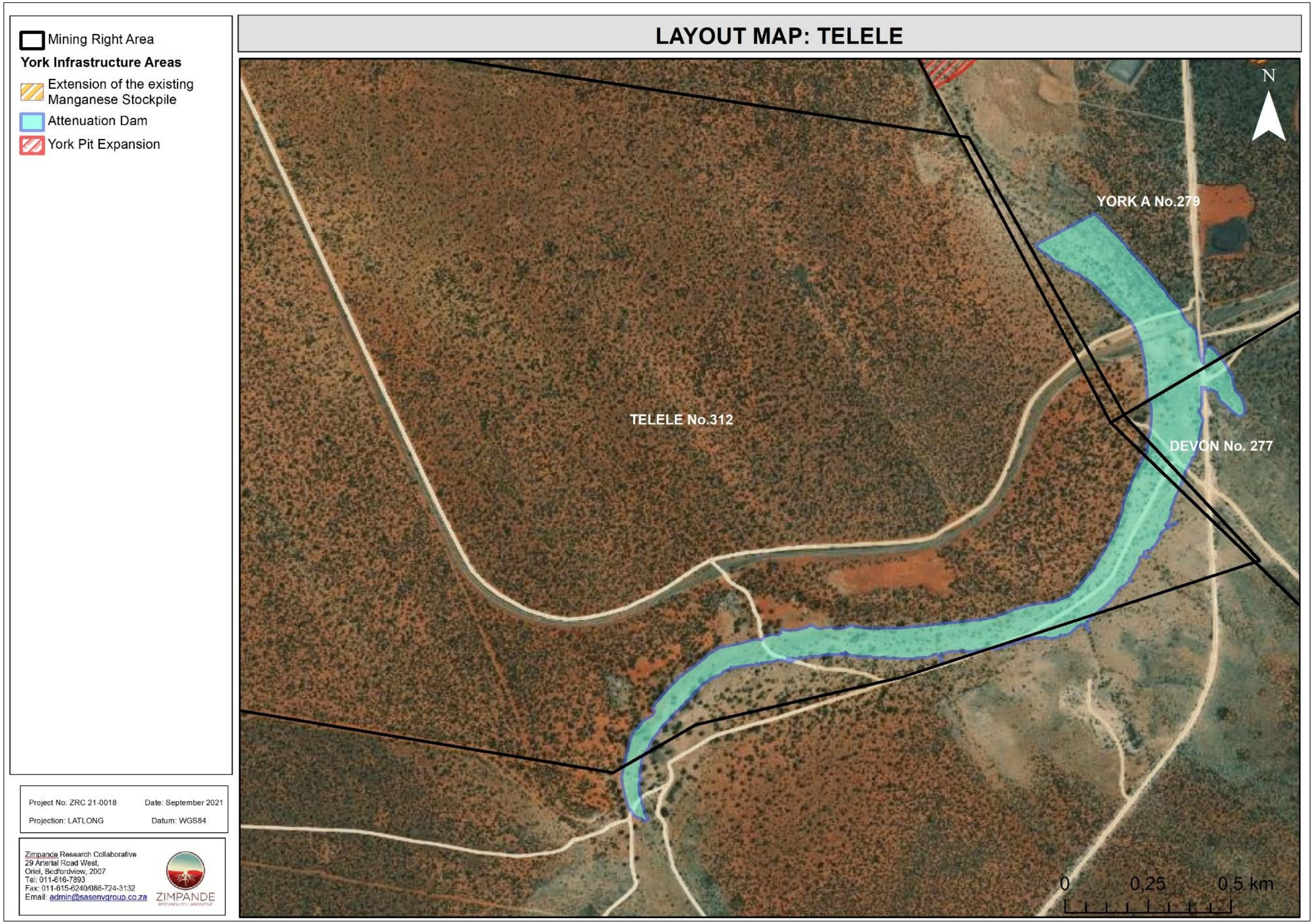

Figure 9: Layout map depicting the Telele farm portion and its associated activities and infrastructure.

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 by not limited to: Soil and Terrain dataset (SOTER), land type and capability maps and soil 2001, to establish broad baseline conditions and sensitivity of MRA both on environmental and agricultural perspective;
- Compile various maps depicting the on-site conditions based on desktop review of existing data;
- Use the soil information report by (Parteson, 2014);
- Identify restrictive soil properties on land capability under prevailing conditions based on the finding by (Parteson, 2014);
- 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 reported by (Parteson, 2014).

1.3 Assumptions and Limitations

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

- This study was undertaken as a desktop assessment only., the information gathered during the analyses of available databases must be considered with caution, as inaccuracies and data capturing errors are often present within these databases;
- No site visit was conducted by the author of this report and thus relied on the soil information report compiled by Paterson (2014) for soil classification and other information;
- The land type data (Eloff *et al*., 1986) was used to gather the soil information on the MRA;
- The soil information compiled by Paterson (2014) was confined to the MRA and does not include adjacent areas, however for the purpose of this study it was limited to the footprint areas;
- This soil information was used to infer the land capability classes of the area; and
- The soil, land use and land capability desktop assessment are confined to the MRA and does not include the neighbouring and adjacent properties.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

Prior to commencement of the report writing, a background study, including a literature review, was conducted to collect the pre-determined soil, land use and land capability data in the vicinity of the investigated MRA. 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

No soil survey was conducted by the author of the report and thus relied on the soil information report compiled by Paterson (2014). The land type data for the region with which the MRA fall under, was compiled by Eloff *et al* (1986). The soils were presumably classified according to the Soil Classification System of South Africa (1977).

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 2: Land Capability Classification (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups	Limitations
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable land**	No or few limitations
II	W	F	LG	MG	IG	LC	MC	IC			Slight limitations
III	W	F	LG	MG	IG	LC	MC	IC			Moderate limitations
IV	W	F	LG	MG	IG	LC					Severe limitations
V	W	F	LG	MG						**Grazing land**	Water course and land with wetness limitations
VI	W	F	LG	MG							Limitations preclude cultivation. Suitable for perennial vegetation

VII	W	F	LG								Very severe limitations. Suitable only for natural vegetation
VIII	W									**Wildlife**	Extremely severe limitations. Not suitable for grazing or afforestation.
W- Wildlife				MG- Moderate grazing						MC- Moderate cultivation	
F- Forestry				IG- Intensive grazing						IC- Intensive cultivation	
LG- Light grazing				LC- Light cultivation						VIC- Very intensive cultivation	

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

Climate Capability Class	Limitation Rating	Description
C1	None to slight	Local climate is 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 4 below presents the land potential classes, whilst Table 5 presents a description thereof, according to Guy and Smith (1998).

Table 4: Table of Land Potential Classes (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 5: The Land Capability Classes Description (Guy and Smith, 1998)

Land Potential	Description of Land Potential Class
L1	**Very high potential:** No limitations. Appropriate contour protection must be implemented and inspected.
L2	**High potential:** Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	**Good potential:** Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L4	**Moderate potential:** Moderately regular and/or severe to moderate limitations due to soil, slope, temperature or rainfall. Appropriate permission is required before ploughing virgin land.
L5	**Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperature or rainfall.
L6	**Very restricted potential:** Regular and/or severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L7	**Low potential:** Severe limitations due to soil, slope, temperature or rainfall. Non-arable.
L8	**Very low potential:** Very severe limitations due to soil, slope, temperature or rainfall. Non-arable.

3. DESKTOP ASSESSMENT RESULTS

**It should be noted that most of the database used in this assessment were compiled prior to mining, thus inaccuracies exist in the data present. However, the data presented gives useful information of the surrounding soils. The MRA was used to gather background information so as to give a broader picture of the soils in the immediate vicinity of the proposed project.*

The following data is applicable to the MRA, according to various data sources including but not limited to the Agricultural Geo-referenced Information System (AGIS).

