APPENDIX K: AGRICULTURAL AGRO-ECOSYSTEM STUDY

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Agricultural Agro-Ecosystem Assessment for the proposed Jindal Melmoth Iron Ore Project

Submitted by TerraAfrica Consult cc

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DOCUMENT AND QUALITY CONTROL

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Table of Contents

List of Figures

List of Tables

1. Introduction

TerraAfrica Consult CC (‘TerraAfrica’) was appointed by SLR Consulting South Africa (Pty) Ltd (‘SLR Consulting South Africa’) to conduct the Agricultural Agro-Ecosystem Assessment (from here onwards referred to as the Agricultural Assessment) for the Mining Right Application (MRA) and Environmental Authorisation (EA) process for the proposed Jindal Melmoth Iron Ore Project. The project applicant is Jindal Iron Ore (Pty) Ltd (‘Jindal’). The project entails the development of an open cast iron ore mine on a site located 25 km southeast of Melmoth, within the Mthonjaneni Local Municipality and King Cetshwayo District Municipality in the KwaZulu Natal Province.

The proposed project area consists of two main areas that are referred to as the North Block and the South Block, respectively. Jindal held two prospecting rights with an extent of up to 20 170 ha. Jindal now intends, with this MRA, to consolidate the Prospecting Rights for the North and South blocks into a single Mining Right. However, development of the mine and mining infrastructure would be undertaken in a phased approach with mining currently only proposed to be undertaken in the south-eastern section of the South Block (Phase 1), where the iron ore resource has been defined through previous prospecting. Infrastructure would be developed to support this mining operation.

Prior to submission of this report, the Jindal Agricultural and Soil Scoping Report was compiled and published as part of the Scoping Phase studies. This report contains the results of a desktop evaluation of available data for both the North Block and South Block. The results are briefly incorporated into the relevant sections of this report to provide background information for the findings of the site visit. While both the main areas were discussed in the Scoping Phase report, only the South Block was studied in greater detail for the EIA Phase as the mining footprint of Phase 1 will be located in the south-eastern section.

The overarching purpose of the Agricultural Assessment is to ensure that the sensitivity of the site to the proposed land use change (from agriculture to establishment of mining infrastructure) is sufficiently considered. Also, that the information provided in this report, enables the Competent Authority, the DMRE, to come to a sound conclusion on the impact of the proposed project on the food production potential of the site.

To meet this objective, the assessment must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the Environmental and Social Impact Assessment (ESIA) report for the proposed project.

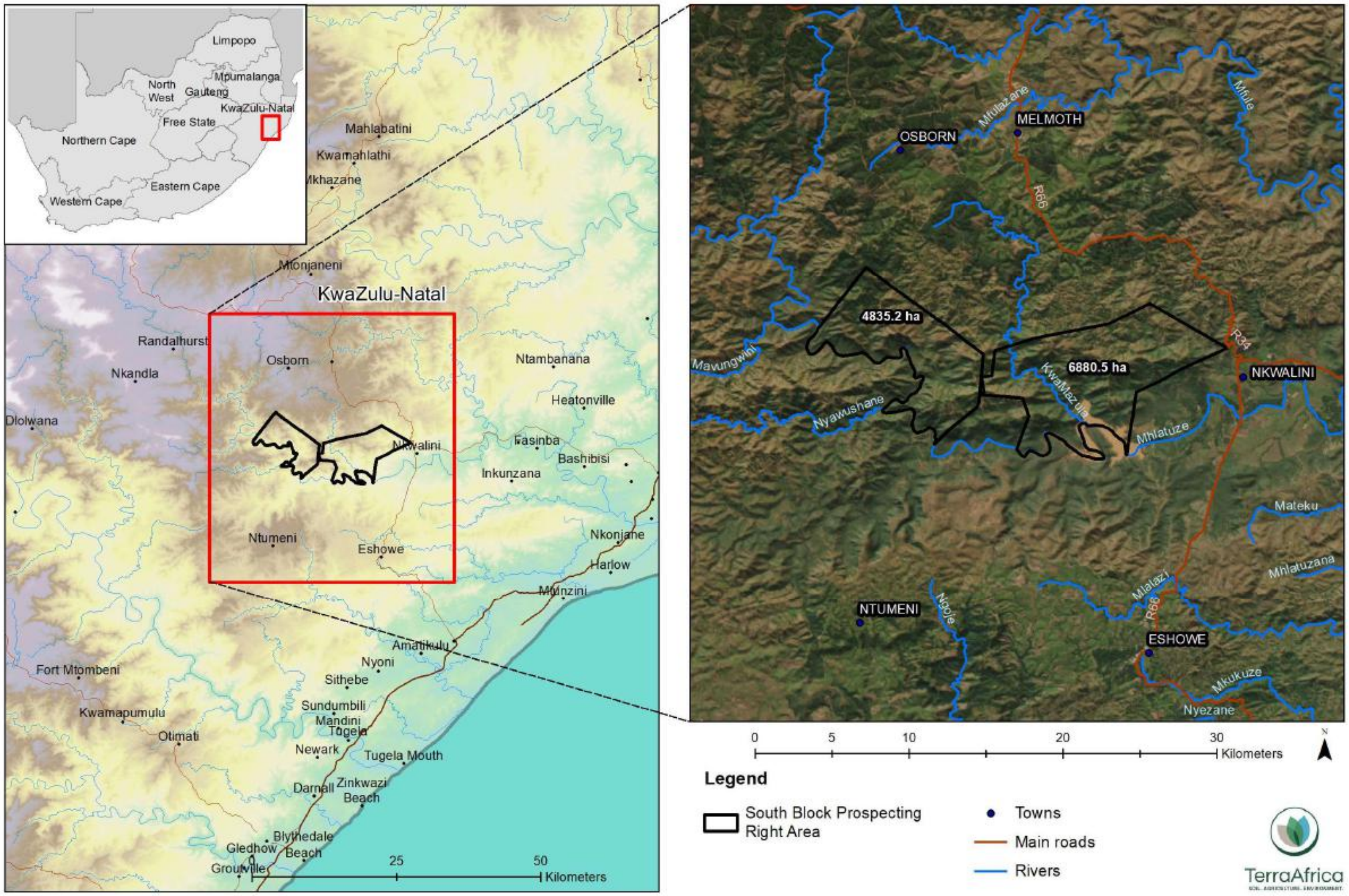

Figure 1 Locality of the South Block of the proposed Jindal Melmoth Iron Ore project

2. Project description of the Phase 1 mine plan

2.1 Phase 1 mine plan

For Phase 1, an open cast pit mining operation is proposed to be developed in the south-eastern section of the South Block known as the South East Pit. Waste rock will be stripped from the pit and disposed of on a Waste Rock Dump (WRD) proposed within the Mining Right Area. Drilling and blasting techniques will be used to excavate the iron ore (proposed to be 32 million tonnes per annum (mtpa)) which will then be loaded onto trucks and transported to the Run-of-Mine (ROM) ore stockpile area where it will be stored and subsequently transferred to the processing plant for milling and magnetic separation. The processing plant will produce iron ore concentrate and a tailings slurry.

The approximately 7.5 mtpa of iron ore concentrate consisting of 67% Fe will be transported to the Richards Bay Port via rail (part of a separate application process). The tailings will be disposed of to a tailings storage facility (TSF) (also part of a separate application process). Associated infrastructure to support the mine will include access and haul roads, electrical transmission line and sub-stations, raw water abstraction and pipelines, stormwater management infrastructure, tailings pipelines, concentrate pipelines, offices, change house, workshops and perimeter fencing (amongst others). Additional detail is provided in the following sections on the major infrastructure.

2.1.1 South East Pit

The South East Pit as shown is approximately 4 km east to west and approximately 1km north to south at its widest point.

2.1.2 Waste Rock Dump

Waste rock dumps are required to accommodate overburden and waste rock excavated as part of the mining process. The waste rock dump would be designed to fit into the existing contours to the extent practical for stability and ultimate closure rehabilitation.

2.1.3 Crushing and Screening

ROM ore will be transported via haul truck to a semi-mobile in pit primary crusher. Primary crushed ore will be transported from the in pit primary crusher to the ROM stockpile via overland conveyor. ROM ore will be reclaimed from the ROM stockpile for further crushing before being deposited onto the crushed ore stockpile.

2.1.4 *Processing Plant*

Ore from the crushed ore stockpile will be fed into the processing plant. It is anticipated that the proposed processing plant would be designed to process 32 mtpa of iron ore. Iron ore will be processed using crushing, milling and magnetic separation techniques. The plant will produce wet iron ore concentrate (upgraded from 30% Fe in feed to 67% Fe in concentrate) which will likely be exported.

The plant will also produce thickened wet tailings slurry which will be deposited on a TSF as discussed in Section 2.2. The following standard activities are proposed as part the processing operations:

- Crushing and Screening;
- High Pressure Grinding Roll (HPGR) and ball/pebble milling;
- Magnetic separation and concentrate re-grind;
- Tailings disposal;
- Concentrate Dewatering and Filtration; and
- Transport, storage and shipment of final beneficiated product.

2.1.5 Water Infrastructure

The mining operations will require water for the processing plant, dust control, for vehicle wash down and for the change house and office use. The conceptual design is for water to be recycled from the TSF and the concentrate filters thereby minimising daily water usage. There will be a need for make up water to replace water losses from seepage, evaporation and interstitial. It is anticipated that the make up water would be acquired from the KZN bulk water supply authority. Water requirements are likely to reduce as the pit deepens due to the reuse of water that collects within the pit.

In addition, water management infrastructure will be required including dirty water dams, pollution control dams and storm water management.

2.1.6 Office Complex

An office complex is required to accommodate all management, technical, and administration staff for the mine. The office complex will include a car park, canteen, meeting rooms, hall, training complex, security and first aid station. The site will have a dedicated sewerage treatment plant.

2.1.7 Workshops

Engineering and vehicle workshops, tyre shops, wash down areas, garages, fuel depots and explosive magazines will be located at the centre of the activity that the facility services for ease of access.

2.1.8 Access Road

The proposed access road is indicated in Figure 2. This access road will be used during the construction phase and for other activities during the operational, decommissioning and closure phases.

2.1.9 Power Supply

Existing 400 kV transmission lines owned by Eskom run through the South Block to a point approximately 700 m from the envisioned main plant intake substation. The lines are relatively new and have adequate installed capacity for the mine requirements. Connecting distribution lines and a substation will be required for the mining operations. This would likely be adjacent to the processing plant as per Figure 2.

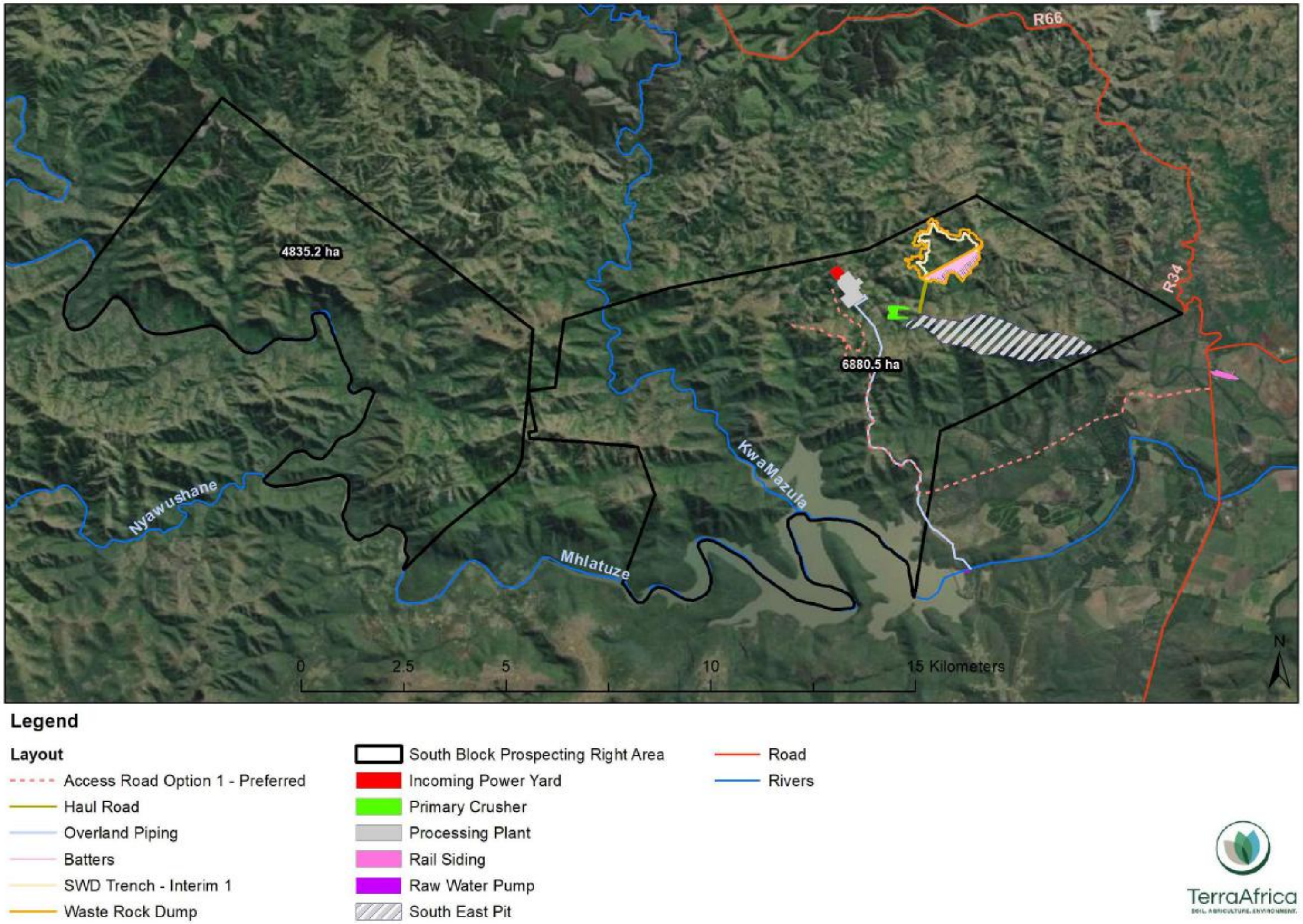

Figure 2 Layout map of the infrastructure of Phase 1 of the proposed Jindal Melmoth Iron Ore Project

2.2 Phase 1 mine plan

Some of the infrastructure required for the mine (e.g. the access road, pipelines and TSF) may be located outside of the Mining Right Area. While the access road and water supply pipelines are part of this application to the DMRE, certain other infrastructure will be subject to separate application, assessment, and approval processes, as required by the applicable legislation. The additional infrastructure required through separate authorisation, is discussed below.

2.2.1 Tailings Storage Facility and Associated Infrastructure

A TSF Site Selection Study was undertaken in 2014/2015 by tailings specialists to ascertain where possible suitable sites would be for the TSF. In 2022, further screening of three possible TFS sites were conducted by SLR. Following the screening process, the most suitable site was identified and the proposed site is now part of a separate Environmental Authorisation process.

2.2.2 Transport of Concentrate to Richard's Bay for Export

The final mode of transportation of the concentrate from the processing plant to the Richards Bay Port for export will be rail. Transport via rail will be from the nearby Nkwalini rail siding) (approximately 80 km) with a 5 km slurry pipeline from the processing plant to the rail siding to be included.

3. Details of the specialist

Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10. Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand. She has consulted in the subject fields of soil, agriculture, pollution assessment and land use planning for the environmental sector of several African countries including Botswana, Mozambique, Democratic Republic of Congo, Liberia, Ghana and Angola. She has also consulted on the soil and agricultural assessment of a gas infrastructure project in Afghanistan. Her contact details are provided in Appendices 1 and 2 attached.

