SCIENTIFIC AQUATIC SERVICES

Reg No. 2003/078943/23
VAT Reg No. 4020235273
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
Email: admin@sasenvgroup.co.za
www.sasenvironmental.co.za

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL ASSESSMENT FOR THE PROPOSED BEESHOEK MINE RAILWAY LINE LINK PROJECT NEAR POSTMASBURG, NORTHERN CAPE

Prepared for

Envirogistics (Pty) Ltd

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Prepared by:	**Scientific Aquatic Services**
Report author :	**B. Mzila**
Report reviewers:	**S. van Staden (Pr.Sci.Nat)**
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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a soil, land use, land capability and land potential assessment for the proposed Railway line as part of the Beeshoek Mine near Postmasburg, Northern Cape. The proposed development will henceforth be referred to as the "Railway Line Link Project" (Figure 1 & 2).

A soil, land use, land capability and land potential survey was conducted between in October 2020, March & June 2021 to understand the potential of the land to support cultivated agriculture under rainfed conditions in line with the Conservation of Agricultural Resources Act No. 43 of 1983. The assessment entailed evaluating:

- Climatic conditions;
- Land scape setting,
- Soil physical; and
- Other current limitations to various land use purposes.

Based on observation during the site assessment, the dominant land uses in the surrounding areas include mining, airfield, wildlife/wilderness, access roads and services roads as well as existing railway line. No cultivated commercial agricultural activities were observed within the study area and the immediate vicinity.

The study area traverses a Calcic and Anthropic catena with Coega/Knersvlakte, Mispah/Glenrosa being the dominant soil forms within the total investigated study area. The remaining portions are occupied by Plooysburg/Vaalbos and Witbank soil forms which occur in small patches within the study area. Arable soils (i.e. Plooysburg/Vaalbos) constitute of approximately 6.3% (4.2 ha) of the investigated study area. These soils are considered ideal for cultivation due to:

- Good drainage characteristics;
- Sufficient depth for root growth;
- Sufficient moisture holding capacity; and
- Nutrient retention capacity to support the optimum growth and production.

Shallow soils of Coega/Knersvlakte (Cg), Prieska/Addo and Mispah/Glenrosa (Ms/Gs) formations collectively cover approximately 51.9% of the total investigated study area and can be considered as having poor physical characteristics ideal in supporting cultivation agricultural practices. This is attributed to the occurrence of Hardrock/Lithic and Hard Carbonate material near and/or at the surface which restricts root growth and development. This creates conditions that are not conducive to the cultivation of most cultivated crops. Some portions of the study area are comprised of extensively disturbed soils classified as Witbank formation (41.8%). Below is a tabular representation of the dominant soils, with relative description of soil horizons as well as associated land capability. Table **A** below presents the dominant soils, with their relative description of soil horizons as well as the associated land capability and land potential.

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

<table>
<tr><th>Soil Forms</th><th>Code</th><th>Diagnostic Horizon Sequence</th><th>Land Capability</th><th>Land Potential</th><th>Areal Extent (ha)</th><th>Percentage (%)</th></tr>
<tr><td>Plooysburg/Vaalbos</td><td>Py</td><td>Orthic/Red Apedal/Hard Carbonate or Hard Rock</td><td>Class (III)</td><td>Restricted potential</td><td>4.2</td><td>6.3</td></tr>
<tr><td>Mispah</td><td>Ms</td><td>Orthic/Hard Rock</td><td rowspan="4">Grazing (Class VI)</td><td rowspan="4">Very Restricted potential</td><td rowspan="4">34.9</td><td rowspan="4">51.9</td></tr>
<tr><td>Glenrosa</td><td>Gs</td><td>Orthic/Lithic</td></tr>
<tr><td>Coega/Knersvlakte</td><td>Cg</td><td>Orthic/Hard Carbonate</td></tr>
<tr><td>Prieska/Addo</td><td>Pk/Ad</td><td>Orthic/Neocarbonate/ Soft Carbonate/Hard Carbonate</td></tr>
</table>

Witbank	Wb	Unspecified	Wilderness (Class VIII)	Very low potential	28.1	41.8
Total					**67.2**	**100**

The findings of this assessment suggest that the relevant soil limiting factors within the study area for land capability and land use potential include the following:

- Shallow effective rooting depth due to shallow indurated bedrock of the Mispah/Glenrosa, Coega/Knersvlakte soil forms. As such, these soils are not considered to contribute significantly to agricultural productivity; and
- Lack of soil medium for plants and crop growth for the rocky outcrop, mine infrastructure, surface water areas and Witbank (Anthrosols) soil types.

The climatic conditions associated with the study area and surroundings are characterised by severe climatic limitations with Mean Annual Precipitation ranging between 201-400mm per annum, thus making the study area unsuitable for commercial cultivation under rainfed conditions due to high risk of plant desiccation and subsequent permanent wilting.From a land capability point of view, the proposed railway line link project footprint is largely dominated by shallow soils with low agricultural potential soils with only minor areas comprising of High agricultural potential. At best, the Coega/Knersvlakte, Mispah/Glenrosa soil forms are suitable for marginal grazing. Although arable soils occur with the railway line link project footprint (Plooysburg), given the climatic constraints of the area (Rainfall less than 400 mm) and lack of irrigation options, these soils are not likely to contribute substantially to national food production. Furthermore, high temperatures occurring in this area are also likely to cause crop wilting, thus affecting crop yield. Given these constraints the extent of the high productivity soils is not considered sufficient for viable cultivated commercial farming.

Livestock commercial farming is marginal for one (1) landowner for the proposed area extent to be affected by mining activities, due to the low grazing capacity for this area (14 Hectares per animal unit). Therefore, this area it is not considered sufficient for viable small-scale commercial farming unless intensive management practices are implemented.

The surrounding areas associated with the proposed railway line link project are dominated by Iron Ore mines, and no cultivated agricultural activities occur in the immediate vicinity. This is largely attributable to the dominance of rocky outcrops and shallow soils which are not ideal for cultivated agricultural production. In addition, lack of rainfall as well as limited irrigation options further disqualifies the area from being ideal for agricultural production. Therefore, based on the above-mentioned limiting factors, the proposed project is anticipated to lead to a relatively low cumulative loss of arable land and medium low cumulative loss of natural grasslands for grazing. Therefore, from a soil and land capability point of view, the addition to the cumulative impact footprint of the region is considered relatively minor.

DOCUMENT GUIDE

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix C
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix C
b)	A declaration that the specialist is independent	Appendix C
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The date of the site investigation	Section 1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 2
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 alternatives	Section 4
h)	Map of the pre-determined soil and land capability data	Section 3
i)	A description of any assumption made and any uncertainties	Section 1.2
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
k)	Any mitigation measures for inclusion in the EMPr	None
l)	Any conditions for inclusion in the environmental authorisation	None
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	None
n)	A reasoned opinion -	Section 7
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	None
(iA)	Regarding the acceptability of the proposed activity or activities	None
(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	None
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.
Pedoturbation	Physical churning and turning of soil either by swelling and shrinking of clays, freezing and thawing or animal action
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

Scientific Aquatic Services (SAS) was appointed to conduct a soil, land use, land capability and land potential assessment for the proposed Railway Line as part of the Beeshoek Mine near Postmasburg, Northern Cape. A 50 m zone of influence was created around proposed railway line and will henceforth be referred to as the study area (Figure 1 & 2. The study area is situated within the Tsantsabane Local Municipality and within the ZF Mgcawu District Municipality.

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). Agricultural potential is directly correlated to Land Capability Class (LCC), measured on a scale of I to VIII, with classes I to III considered as prime agricultural soils, and classes V to VIII not suitable for cultivation. High potential agricultural land is defined as having "*the soil and terrain quality, growing season and adequate available moisture supply to sustain crop production when treated and managed according to best possible farming practices*" (Land Capability report, ARC, 2006).

1.1 Project Description

Assmang (Pty) Ltd is the holder of the new order rights in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) in respect of high-grade hematite iron ore deposits at the Beeshoek Mine, on the farms Beesthoek and Olynfontein. The mining method currently entails an opencast mining operation, which consists of five (5) active opencast pits (Village Opencast Pit, HF Opencast Pit, BF Opencast Pit, East Opencast Pit, Beeshoek North (BN) Opencast Pit). Although other opencast pits are dormant at this time, these are continuously assessed in terms of their economic value for intended remining. The current resources of the mine are approximately 87 million tonnes with a reserve of about 26 million tonnes.

The Beeshoek Mine can be broadly categorised as follows:

- Northern mining area (North Mine): This area comprises active as well as historical mining areas. Several small quarries and mine residue dumps of various categories are located within this area. The area also includes the Iron Ore Beneficiation Plant, Slimes Dam, as well as the BN Opencast Pit.

- Main Offices, Village (demolished) and recreational area; and
- Southern mining area (South Mine): This area comprises large opencast pits and associated Waste Rock Dumps (WRDs). The Village Opencast Pit and associated WRD are the main activities in this area. This area also includes a crushing and screening area as pre-preparation of the run of mine iron ore before being routed by overland conveyor to the Iron Ore Beneficiation Plant located at the North Mine.

To allow Beeshoek to export iron ore through the Saldanha Port in the Western Cape Province, the mine has investigated the options of linking Beeshoek to the Transnet Freight Rail (TFR) Ore line, via the existing Kolomela Direct Link. This in turn would allow Beeshoek Mine greater flexibility to also export ore through Saldanha port. Negotiations with Transnet have not as of yet been concluded in terms of allocations, and for this reason the project is presented as the best practical outcome.