- The Mean Annual Precipitation (MAP) is estimated to range between 201 and 400 mm per annum. These conditions have a low yield potential for a selected range of adapted crops but planting date options are limited for supporting rain fed agriculture;
- The mean annual evaporation ranges between 2201-2400 mm per annum on the Eastern portion of the Mining Right Area (MRA) encompassing the Klipping, Hotazel and York areas. The western portion encompassing the Mining Right Telele is characterised by a mean annual evaporation above 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 10);

- The geology associated with the MRA is considered to form part of the sandstone geological types;
- The Landform type occurring within the MRA is classified as a Plain Landform, which means the terrain is suitable to allow agricultural activities and also a High gradient hill where the combined footprint area is situated (Figure 11).
- The Soil and Terrain (SOTER) database indicates that the majority of the MRA comprises Ferric Arenosols soil group (rich in iron), whereas Chromic Cambisols and Calcic Solonchaks dominate small portions of the Mining Right Telele portion (Figure 12);
- The majority of the MRA is comprised of soils poor suitability for arable agriculture where climate permits, while the remaining portion located to the south is characterised by soils not suitable for arable agriculture (SOTER Database) (Figure 13);
- According to the AGIS database, the soil medium occurring within the MRA is not considered to be saline or sodic;
- According to the AGIS database, the livestock grazing capacity potential is estimated to range between 18-21 hectares per livestock Unit (ha/LSU) for the majority of the MRA, while the small portion of the Hotazel town is characterised as transformed rangeland;
- According to the database, the beneficial water retaining characteristics scarce or absent on the soils associated with the MRA;
- The soil pH of soil occurring within the MRA are slightly acidic with pH range of 6.5 - 7.4 which means that some nutrients will not be available for plant uptake. This is however not considered a limitation as the soils pH condition can be ameliorated through application of lime; and
- The predicted soil loss for most of the MRA is considered very low

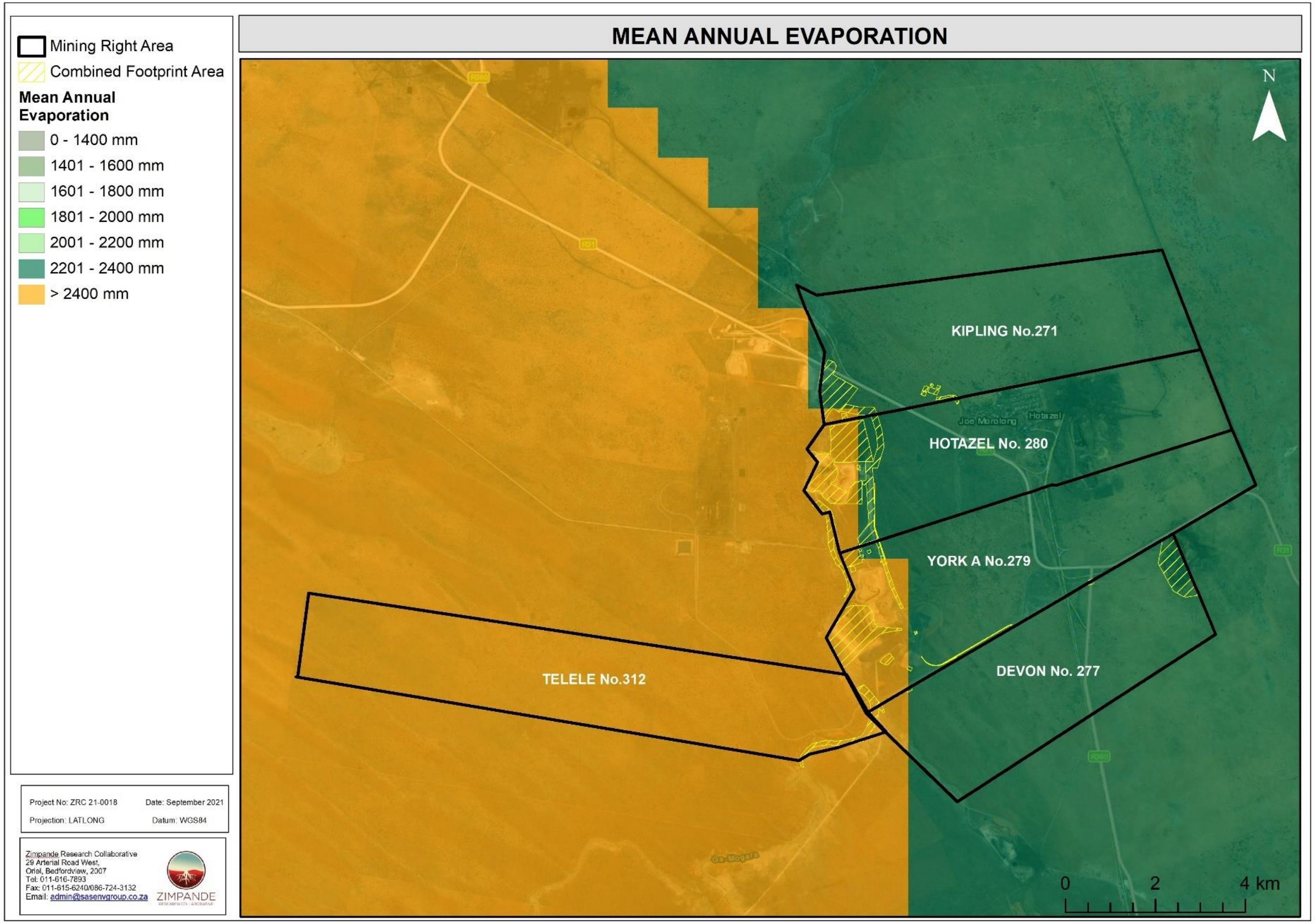

Figure 10: Dominant soils forms associated with the MRA according to the Soil and Terrain Database.

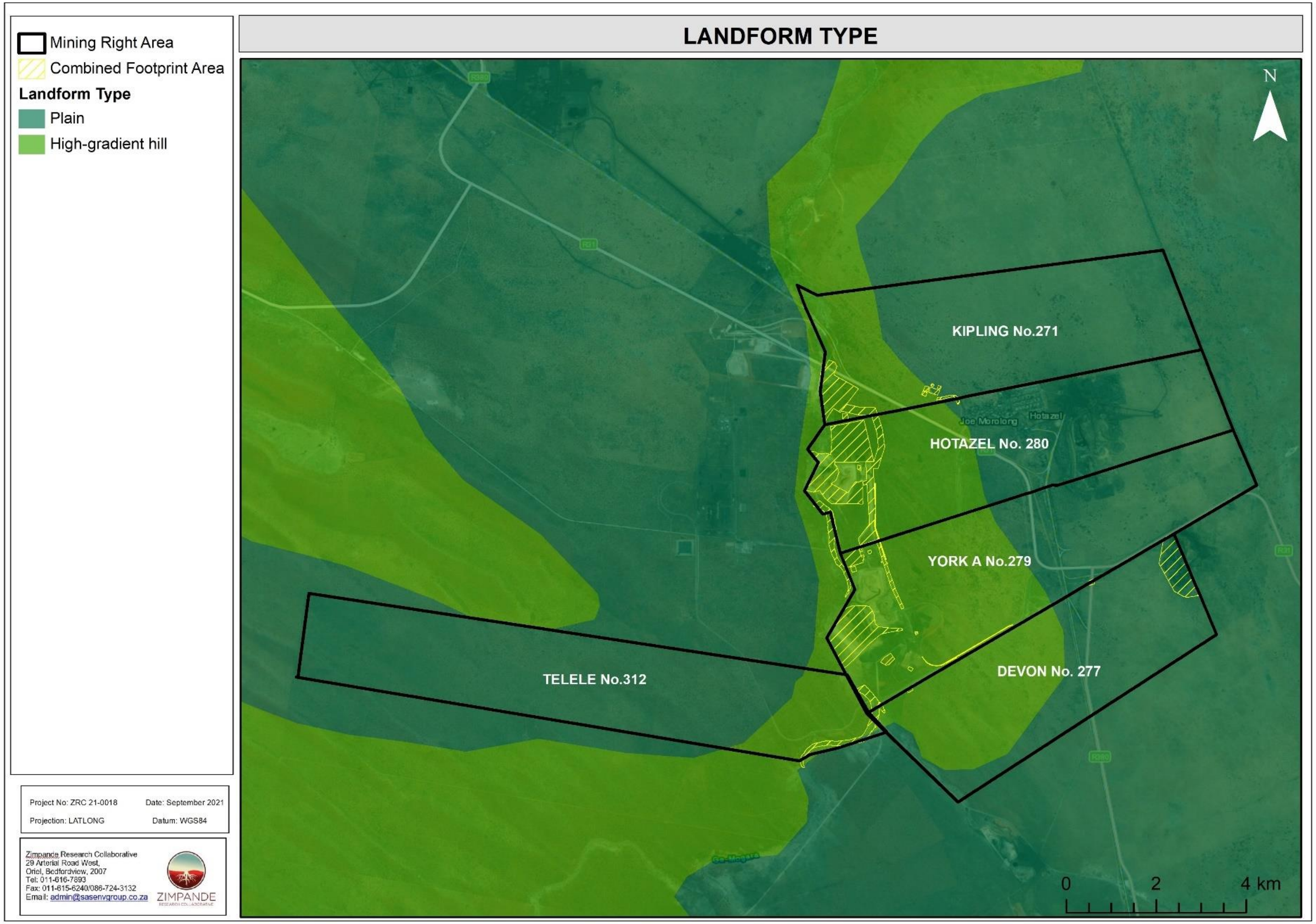

Figure 11: Description of the soils associated with the MRA.