4. Legislative framework for the assessment

The report follows the protocols as stipulated for the Agricultural Assessment in Government Notice 320 of 2020 (GN320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (No. 107 of 1998) (from here onwards referred to as NEMA). It replaces the previous requirements of Appendix 6 of the Environmental Impact Assessment Regulations of NEMA.

In addition to the specific requirements for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity:

- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. This Act requires the protection of land against soil erosion

and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Section 3 of the Subdivision of Agricultural Land Act 70 of 1970 may be relevant to the development.

5. Agricultural Sensitivity

For the purpose of the assessment, the project site of the Jindal Melmoth Iron Ore Project, was screened for agricultural sensitivity using the National Environmental Screening Tool (www.screening.environment.gov.za). The screening report for the iron ore project site was generated by SLR on 9 April 2021 and presented as **Error! Reference source not found.** and **Error! Reference source not found.**. The requirements of GN320 stipulates that a 50m buffered development envelope must be assessed with the screening tool. While the project site was used for the screening, the surrounding area is also visible in each map (which shows a buffered area of 1km or more around the project site boundary).

According to Figure 3, most of the South Block consist of land with Low sensitivity (southern side of the project site), while Medium and High sensitivity is found in the northern boundary of the project site. High sensitivity soils are allocated to soils with a land capability of Moderate-High (Classes 09 and 10), while Medium and Low sensitivity soils had Low-Moderate (Classes 06 and 07), Moderate (Class 08) and Very low (Classes 02 and 03), Very low-Low (Class 04) and Low (Class 05) land capability classes respectively.

Figure 4 shows the sensitivity for the North Block. Medium to High sensitive areas are found between the southern boundary and the centre of the study area and Low sensitive areas more to the north. High sensitivity soils are allocated to soils with a land capability of Moderate-High (class 09 and 10) while Medium and Low sensitivity soils have Low-Moderate (class 06 and 07), Moderate (class 08) and Very low (class 02 and 03), Very low-Low (class 04) and Low (class 05) land capability classes respectively.

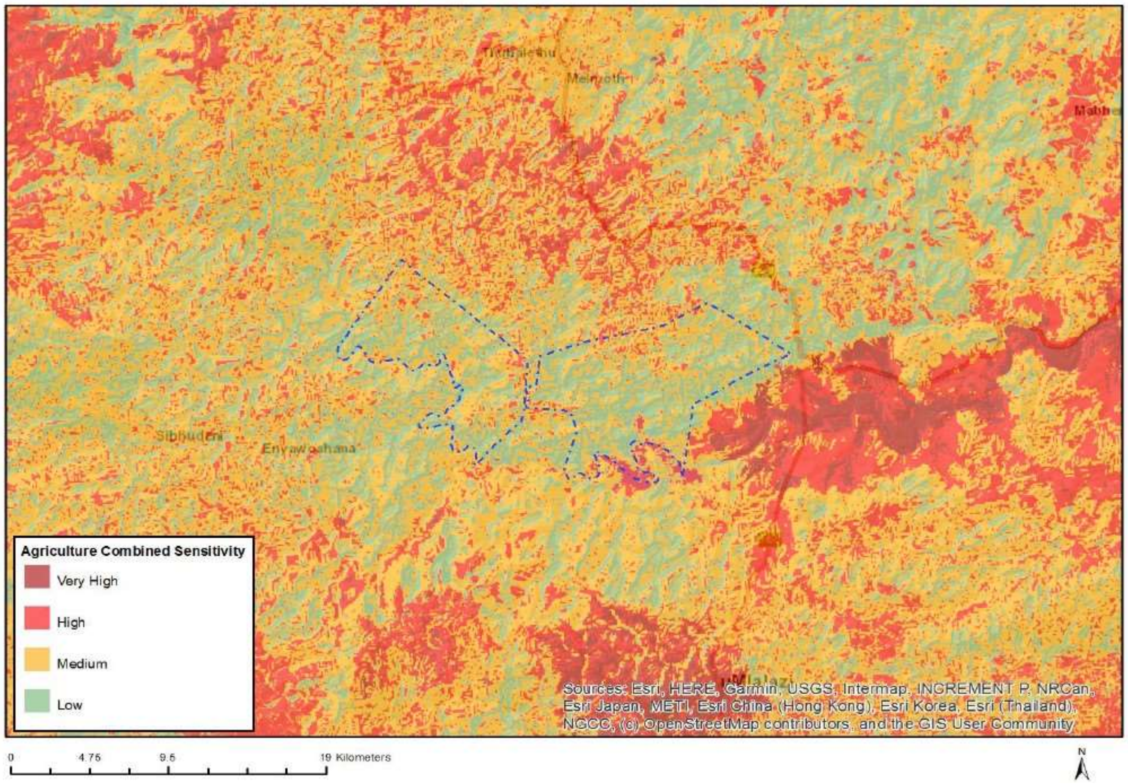

Figure 3 Relative agricultural sensitivity of the North Block of the Jindal Melmoth (DFFE Screening Tool, March 2021)

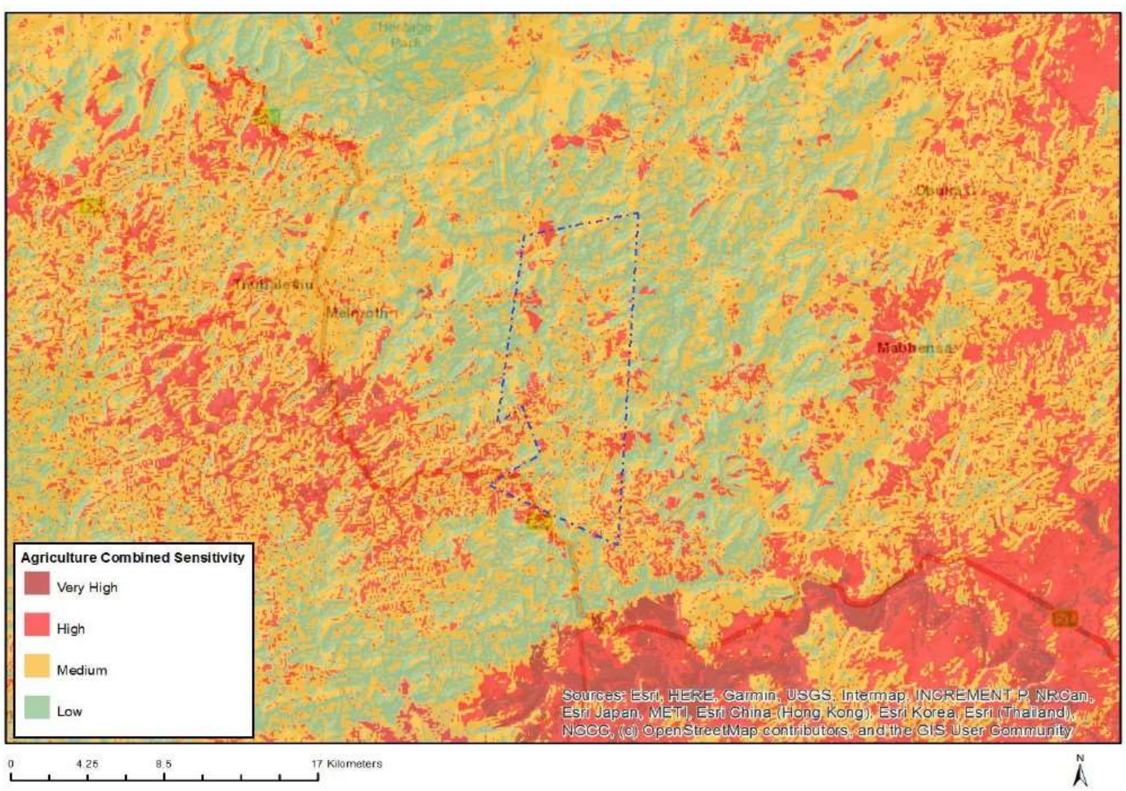

Figure 4 Relative agricultural sensitivity of the North Block of the Jindal Melmoth (DFFE Screening Tool, March 2021)

6. Requirements of assessment protocol

According to GN320, the Agricultural Agro-Ecosystem Assessment that is submitted must meet the following requirements:

- It must identify the extent of the impact of the proposed development on the agricultural resources.
- It has to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.

The following checklist is supplied as per the requirements of GNR 320, detailing where in the report the various requirements have been addressed:

Table 1 Requirements for the agricultural assessment according to the GNR 320 protocols

GNR 320 requirements of an Agricultural Agro-Ecosystem Statement (High to Very High Sensitivity)	Reference in this report
Details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vitae;	Section 2 and Appendices 1 & 2
A signed statement of independence by the specialist;	Appendix 1
The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 7.2
A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant;	Section 7.2
A map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Section 5, Figure 3&4
An indication of the potential losses in production and employment from the change of the agricultural use of the land because of the proposed development;	Section 9
An indication of possible long term benefits that will be generated by the project in relation to the benefits of the agricultural activities on the affected land;	Section 9.2
Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc.;	Section 11
Information on the current agricultural activities being undertaken on adjacent land parcels;	Section 9
An identification of any areas to be avoided, including any buffers	
A motivation must be provided if there were development footprints that were identified as having a “medium” or “low” agriculture sensitivity and that were not considered appropriate;	Sections 10
Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;	Section 11
A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed	Section 12

development and a recommendation on the approval or not of the proposed development;	
Any conditions to which this statement is subjected;	Sections 12
Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr);	Section 11
A description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 6

7. Methodology for baseline assessment

7.1 Desktop analysis of satellite imagery and other spatial data

The most recent aerial photography of the area available from Google Earth was obtained. The satellite imagery was analysed prior to the site visit to determine any areas of existing impacts and land uses within the Jindal Melmoth Iron Ore project site as well as the surrounding areas. It was also scanned for any areas where crop production and farming infrastructure may be present. To get a comprehensive overview of the natural resources that contribute to the agro-ecosystem of the proposed project site, the following spatial data was analysed:

- The National Land Capability Evaluation Raster Data Layer was obtained from the DAFF to determine the land capability classes of the project area according to this system. The data was developed using a spatial evaluation modelling approach (DAFF, 2017).
- The long-term grazing capacity for South Africa 2018 was analysed for the area and surrounding area of the project assessment zone. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Kwazulu-Natal Field Crop Boundaries (November 2019) was analysed to determine whether the proposed project assessment zone falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming.

7.2 Site assessment

The project site was visited during the South African autumn, from 27 April 2022 to 6 May 2022. The season during which the soil survey is conducted has no influence on the results of the soil classification or the agricultural potential that is derived from the soil classification. Pedogenesis (soil formation) is a very slow process that occurs over decades and is not influenced by annual seasonal fluctuations such as precipitation and temperature. The season of the survey is therefore irrelevant to the results and conclusions of the assessment. The site assessment included a soil classification survey, the collection of soil samples as well as the collection of photographic evidence about the current land uses. Data was recorded at 216 observation points (Figure 5). Observations were made in higher density where the proposed development footprint is located. The soil profiles were examined to a maximum depth of 1.5 m or the point of refusal using a hand-held soil auger.

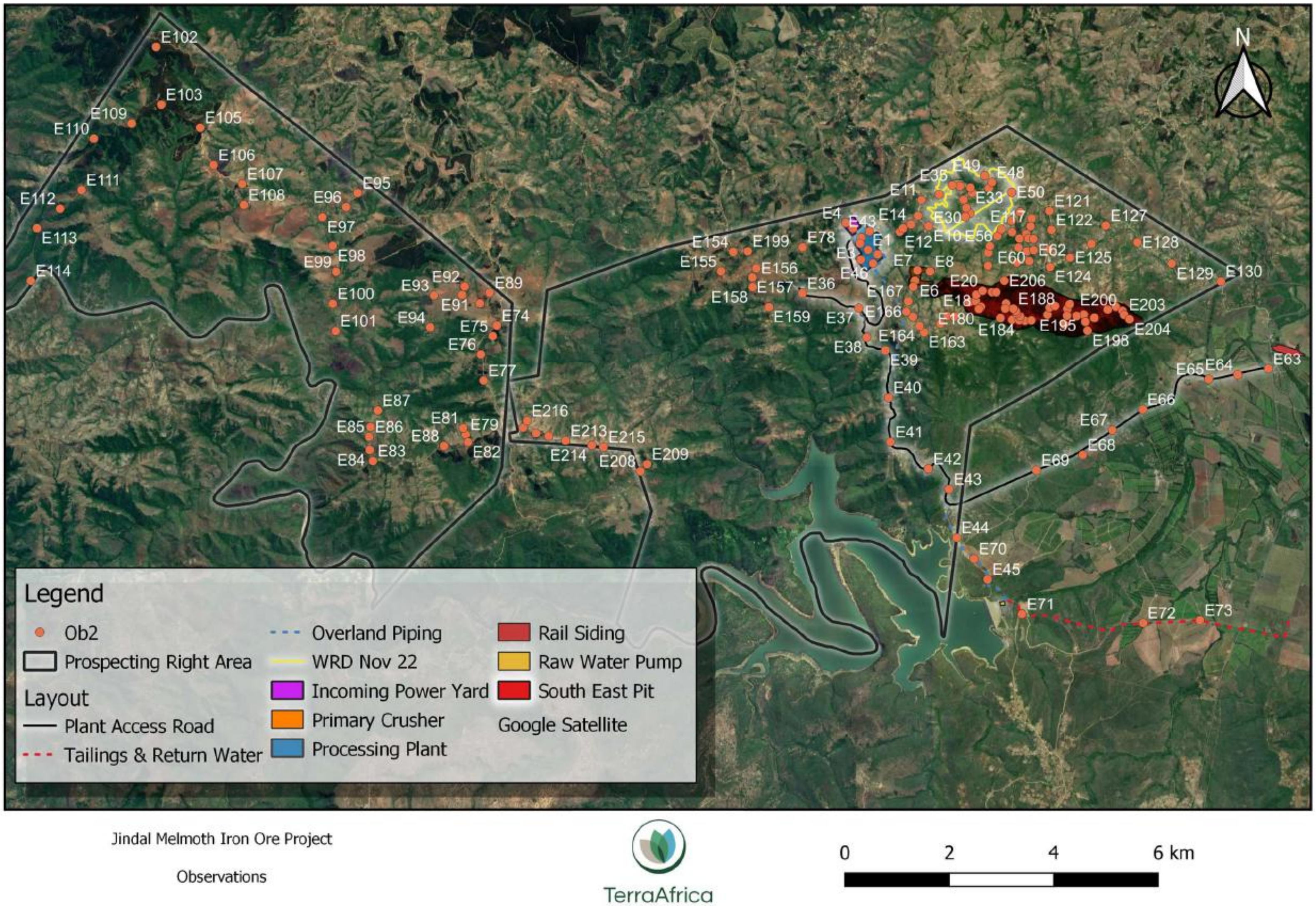

Figure 5 Locality of the observation points of the site survey

Observations were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). The locality of each of the survey points, are indicated in **Error! Reference source not found.** below. Photographic evidence of soil properties, current land uses and other evidence were taken with a digital camera.

7.3 Analysis of samples

Twelve soil samples were collected from the different horizons of modal soil profiles. The soil was stored and sealed in clean sampling bags and submitted to Van's Lab in Bloemfontein for analysis. Samples were analysed for the following parameters:

- pH (using potassium chloride);
- Major cationic plant nutrients (calcium, magnesium, potassium, sodium) using ammonium acetate;
- Plant-available phosphorus (using Bray 1 extract);
- Cation Exchange Capacity;
- Organic carbon (Walkley-Black); and
- Soil texture (three fraction particle size analysis).