The line will comprise a 2.8km main link line of approximately 5.5m in width with a 5m bulk fill (varies along the alignment). The line will tie from the existing TFR Postmasburg line at the Beeshoek Iron Ore Mine, crossing over the road accessing Tommysfield Airport. The existing R385 will be lifted into the road over rail system to allow for the railway line to cross under the R385 regional tar road before linking to the existing TFR Yard that services Kolomela Mine. Considering that one 4m access road will be constructed along the alignment with an 8m buffer on either side of the railway line, the approximate extent of the development is 9ha (85 400 m^2). During the construction phase, the Tommy's field airport will be closed for a limited period to allow for the road crossing. A temporary road deviation (of less than 1 km, will be provided for vehicles travelling on the R385 during the construction of the road bridge. The approach of TFR is to run trains with three rakes of 116 wagons, giving trains a total length of 348 wagons. For this reason the current operational concept is for Beeshoek to load a single train rake (116 wagons) to form part of a 3 rake train (348 wagons) which would be transported to Saldanha. The other two rakes of the train will be loaded by Kolomela.

The project requirements will include:

- Overall Design:
  - Railway formation – 5.5m
  - Bulk fill – 5m
  - One service road – 4m
  - Buffer – 8m on each side
- TFR train design
  - 348 wagons (3 x 116 rakes)

  - 30t axle load
- Beeshoek Traffic
  - 1 x 116 rake (Saldanha traffic)
  - 30t axle loads

Based on the above, it was therefore the objective of the study to:

- Assess the spatial distribution of various soil forms and soil groups within the study area;
- Define the current land uses within and in close proximity to the study area; and
- Identify restrictive soil properties on land capability, prevailing climatic conditions and land potential.

A soil land use and land capability and land potential survey was conducted in October 2020 and June 2021. The assessment entailed evaluating physical properties and current limitations to various land use purposes. Subsurface soil observations were made using a manual hand auger to assess individual soil sampling points.

1.2 Terms of Reference and Scope of Work

The soil and land capability assessment entailed the following aspects:

- A desktop review of existing soil and climatic database, to establish broad baseline conditions and areas of environmental sensitivity and sensitive agricultural areas;
- Assess spatial distribution of various soil forms within the study area;
- Identify restrictive soil properties on land capability under prevailing conditions;
- Compile various maps depicting the on-site conditions, current land uses, soil forms and land capability based on desktop review of existing data;
- Conduction a soil classification survey within the study area;
- Subsurface soil observations and sampling undertaken by means of a manual bucket hand auger;
- Classify the dominant soil forms according to the South African Soil Classification System (Soil Classification Working Group, 2018);
- Compile a report presenting the results of the desktop study and a description of the findings during the field assessment; and
- Provide high level recommended mitigation measures and management practices, including areas of increased land capability to avoid and implement in order to comply with applicable articles of legislation.

1.3 Assumptions and Limitations

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

- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and land capability may have been overlooked in this assessment. However, it is the opinion of the professional specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the Environmental Assessment Practitioner (EAP) and the regulating authorities to make an informed decision regarding the proposed mining activities;
- Land Capability and land potential was classified according to current soil restrictions, with respect to prevailing climatic conditions on site; however, it is virtually impossible to achieve 100% purity in soil mapping, the delineated soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute but rather form a continuum and gradually change from one type to another. Soil mapping and the findings of this assessment were therefore inferred from extrapolations from individual observation points;
- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. for this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa; and
- Soil fertility status was not considered a limitation, seeing as inherent nutrient deficiencies and/or toxicities would be rectified by appropriate liming and/or fertilization prior to cultivation.

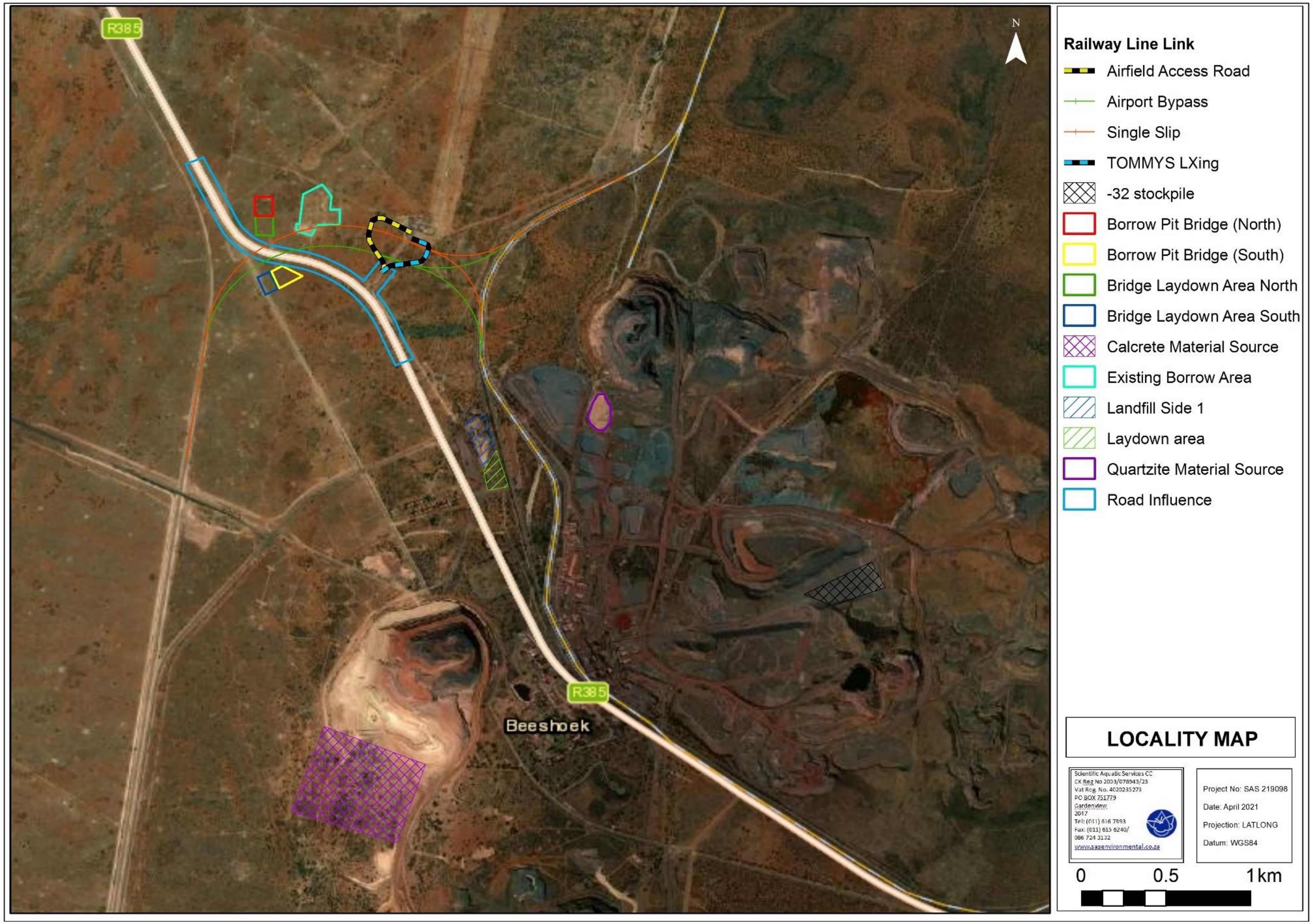

Figure 1: Digital satellite imagery depicting the locality of the study area in relation to the surrounding areas.

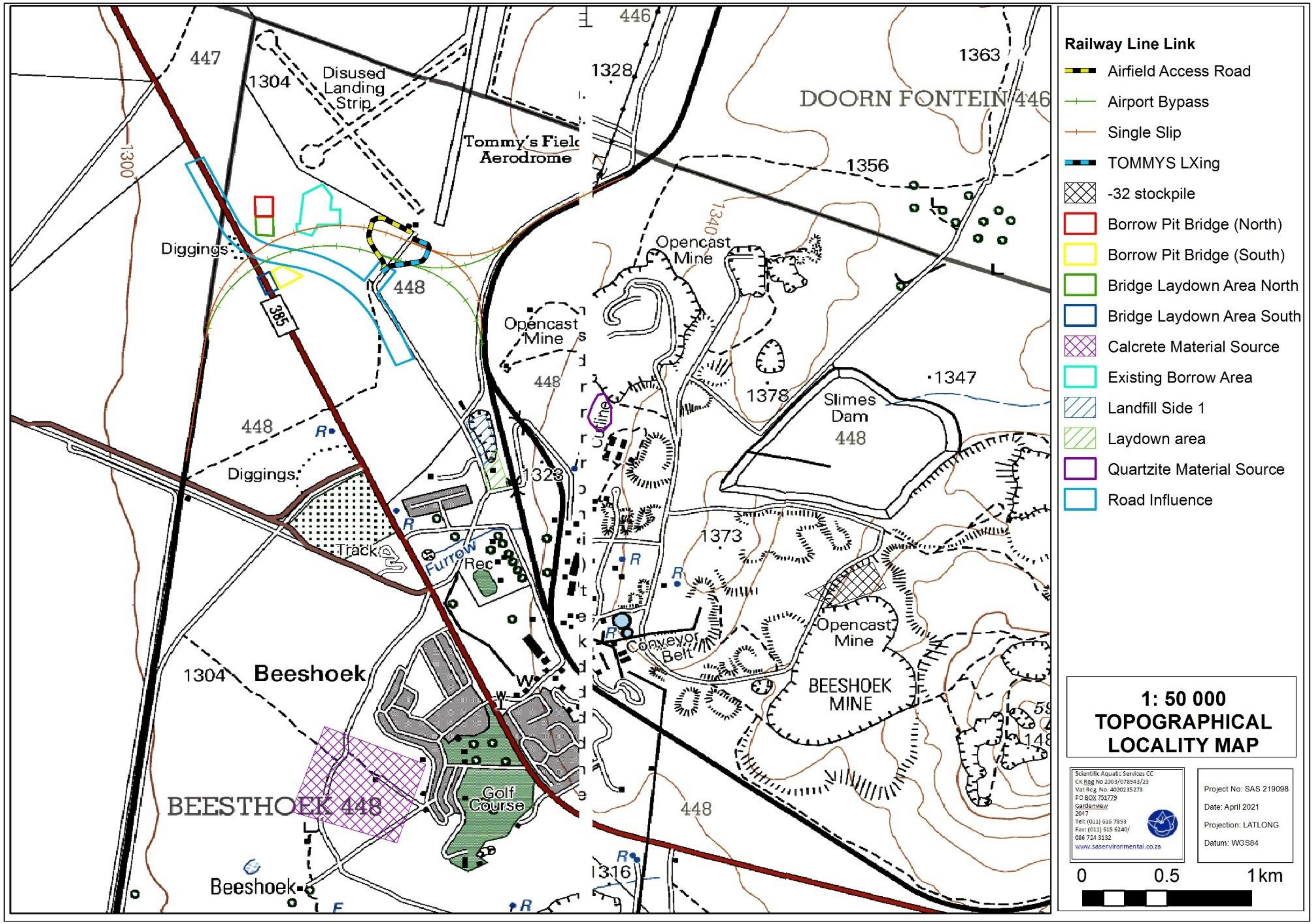

Figure 2: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

A desktop study was compiled from various data sources including but not limited to the Agricultural Geo-referenced Information System (AGIS) and other sources as listed under references.