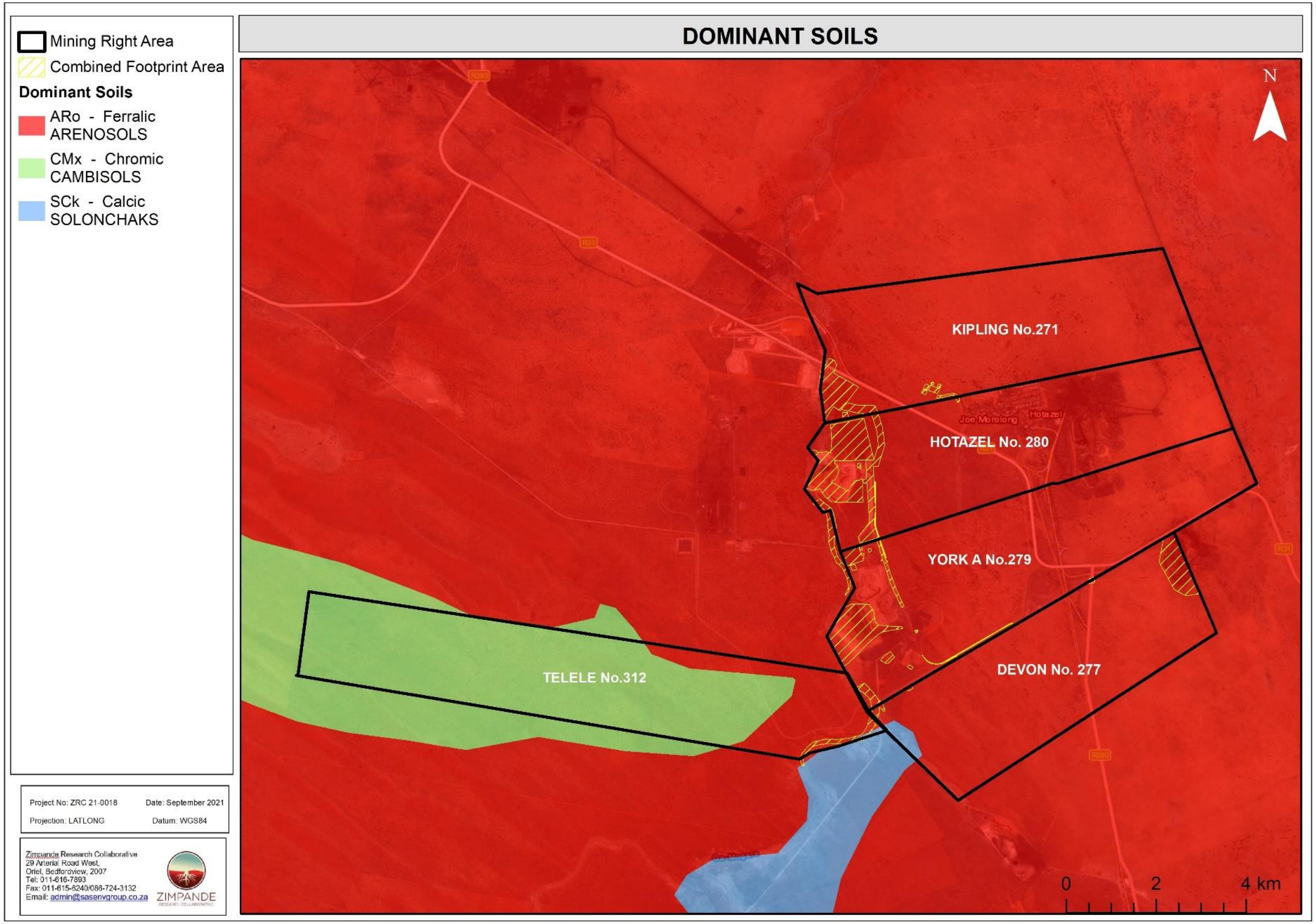

Figure 12: Land capability associated with the soils occurring within the MRA (based on existing SOTER database).

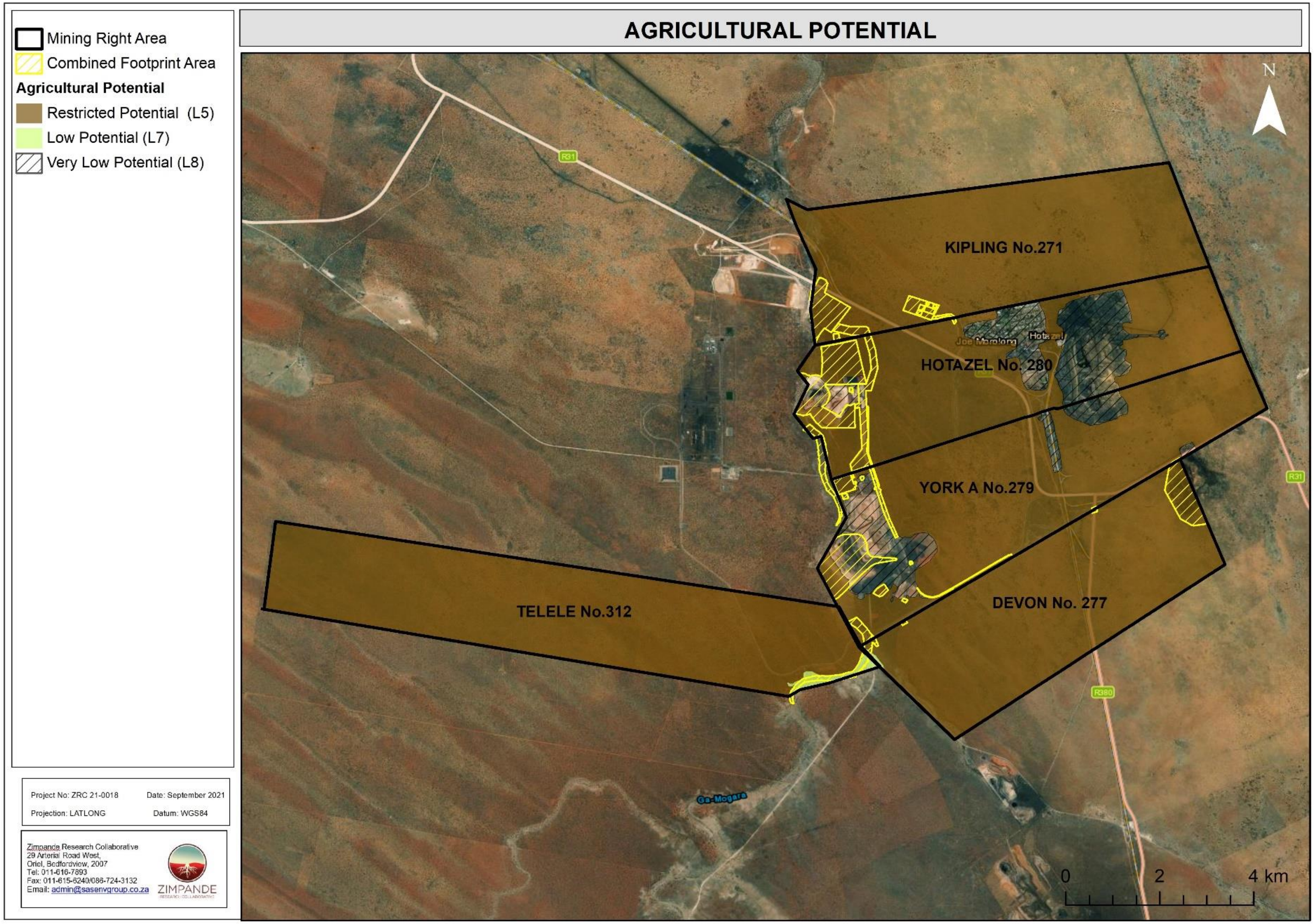

Figure 13: Land capability classes associated with the soils occurring within the MRA (based on existing SOTER database)