7.4 Soil form calculations and mapping

For soil mapping of the project site, the soils were grouped into classes with relatively similar soil characteristics. The general approach used was Land Type disaggregation to predict the soil form, or soil association, on the representative Topographic Morphological Unit (TMU). This was used in conjunction with terrain analysis, observations made on site and satellite imagery.

A land type is an area which can be demarcated at a scale of 1:250 000 with similar soil forming factors and therefore soil distribution patterns. A Land Type does not therefore represent uniform soil polygons, but rather information regarding the occurrence of different soils on different terrain units. A raster with the Terrain Units of the site (van den Berg, 2021) was overlaid with Land Type. Each Land Type was divided into a TMU, and a soil type, or soil association, was ascribed to the TMU based on the disaggregation.

8. Baseline description of the agro-ecosystem

8.1 Land type disaggregation of South Block

The South Block consisted of the 11 land types presented in Figure 6. The area surrounding the South Block, includes 13 more land types. The broad land types found in the South Block area are Ac, Db, Fa, and Fb. The Ac land types are dominated by freely drained, red and yellow, dystrophic or mesotrophic, apedal soils that comprise more than 40% of the land type (where red and yellow soils each are present in more than 10% of the area). The Db land types are dominated by duplex soils (sandier topsoil abruptly overlying more clayey subsoil) which comprise of more than 50% of the total land type area. More than 50% of the duplex soils of this land type, have non-red B horizons. The Fa land types are dominated by shallow soils (Mispah & Glenrosa forms) with little or no lime in the landscape. The Fb land types consist of shallow soils (Mispah & Glenrosa forms) predominately and there is usually lime in some of the lower TMU's in the landscape.

Each of the land types consist of a specific combination of soil categories that group soils with similar base properties together. Although many land types are present in the study area, the South Block is dominated by two soil categories, i.e. soil categories 2 and 13. Category 2 consists of Hutton (Hu), Clovelly (Cv), Griffin (Gf), Shortlands (Sd), and Oakleaf (Oa) soil types (**Error! Reference source not found.**), which are characterized by red structureless soils. Category 13 consists of Mispah (Ms) and Glenrosa (Gs) soils, which are characterized by shallow depths.

The soil distribution, average depth, and average clay contents within the land type is presented in Table 2. The soil forms and soil series allocated to each category, is shown in Table 3. The soil series of the 1977 soil classification system (Macvicar et al., 1977) was used as this system formed the foundation of the land type classification system.

Table 2: The selected soil properties within land types of the South Block

Landtype	Average depth (mm)	Average clay (%)	Soil category (% of area)
Ac62	708,5	25,3	S2 (57) & S13 (37)
Ac63	621,2	34,8	S2 (61) & S13 (31)
Db151	554,6	28,3	S2 (24) & S7 (46)
Fa108	664,4	33,9	S2 (50) & S13 (27)
Fa126	333,2	24,3	S2 (6) & S13 (73)
Fa127	211,4	16,2	S2 (10) & S13 (76)
Fb320	519,8	27,3	S2 (16) & S13 (52)
Fb321	518,2	20,3	S7 (11) & S8 (15) & S13 (49)
Fb322	514,4	30,6	S2 (30) & S13 (51)
Fb323	413,5	25,4	S7 (7) & S13 (72)
Fb324	478,0	16,7	S8 (15) & S13 (53)

Table 3: Soil forms and series allocated to categories reported in **Error! Reference source not found.**

	Form *	Series *
Category 2	Hu, Cv, Gf, Sd, Oa	All
Category 7	Va, Sw	All
Category 8	We, Cf, Lo, Wa, Kd	All, Kd10, 15, 20, 22
Category 13	Ms, Gs	All

The results of the disaggregation each of each land type, is presented in

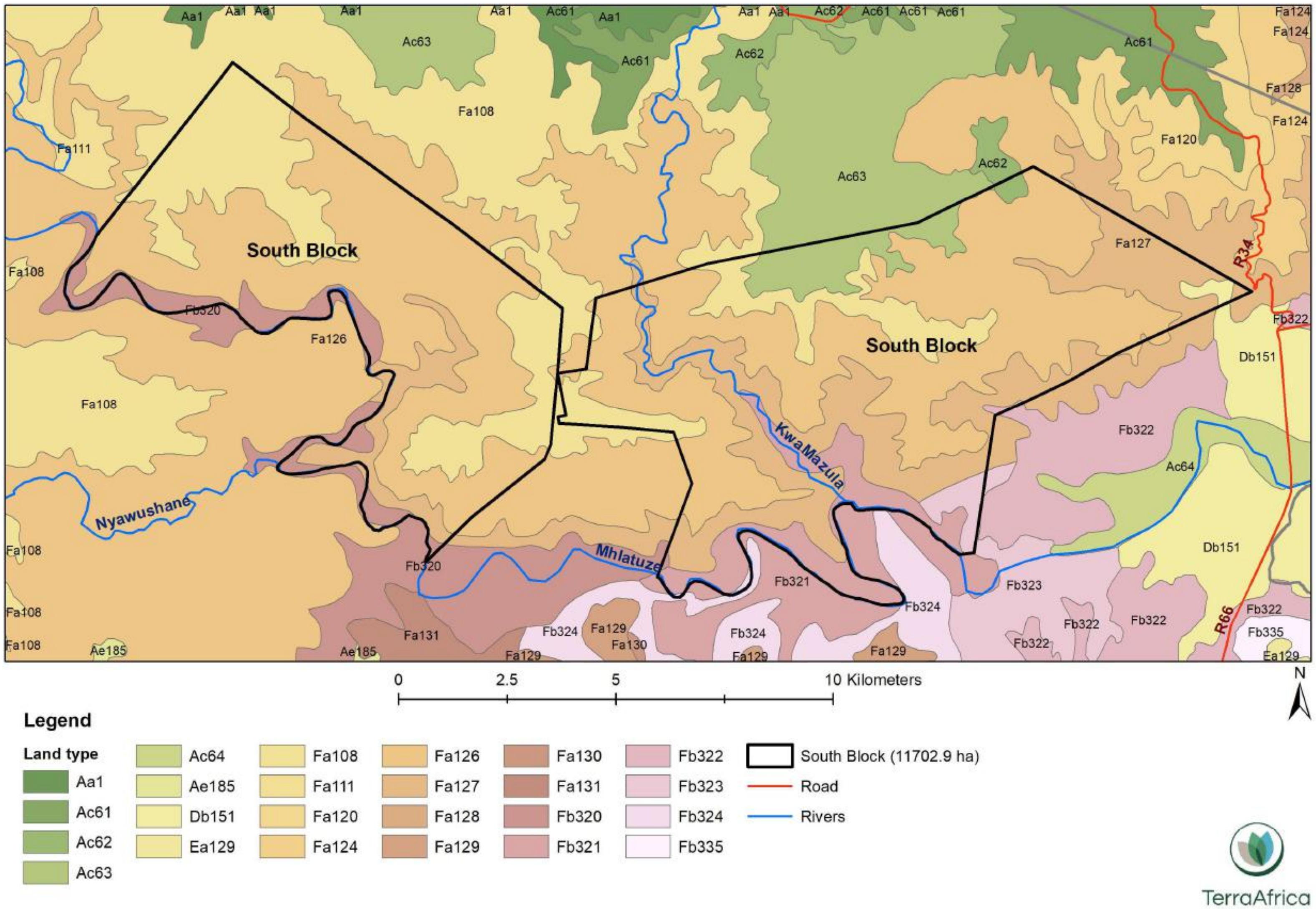

Figure 6 Land type classification of the South Block and surrounding area

8.1.1 Land Type Ac62 Disaggregation

The land type occupies 30.25 ha (0.3% of the South Block) and is situated in the north-eastern corner (Figure 7). The land type is dominantly on the TMU 1, with a portion on the TMU 3 position. These are slopes of 2%-6% (TMU 1) and 6%-10% (TMU 3). The soil distribution on the TMU 1 and 3 are similar and the soils are dominated by apedal soil types. Soils within this land type has relatively high clay contents. The TMU 5 is dominated by streams and Katspruit soil. Deep red apedal soils (Hutton and Griffin) dominate the land type representing 50% of the TMU 1 and 3 positions, all of which are classified as having a very high agricultural protentional. The Glenrosa soils are relatively shallow depths which limit the soil capability. The observations made within the land type during the site survey, support the data of the land type inventory. The only exception is the Glenrosa soil observations within the study area. These soils have a weathered lithic horizon that can be penetrated by roots and thus higher agricultural potential. Therefore, Glenrosa soil forms within fields dominated by apedal soils would not drastically reduce the agricultural productivity.

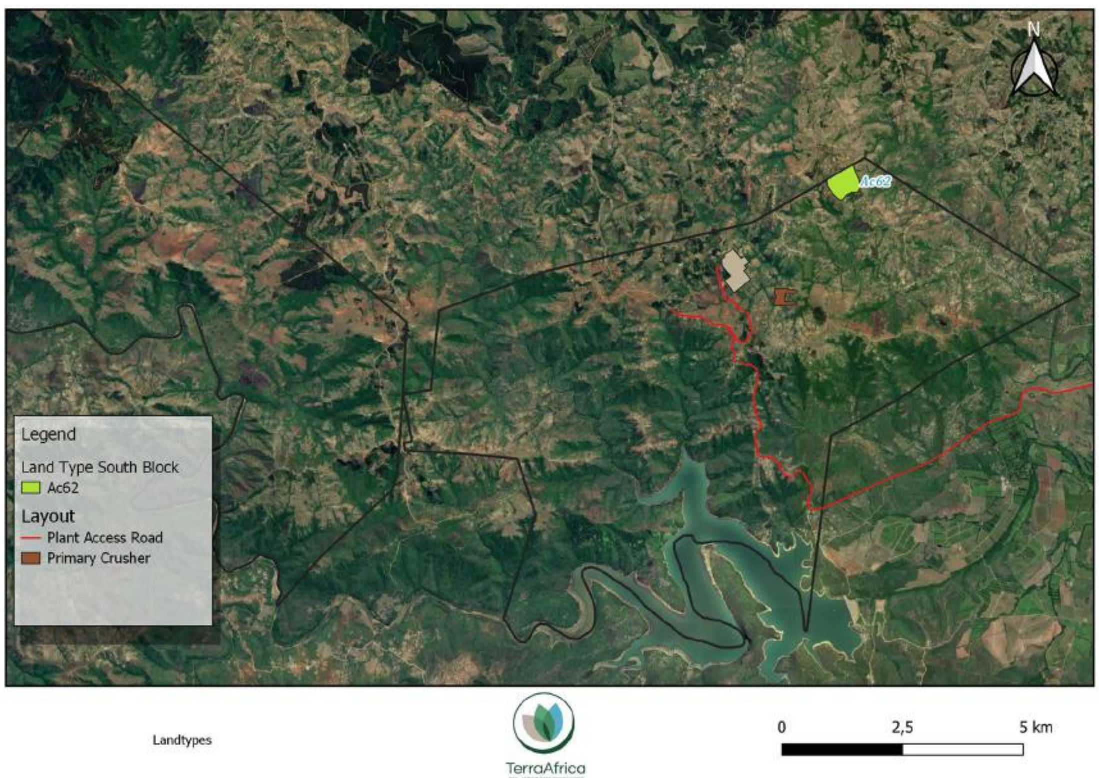

Figure 7: The location of Ac62 in the South Block

8.1.2 Land Type Ac63 Disaggregation

The land type occupies 371.5 ha (3.2% of the South Block) and is situated along the middle of the northern boundary of the eastern part (Figure 8). The land type is predominantly located on the TMU 3 position at slopes of 10-20%. The dominant soil form of this land type is Hutton soils. Apart from the Hutton soils, the rest of the soil forms are relatively shallow. The valley bottoms are dominated by the Katspruit soils.

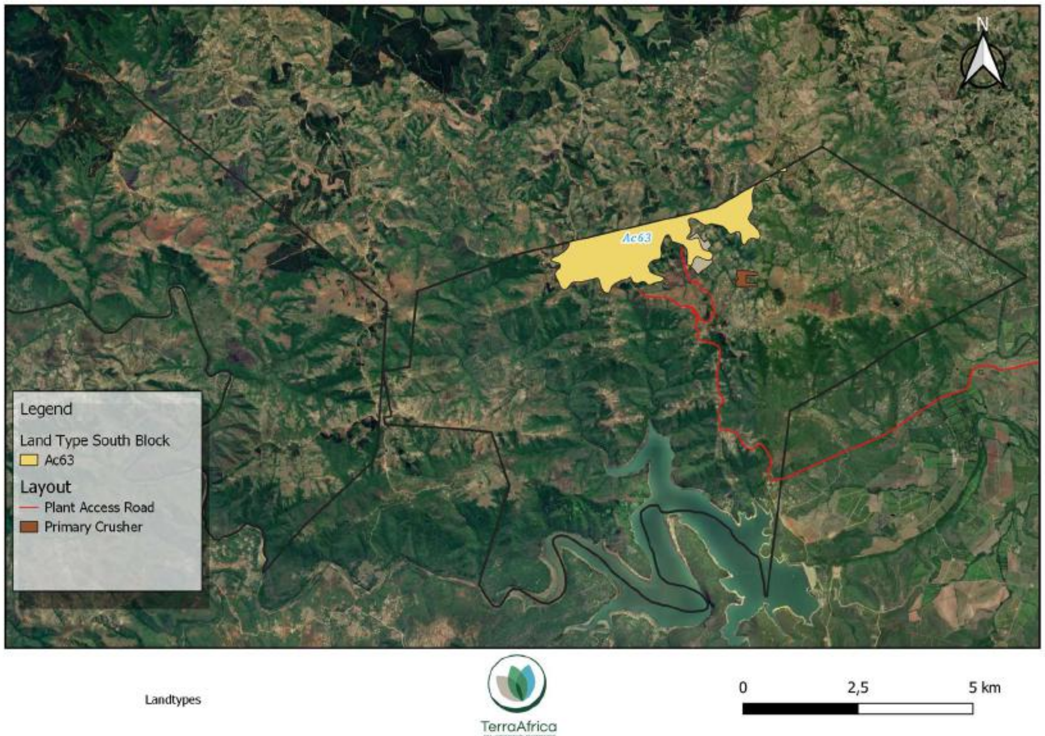

Figure 8: The location of Ac63 in the South Block

8.3.3 *Land Type Db151 Disaggregation*

The land type occupies 39.1 ha and is situated in the east corner (Figure 9).