2.2 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. Soil patterns as well as land capability data within the study area was reviewed on the Agricultural Geo-referenced Information System (AGIS) and/or Agricultural Research Council Institute for Soil Climate and Water (ARC-ISCW) databases.

2.3 Soil Classification and Sampling

A soil survey was conducted in October 2020 and March 2021 by a qualified soil specialist, at which time the identified soils within the study area were classified into soil forms according to the South African Soil Classification System (Soil Classification Working Group,2018):

- Subsurface soil observations and sampling were made by means of a manual bucket hand auger;
- Dominant soil forms were classified according to the South African Soil Classification System (Soil Classification Working Group, 2018);
- Assessed survey and sampling points were recorded on a Global Positioning System (GPS);
- Physical soil properties were described including the following parameters:
  - Terrain morphological unit (landscape position) description;
  - Diagnostic soil horizons and their respective sequence;
  - Depth of identified soil horizons;
  - Soil form classification name(s);
  - Observed land capability limitations of the identified soil forms; and
  - Depth to saturation (water table), if encountered.
- Uniform soil patterns were grouped into map units, according to observed limitations; and

- Soil data was analysed to assess the contamination risk / impacts under current conditions.

It was also the objective of the assessment to provide recommended mitigation measures and management practices to implement in order to comply with applicable articles of legislation.

2.4 Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table 1 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 C1 to C8, as illustrated in Table 1 below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed in order to inform the necessary mitigation measures.

Table 1: Land Capability Classification (Smith,2006)

<table>
<tr><th>Land Capability Class</th><th colspan="9">Increased Intensity of Use</th><th>Land Capability Groups</th></tr>
<tr><td>I</td><td>W</td><td>F</td><td>LG</td><td>MG</td><td>IG</td><td>LC</td><td>MC</td><td>IC</td><td>VIC</td><td rowspan="4">Arable land</td></tr>
<tr><td>II</td><td>W</td><td>F</td><td>LG</td><td>MG</td><td>IG</td><td>LC</td><td>MC</td><td>IC</td><td></td></tr>
<tr><td>III</td><td>W</td><td>F</td><td>LG</td><td>MG</td><td>IG</td><td>LC</td><td>MC</td><td>IC</td><td></td></tr>
<tr><td>IV</td><td>W</td><td>F</td><td>LG</td><td>MG</td><td>IG</td><td>LC</td><td></td><td></td><td></td></tr>
<tr><td>V</td><td>W</td><td></td><td>LG</td><td>MG</td><td></td><td></td><td></td><td></td><td></td><td rowspan="3">Grazing land</td></tr>
<tr><td>VI</td><td>W</td><td>F</td><td>LG</td><td>MG</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>VII</td><td>W</td><td>F</td><td>LG</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>VIII</td><td>W</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Wildlife</td></tr>
<tr><td colspan="3">W- Wildlife</td><td colspan="4">MG- Moderate grazing</td><td colspan="4">MC- Moderate cultivation</td></tr>
<tr><td colspan="3">F- Forestry</td><td colspan="4">IG- Intensive grazing</td><td colspan="4">IC- Intensive cultivation</td></tr>
<tr><td colspan="3">LG- Light grazing</td><td colspan="4">LC- Light cultivation</td><td colspan="4">VIC- Very intensive cultivation</td></tr>
</table>

Table 2: Climate Capability Classification (Scotney et al., 1987)

Climate Capability Class	Limitation Rating	Description
C1	None to slight	Local climate is favourable for good yield for a wide range of adapted crops throughout the year.
C2	Slight	Local climate is favourable for good yield for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1.
C3	Slight to moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.
C4	Moderate	Moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.

C5	Moderate to severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss.
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops for which frequently experience yield loss.
C7	Severe to very severe	Severely restricted choice of crops due to heat, cold and/or moisture stress.
C8	Very severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.

The land potential assessment entails the combination of climatic, slope and soil condition characteristics to determine the agricultural land potential of the investigated area. The classification of 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 3 below presents the land potential classes, whilst Table 4 presents description thereof, according to Guy and Smith (1998).

Table 3: Table of Land Potential Classes (Guy and Smith, 1998)

Land Capability Class	Climate Capability Class							
	C1	C2	C3	C4	C5	C6	C7	C8
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 4: 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

The following data is applicable to the study area, according to various data sources reviewed as part of the desktop assessment:

- The Mean Annual Precipitation (MAP) is estimated to range between 201 and 400mm per annum, which is considered too low to support cultivation under rainfed conditions;
- According to the 1:250 000 geological map of South Africa, the entire project footprint is underlain by Transvaal, Rooiberg and Griqualand-West;
- The majority of the study area is sub-dominated by sand and is therefore susceptible to wind erosion, the remaining central western portion of the study area is dominated by pure sands and is thus highly susceptible to wind erosion (Figure 3);
- The susceptibility to water erosion for the majority of the project footprint areas ranges from low to high, while the eastern portion of the 32 stockpile area is highly susceptible to water erosion, as indicated in Figure 4;
- The 2001 Geological Database of South Africa indicates that majority of the project footprint is underlain by sedimentary rock formation, while some infrastructure is located within Tillite and Dolomite Rock formations, refer to Figure 5;
- The Soil and Terrain (SOTER) database indicates that the western portion of the study area is underlain by clastic sedimentary rock, while the eastern portion is underlain by limestone and other carbonate rocks (Figure 6);
- The AGIS database indicates that the soils on the western portion of the footprint areas is Chromic Cambisols, while the eastern portions are characterised by Calcic Solonchak. Refer to Figure 7;
- The desktop assessment indicates that the study area has a very low land capability and is considered non-arable;
- The entire study area is considered suitable for marginal livestock grazing (Class VII). According to the AGIS database, the livestock grazing capacity potential is estimated to be approximately 14 hectares per large animal unit, which is not considered viable for (Morgenthal *et al.*, 2005);
- The natural soil pH is estimated to be range between 6.5 and 7.4, indicating that the soils range between slightly acidic and neutral, as interpolated from topsoil pH values obtained from the National Soil Profile Database (AGIS database);
- According to the Soils 2001 Layer the study area is situated within an area where the soils are classified as red-yellow apedal freely drained soils with a high base status and < 300mm depth. This implies that the soils are not ideal for cultivation.
- Predicted soil loss is very low for the entire study area;
- The entire study is located on a Plain Landform setting; and

- The soils within the study area have a low to moderate water or wind erosion hazard, and the area is generally level to gently sloping land. The soils therefore have low to very high erodibility.

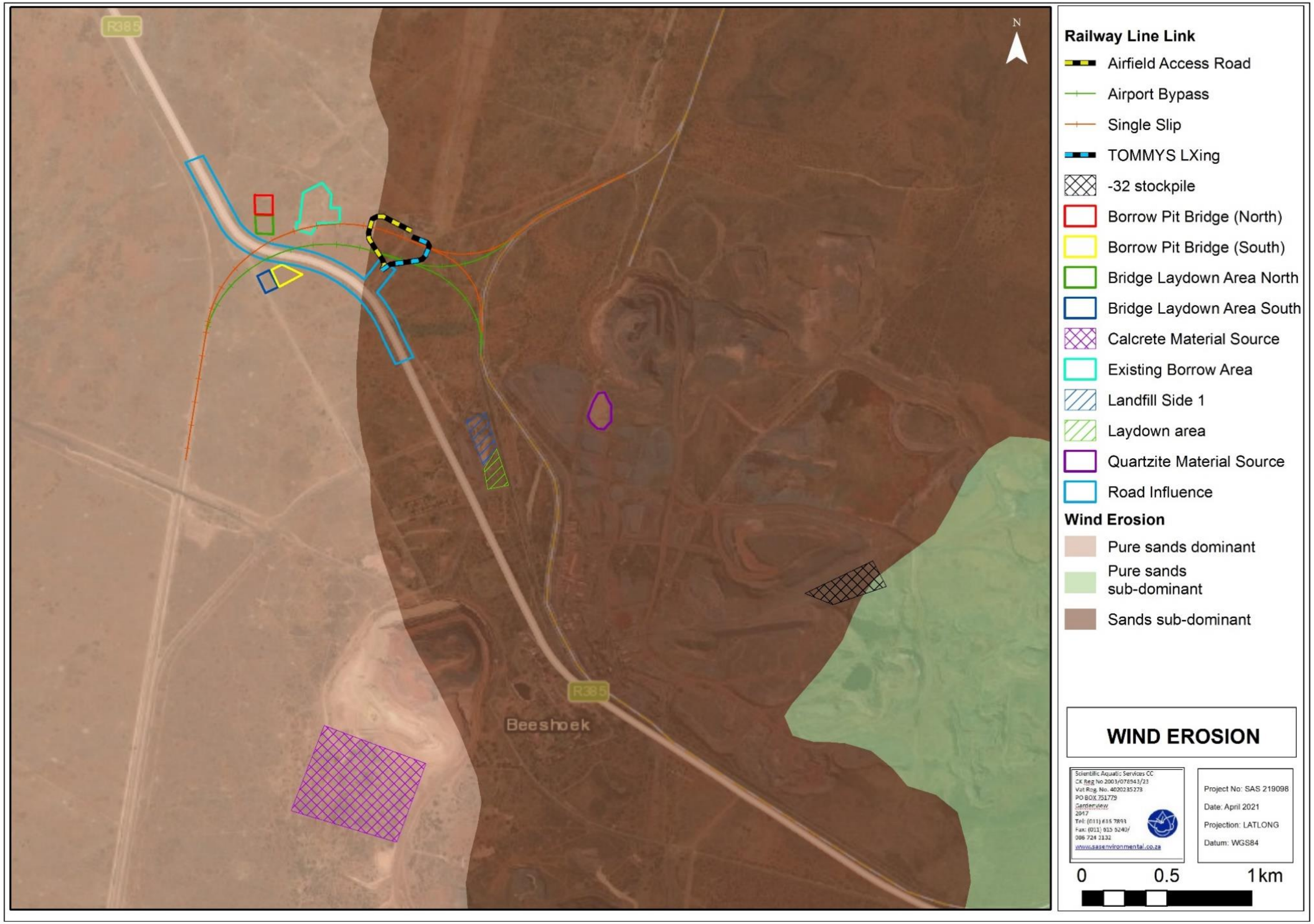

Figure 3: Wind erosion of the soils associated with the study area.