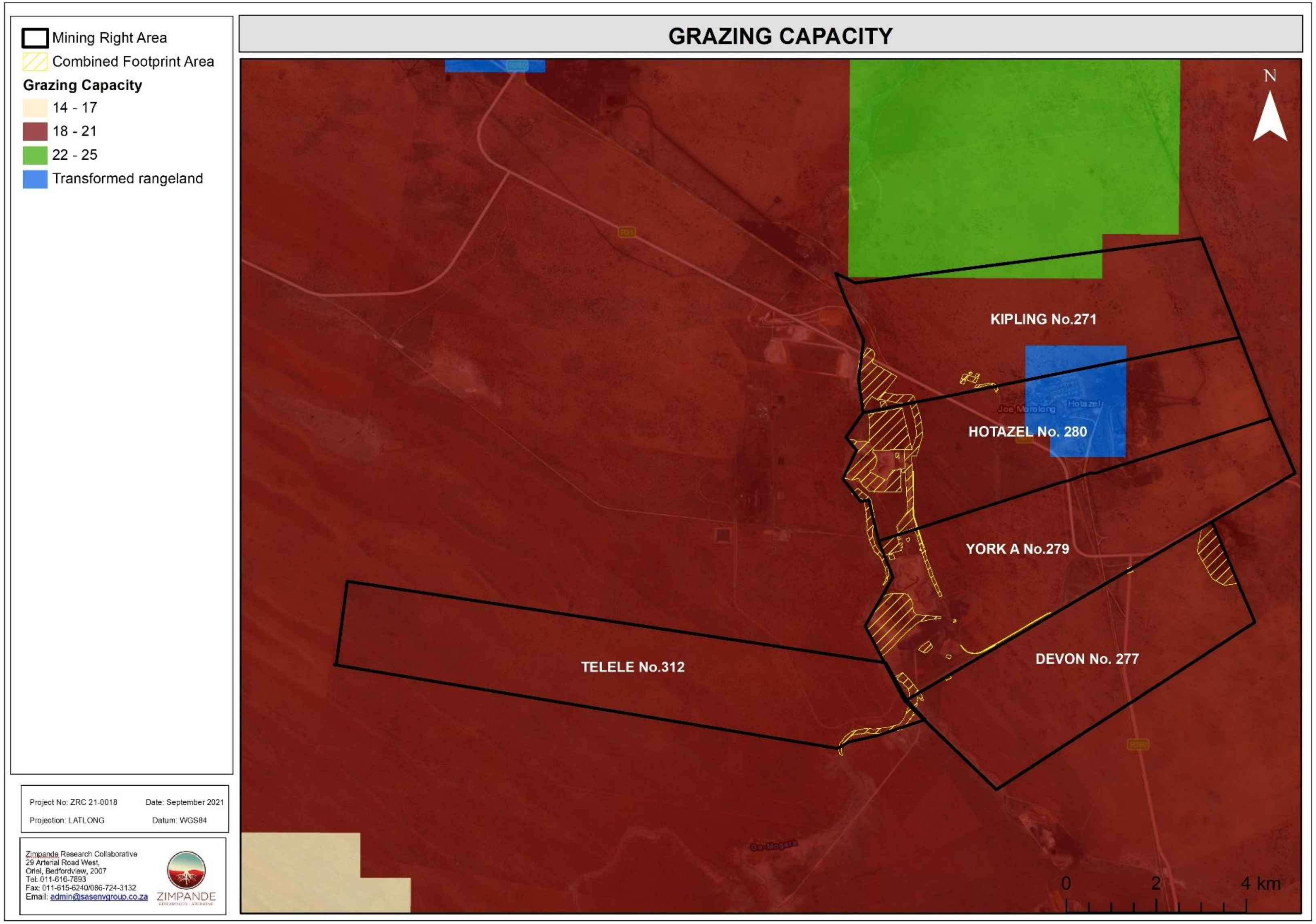

Figure 14: Grazing capacity associated with the MRA.

4. ASSESSMENT RESULTS

4.1 Current Land Use

Based on the information sourced from SLR (2014) the dominant land use within the MRA is mining related activities (infrastructure/servitudes, pipelines, powerlines open cast pits and etc), *ad-hoc* game and cattle farming and isolated residences/residential areas. Figure 15 presents images of the current land uses in the MRA.

Figure 15: Photographs illustrating some of the land uses within the MRA.

4.2 Dominant Soil Forms

The dominant soils occurring within the footprint areas are Hutton, Hutton/Clovelly, Mispah and Witbank forms (Paterson, 2014). These soils can be broadly classified as ideal for agricultural cultivation where the climate permits and under irrigation if the weather does not permit. The physical characteristics of the surrounding soil forms can largely be described as structureless, fine-grained, sandy soils. The deep soils were classified as Hutton/Clovelly, whereas the shallow soils with the occurrence of rock outcropping and calcrete layers were classified as Mispah soil forms. Disturbed soils due to current mining operations are also present and classified as Witbank soil forms. Figure 16 below depicts the dominant soil forms identified by the Eloff *et al*., (1986).

Table 6: Dominant soil forms within the footprint areas.

Soil Form	Code	Diagnostic Horizon Sequence
Hutton	Hu	Orthic/Red apedal
Clovelly	Co	Orthic/Yellow Brown/Lithic
Mispah	Ms	Orthic/Hardrock
Witbank	Wb	Transported Technosols

***Infrastructural areas were not included in the table above since they not considered in the land capability ratings**

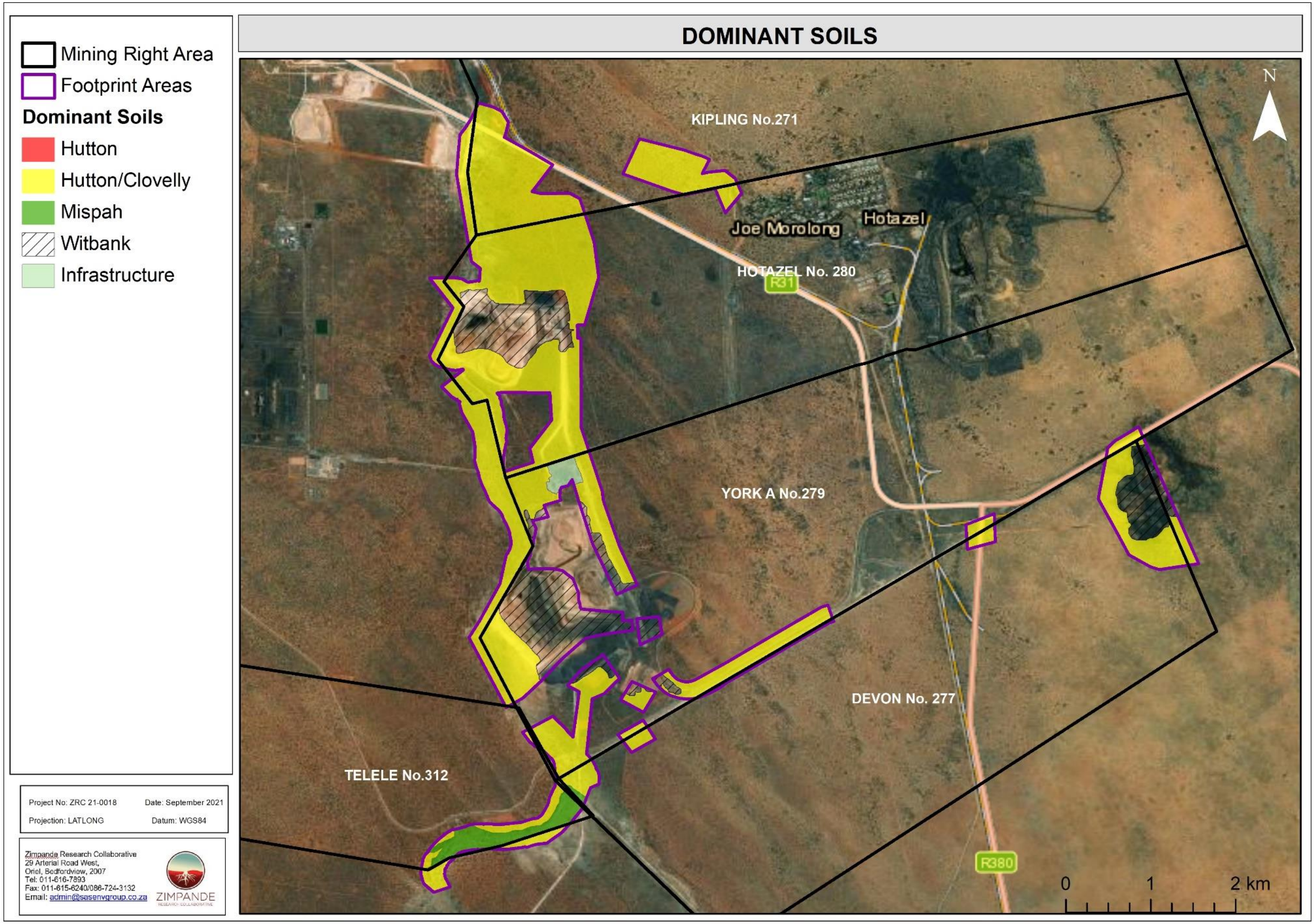

Figure 16: Dominant soils forms within the footprint areas.