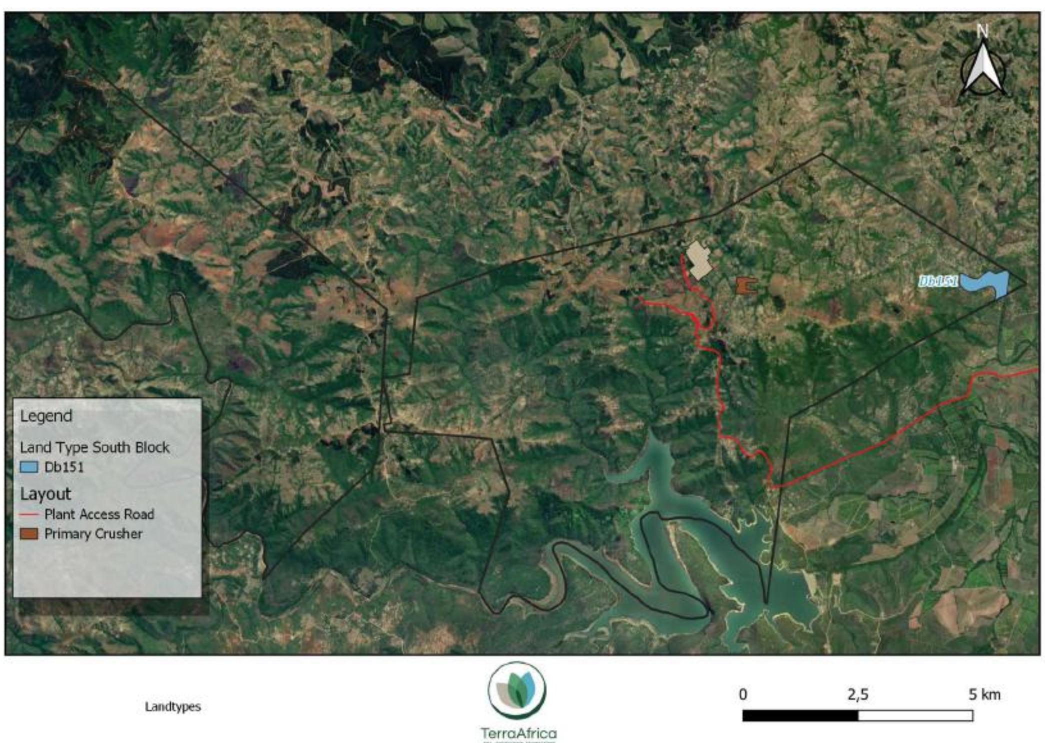

Figure 9: The location of Db151 in the South Block

The land type is predominantly on the TMU 3 position (90%) at slopes of 1-13%. The dominant soils are pedocutanic soils of the Valsrivier and Swartland forms. Hutton and Shortlands are also present in smaller areas of the land type area. The valley bottom has a combination of different soils.

8.3.4 Land Type Fa108 Disaggregation

The land type occupies 2051.9 ha and is situated across the area (Figure 10).

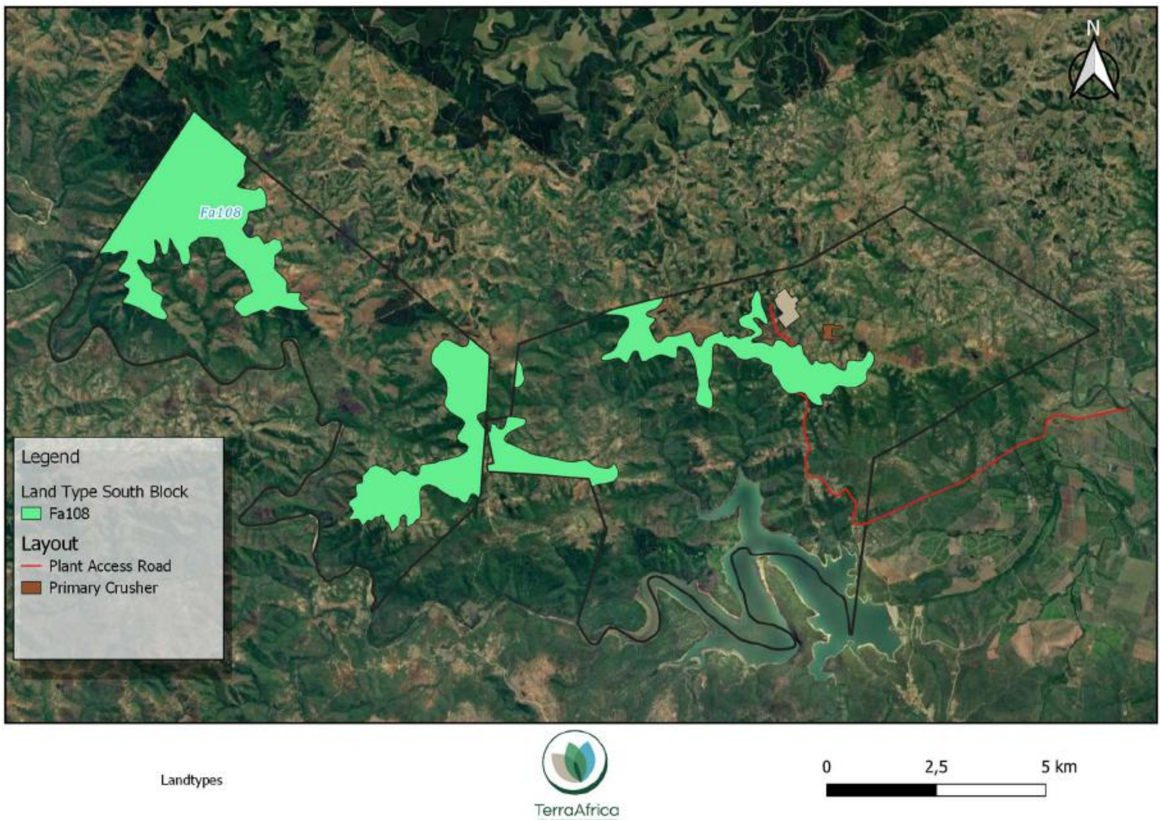

Figure 10: The location of Fa108 in the South Block

It is the third largest land type in the South Block. The land type is predominantly on the TMU 3 position (80%) at slopes of 20-100%. Hutton and Shortlands occupy >60% of soils the land type. Glenrosa is prominent are prominent on TMU 1. The valley bottom has a variety of soils, but Dundee and Oakleaf are characterized by not being saturated. Saprolite is the dominant material underlying the soils. Red soils dominate the land type on the TMU 3 position, while the valley bottom is difficult to distinguish a dominant soil type, with 2/3 of the soils not being saturated.

8.3.5 Land Type Fa126 Disaggregation

The land type occupies 5884.6 ha (50.2% of the South Block) and is situated across the area (Figure 11).

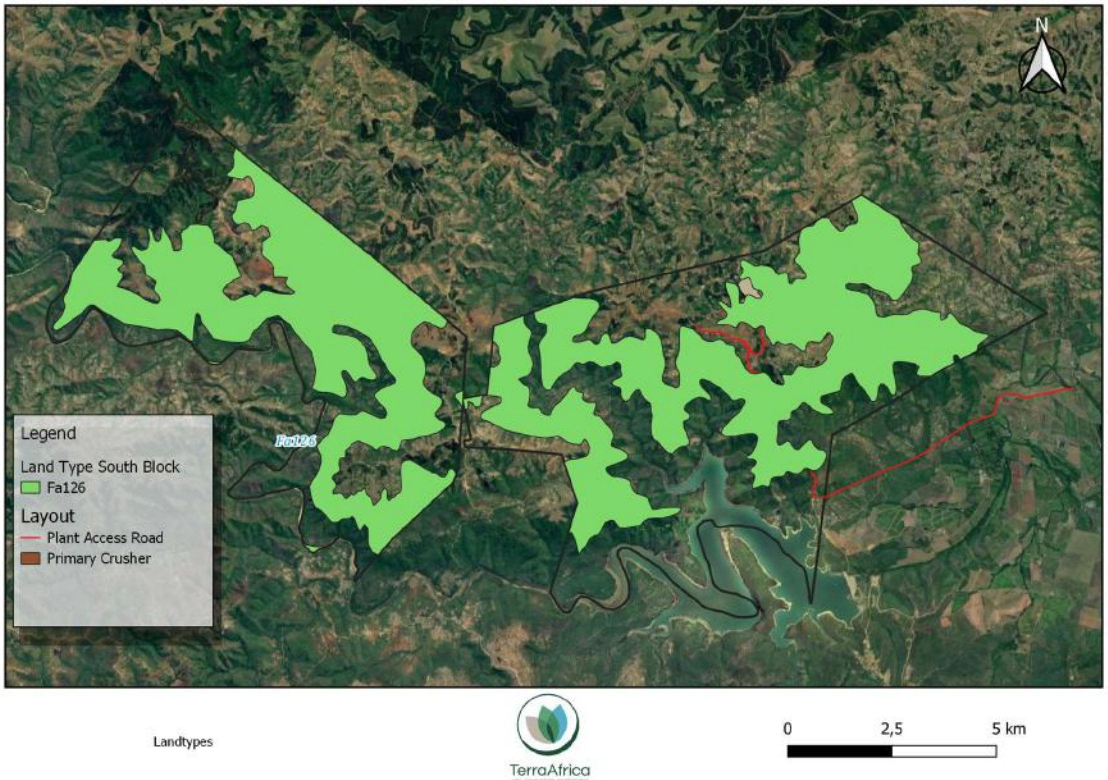

Figure 11: The location of Fa126 in the South Block

It is the largest land type in the South block. The land type is predominantly on the TMU 3 position (77%) at slopes of 6-90%. Hutton and Shorts occupy >60% of soils the land type. Glenrosa soils are prominent on TMU 1. The valley bottom has a variety of soils, but Dundee and Oakleaf are characterized by not being saturated. Saprolite is the dominant material underlying the soils. Red soils dominate the land type on the TMU 3 position, while the valley bottom is difficult to distinguish a dominant soil type, with 2/3 of the soils not being saturated.

8.3.6 Land Type Fa127 Disaggregation

The land type occupies 2215.6 ha (18.8% of the South Block) and is situated across the area (Figure 12). It is the second largest land type in the South Block. The land type is predominantly on the TMU 3 position (95%) at slopes of 12-45%. All the soils are very shallow. Katspruit is the only soil on the TMU 5 (valley bottoms). Glenrosa and Mispah soils dominate the land type on the TMU 3 position, while the valley bottom only has Katspruit soils. The shallow Hutton soils overlying saprolite would have the same properties as the Glenrosa.

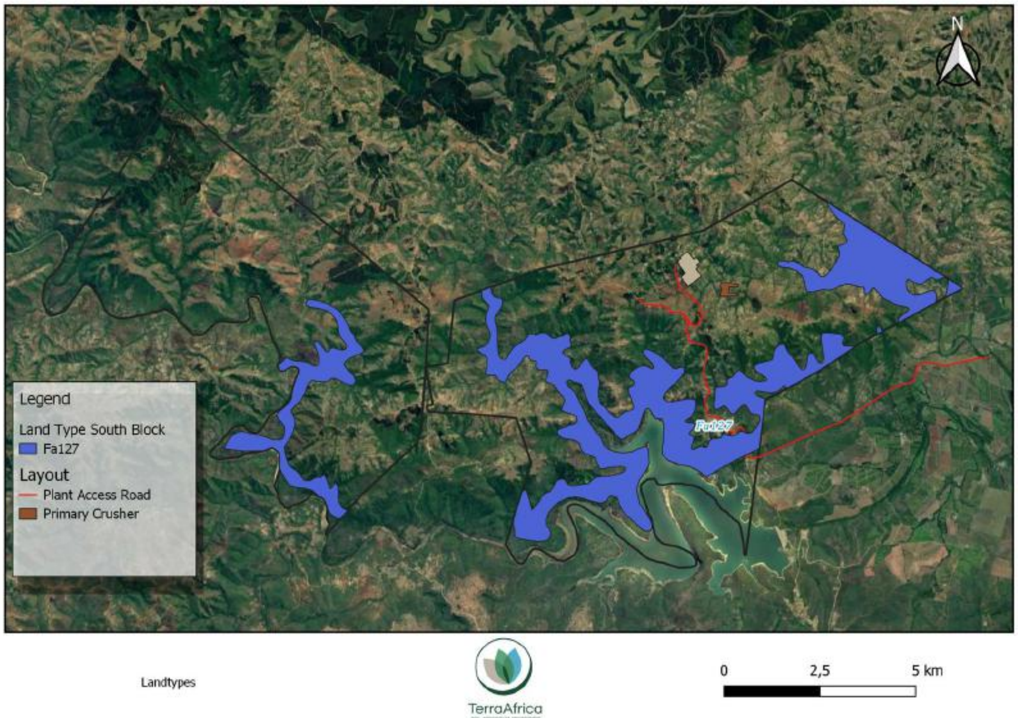

Figure 12: The location of Fa127 in the South Block

8.3.7 Land Type Fb320 Disaggregation

The land type occupies 272 ha (2.3% of the South Block) and is situated in the west of the area (Figure 13).

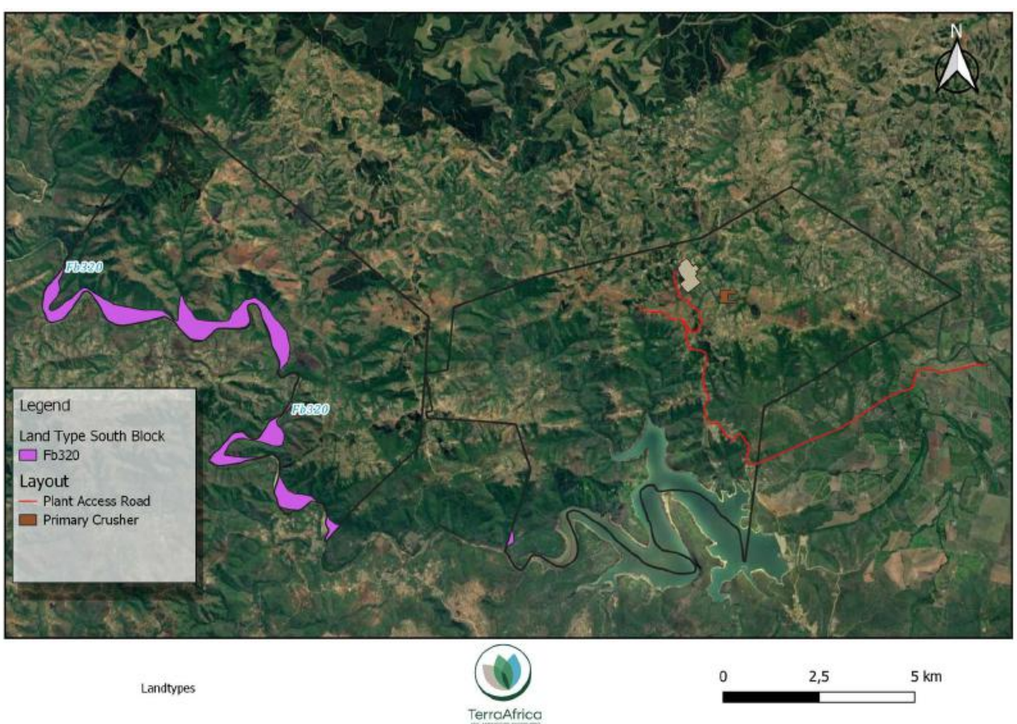

Figure 13: The location of Fb320 in the South Block

It is a relatively small land type in the South block. The land type is predominantly on the TMU 3 position (72%) at slopes of 3-30%, but 20% of the land type is on the TMU 5. The TMU 3 is dominated by shallow soils. Structureless Oakleaf and Dundee soils dominate the TMU 5. Glenrosa and Mispah soils dominate the land type on the TMU 3 position, while the valley bottom has Oakleaf and Dundee soils.

8.3.8 Land Type Fb321 Disaggregation

The land type occupies 610.4 ha (5.2% of the South Block) and is situated in the south of the eastern part of the South Block (Figure 14). The land type is predominantly on the TMU 3 position (75%) at slopes of 3-12%, but 20% of the land type is on the TMU 5 (valley bottoms). The TMU 5 includes a section of the dam as this is also located in a valley bottom area. The TMU 3 is dominated by shallow soils. The valley bottom has a variety of soils, but Dundee and Oakleaf are characterized by not being saturated. Glenrosa and Mispah soils dominate the land type on the TMU 3 position, while the valley bottom has Oakleaf and Dundee soils.