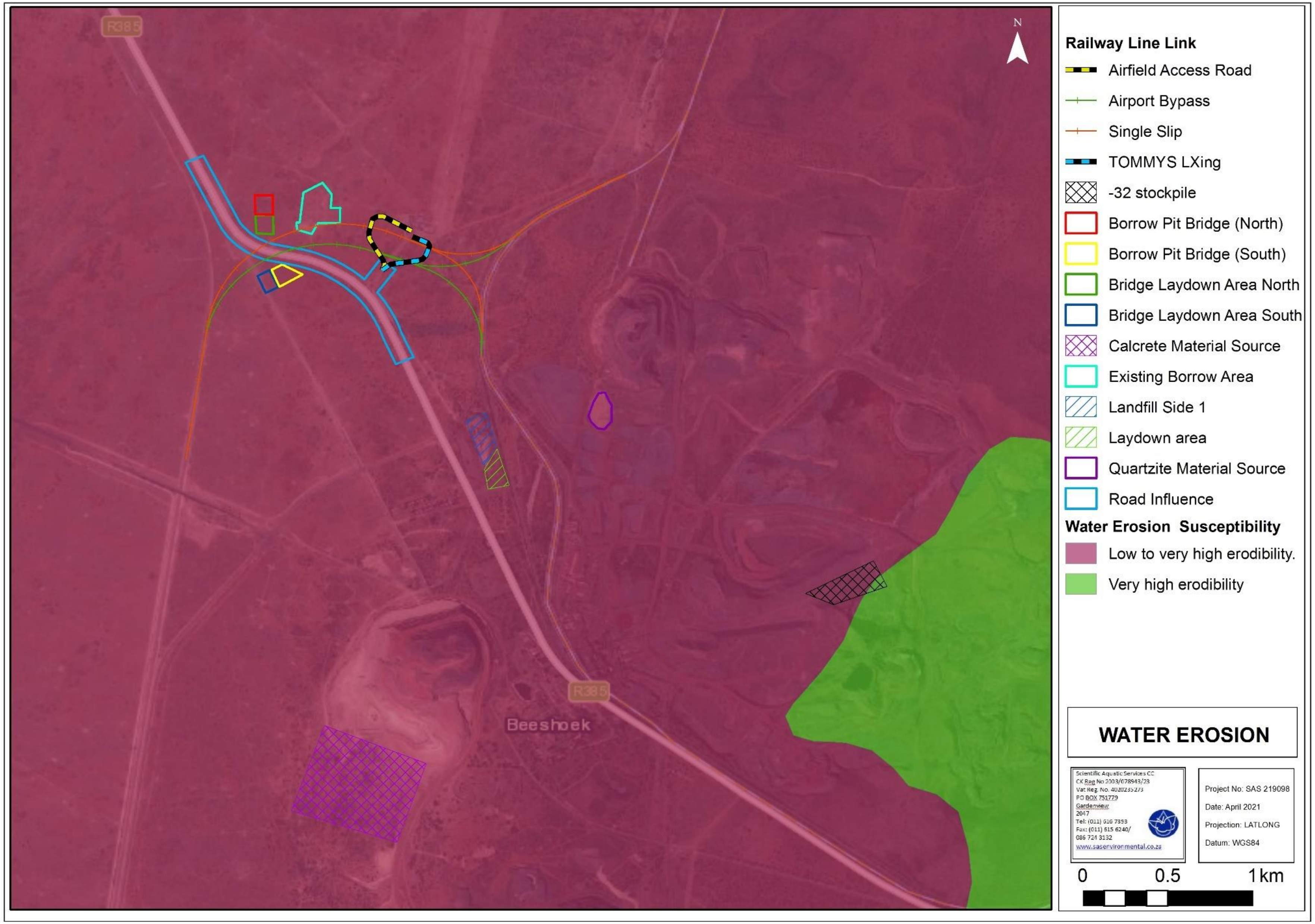

Figure 4: Water erosion of the soils associated with the study area.