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 MRA falls into Climate Capability Class 8 due to very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.

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 from Figure **17** below. The identified land capability limitations for the identified soils are discussed in comprehensive “dashboard style” summary tables presented from Tables **8**, **9** and **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 as well as areal extent expressed as hectares as well as percentages.

Table 7: Identified soil forms within the footprint area and their respective land capability.

Soil Form	Land capability	Land Potential	Area (ha)	Percentage
Hutton	Arable (Class II)	L5	25.60	2.01
Hutton/Clovelly	Arable (Class II)	L5	800.84	63.04
Mispah	Grazing (Class VI)	L7	33.98	2.67
Witbank	Wilderness (Class VIII)	L8	409.97	32.27
Total Enclosed Area			**1270.39**	**100**

***Infrastructural and industrial areas 10.5 (0.83%) were not included in the table above since they not considered in the land capability ratings.**

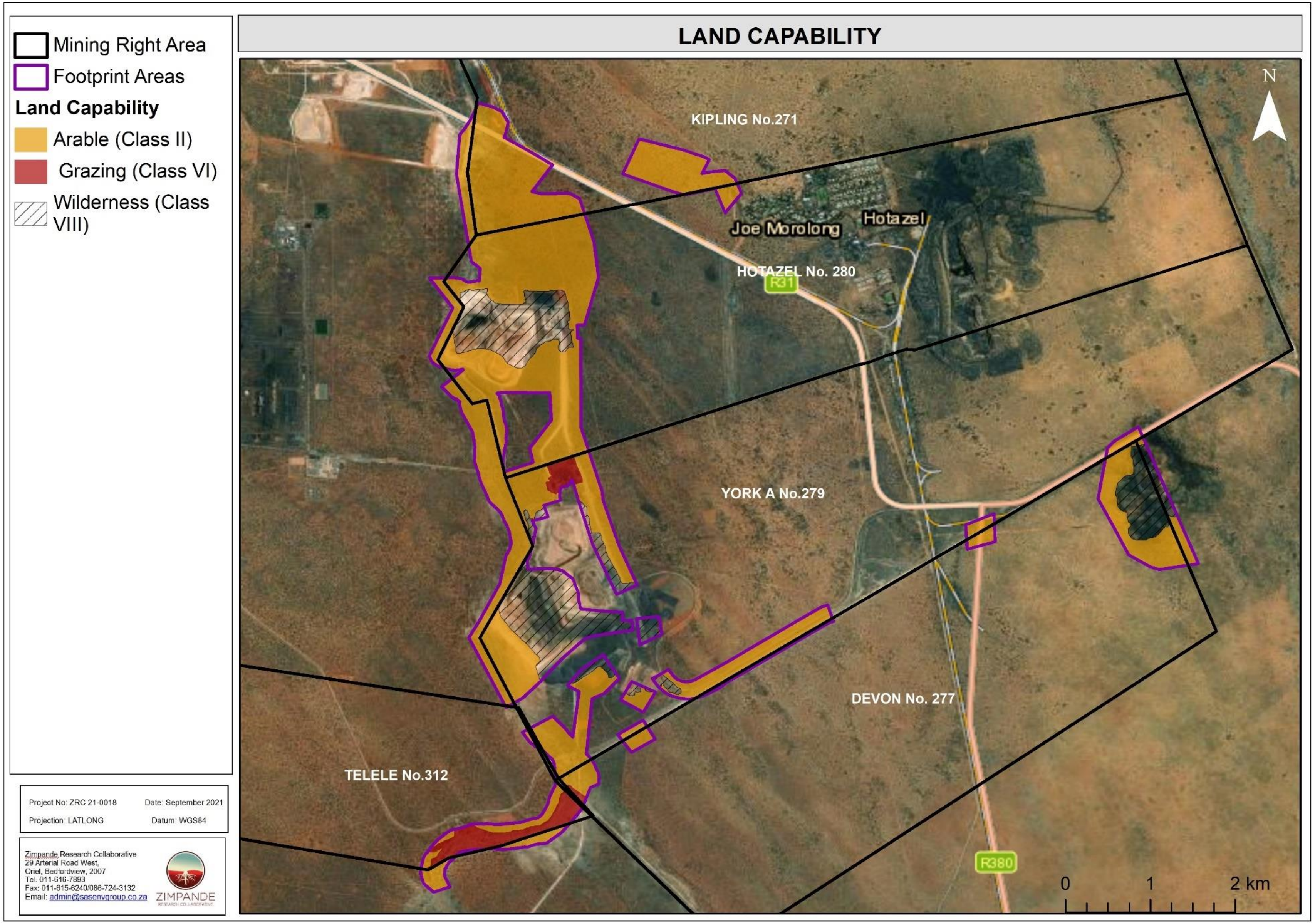

Figure 17: Map depicting Land capability of soils occurring within the footprint areas.