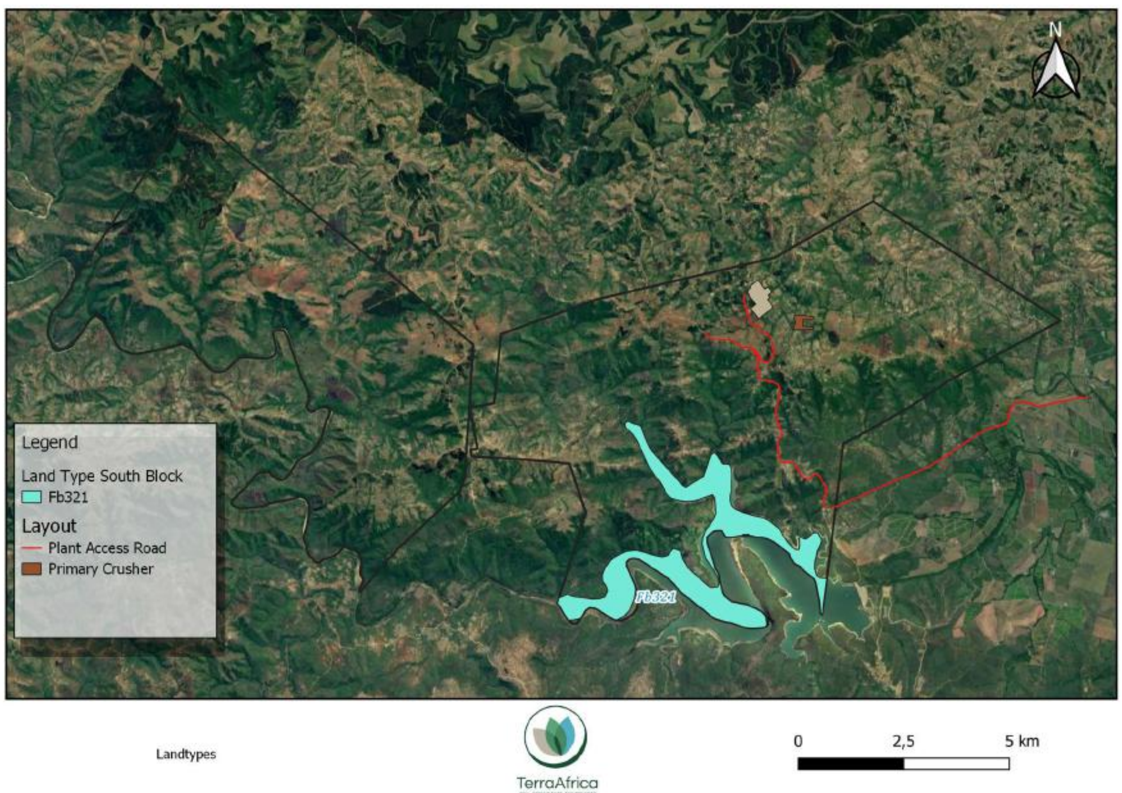

Figure 14: The location of Fb321 in the South Block

8.3.9 Land Type Fb322 Disaggregation

The land type occupies 9.9 ha (0.1% of the South Block) and is situated in the southeast of the area (Figure 15). It is a small land type in the South block. The land type is predominantly on the TMU 3 position (87%) at slopes of 3-12%, but 10% of the land type is on the TMU 1. The TMU 3 is dominated by shallow soils, with Hutton soils in between. The valley bottom has a variety of soils, both structured and saturated. Glenrosa and Mispah soils dominate the land type on the TMU 3 position, while the valley bottom largely has structured soils.

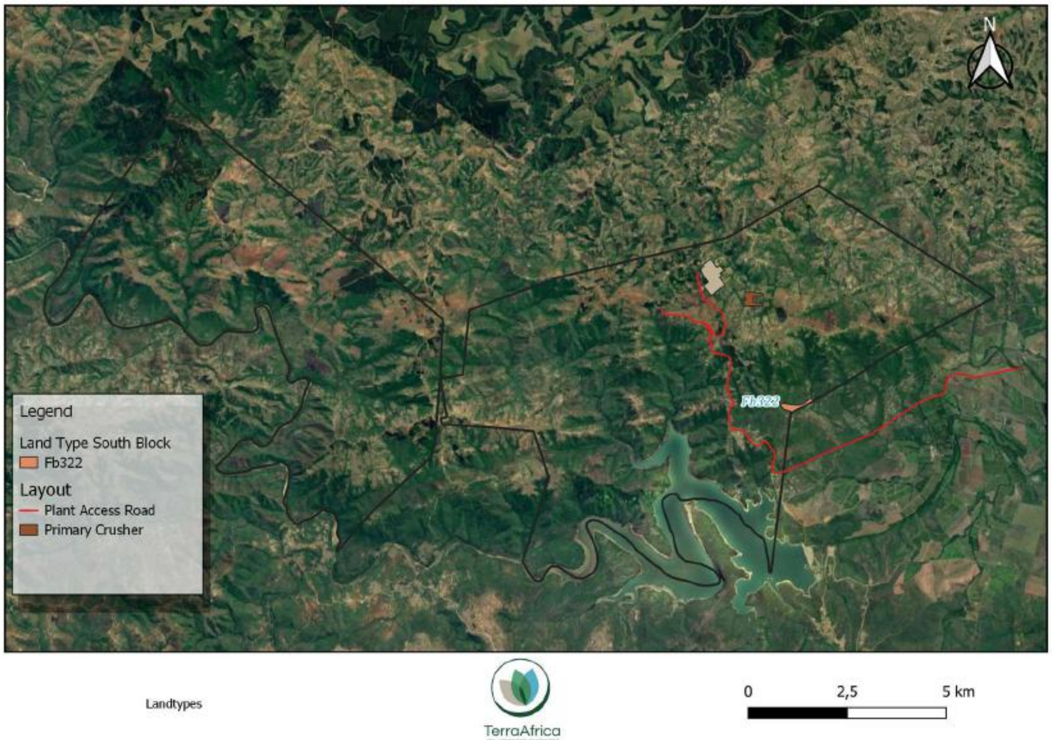

Figure 15: The location of Fb322 in the South Block

8.3.10 and Type Fb323 Disaggregation

The land type occupies 108.3 ha (Figure 16).

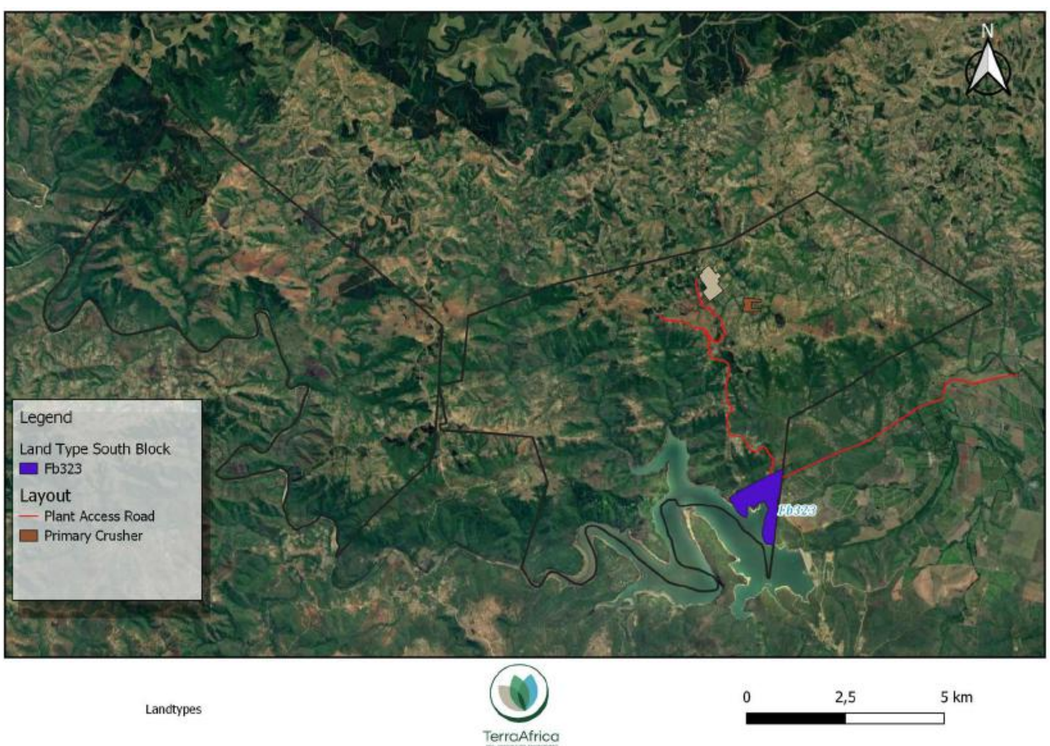

Figure 16: The location of Fb323 in the South Block

The land type is predominantly on the TMU 3 position (80%) at slopes of 3-50%, but 13% of the land type is on the TMU 1. The TMU 3 is dominated by shallow soils, with Hutton soils in between. The valley bottom has a variety of soils, both structured and saturated. Glenrosa and Mispah soils dominate the land type on the TMU 3 position, while the valley bottom largely has structured soils.

8.2 Soil properties

8.2.1 Introduction to soil associations

South Africa has a rich history of soil classification, and the classification system has been adapted through the years. The latest edition of the soil classification system is the third time the system has been updated. The number of soil forms have increased with newer editions which has led to better accuracy when describing soils. The disadvantage of adding new soil forms and keeping older names, is that it can be difficult to reconcile older databases with new classifications. The Land Type data (described in Section 8.1) was classified with the soil forms of the Soil Classification: A binomial system for South Africa (MacVicar et al., 1977)), which was followed by the Soil Classification: A taxonomoic system for South Africa (Soil Classification Working Group, 1991). The soil classification of the South Block was done using the most recent system, referred to as Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018).

To illustrate how the increased number of soil forms now part of the classification system, can still be considered together with the original soil forms described in the Land Type data, the example of subdivision of the original Hutton soil form, is illustrated in Table 4. The soil form initially called "Hutton" (MacVicar et al., 1977), can now either be called Hutton, Nkonkoni or Vaalbos (Soil Classification Working Group, 2018) depending on the effective depth of the profile and the nature of the underlying material.

Table 4: Subdivision of Hutton soil form (1977) into soil forms according to the 2018 classification system

Soil form (2018)	Brown Book	Description	Soil Association
Nkonkoni	Hutton (with limited soil depth)	The Nkonkoni soils consist of orthic topsoil, overlying red apedal subsoil that is limited in depth at 1500 mm or shallower by lithic material	Hutton
Vaalbos	Hutton (with limited soil depth)	The Vaalbos soils consist of orthic topsoil, overlying red apedal subsoil that is limited in depth at 1500 mm or shallower by solid and/or fractured hard rock	Hutton
Hutton	Hutton (with limited soil depth)	The Hutton soils consist of orthic topsoil, overlying red apedal subsoil that is 1500 mm or deeper	Hutton

Variation within the disaggregated polygons is expected, due to the scale of the Land Type data. Generally, the variation can be explained by classification (see above) or by micro elements influencing the classification. These variations in morphology, which are important for classification, often do not change the land capability. Therefore, the interpretation and impact remain the same. This was also the case within the South Block where any variation between the disaggregated land type data and the soil classification results, have no effect on the rating of the land capability of the area.

8.2.1 Soil forms

To accommodate the recent soil form differentiation with the soil data of the Land Type data sheets, soil associations were used to group soil forms with similar properties together. Following the combination of the soil survey results and the land type disaggregation, eight main soil association are found within the South Block (see Figure 17). The eight associations are named after the most prevalent soil form in the group i.e. Glenrosa, Hutton, Katspruit, Dundee, Mispah, Oakleaf, Swartland and Valsrivier.

Seven of the eight soil associations are present within and around the infrastructure footprint, only the Valsrivier association is outside of the development footprint (see Figure 18). The Glenrosa group is the most prevalent in the South Block, followed by the Hutton group and then the Mispah group. Much smaller areas of the Katspruit, Dundee, Oakleaf, Swartland and Valsrivier groups are present in mainly valley bottom areas. The Glenrosa association consists of the Glenrosa and Nomanci soil forms with both these soils consist of topsoil (orthic for Glenrosa and humic for Nomanci) that overlies lithic material. The Hutton association includes several soil forms i.e., Shortlands, Clovelly, Ermelo, Hutton, Nkonkoni, Griffin, Magwa, Inanda, Magudu and Gangala

The Katspruit and Dundee association are associated with areas next to the river and streams (valley bottoms). The Dundee group consists of the Dundee and Fernwood soil forms. While the Katspruit soils indicate areas with saturated soil profiles, about 66% of the Dundee group's soils are not water saturated. The Oakleaf soil category, consisting of the Tubatse and Henley soil forms are found at elevations directly above that of the Katspruit and Dundee soil groups. The Tubatse and Henley soils have either an orthic or humic horizon overlying a neocutanic horizon.

The properties of the soil forms identified during the survey and the associations into which they are grouped, are described in Table 5.

Table 5: Properties of soil forms identified during the site survey

Soil form (2018)	Description	Soil Association
Nomanci (No)	The Nomanci soil form consists of a humic topsoil horizon overlying a lithic subsoil horizon. The humic topsoil horizon is 300 mm deep and the lithic defined as saprolithic. The Nomanci is found on two terrain positions within the South Block, i.e. valley bottoms and crests.	Glenrosa
Shortlands (Sd)	The Shortlands soil form consists of an orthic topsoil horizon overlying a red structured horizon. The red structured horizon has strong structure and was homogenous in colour. The red structured is mesotrophic with a CEC between 5-15 cmol/kg soil.	Hutton
Clovelly (Cv)	Chromic topsoil, with yellow-brown between 500-1000 mm soil depth. The yellow-brown apedal was aluvic and mesotrophic. The lithic horizon is defined as saprolithic.	Hutton

Ermelo (Er)	The Ermelo has a chromic topsoil and reaches depths to 1200 mm and was only found in small areas. The Ermelo soil was aluvic, indicating that water will drain freely.	Hutton
Glenrosa (Gs)	Chromic topsoil is found in the development area. Total soil depths are between 100-400 mm, the difference in depth was mainly due to degree of weathering in the lithic. The Glenrosa is found in the Talus of the slope.	Glenrosa
Mispah (Ms)	The Mispah soil had a chromic topsoil with rock on the surface. The Mispah was found close to the Dundee soil forms which leads to the river.	Mispah
Hutton (Hu)	A chromic topsoil is found in the Hutton soils. The red apedal has a 5YR 4/6 Munsell colour and a soil depth of 1200 mm. The red apedal was aluvic. Freely drained to 1200 mm supported by the weak structure of the red apedal.	Hutton
Nkonkoni (Nk)	The Nkonkoni had a chromic topsoil, red apedal thickness between 500-1000 mm. The red apedal was aluvic. Water will drain freely to the lithic horizon.	Hutton
Fernwood (Fw)	The Fernwood soil forms has a chromic topsoil and a depth of 1200 mm. A Fernwood consists of an orthic A overlying an albic horizon. The soil was found close to the river and is found at the footslope.	Mispah
Longlands (Lo)	The Longlands soil form has a chromic topsoil. The Albic horizon was unsaturated. The albic had a depth of 700 mm whereafter a soft plinthic horizon is found. The Longlands is found higher up in the elevation profile.	Katspruit
Dundee (Du)	The Dundee soil has a chromic topsoil with a brown alluvial. Alluvial wetness was not present. The Dundee occurs in the valley bottom.	Mispah
Griffen (Gf)	The Griffen soil form consists of an orthic A overlying a yellow-brown with a red apedal underneath. The yellow-brown is mesotrophic, aluvic and has a depth of 500 mm. The Griffen is only found on a small area.	Hutton
Magwa (Ma)	The Magwa soil form consists of a humic A, overlying a yellow-brown apedal. The humic was thin and the yellow-brown aluvic. The Magwa is only found on two places, which occur higher up in the elevation profile.	Hutton
Inanda (Ia)	The Inanda soil form has the same properties as the Magwa,with the yellow-brown being a red apedal.	Hutton
Magudu (Md)	The Magudu soil form is found between the Glenrosa soil forms, which occur higher up in the elevation profile. The Magudu consists of an orthic A, overlying a red structured with a saprolithic underneath. The red structured has depths up to 700 mm. The orthic was chromic and the red structured mesotrophic.	Hutton
Gangala (Ga)	The Gangala soil form consists of an orthic A, overlying a red apedal, with a lithic underneath. The Gangala is only found in one small area within the processing plant. The red apedal has a depth to 450 mm, whereafter the lithic horizon occurs.	Hutton
Tubatse (Tb)	The Tubatse soil form has a chromic topsoil, with a brown, aluvic neocutanic and a saprolithic horizon underneath. The Tubatse occurs in various areas of the development. The neocutanic has a depth of 400-1200 mm.	Oakleaf
Henley (He)	The Henley soil forms has the same characteristics as the Tubatse with only the A horizons being different. The Henley has a humic horizon overlying the neocutanic (700-800 mm depth). The lithic horizon is also saprolithic.	Oakleaf