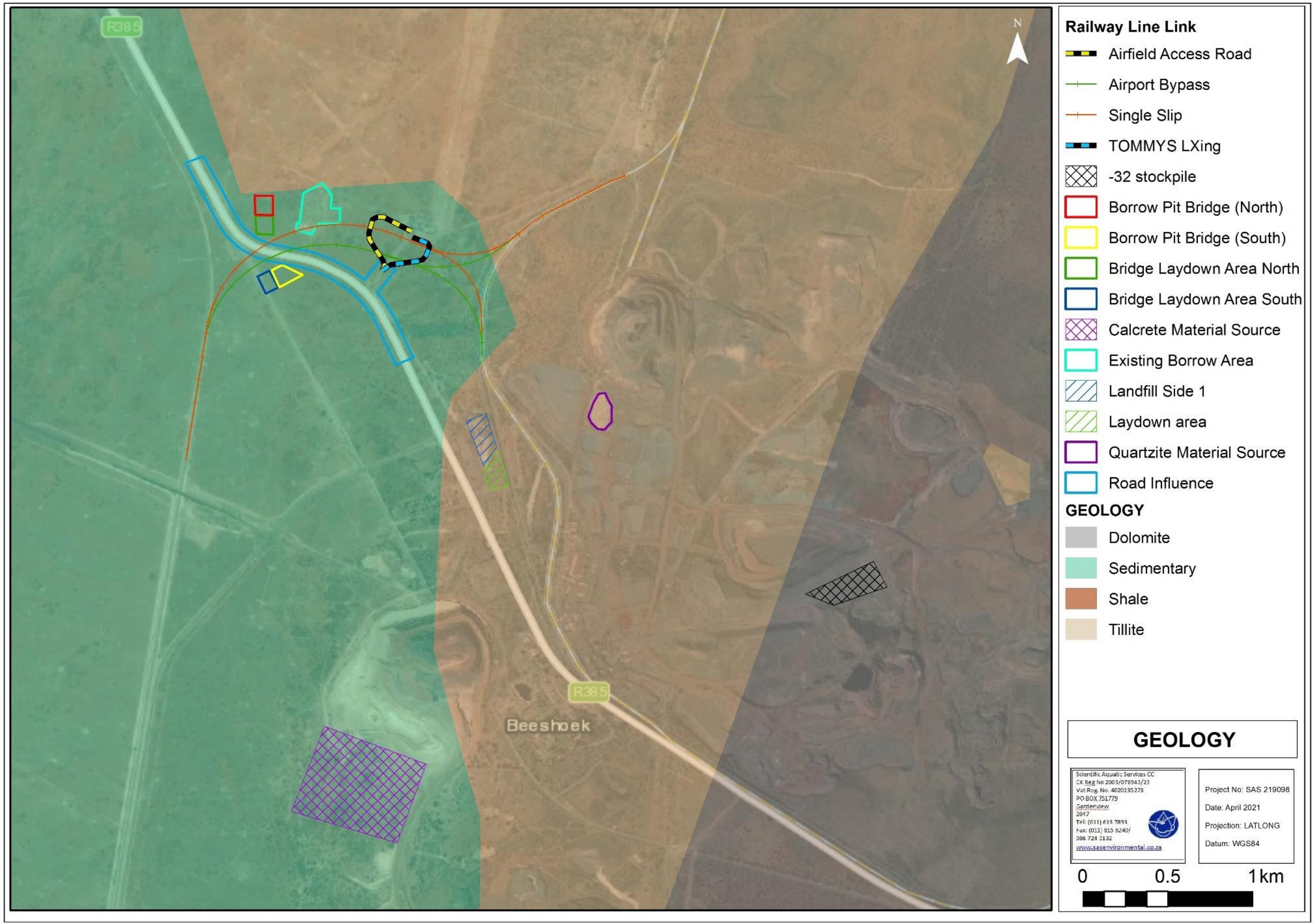

Figure 5: Geology associated with the development

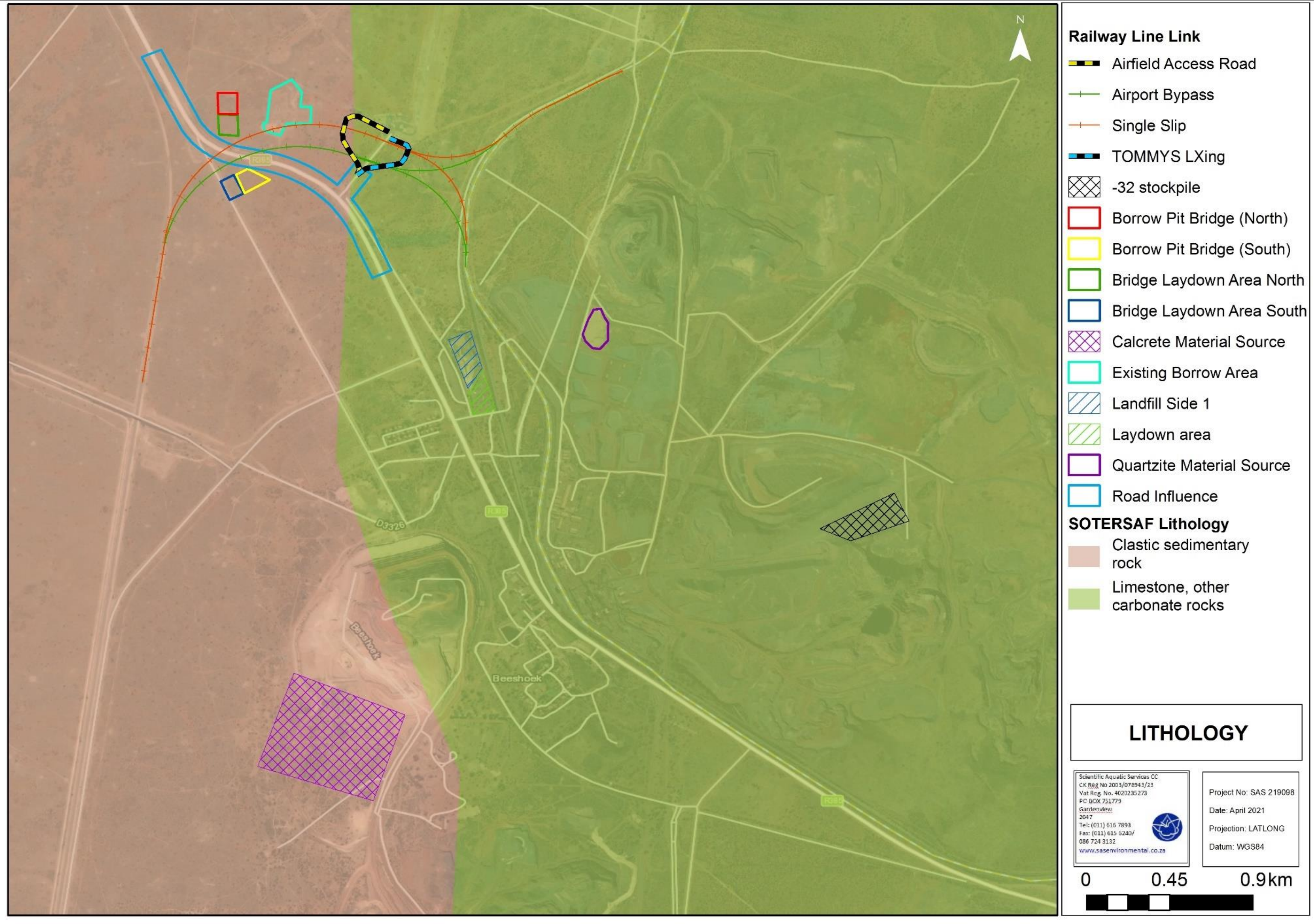

Figure 6: Lithology of the area associated with the study area according to the SOTER Database.

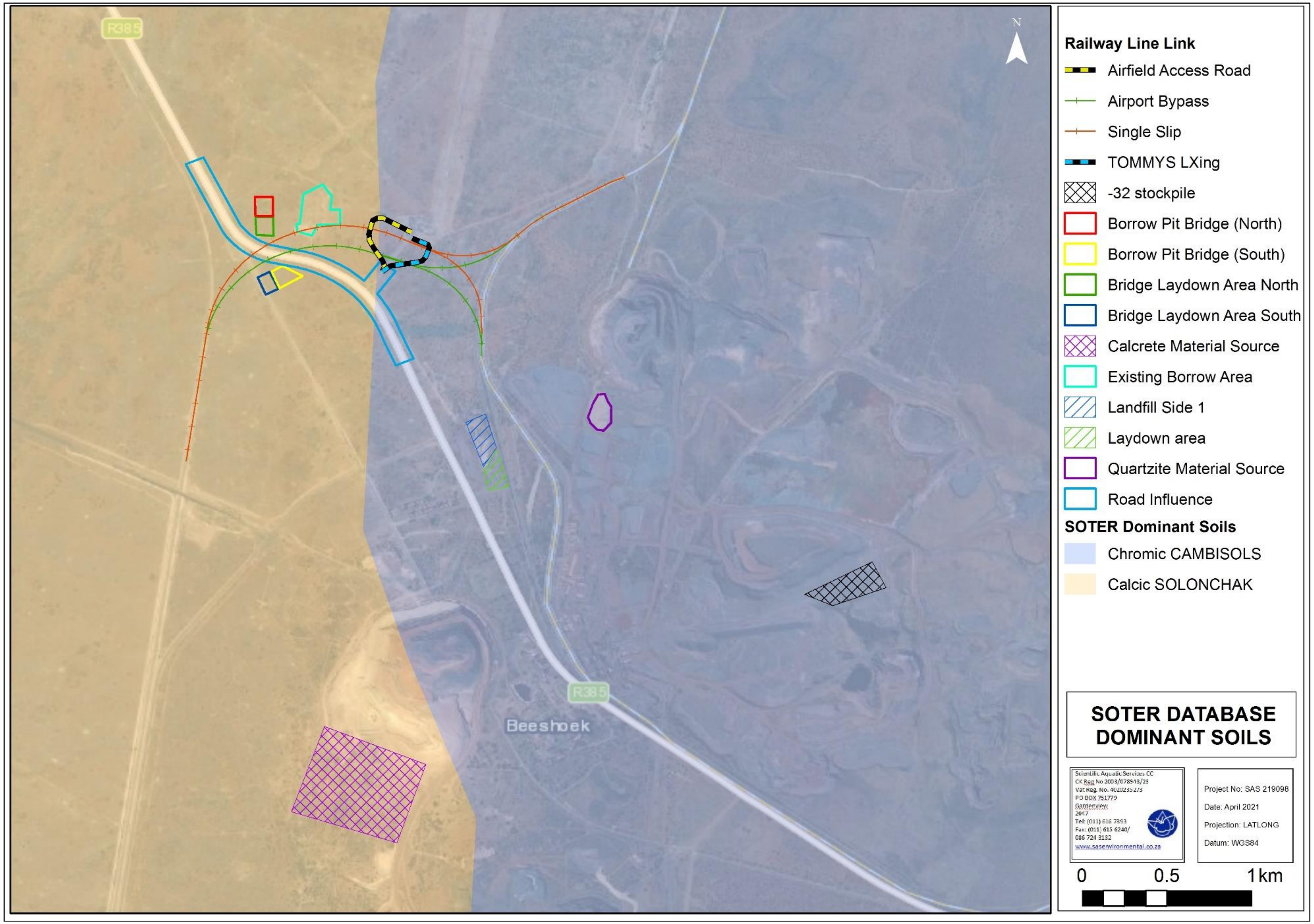

Figure 7: Dominant soils associated with the study area according to the SOTER Database.

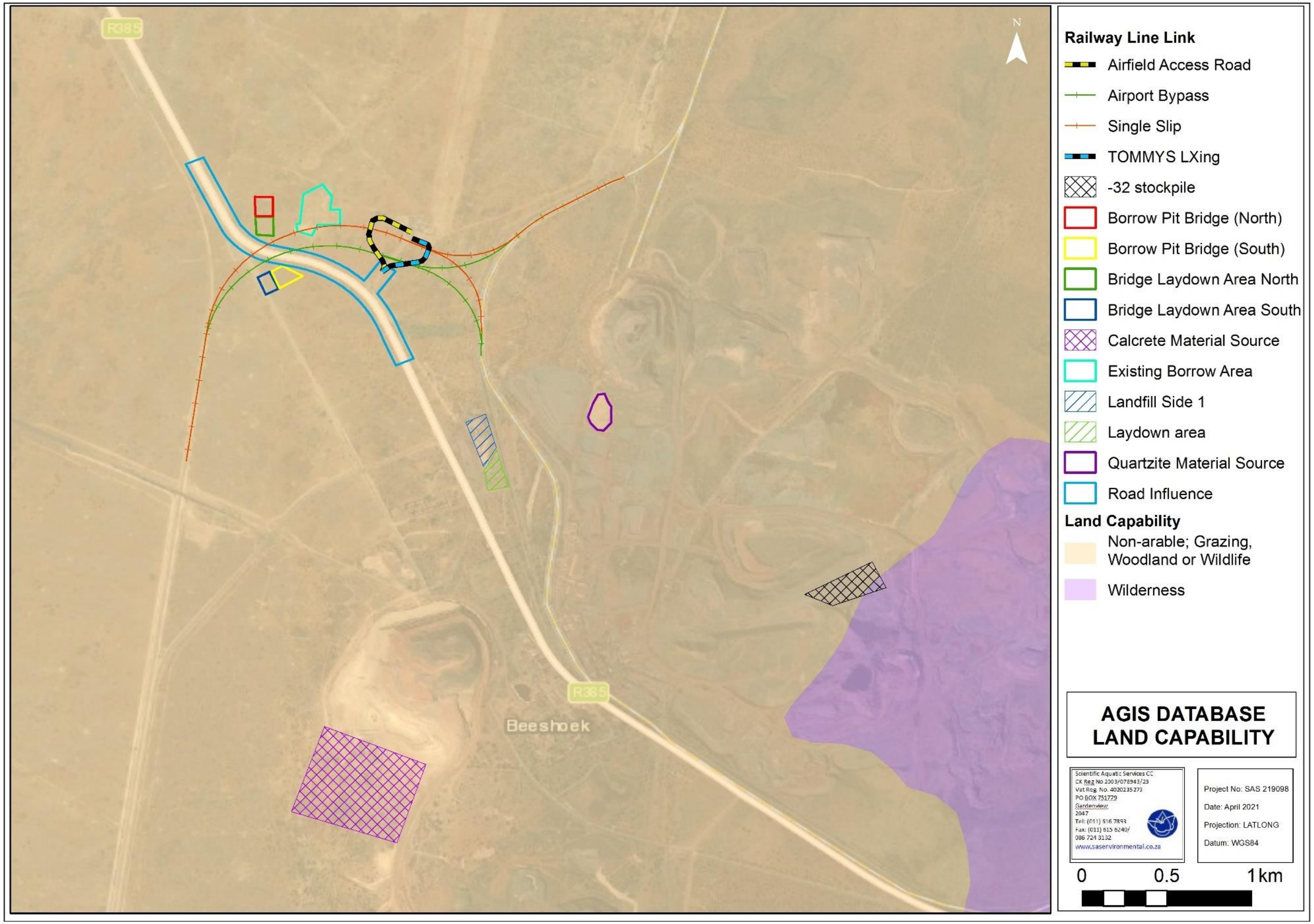

Figure 8: land capability associated with the study area according to the AGIS Database.