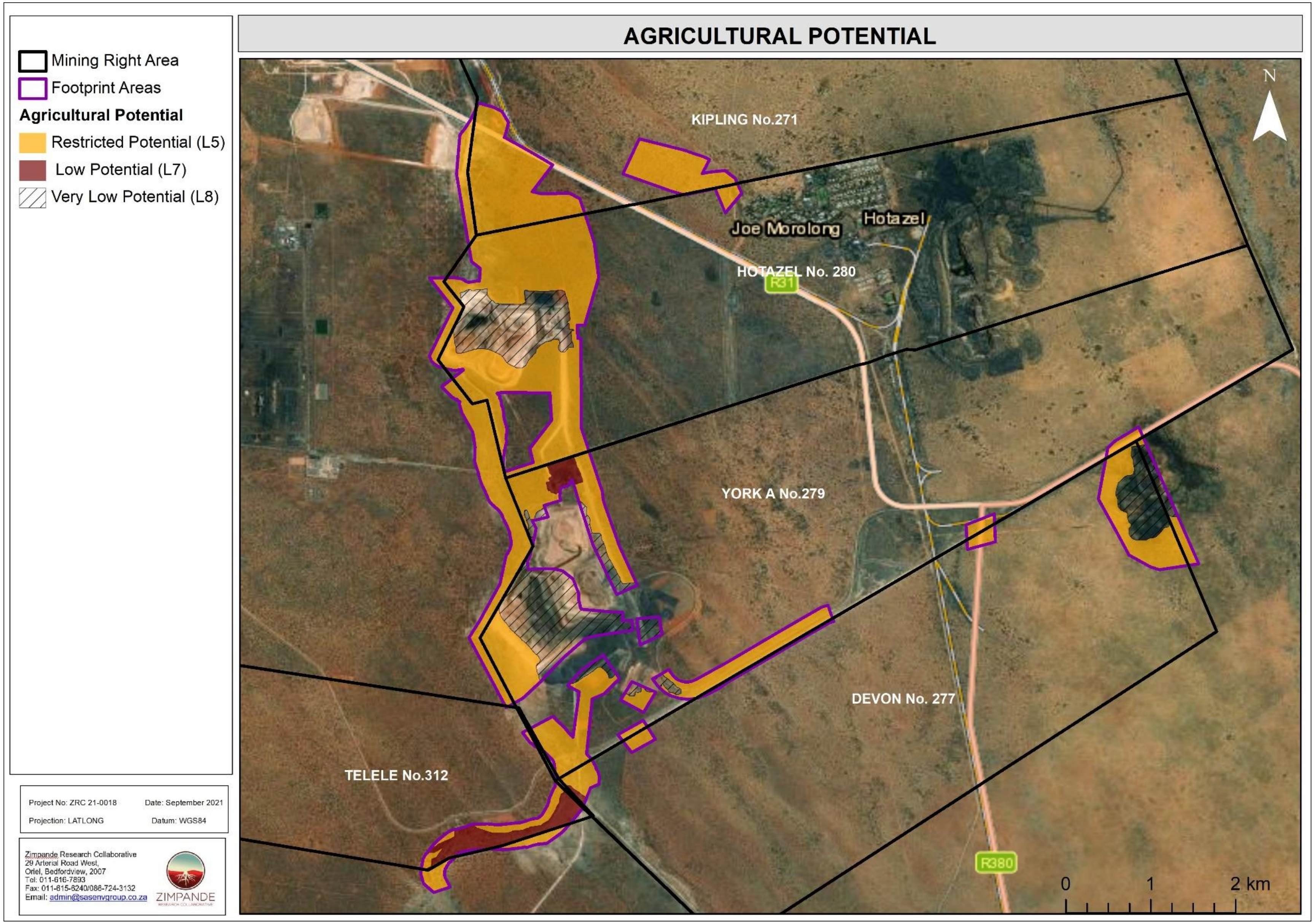

Figure 18: Map depicting Land capability of soils occurring within the footprint areas.

Table 8: Summary discussion of the Grazing (Class V) land capability class

<table>
<tr><td colspan="5">Land Capability: Arable (Class II) and High potential with minor limitations</td></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 red and yellow brown apedal soil horizon associated with the Hutton and Clovelly soil forms associated with the MRA.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Hutton and Clovelly</td><td>Area Extent</td><td>825.44 ha (65.05% of the footprint 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
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 where climate permits. 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">L5: Restricted Potential: Moderately regular and/or severe to moderate limitations due to steeper slopes, high temperatures and low 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 expansion of the existing infrastructure and open cast pit on land capability and land potential is anticipated to be Medium (M) without mitigation and Low (L) with mitigation measures, due to the low agricultural potential of the soils. However, the proposed expansion project will result in a 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 important soils for potential agricultural use, the suitability for crop production is limited by the climate because this area experiences erratic and very low rainfall which is necessary for successful dryland agriculture. The soils are sandy in nature and thus more likely to be devoid of nutrients and good water holding characteristics. 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 rock outcroppings associated with the Mispah soil forms.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Mispah</td><td>Areal Extent</td><td>33.98 ha (2.67% of the Footprint Area)</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 limited rock weathering.</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 makes 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">L5: Restricted potential: Regular and/or moderate to severe limitations due to due to steeper slopes, high temperatures and low rainfall.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>L</td><td rowspan="2">The overall impact of the proposed expansion of the existing infrastructure and open cast pit 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 expansion project and activity/infrastructure changes 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 productively used for the common crops and grazing, 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 Wildlife/ Wilderness (Class VIII) 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>409.97 ha (7.99% of the Footprint Area)</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>Land Potential</td><td colspan="2">L8: Very Low Potential: Due to significantly disturbed areas due from anthropogenic 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 expansion of the existing infrastructure and open cast pit 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 so as 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

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 significance of the impacts is summarised on Tables presented below the proposed development.

Proposed Activity Description:

The proposed KMR expansion project will entail the following:

- A new Opencast Pit mine on Kipling;
- Expansion of the Hotazel and York Opencast Pits to allow for the mining of KMRs boundary pillar associated with each pit;
- Two attenuation dams on the Ga-Mogara River, to allow for the expansion of the York and Hotazel Opencast Pits; and
- The secondary infrastructure and activities associated with the above-mentioned activities.

5.1 Activities and Aspect Register

The impact assessment rating is applicable to the following activities:

Table 11: Activities associated with proposed development during different phases

ACTIVITIES AND ASPECTS REGISTER
Pre-Construction Phase
- Planning and design of the footprint areas. - Preparation for the construction activities - **Impact: E**xcessive vegetation clearance within infrastructure Increased soil erosion
Construction Phase
- Land and footprint clearing. - **Impact:** Increased soil erosion and subsequent soil loss
- Topsoil stripping and stockpiling. - **Impact:** Vehicle/equipment movement leading to soil erosion and compaction
- Establishment of surface infrastructure - **Impact:** Spillage of hydrocarbons leading to soil contamination
Operational and Maintenance Phases
- Operation of the surface infrastructure. - **Impact: I**ncreased soil erosion, compaction and spillage of hydrocarbons
Decommissioning and Closure Phases
- Dismantling and decommissioning of infrastructure and buildings. - **Impact:** Demolition activities leading to erosion, compaction and soil contamination

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 expansion development footprint is located on a relatively flat to gently sloping terrain, which decreases the erosion hazard. While the identified soils display low susceptibility to erosion under current conditions, their susceptibility to erosion is likely to increase once the land is cleared for construction activities, and the soils will inevitably be exposed to wind and stormwater. Refer to the impact Tables 12, 13 and 14 below for the impact significance ratings.

5.1.2 Impact: Soil compaction

Heavy equipment traffic during construction and activities is anticipated to cause soil compaction. The severity of this impact is anticipated to be high for most of the soils due to the sandy texture of soils. Refer to the impact Tables 12, 13 and 14 below for the impact significance ratings.

5.1.2 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 considered to be medium-high for all identified soils without 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 (EMP) and monitoring guidelines should be adhered to during the construction and operational activities. Refer to the impact Tables 12, 13 and 14 below for the impact significance ratings.

5.1.3 Loss of Agricultural Land Capability

The loss of land capability is anticipated to be Medium as the significant portion (120.8 ha out of 466.8) of the dominant soils are considered ideal for cultivation based on the land capability classification. Large portions of arable soils will be stripped and stockpiled and thus potentially reducing the fertility status of the soils and being prone to erosion. The proposed activities will lead to a permanent change of land use if not properly mitigated. Consequently, the loss of agricultural soils and the permanent change in land use will be localized and also considering that mining related activities are already taking place on Hotazel and York farm potions. Refer to the impact Tables 12, 13 and 14 below for the impact significance ratings.

5.1.4 Cumulative Impacts

The proposed expansion activities will lead to a permanent change of land use if not properly mitigated. The cumulative loss from a soil and land capability point of view is anticipated to be Medium pre-mitigation and Low after mitigation. This is due to the significant portion (65.05%) of the footprint area having soils classified as suitable for agricultural cultivation according to the land capability classification. However, the suitability for successful dry land agriculture is low due to the climatic conditions of the area and thus renders the soils to a restricted potential based on the land potential classification. 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 landuses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced in this manner. Lastly, the loss of agricultural soils and the permanent change in land use will be limited to the footprint areas. 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.

Table 12: Impact on the soil and land capability from the proposed Key Infrastructure (Open Cast Pits) for the Pre-Construction Phase, Construction Phase, Operational Phase and Decommissioning / Rehabilitation Phase associated with the proposed KMR Expansion proposed KMR Expansion Project. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource.