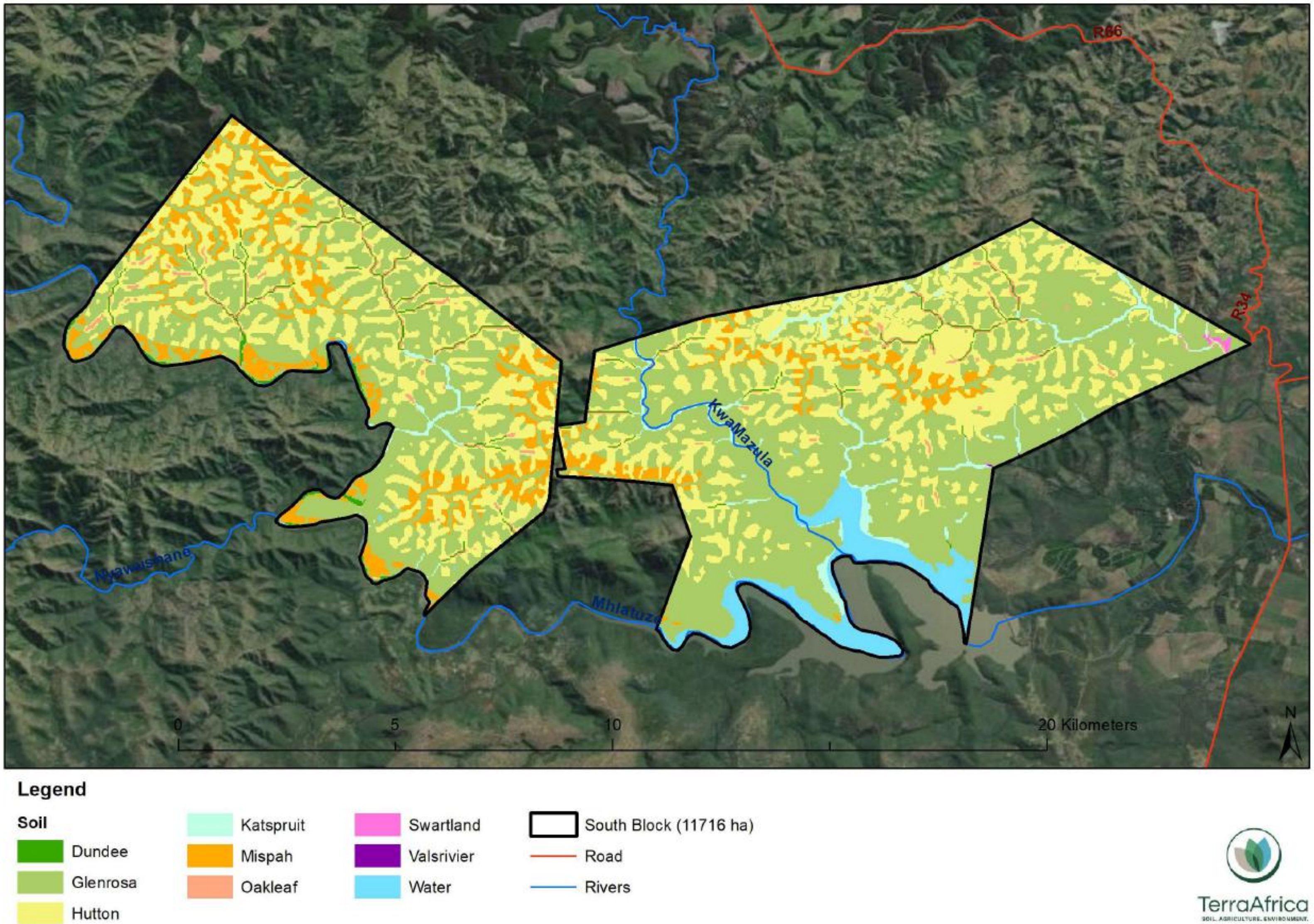

Figure 17 Soil classification map of the South Block

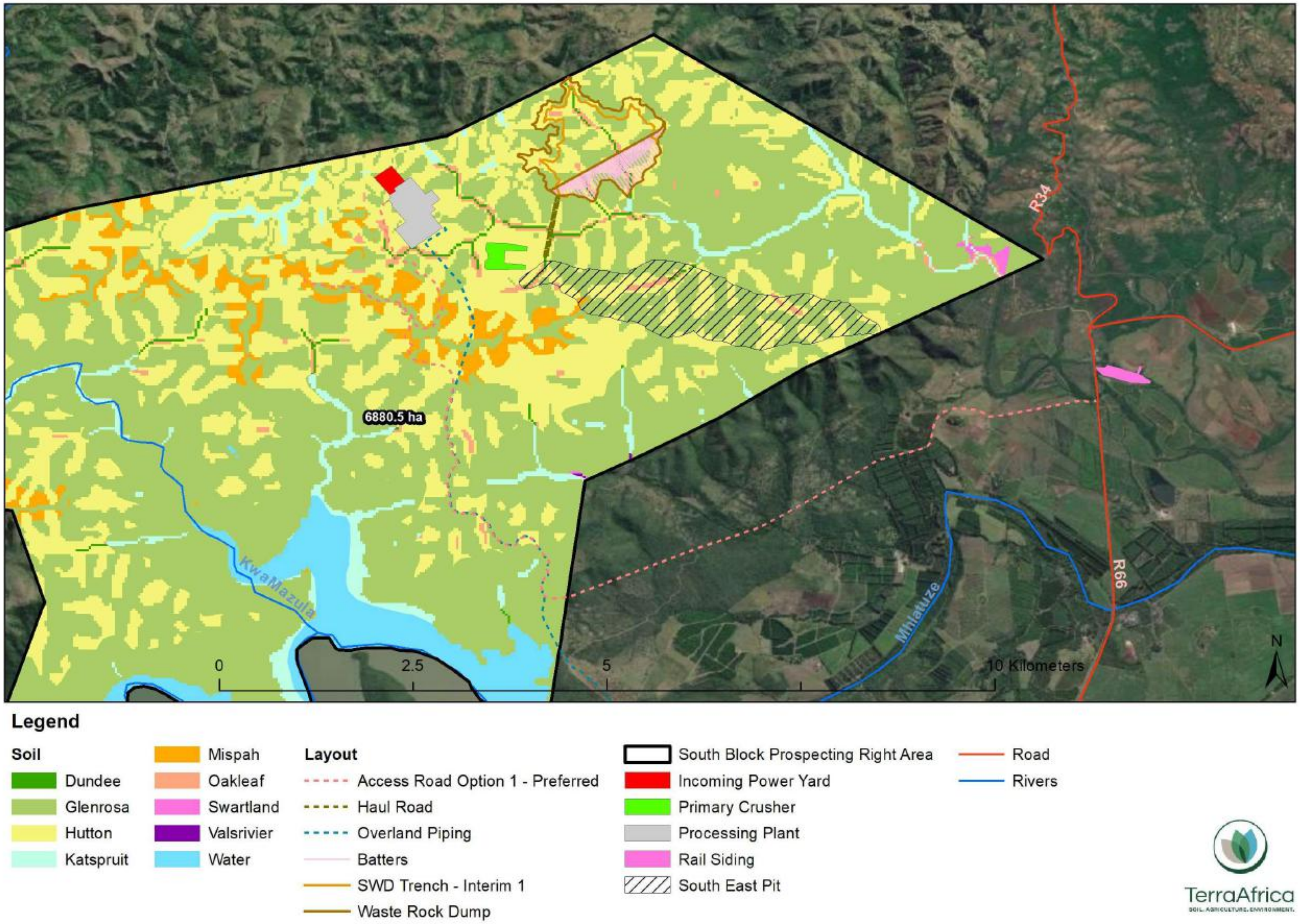

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Figure 18 Infrastructure layout superimposed on the soil classification map

Figure 19 Glenrosa soils with red chromic topsoil (left) and bleached topsoil (right)

Figure 20 Hutton soil profile within the South Block

Figure 21 Griffin soil profile within the South Block

Figure 22 Soil forms of the Dundee group consisting of Dundee soils (left) and Fernwood (right)

Figure 23 Tubatse soil profile within the South Block

8.2.2 Results of soil analysis

Soil sampling for laboratory analysis was done per individual horizon (red apedal, yellow-brown apedal, red structured orthic and humic) and not per soil form as different soil forms contain the same horizon e.g. a Clovelly and a Ermelo both have a orthic overlying a yellow-brown apedal. Additionally, soil samples were taken in areas which may have the potential for agricultural activity. It is for this reason the albic and alluvial horizon was not sampled as these horizons occur in the pathway of rivers or streams where the potential for agriculture would not be viable. More topsoil horizons were taken as most of the area had shallow soil depths of the Glenrosa, which consist of an orthic overlying a lithic horizon.

a) *Soil texture*

The soil texture of the soils present within the proposed project site, was calculated by using the results of the particle size analysis for the soil texture triangle formulas as provided on the website of the United States Department of Agriculture's under Natural Resource Conservation Services (Soil) (www.nrcs.usda.gov). The results of the particle size analysis of the soil samples as well as the soil texture class into which results translate, are presented in Table 6 below. Following the results, the topsoil samples analysed within have mostly Sandy Clay Loam texture, with only a few samples having Clay Loam and Clay texture. The subsoils have Sandy Clay Loam, Clay and Clay Loam texture.

Table 6: Summary of particle size distribution and soil texture classes of the soil samples analysed

Sample no		Horizon	Particle size distribution			Texture class
			Sand	Silt	Clay	
E4 A	Topsoil	orthic	63,4	13,3	23,7	Sandy clay loam
E4 B	Subsoil	red apedal	46,7	23,6	30,6	Sandy clay loam
E6 B	Subsoil	Yellow-brown	39,9	25	35,4	Clay loam
E7 A	Topsoil	orthic	43,6	21,6	35	Clay loam
E9 A	Topsoil	orthic	46,3	21,8	32,2	Sandy clay loam
E13 A	Topsoil	orthic	54,3	18,6	28	Sandy clay loam
E17 B	Subsoil	red structured	11,2	38	50,9	Clay
E32 A	Topsoil	humic	71,9	11,9	16,5	Sandy loam
E47 A	Topsoil	orthic	12,7	26,4	61,9	Clay
E49 A	Topsoil	orthic	49,5	18,6	32,6	Sandy clay loam
E54 A	Topsoil	orthic	66,4	10,8	23,2	Sandy clay loam
E76 A	Topsoil	orthic	32,2	27,8	40,5	Clay

b) Soil fertility parameters

The results of the soil chemical analysis are presented in Table 7.

Table 7 Results of soil chemical analysis of samples

Sample ID	Lab nr	Horizon	pH KCl	P (Bray 1)	Ca	Mg	K	Na	S
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
E4 A	742	orthic	4,17	4,04	196,95	34,43	35,77	5,46	9,02
E4 B	743	red apedal	4,13	3,60	22,73	39,94	17,37	26,87	31,64
E6 B	744	Yellow-brown	3,82	4,08	313,31	132,02	43,27	8,45	11,44
E7 A	745	orthic	4,20	5,10	1419,82	526,62	323,09	11,77	8,50
E9 B	746	orthic	3,91	5,22	473,64	153,33	31,87	75,32	6,02
E13 A	747	orthic	3,32	5,44	248,93	111,87	58,68	4,16	17,61
E17 B	748	red structured	4,01	2,84	718,23	661,82	594,45	140,08	16,01
E32 A	749	humic	4,77	63,84	927,48	205,14	286,43	8,87	22,59
E47 B	750	orthic	3,28	2,74	362,15	209,34	29,22	18,08	55,75
E49 A	751	orthic	3,79	7,20	1038,50	305,81	201,56	22,40	6,20
E54 A	752	orthic	4,94	8,52	2937,48	580,09	104,67	4,82	18,55
E76 A	753	orthic	4,15	4,66	1660,21	517,12	30,78	10,99	16,77

From the perspective of the soil fertility parameters analysed, the soil does have limitations to crop production. The soil pH(KCl) values are strongly acidic with a pH of 3.32 in sample E13 to 4.94 in sample E54. For crop production, pH values above 4.5 are recommended to prevent aluminium toxicities, prevent phosphate fixation, and allow for optimal nutrient uptake by crop roots. Thus, should the soil have been used for crop production, only the areas where samples E54 and E32 were collected, would have been suitable for crop production without soil amendment. The rest of the areas where samples were collected, are a risk to aluminium toxicity and nutrient deficiencies from nitrogen, calcium, magnesium, and phosphate. Large volumes of lime would be needed to amend the soil pH. This will be challenging to do as a result of the cost associated with soil amendment and access limitations posed by the terrain.

The calcium levels range between 22.73 mg/kg in sample E4-B and 2937.48 mg/kg in sample E54-A. The magnesium levels are the lowest in sample E4-A (34.43 mg/kg) and highest in sample E17-B (661.82 mg/kg). The potassium levels range between a low of 17.37 mg/kg in sample E4-B and 594.45 mg/kg in sample E17-B. The cation concentrations (calcium, magnesium, and potassium) are present at sufficient concentrations should the soil have been used for crop production.

The plant-available phosphorus levels are low in all samples analysed excluding sample E32-A (63.84 mg/kg) and range between 3.60 mg/kg (sample E4-B) and 8.52 mg/kg (sample E54-A). The recommended concentration for maize is 17 mg/kg. Thus, indicating that all samples excluding E32-A are too low and would require additional fertilizer. Low soil phosphorus concentrations are typical of soils under natural vegetation (and without the addition of fertilizer) in South Africa.

8.3 Climate capability

The Department of Agriculture, Land Reform and Rural Development (2017) compiled an updated description of the agricultural suitability of South African climatic conditions, accompanied by a raster data layer of the entire country. The description of climate capability refers to a definition by Strydom (2014) that defines it as the “capability of a geographic area to grow an agricultural crop under existing climatic conditions” (DALRRD, 2017). The climate capability includes three parameters i.e., moisture supply capacity, physiological capacity, and climatic constraints. The climate capability classes range from 1 (the lowest or worst) to 9 (the highest or best climate for agricultural production).

According to the climate capability raster data, the entire South Block has High (Class 07) climate capability (refer to **Error! Reference source not found.**). This indicates that the climate of the area could be highly suitable for rainfed crop production.