4. FIELD ASSESSMENT RESULTS

4.1 Current Land Use

Based on observation during the site assessment, the dominant land uses in the surrounding areas include mining, airfield, wildlife/wilderness, access roads and services roads as well as existing railway line. No cultivated commercial agricultural activities were observed within the study area and the immediate vicinity. Current land use examples are presented in Figure 7 and 8 below.

Figure 9: Photographic presentation of the dominant land uses within the study area and surrounding areas.

4.2 Dominant Soil Forms

The study area traverses a Calcic and Anthropic topo catena Coega/Knersvlakte, Mispah/Glenrosa, Plooysburg and Witbank soil forms being the dominant soil forms within the total investigated study area. Arable soils (i.e. Plooysburg) constitute of approximately 6.3% (4.2 ha) of the investigated study area. These soils are considered ideal for cultivation due to:

- Good drainage characteristics;
- Sufficient depth for root growth;
- Sufficient moisture holding capacity; and
- Nutrient retention capacity to support the optimum growth and production.

Shallow soils of Coega/Knersvlakte (Cg), Prieska/Addo and Mispah/Glenrosa (Ms/Gs) formations collectively cover approximately 51.9% of the total investigated study area and can be considered as having poor physical characteristics ideal in supporting cultivation agricultural practices. This is attributed to the occurrence of Hardrock/Lithic and Hard Carbonate material near and/or at the surface which restricts root growth and development. This creates conditions that are not conducive to the cultivation of most cultivated crops. Some portions of the study area are comprised of extensively disturbed soils classified as Witbank formation (41.8%). **Table 5** below present the dominant soil forms and their respective diagnostic horizon sequence.

Table 5: Dominant soil forms associated with the proposed development

Soil Form	Code	Diagnostic Horizon Sequence
Plooysburg	Py	Orthic/Red Apedal/Hard Carbonate
Mispah	Ms	Orthic/Hard rock
Prieska	Pk	Orthic/Neocarbonate/Soft Carbonate
Addo	Ad	Orthic/Neocarbonate/Hard Carbonate
Coega/Knersvlakte	Cg	Orthic/ Hard Carbonate
Witbank	Wb	Unspecified

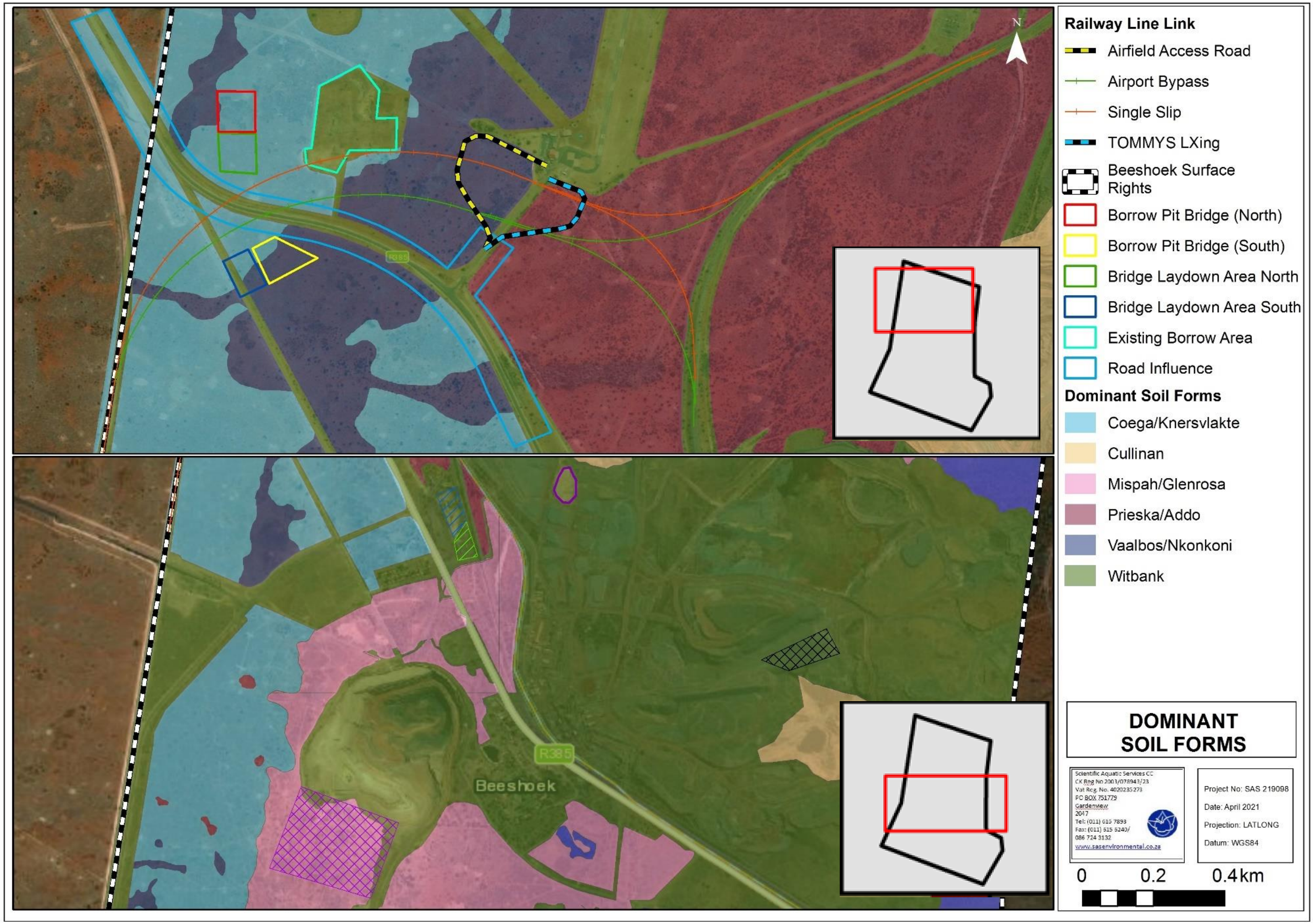

Figure 10: Soil map depicting identified soil forms associated with the proposed development

4.3 Land Capability and Land Potential Classification

Agricultural land capability in South Africa is commonly restricted by climatic conditions, with specific mention to water availability (Rainfall). Even within similar climatic zones, different soil forms 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 and land potential were inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Climate Capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification. The study area falls into Climate Capability Class 6 due to high temperatures and moisture stress, with limited suitable crops which experience frequent yield loss throughout the year.

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 10 to Figure 11** below. The identified land capability limitation for the identified soils are discussed in comprehensive "dashboard style" summary tables presented from **Table 6 to 8** below. The dashboard reports aim to present all the pertinent information in a concise and visually appealing fashion.

Figure 11: Map depicting land capability classes of soils occurring within the study area.

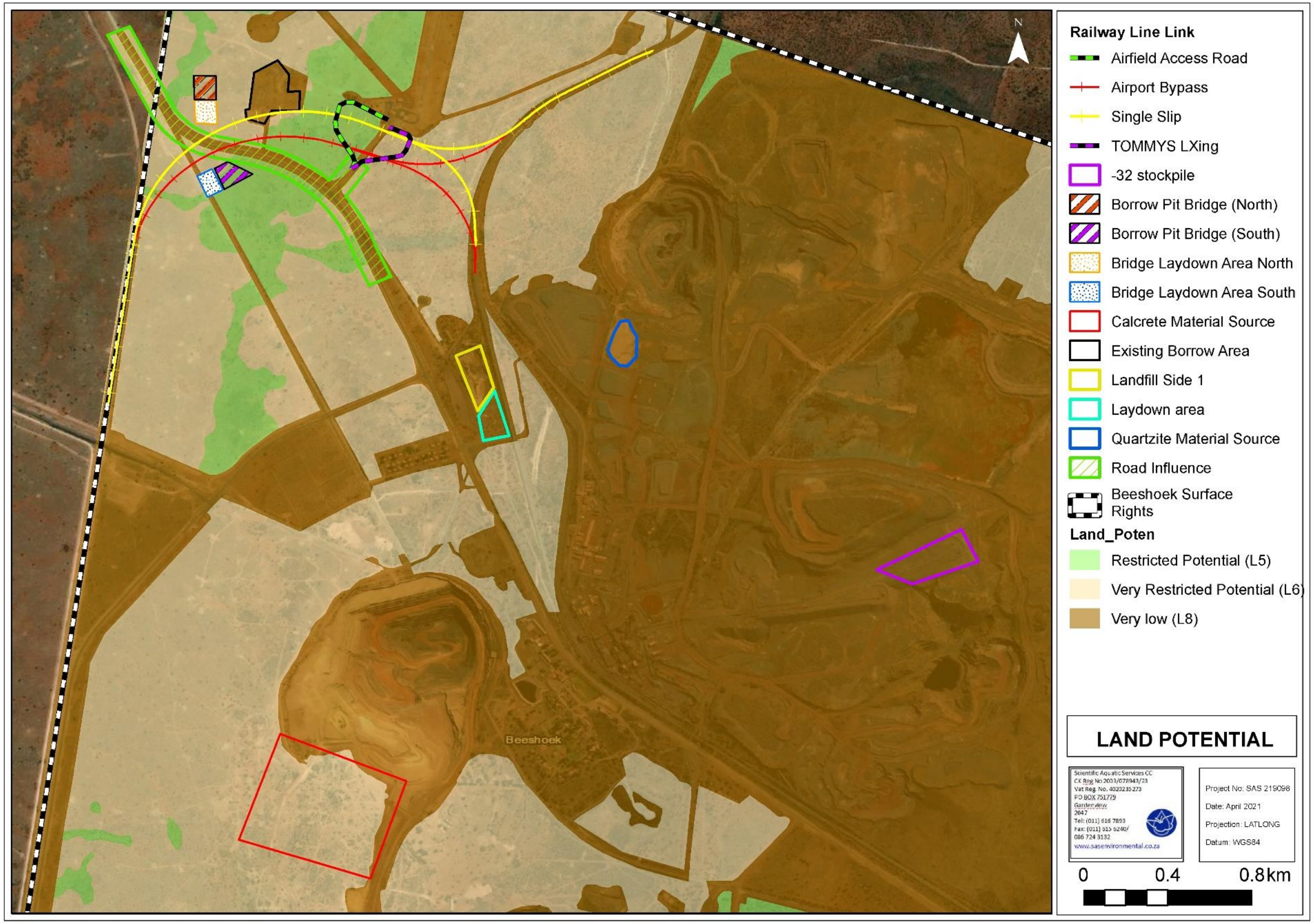

Figure 12: Map depicting land potential classes of soils occurring within the study area.