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
ACTIVITY: Key Infrastructure development: - **A new Opencast Pit mine on Kipling; and** - **Expansion of the Hotazel and York Opencast Pits to allow for the mining of KMRs boundary pillar associated with each pit.**																	
Pre-Construction Phase																	
Potential poor planning leading to excessive placement of infrastructure outside of the demarcated open pit areas leading to increased soil erosion	-	4	4	3	8	3	**60**	**High**	The footprint of the proposed infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the open pit footprint as far as practically possible.	3	2	2	4	2	**24**	**Low**	60
Potential poor planning and control mechanisms leading to excessive vegetation clearance within open pit areas	-	4	4	3	8	3	**60**	**High**	The footprint of the proposed infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the open pit footprint as far as practically possible.	3	2	2	4	2	**24**	**Low**	60

Construction Phase																	
Vegetation clearance leading to soil erosion within footprint areas.	-	5	4	3	8	4	75	High	*The footprint of the proposed infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the open pit footprint as far as practically possible; *If possible, vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low; *Bare soils 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; *Restrict vegetation clearance to priority areas of development *All disturbed areas adjacent to the open pit areas can be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission.	3	3	3	6	2	36	Moderate	52
Movement of construction vehicle/equipment leading to soil compaction	-	5	5	3	8	4	80	High	*Laydown areas should be located within the already disturbed soils (Anthrosols) from the currently active pits to avoid compaction of natural soils; *If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the open pits footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	4	3	2	6	2	44	Moderate	45

Spillage of hydrocarbons leading to soil contamination	-	4	4	3	8	3	**60**	**High**	*Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented and 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 should be compiled to guide the construction works; and *An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur.	3	3	2	6	2	**33**	**Low**	45
Land degradation leading to loss of land capability	-	4	4	3	8	3	**60**	**High**	*Excavation and long-term stockpiling of soil should be limited within the demarcated areas as far as practically possible; *Ensure all stockpiles are clearly and permanently demarcated and located in defined no-go areas; *Stockpiles height should be restricted to that which can deposited without additional traversing by machinery. Maximum height of 2-3 m is proposed, and the stockpile should be treated with temporary soil stabilization;	4	4	3	6	3	**52**	**Moderate**	13.3
Operational Phase																	

Movement of construction vehicle/equipment leading to soils compaction	-	5	4	3	8	4	75	High	*Laydown areas should be located within the already disturbed soils (Anthrosols) from the currently active pits to avoid compaction of natural soils; *If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the open pits footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation	4	3	2	6	3	44	Moderate	41.3
spillage of hydrocarbons leading to soil contamination	-	4	4	3	8	3	60	High	*No vegetation clearance is allowed outside of the demarcated footprint areas. Disturbed areas beyond the footprint are to be suitably rehabilitated in accordance with the rehabilitation plan.	4	3	3	6	3	48	Moderate	20
Land degradation leading to loss of land capability	-	4	4	3	8	3	60	High	*Operational vehicles are to utilise only designated roads. No driving through the surrounding habitat is to be permitted. *At decommissioning and rehabilitation phase, replace soil to appropriate soil depths in the correct order, and cover areas to mimic a natural topographic aspect so as to achieve a free draining landscape that is as close as possible the pre-mining land capability rating.	4	3	3	6	3	48	Moderate	20

Closure/Rehabilitation Phase																		
Disturbance of soils as part of demolition activities leading to Sedimentation and erosion.	-	4	4	2	6	3	**48**	**Moderate**	*All disturbed areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion; *Temporary erosion control measures may be used to protect the disturbed soils during the rehabilitation until adequate vegetation has established; *A site-specific drainage system design should be implemented to reduce the volume and velocity of flows crossing disturbed areas and to prevent the mixing of clean and dirty flows; and *Runoff attenuation, which function as wetlands can potentially be placed at strategic points in the bottom of the landscape to assist with the assimilation of contaminants and to trap sediments.	3	3	2	4	2	**27**	**Low**	43.7
Disturbance of soils as part of demolition activities leading to soil compaction.	-	4	4	2	6	3	**48**	**Moderate**	*All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible; *Laydown areas should be located ithin disturbed soils (Witbank Soil forms) to avoid compaction of natural soils; *Avoid placement of material in the soil associated with wetland which has high clay content, where possible; *Decommissioning activities should be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low, such that the soils are less prone to compaction; and *Compacted soils within the mine footprint should be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	3	4	2	4	1	**30**	**Low**	37.5

Spillage of hydrocarbons resulting from leakages in demolition equipment/machinery, leading to Soil Contamination.	-	4	4	2	6	3	**48**	**Moderate**	*Regular monitoring of machinery must be undertaken to identify spills or leaks; *An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur; *The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly; *Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling areas.	3	3	2	4	2	**27**	**Low**	43.7
Cumulative Impacts																	
Cumulative Loss of Land Capability	-	4	4	3	6	3	**52**	**Moderate**	*See mitigation measures above	3	3	2	4	2	**27**	**Low**	48.1

Table 13: Impact on the soil and land capability from the proposed Key Infrastructure (Attenuation Dams) for the Pre-Construction Phase, Construction Phase, Operational Phase and Decommissioning / Rehabilitation Phase associated with the proposed KMR Expansion Project. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource.

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
ACTIVITY: Key Infrastructure development: - Two attenuation dams on the Ga-Mogara River, to allow for the expansion of the York and Hotazel Opencast Pits.																	
Pre-Construction Phase																	
Site preparation prior to construction activities related to the construction of the dam wall, including placement of contractor laydown areas and storage facilities.	-	4	4	3	6	3	52	Moderate	The footprint of the proposed two attenuation dams should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible	3	3	3	4	2	30	Low	42.3
Removal of topsoil and vegetation from project footprint	-	4	4	3	6	3	52	Moderate	The footprint of the proposed two attenuation dams should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible	3	3	3	4	2	30	Low	42.3
Construction Phase																	

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Movement of construction vehicle/equipment during the construction of the dam leading to soil erosion	-	4	4	3	8	3	60	High	*The footprint of the proposed infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible; *If possible, vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low; *Bare soils 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; *Restrict vegetation clearance to within the dam infrastructure *Keep speed limit below 40 km/h. *All disturbed areas adjacent to the attenuation dams can be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission	3	3	3	6	3	36	Moderate	40
Vegetation clearance leading to soil compaction within footprint areas.	-	5	4	3	8	3	75	High	*If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the dam infrastructure footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation	4	3	3	6	3	48	Moderate	36

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
spillage of hydrocarbons leading to soil contamination	-	5	4	3	8	3	75	High	*Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented and 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 should be compiled to guide the construction works; and *An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur.	4	3	3	6	3	48	Moderate	36
Land degradation leading to loss of land capability	-	4	3	3	8	3	56	Moderate	*Earthworks and long-term stockpiling of soil should be limited within the demarcated areas as far as practically possible;	3	3	2	4	2	27	Low	51.8
Operational Phase																	

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Movement of construction vehicle/equipment during the construction of the dam leading to soil compaction	-	4	4	3	6	3	54	Moderate	*Laydown areas should be located within disturbed soils (Anthrosols) to avoid compaction of natural soils; *If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the attenuation dams and associated infrastructure footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation	3	3	3	4	3	30	Low	44.4
spillage of hydrocarbons leading to soil contamination	-	5	4	3	6	3	65	High	*No vegetation clearance is allowed outside of the demarcated footprint areas. Disturbed areas beyond the footprint are to be suitably rehabilitated in accordance with the rehabilitation plan.	4	3	3	4	3	40	Moderate	38.5
Land degradation leading to loss of land capability	-	4	3	3	6	3	48	Low	*Operational vehicles are to utilise only designated roads. No driving through the surrounding habitat is to be permitted.	3	3	2	4	2	27	Low	43.8
Closure/Rehabilitation Phase																	

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Disturbance of soils as part of demolition activities leading to Sedimentation and erosion.	-	3	4	2	6	3	36	Moderate	*All disturbed areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion; *A site-specific drainage system design should be implemented to reduce the volume and velocity of flows crossing disturbed areas and to prevent the mixing of clean and dirty flows; and •Runoff attenuation, which function as wetlands can potentially be placed at strategic points in the bottom of the landscape to assist with the assimilation of contaminants and to trap sediments.	3	3	2	4	2	27	Low	#DIV /0!
Disturbance of soils as part of demolition activities leading to soil compaction.	-	3	4	2	6	3	36	Moderate	*Avoid placement of material in the soil associated with wetland which has high clay content, where possible; *Decommissioning activities should be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low, such that the soils are less prone to compaction; and *Compacted soils within the dam footprint should be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	3	4	2	4	1	30	Low	16.7
Spillage of hydrocarbons resulting from leakages in demolition equipment/machinery, leading to Soil Contamination.	-	3	4	2	6	3	36	Moderate	Regular monitoring of machinery must be undertaken to identify spills or leaks; • An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur; • The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly; • Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling areas.	3	3	2	4	2	27	Low	16.7

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Cumulative Impacts																	
Cumulative Loss of Land Capability	-	3	4	2	6	3	36	Moderate	*See mitigation measures above	3	3	2	4	2	27	Low	16.7

Table 14: Impact on the soil and land capability from the proposed Secondary Infrastructure for the Pre-Construction Phase, Construction Phase, Operational Phase and Decommissioning / Rehabilitation Phase associated with the proposed KMR Expansion Project. Abbreviations are as follows: P = Probability, D = Duration, E = Extent, M = Magnitude and LoR = Loss of Resource.