Figure 24 Climate capability rating of the Jindal Melmoth Iron Ore project site (source: DALRRD, 2017)

8.4 Terrain capability

Similar to the climate capability data, the terrain capability data layer developed by DALRRD (2017), provides a range of terrain capabilities for the entire South Africa. The two main concerns embedded in the terrain capability modelling, is plant physiology and terrain sensitivity. The plant physiology component includes moisture accumulation and photosynthesis while the terrain sensitivity component includes mechanical limitations, flooding and erodibility. This, together with the climate and soil data of an area, contributes to the final land capability of an area. The terrain capability data has values of 1 to 9, with 1 being the lowest possible value and 9, the highest. However, no area in South Africa either has terrain capability of 1 or 9.

The terrain capability raster data shows that the largest part of the South Block has Class 3 (Low) terrain capability. Smaller areas with higher terrain capability that ranges from Class 4 (Low-Moderate) to High (Class 7) are interspersed between the land with Class 3 terrain capability. The higher terrain capability classes are associated with the small valley bottom areas and flatter areas in between the hills.

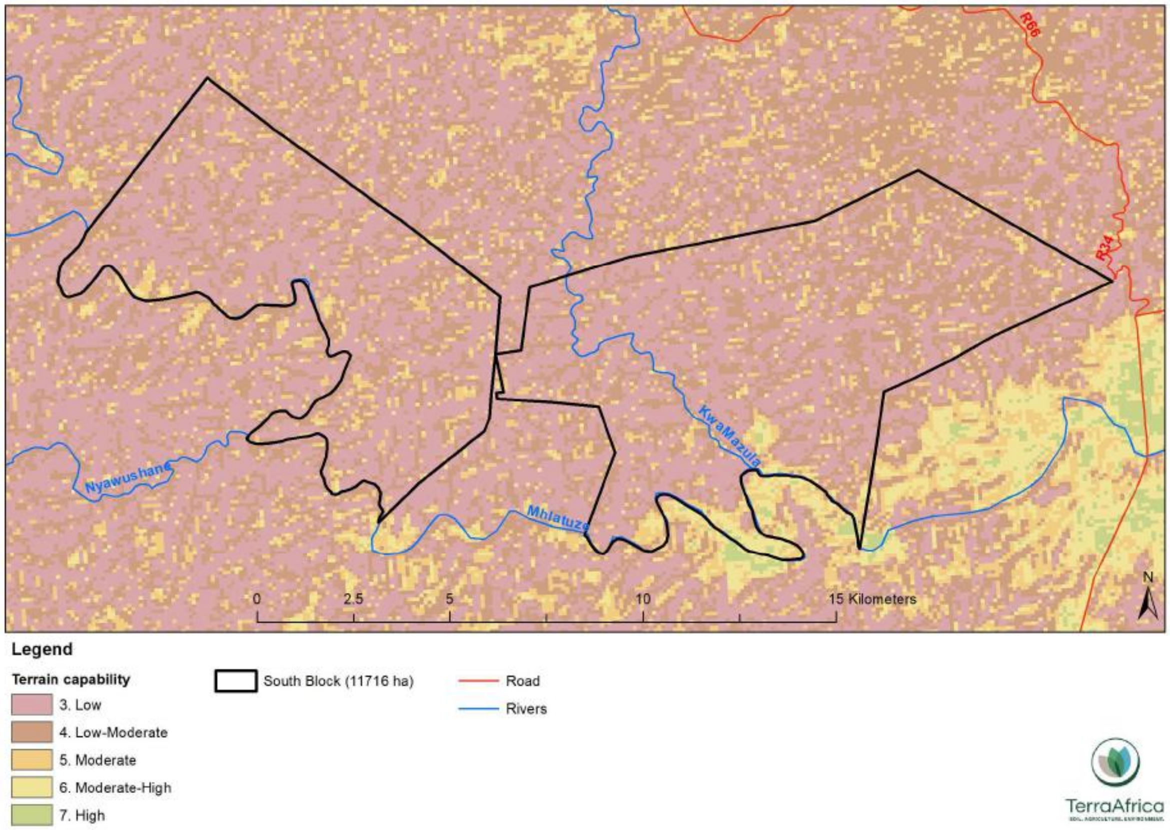

Figure 25 Terrain capability of the South Block area

8.5 Land capability

The final land capability classification of the South Block was developed by integration of the soil classification data (refer to Figure 17) and the terrain capability (refer to Figure 25). Since the climate capability of the entire area is high (refer to Figure 24), climate is not considered a restrictive factor to the land capability of the area. The result shows that the South Block area has five different land capability classes (see **Error! Reference source not found.**). The most prevalent land capability class is Class 5 (Low) where a combination of shallower soil profiles and steep slope limit the crop production potential of the land. These areas consist of the Glenrosa soil category and are more suitable for livestock grazing. The small areas consisting of Class 04 (Low-Very low) land capability, are the areas where the very shallow Mispah soils are present.

Several small, narrow areas with Class 6 (Low-Moderate) land capability, are associated with the Katspruit, Swartland and Valsrivier soils. Larger areas of Class 8 (Moderate) land capability are present where the Hutton, Dundee and Oakleaf soil groups occur in areas with lower terrain capability (Class 3 and Class 4). The small areas with Class 10 (Moderate-High) land capability that are the areas where the Hutton, Dundee and Oakleaf soil groups coincide with better terrain capability (Class 5, Class 6 and Class 7). The proposed infrastructure of the Jindal Melmoth Iron Ore project will affect land of all five of the land capability classes. This includes land with Class 10 and Class 8 land capability, with both classes considered suitable for rainfed crop production.

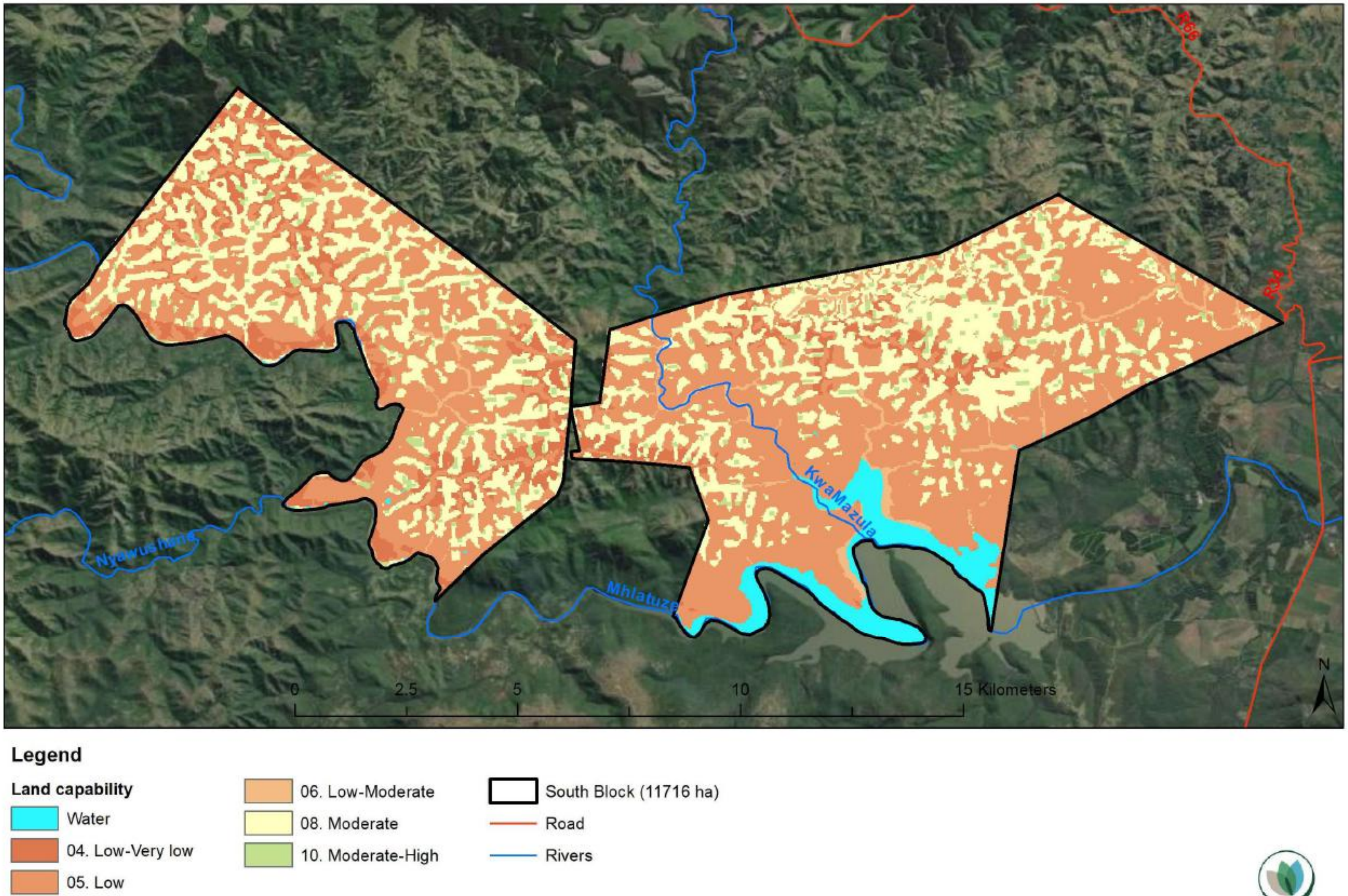

Figure 26 Land capability of the South Block

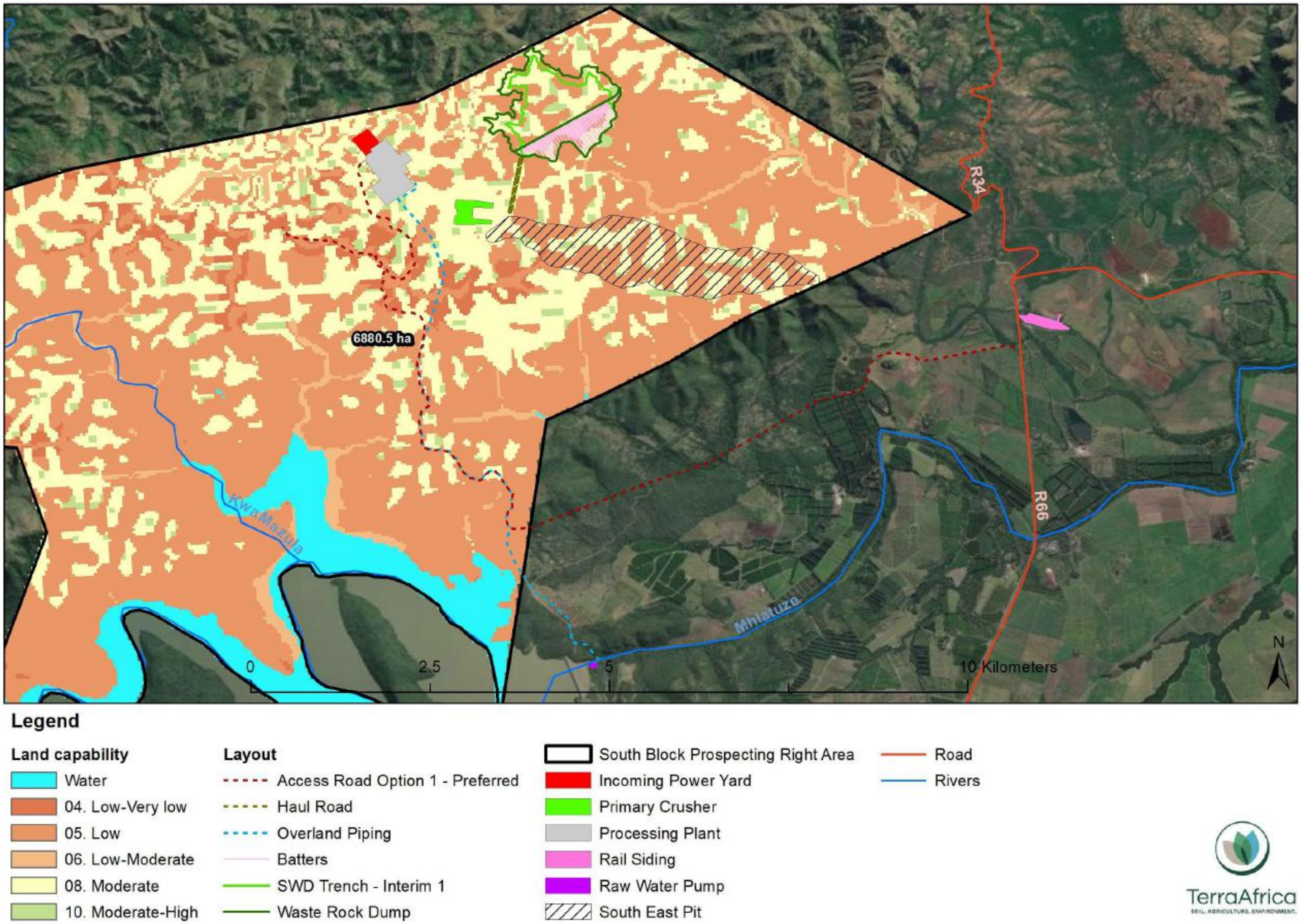

Figure 27 Proposed infrastructure layout superimposed on the land capability classification of the area

8.6 Land cover and land use

South African National Land-Cover 2020 (SANLC 2020) (GeoTerraImage, 2020) was compared to the 2014 Land Cover to determine if there was a land use change since 2014. The 2014 Land Cover is significant because it was used to calculate agricultural sensitivity in the screening tool.