Table 6: Summary discussion of the Arable (Class III) land capability class and land potential class

<table>
<tr><th colspan="4">Land Capability: Arable (Class III) and Moderate land potential class</th></tr>
<tr><td colspan="4">  </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Relatively flat terrain</td><td>Photograph notes</td><td>View of the Red Apedal diagnostic horizon</td></tr>
<tr><td>Soil Form(s)</td><td>Vaalbos and Plooysburg</td><td>Area Extent</td><td>4.2 ha which constitutes 6.3% of the total investigated area</td></tr>
<tr><td>Physical Limitations</td><td>These soils have sufficient depth for most cultivated crops and rapid drainage characteristics (well-drained). However, the occurrence of impeding layers (layer of refusal), such as Hard Rock and Hard Carbonate may be the limiting factor for deep-rooted plants.</td><td colspan="2">Land Capability
The identified Plooysburg soil forms are considered high potential agricultural soils, with high land capability (Class III) and moderate land potential. These soils are suitable for arable agricultural land use with minimal management interventions. Therefore, they potentially contribute to provincial and/or national agricultural productivity if used for crop cultivation, and are essentially also well-suited for other less intensive land uses such as grazing etc. However, emphasis is directed to their agricultural crop productivity due to the scarcity of such soil resources on national scale and food security concerns.</td></tr>
<tr><td colspan="4">Business case and Conclusion</td></tr>
<tr><td colspan="4">The identified soils are considered prime agricultural soils suitable for arable crops. These soils can yield profit returns under prudent crop selection and conservation soil management practices. However, the prevailing local climatic conditions severely restricts the choice of crop cultivation under rainfed agriculture. Lack of irrigation options further disqualify this area for commercial cultivated agriculture although ideal soils occur. Site-specific striping and stockpiling management measures must be implemented during all phases of any future development with the study area to ensure that soils are stripped accordingly, and high potential soils are not mixed with low potential soils to try and reinstate which can be used for optimal support of grazing post mining.</td></tr>
</table>

Table 7: Summary discussion of the Grazing (Class VI) land capability class and land potential class

<table>
<tr><th colspan="4">Land Capability: Grazing (Class VI) and Restricted land potential</th></tr>
<tr><td colspan="4">  </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Relatively flat to gently sloping landscape of < 2% slope gradient</td><td>Photograph notes</td><td>View of the morphology of the identified Glenrosa/Mispah and Coega/Knersvlakte/Knersvlakte soil forms</td></tr>
<tr><td>Soil Form(s)</td><td>Glenrosa/Mispah and Coega/Knersvlakte/Knersvlakte</td><td>Area Extent</td><td>15.33 ha; which constitutes 52.9 % of the total investigated area</td></tr>
<tr><td>Physical Limitations</td><td>Shallow effective rooting depth is the primary limitation of the land capability of the Glenrosa/Mispah and Coega/Knersvlakte soil forms, which is due to the occurrence of a Lithic/Hard Rock and Hard Carbonate at relatively shallow depth, which would hinder penetration of plant roots.</td><td colspan="2">Land Capability
The identified Glenrosa/Mispah and Coega/Knersvlakte soil forms are classified in the poor land capability (class VII) and restricted land potential. These soils are not suitable for arable agricultural land use attributable to the occurrence of parent material at shallow depths which inhibits root penetration. These soils are, at best, suitable for natural pastures for light livestock grazing. The contribution of these soils to local, regional and national food production is limited. However, livestock farming under managed grazing interventions may be of significant contribution to the food security of the country.</td></tr>
<tr><td colspan="4">Business case and Conclusion</td></tr>
<tr><td colspan="4">These soils only support shallow rooted crops due to their shallow nature which hinders root growth, leading to stunted growth to most crops. These soils, at best, are suited for grazing and/or wilderness practices. The impact to the land capability and land potential of these soils is anticipated range between moderate and low. However, implementation of rehabilitation interventions and the integrated measures to manage any potential impacts such as soil erosion, contamination and compaction can reduce impact significance to low levels.</td></tr>
</table>

Table 8: Summary discussion of the Wildlife/Wilderness (Class VIII) land capability class and land potential class

Land Capability: Wildlife/Wilderness (Class VIII) and Very low land potential			
 			
Terrain Morphological Unit (TMU)	Not applicable; Significantly disturbed areas	**Photograph notes**	View of the identified Witbank soil forms
Soil Form(s)	Witbank and Cullinan (Anthrosols)	**Area Extent**	28.1 ha; which constitutes 41.8 % of the total investigated area
Physical Limitations	Comprises of significantly disturbed areas due from anthropogenic activities to an extent that no recognisable diagnostic soil horizon properties could be identified. These soils included existing gravel/dirt roads and open excavation as observed during the site assessment. These soils are characterised by various limitations, primarily the absence of soil as a growth medium for arable agriculture.	**Land Capability** These identified soils (Witbank and Cullinan) have very poor land capability (Class VIII) and very low land potential, attributed to historic and ongoing mining activities. In addition, some of these soils have been subjected to long term compaction, erosion and chemical soil composition alteration. These soils are therefore not considered to make a significant contribution to agricultural productivity even on a local scale.	
Business case and Conclusion			
The current state of these soils requires major rehabilitation already and currently have agricultural production potential. These areas can therefore be rehabilitated holistically at closure phase of any future development that may occur within the study area.			

5. IMPACT STATEMENT

This section aims to present potential impact which will likely occur, particularly during site preparation in the pre-construction phase. Even though the project footprint has not yet been specified, however the soils will be impacted once vegetation has been cleared which will result to various impacts including, but not limited to:

- **Soil erosion** - The soils will become more vulnerable to erosion once the vegetation is cleared for construction activities, and the soils will inevitably be exposed to wind and some surface runoff during intensive rainfall events;
- **Soil compaction** - Heavy equipment traffic during construction activities is anticipated to cause soil compaction, particularly for soils where the layer of refusal or bedrock its occurrence is not at/ near surface;
- **Potential Soil Contamination** - The soils will be equally predisposed to potential contamination, as contamination sources are generally unpredictable and often occur as incidental spills or leak for construction developments; and

  Loss of Agricultural Land Capability and Land Potential - The study area comprises approximately 6.3% arable soils. The prevailing climatic conditions (MAP ranges between 201 and 400 mm per annum) are the main limiting factor for these soils for cultivated agriculture under rainfed conditions. If arable soils are avoided and development largely occurs in shallow and disturbed soils, the proposed development will not result in significant loss of agricultural land capability and land potential.

5.1 Railway Line and Associated Activities

The potential impact triggers at various phases of the proposed development are presented in Table 9 below.

Table 9: Summary of the anticipated activities for the proposed railway and associated infrastructure development

Phase	Activities and associated impacts on soils and land capability
Preconstruction and construction	- Vegetation clearing within the proposed railway line and associated infrastructure line; - Soil erosion on cleared areas; and - Soil compaction from frequent traffic of construction vehicles.
Operational	- Operation of railway line and associated infrastructure
Decommissioning and closure	- Demolishing and decommissioning the railway and associated infrastructure; - Reshaping of the landscape and reinstatement of the natural topography; and - Rehabilitation of the impacted areas in the vicinity of the railway footprint.
Post-closure	- Resumption of former land use activities; and - Potential latent impact on soil chemistry and physical attributes.

1.1.1 Impact: Soil erosion

Shallow, and sandy textured soils have a low water retention capacity and are typically more susceptible to erosion in comparison to clay textured soils, which in contrast are less susceptible to erosion. However, the parameters determining the extent and severity of soil erosion are highly complex, with water and wind as the main geomorphic agents. Soil erosion is largely dependent on land use and soil management and is generally accelerated by human activities such as tillage practices.

The proposed study area is located on a relatively flat and gently sloping terrain of less than 1% slope gradient at most, consisting of rocky outcrops of Coega/Knersvlakte, Mispah/Glenrosa soils with very shallow to no soils.

The identified soils will become more vulnerable to erosion once the vegetation is cleared for construction activities, and the soils will inevitably be exposed to wind and some surface runoff during intensive rainfall events. This will most likely lead to:

- Reduced soil fertility status of soils and subsequently loss of valuable arable land;
- Reduced farm yields due to loss of arable land; and
- Possible pollution and sedimentation of nearby water sources consequently affecting the water quality for livestock.