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
ACTIVITY: secondary infrastructure and activities associated with the Key Infrastructure.																	
Pre-Construction Phase																	
Potential poor planning leading to excessive placement of secondary infrastructure outside of the demarcated infrastructure areas leading to increased soil erosion	-	4	4	3	8	3	60	High	*The footprint of the secondary infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible.	3	2	2	6	1	30	Moderate	60
Potential poor planning and control mechanisms leading to excessive vegetation clearance within the secondary infrastructure areas	-	4	4	3	8	3	60	High	*The footprint of the secondary infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible.	3	2	2	6	1	30	Moderate	60
Construction Phase																	

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Vegetation clearance leading to soil erosion within footprint areas.	-	5	4	3	8	4	75	High	*The footprint of the secondary infrastructure areas should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible; *If possible, vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low; *Bare soils 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; *Restrict vegetation clearance to priority areas of development; *Keep speed limit below 40 km/h. *All disturbed areas adjacent to the secondary infrastructural areas can be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission	3	3	3	6	2	36	Moderate	52
Movement of construction vehicle/equipment leading to soil compaction		5	5	3	8	4	80	High	*If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the secondary infrastructure footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	4	3	2	6	2	44	Moderate	45

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
spillage of hydrocarbons leading to soil contamination	-	4	4	3	8	3	60	High	*Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be implemented and 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 should be compiled to guide the construction works; and *An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur.	3	3	2	6	2	33	Low	45
Land degradation leading to loss of land capability	-	4	4	3	8	3	60	High	*Earthworks related to construction of secondary infrastructure should be limited within the demarcated areas as far as practically possible; *Ensure all stockpiles are clearly and permanently demarcated and located in defined no-go areas;	4	4	3	6	3	52	Moderate	13.3
Operational Phase																	
Movement of construction vehicle/equipment leading to soils compaction	-	5	5	3	8	4	80	High	*If possible, vegetation clearance, can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low to avoid surface crusting and sealing of exposed soils *Direct surface disturbance of soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);and *Compacted soils adjacent to the open pits footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	4	3	2	6	2	44	Moderate	45

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
spillage of hydrocarbons leading to soil contamination	-	4	4	3	8	3	60	High	*No vegetation clearance is allowed outside of the demarcated footprint areas. Disturbed areas beyond the footprint are to be suitably rehabilitated in accordance with the rehabilitation plan.	4	3	3	6	3	48	Moderate	20
Land degradation leading to loss of land capability	-	4	4	3	8	3	60	High	*Operational vehicles are to utilise only designated roads. No driving through the surrounding habitat is to be permitted.	4	3	3	6	3	48	Moderat	20
Closure/Rehabilitation Phase																	
Disturbance of soils as part of demolition activities leading to Sedimentation and erosion.	-	4	4	2	6	3	48	Moderate	*All disturbed areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion; *Temporary erosion control measures may be used to protect the disturbed soils during the rehabilitation until adequate vegetation has established; *A site-specific drainage system design should be implemented to reduce the volume and velocity of flows crossing disturbed areas and to prevent the mixing of clean and dirty flows; and *Runoff attenuation, which function as wetlands can potentially be placed at strategic points in the bottom of the landscape to assist with the assimilation of contaminants and to trap sediments.	3	3	2	4	2	27	Low	43.8

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Disturbance of soils as part of demolition activities leading to soil compaction.	-	4	4	2	6	3	**48**	Moderate	*All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible; *Laydown areas should be located within disturbed soils (Witbank Soil forms) to avoid compaction of natural soils; *Avoid placement of material in the soil associated with wetland which has high clay content, where possible; *Decommissioning activities should be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low, such that the soils are less prone to compaction; and *Compacted soils within the mine footprint should be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.	3	4	2	4	1	**30**	Low	37.5
Spillage of hydrocarbons resulting from leakages in demolition equipment/machinery, leading to Soil Contamination.	-	4	4	2	6	3	**48**	Moderate	*Regular monitoring of machinery must be undertaken to identify spills or leaks; *An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur; *The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly; *Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling areas.	3	3	2	4	2	**27**	Low	43.8
Cumulative Impacts																	
Cumulative Loss of Land Capability	-	4	4	3	6	3	**52**	Moderate	*See mitigation measures above	3	3	2	4	2	**27**	Low	48.1

**The cumulative impact was rated on the basis that the areas within the MRA will still utilised for mining purposes in the future.*

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

- The footprint of the proposed Kudumane Manganese Resources (KMR) expansion activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible;
- 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 expansion activities 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 and 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 rubble, 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

- Close supervision and monitoring of the stripping process is required to ensure that soils are stripped correctly and backfilled where pipelines are involved;

- 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.

6. CONCLUSION

The proposed expansion project traverse soils which may potentially support agriculture; thus, it was imperative to understand the surrounding soils, land uses and land capability as well as the land potential to ensure that the proposed mining related development 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, as per Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983).

The soils identified by the previous soil study can be broadly classified as arable under irrigation. However, based on the current climatic conditions of the MRA this decreases the agricultural productivity and potential of the soil identified within the MRA. The low clay content due to high sand fraction of the soils renders the soils to be of low nutritional value and low water holding capacity. Thus, the soils are limited to grazing and game farm purposes only.

The Mean Annual Precipitation (MAP) within the MRA 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.

Based on the information sourced from SLR (2014) the dominant land use within the MRA is mining related activities (infrastructure/servitudes, pipelines, powerlines open cast pits and etc), *ad-hoc* game and cattle farming and isolated residences/residential areas.

The dominant soils occurring within the footprint area are Hutton, Hutton/Clovelly, Mispah and Witbank forms (Paterson, 2014). These soils can be broadly classified as ideal for agricultural cultivation where the climate permits and under irrigation if the weather does not permit. The physical characteristics of the surrounding soil forms can largely be described as structureless, fine-grained, sandy soils. The deep soils were classified as Hutton/Clovelly, whereas the shallow soils with the occurrence of rock outcropping and calcrete layers were classified as Mispah soil forms. Disturbed soils due to current mining operations are also present and classified as Witbank soil forms.

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

Soil Form	Land capability	Area (ha)	Percentage
Hutton	Arable (Class II)	25.60	2.01
Hutton/Clovelly	Arable (Class II)	800.84	63.04
Mispah	Grazing (Class VI)	33.98	2.67
Witbank	Wilderness (Class VIII)	409.97	32.27
Total Enclosed Area		**1270.39**	**100**

The loss of land capability is anticipated to be Medium before mitigation measures have been put in place, as the significant portion (826.44 ha out of 1270.39 (65%)) of the dominant soils are considered ideal for cultivation based on the available data land capability classification. However, the suitability 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. In addition, no large dams or irrigation schemes are available in the area thus limiting the soils in the area to grazing and wildlife landuses. The high evaporation rate of the hot, dry climate will result in regular irrigation needed should crops be produced in this manner.

Large portions of potentially arable soils will be stripped and stockpiled and thus potentially reducing the fertility status of the soils. The proposed expansion activities will lead to a permanent change of land use if not properly mitigated. The cumulative loss from a soil and land capability point of view is anticipated to be Medium pre-mitigation and Low after mitigation. The loss of agricultural soils and the permanent change in land use will be limited to the footprint areas. 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.

It is the opinion of the specialist that this study provides the relevant information required to guide the decision-making process by the relevant authorities to ensure that appropriate consideration of the agricultural resources in the footprint area is made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

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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 from 24 February 2020 by a qualified soil specialist, at which time the identified soils within the infrastructure areas and associated access roads were classified into soil forms according to the Soil Classification Working Group for South Africa (2018). Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles, which entailed evaluating physical soil properties and prevailing limitations to various land uses.

Land Capability Classification

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

Table A1: Land Capability Classification (Smith, 2006)

Land Capability Class	**Increased Intensity of Use**									**Land Capability Groups**
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable land**
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC	IC		
IV	W	F	LG	MG	IG	LC				
V	W		LG	MG						**Grazing land**
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									**Wildlife**

W- Wildlife	MG- Moderate grazing	MC- Moderate cultivation
F- Forestry	IG- Intensive grazing	IC- Intensive cultivation
LG- Light grazing	LC- Light cultivation	VIC- Very intensive cultivation

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

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

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

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

Land Capability Class	Climate Capability Class							
	C1	C2	C3	C4	C5	C6	C7	C8
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	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.

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

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 – 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