The significance of this impact is considered medium low and will be reduced to low impact if mitigation measure outlined in this document are adhered to, as illustrated on the impact rating table below.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary clearing and removal of vegetation outside of the demarcated infrastructure areas	Site clearing, the removal of vegetation, and associated disturbances to soils, leading to increased runoff, erosion subsequent loss of land capability	Constant disturbances of soils, resulting in detachment of soil particles, reduced soil quality and risk of erosion, attributed to mining activities.	Ineffective rehabilitation may lead to further loosening and detachment of soil particles and risk of erosion.
		Ongoing disturbances to soils, resulting in increased sedimentation and risk of erosion, arising from mining activities.	Decommissioning activities may lead to habitat transformation and increased alien plant species proliferation, and potential changing the nutrient status of the soils.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	3	2	8	9	72 (Medium-low)
Operational phase	4	4	4	3	2	8	9	72 (Medium-low)
Decommissioning and Closure	5	4	4	3	2	8	8	72 (Medium-low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	3	4	1	2	5	8	40 (Low)
Operational phase	2	3	4	1	3	5	9	45 (Low)
Decommissioning and Closure	2	3	4	1	2	5	8	40 (Low)

1.1.2 Impact: Soil compaction

Heavy equipment traffic during construction activities is anticipated to cause significant soil compaction. The severity of this impact is anticipated to be moderate for soils such as the Plooysburg soil due to loamy sand texture. Whereas soils with a relatively shallow bedrock and lithocutanic character (partly weathered rock material) such as the Coega/Knersvlakte and Glenrosa/Mispah soil forms are anticipated to be less impaired due to the resistance offered by the underlying bedrock. Soil compaction will potentially lead to:

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

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary placement of infrastructure in soils highly prone to compaction.	Potential movement of construction equipment/machinery leading to soil compaction.	Movement of service vehicles on gravel services roads leading to further soil compaction.	Disturbance of soils as part of demolition activities and backfilling.
	Unnecessary placement of construction material in soils which are prone to compaction.		Ineffective rehabilitation may lead to significant soil compaction, resulting in lower infiltration rate, and consequently increased surface runoff.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	2	5	2	4	5	11	55 Medium-low)
Operational phase	3	2	5	2	4	5	11	55 (Medium-low)
Decommissioning and Closure	2	2	5	1	3	4	9	36 (low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	1	5	1	3	3	9	36 (Low)
Operational phase	2	1	5	1	3	3	9	36 (Low)
Decommissioning and Closure	1	1	5	1	3	2	9	18 (Very Low)

1.1.3 Impact: Potential Soil Contamination

All the identified soils are considered equally predisposed to potential contamination, as contamination sources are generally unpredictable and often occur as incidental spills or leak for construction developments. The significance of soil contamination is considered to be medium-high for all identified soils, largely depending on the nature, volume and/or concentration of the contaminant of concern. Therefore, strict waste management protocols and activity specific Environmental Management Programme (EMP) guidelines should be adhered to during the construction activities. If the management protocols are not well managed this will more likely lead to:

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

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential inadequate design of infrastructure leading to risks of contamination of soils due to seepages and runoff.	Potential leakages in construction equipment/machinery leading to contamination.	Seepage and runoff from mining infrastructure (e.g. overburden) to high potential agricultural soils within the footprint.	Contamination of soils during demolition activities and backfilling.
		Potential leakages in construction equipment/machinery leading to contamination.	Potential ineffective rehabilitation may lead to decant which can affect soil chemistry.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	4	2	2	6	8	48 (low)
Operational phase	3	3	4	2	4	6	10	60 (Medium-low)
Decommissioning and Closure	3	3	4	2	2	6	8	48 (low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	2	4	1	2	4	8	32 (Low)
Operational phase	2	2	4	1	3	4	9	36 (Low)
Decommissioning and Closure	2	2	4	1	2	4	8	32 (Low)

1.1.4 Impact: Loss of Agricultural Land Capability

The proposed railway line link project is not anticipated to result in significant loss of agricultural land capability since the majority of the soils within the footprint areas are not considered to contribute substantially to national food production. Although the Plooysburg soil form is considered a high potential agricultural soil type, low crop yields are foreseen for this area due to climatic constraints and lack of irrigation options. The footprint of the railway line link project is limited in extent hence the resultant impact on natural (undisturbed) soil resources will be limited.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary placement of infrastructure high potential agricultural soils	Site clearing, the removal of vegetation, and associated disturbances to soils, leading to increased nutrient leaching, runoff and erosion and	Ongoing disturbances to soils, resulting in increased leaching of soil nutrients and risk of erosion, attributed to mining activities.	Compaction and contamination of soils during demolition activities and backfilling.
Potential inadequate design of infrastructure leading to risks of contamination of soils due to seepages and runoff.	Potential indiscriminate disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Potential increase in concentrations of contaminant concentration in the soil.	Decommissioning activities may lead to soil transformation and increased alien plant species proliferation, which will ultimately alter the chemical composition and nutrient status of the soil.
		Ongoing disturbance as a result of maintenance activities, leading to altered vegetation community structures, and consequently altering the quality and nutrient status of the soil.	Disturbance of soils as part of demolition activities as well as backfilling, which may lead to the formation of Witbank soils (Anthrosols) which reduce long term land capability.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	3	2	4	9	9	81 (High)
Operational phase	5	4	4	2	4	9	9	81 (High)
Decommissioning and Closure	3	4	3	2	4	7	9	63 (Medium-low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	2	4	1	2	5	7	35 (Low)
Operational phase	2	2	3	1	3	4	7	28 (Low)
Decommissioning and Closure	2	2	3	1	3	4	7	28 (Low)

1.1.5 Cumulative impacts

The surrounding areas within which the proposed railway line link project is to occur are dominated by Iron Ore mines, and no cultivated agricultural activities occur in the immediate vicinity. This is largely attributable to the dominance of rocky outcrops and shallow soils which are not ideal for cultivated agricultural production. In addition, lack of rainfall as well as limited irrigation options further disqualifies the area from being ideal for agricultural production. Therefore, based on the above-mentioned limiting factors, the proposed project is anticipated to cause a relatively low cumulative loss of arable land and medium low cumulative loss of natural grasslands for grazing. Therefore, from a soil and land capability point of view, the addition to the cumulative impact footprint of the region is considered relatively minor.

6. SUMMARY OF 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:

Soil Erosion and Dust Emission Management

- ➢ The footprint of the proposed infrastructure area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- ➢ Clearing of vegetation should take place in a phased manner as to keep bare soil areas as small as possible to limit the erosion potential;
- ➢ Moisture control will be necessary on large bare areas during dry season construction, in order to reduce the frequency and amount of dust suspended in the ambient air;
- ➢ The mine should implement adequate wet suppression techniques to limit dust release;
- ➢ Regulated speed limits of 40km/hr must be maintained on gravel roads to minimize dust generation; and
- ➢ All disturbed areas adjacent to the footprint 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.

Soil Compaction management

- ➢ All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible; and

- Compacted soils adjacent to the mining and associated infrastructure footprint should be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.

Soil Contamination Management

- Regular monitoring of site activities and machinery must be undertaken to identify spills or leaks that could impact on soil chemistry and integrity;
- A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans must be developed and be implemented;
- Withdraw equipment for maintenance if change in emission characteristics is noticeable;
- Spill kits (such as spill-sorb or a similar type product) must be kept on site and used to clean up hydrocarbon spills in the event that they should occur; 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.

Loss of Land Capability Management

- Direct surface disturbance of the identified arable soils can be avoided where possible to minimise loss of soil resources;
- During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility;
- The footprint should be ripped to alleviate compaction;
- Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface;
- The topsoil should be ameliorated according to soil chemical analysis; and
- Revegetate with an indigenous grass mix, to re-establish a natural protective cover, in order to minimise soil erosion and allow pre construction activities to take place (grazing and wildlife).

7. CONCLUSION

From a land capability point of view, the area within which the proposed railway line link project is to occur is largely dominated by shallow soils with low agricultural potential soils with only minor areas comprising of High agricultural potential. At best, the Coega/Knersvlakte, Mispah/Glenrosa soil forms are suitable for marginal grazing. Although arable soils occur with the railway footprint (Plooysburg), given the climatic constraints of the area (Rainfall less than 400 mm) and lack of irrigation options, these soils are not likely to contribute substantially to national food production. Furthermore, high temperatures occurring in this area are also likely to cause crop wilting, thus affecting crop yield. Given these constraints the extent of the high productivity soils is not considered sufficient for viable cultivated commercial farming.

Livestock commercial farming is marginal for one (1) landowner for the proposed area extent to be affected by the project, due to the grazing capacity low grazing capacity for this area (14 Hectares per animal unit). Therefore, this area it is not considered sufficient for viable small-scale commercial farming unless intensive management practices are implemented.

The findings of this assessment suggest that the relevant soil limiting factors within the study area for land capability and land use potential include the following:

- Shallow effective rooting depth due to shallow indurated bedrock of the Mispah, Glenrosa, Coega/Knersvlakte soil forms. As such, these soils are not considered to contribute significantly to agricultural productivity; and
- Lack of soil medium for plants and crop growth for the rocky outcrop, mine infrastructure, lack of water supply and Witbank (Anthrosols) soil types.

The surrounding areas within which the railway line link project is to occur are dominated by Iron Ore mines, and no cultivated agricultural activities occur in the immediate vicinity. This is largely attributable to the dominance of rocky outcrops and shallow soils which are not ideal for cultivated agricultural production. In addition, lack of rainfall as well as limited irrigation options further disqualifies the area from being ideal for agricultural production. Therefore, based on the above-mentioned limiting factors, the proposed project is anticipated to lead to a relatively low cumulative loss of arable land and medium low cumulative loss of natural grasslands for grazing. Therefore, from a soil and land capability point of view, the addition to the cumulative impact footprint of the region is considered relatively minor.

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APPENDIX A: METHOD OF ASSESSMENT

Desktop Screening

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

Soil Classification and Sampling

A soil survey was conducted in October 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 3 below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed 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

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

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Signature of the Specialist

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

I, Braveman Mzila, declare that -

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

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Soil and Land Capability Assessment

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

Visual Impact Assessment

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

Legislative Requirements, Processes and Assessments

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

SAS ENVIRONMENTAL GROUP OF COMPANIES – 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