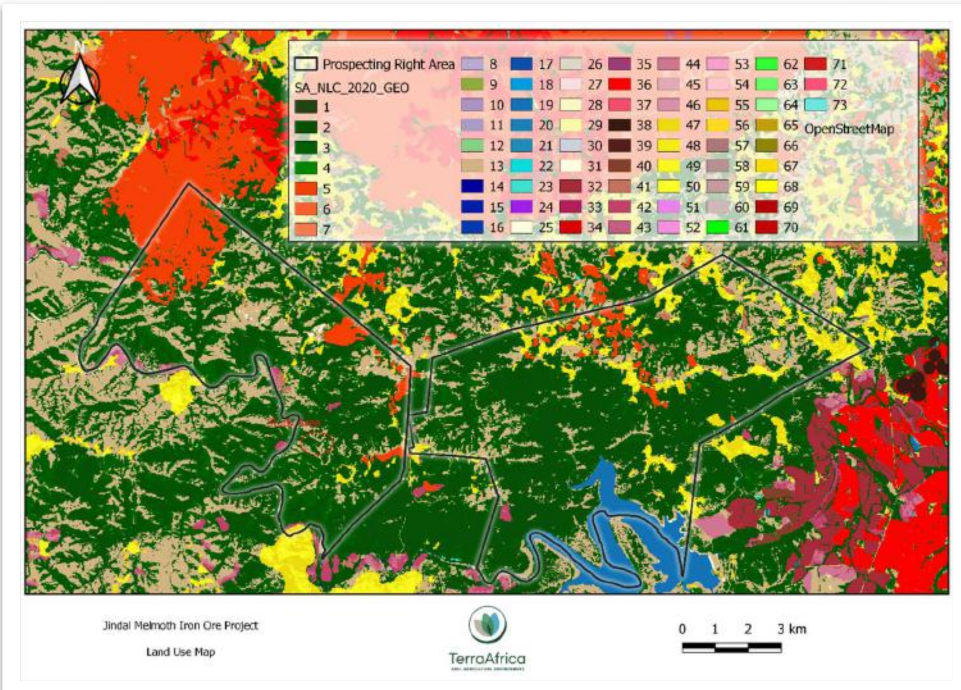

Figure 28: South African National Land-Cover 2020 (SANLC 2020)

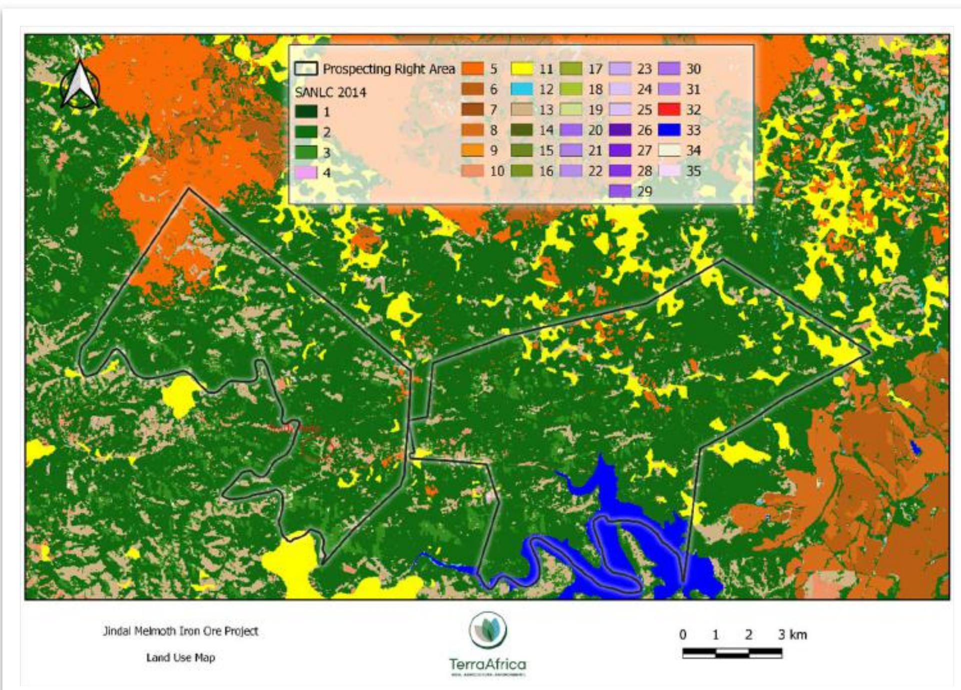

Figure 29: South African National Land-Cover 2014 (SANLC 2014)

The land use is very similar in 2014 and 2020 (Figure 28 and Figure 29). The area is large and vast, dominated by class 2 and 3 (Contiguous Low Forest & Thicket and Natural Grassland). The northeast has planted trees as a landcover, and small isolated areas scattered throughout the area. Class 41 (Subsistence Annual Crops) would also be considered areas where land cover indicates high sensitivity agricultural land use.

Table 8: Legend to Figure 28 (Land cover that falls within the South Block area)

No.	Class Name	Class Definition
2	Contiguous Low Forest & Thicket	Natural tall woody vegetation communities, with 75% or more canopy cover, and canopy heights exceeding 6 metres. Typically representative of tall, indigenous forests.
3	Dense Forest & Woodland	Natural tall woody vegetation communities, with canopy cover ranging between 35 - 75%, and canopy heights exceeding 2.5 metres. Typically represented by dense bush, dense woodland and thicket communities.
5	Contiguous & Dense Planted Forest	Dense to contiguous cover, planted tree forests, consisting primarily of exotic timber species, with canopy cover exceeding 35%, and canopy heights exceeding 2.5 metres. Typically represented by mature commercial plantation tree stands. This class also includes smaller woodlots and windbreaks, where they have been identified by the same spectral-based image modelling procedures used to detect the plantation forests.
13	Natural Grassland	Natural and/or semi-natural indigenous grasslands, typically devoid of any significant tree or bush cover, and where the grassland component is typically dominant over any adjacent bare ground exposure. Typically representative of low, grass-dominated vegetation communities in the Grassland and Savanna Biomes.
41	Subsistence Annual Crops	Active or recently active cultivated lands used for the production of agricultural crops, in this case specifically associated with small-scale commercial or subsistence-level annual crops, The plants only remain in the field for one growing seasons and one harvest, and are grown non-irrigated, rainfed fields.
47	Residential Formal (Tree)	Built-up areas primarily containing formally planned and constructed residential structures and associated utilities. The dominant vegetation (in gardens etc) is tree-based.
49	Residential Formal (low veg / grass)	Built-up areas primarily containing formally planned and constructed residential structures and associated utilities. The dominant vegetation (in gardens etc) is grass and/or low shrub based.

According to the field crop boundaries of the Crop Estimates Consortium (2019), the crop fields within the South Block area only consist of a few small areas of subsistence farming (shown in Figure 30). These subsistence farming fields are mostly scattered along the eastern part of the northern boundary as well as a small area along the western part of the southern boundary of the South Block. The subsistence farming areas within the South Block, are all classified as Subsistence Farming 1 which indicate that it is small scale or emerging farming where the output is produced primarily for home consumption (Crop Estimates Consortium, 2019). It consists of many small fields between 5 and 10 ha and it is difficult to distinguish between individual field crop boundaries within these areas. Subsistence Farming 1 areas are usually found close to small villages and in rangeland areas. More Subsistence Farming 1 areas are located outside the South Block, approximately 1.5 km or more to the north.

Subsistence Farming 1 differs from Subsistence Farming 2 in that Subsistence Farming 2 are associated with larger areas of production near commercial farming. The only Subsistence 2 areas indicated, are located at least 25 km southwest of the South Block area.

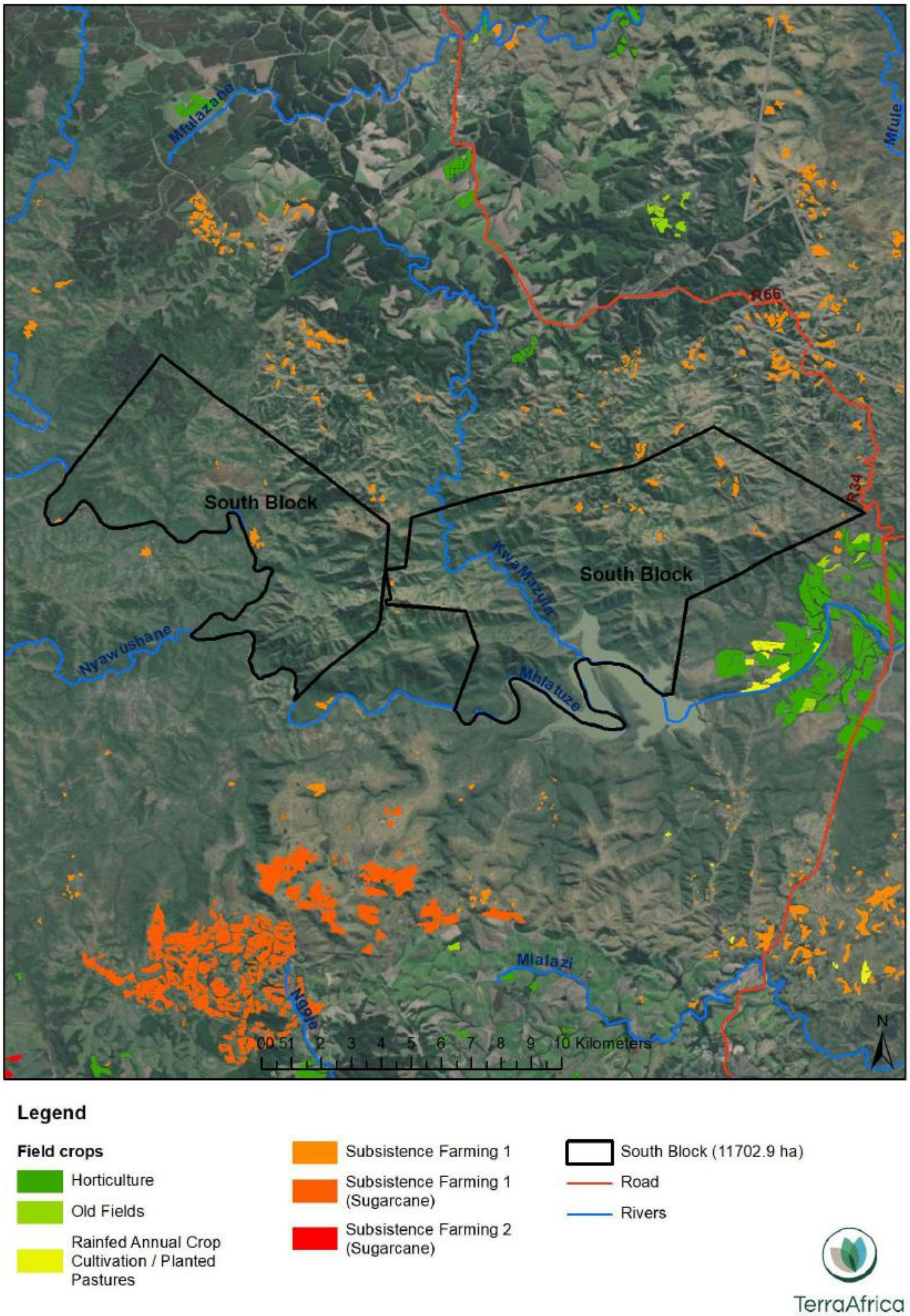

Figure 30 Crop field boundaries of the South Block (Crop Estimates Consortium of DALRRD, 2019)

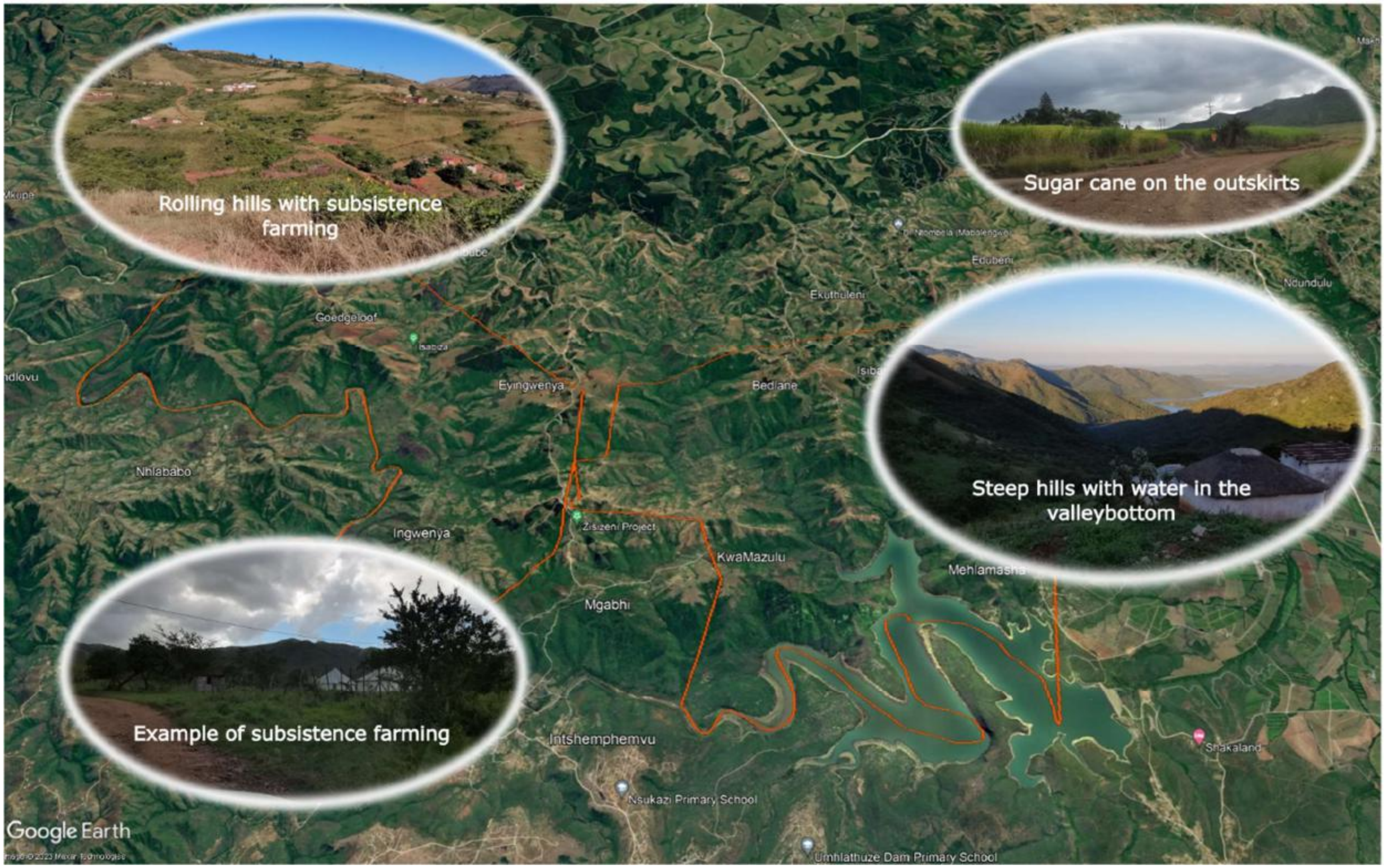

Figure 31 Land uses of the surveyed area

In field observations did show evidence of subsistence farming, but the terrain was often too steep for cultivation of crops. The photographs above show that when the hills are less steep, that subsistence farming does occur (see Figure 31). However, these lands are often small. The steeper slopes could be grazed by animals. Apart from subsistence farming, there are no areas with large fields of rainfed annual crops or planted pasture within the South Block.

However, outside the South Block, rainfed crops and horticultural crops are cultivated. The most prominent production area located southeast of the south-eastern boundary of the South Block, is the Nkwalini valley. In this area, a variety of horticultural crops are produced under irrigation that include citrus, macadamias, bananas and passion fruit. Other areas consist of irrigated sugar cane. Irrigation systems used in the area include micro and drip irrigation as well as centre pivot irrigation used for sugar cane.

Figure 32 Passion fruit production in the Nkwalini valley

Figure 33 Sugar cane production under pivot irrigation in the Nkwalini valley

8.7 Agricultural sensitivity

The agricultural sensitivity was assigned by combining the land capability classification and the field crop boundaries of the South Block. Areas with Moderate-High (Class 09) land capability as well as all the areas where there is Subsistence 1 field crop boundaries, are classified as High agricultural sensitivity. Areas with Moderate (Class 08) and Low-Moderate (Class 06) land capability, has Medium agricultural sensitivity. The rest of the areas where there is Low (Class 05) and Low-Very low (Class 04) land capability, has Low agricultural sensitivity.

Following this delineation, the entire South Block area is dominated by land with Low agricultural sensitivity (a total area of 7542 ha), followed by land with Medium agricultural sensitivity (3716 ha) and with High agricultural sensitivity delineated for a total area of 456 ha (see Figure 34). The areas with High sensitivity include areas where deep soils from the Hutton soil association is present on terrain with suitable slope for cultivation. It also includes the areas where there is homesteads with subsistence agricultural fields near them. The proposed infrastructure layout of the Jindal Melmoth Iron Ore project includes areas of all three sensitivity classes (Figure 35).

9. Assumptions, limitations and information gaps

The following assumptions are embedded within the results and discussions of this report:

- It is assumed that the development footprint will remain within the boundaries of the project site and be located where the current infrastructure layout (see Figure 2) indicates.
- It is assumed that the areas where subsistence farming is present near homesteads, will be considered in any resettlement action planning and that the discussion of resettlement, falls outside the scope of this assessment.
- Soil categories were created for the soil mapping to integrate soil classification data from the land type data set that originates from 1977, with the most recent soil classification system (Soil Classification Working Group, 2018).

No other information gaps or uncertainties are identified.

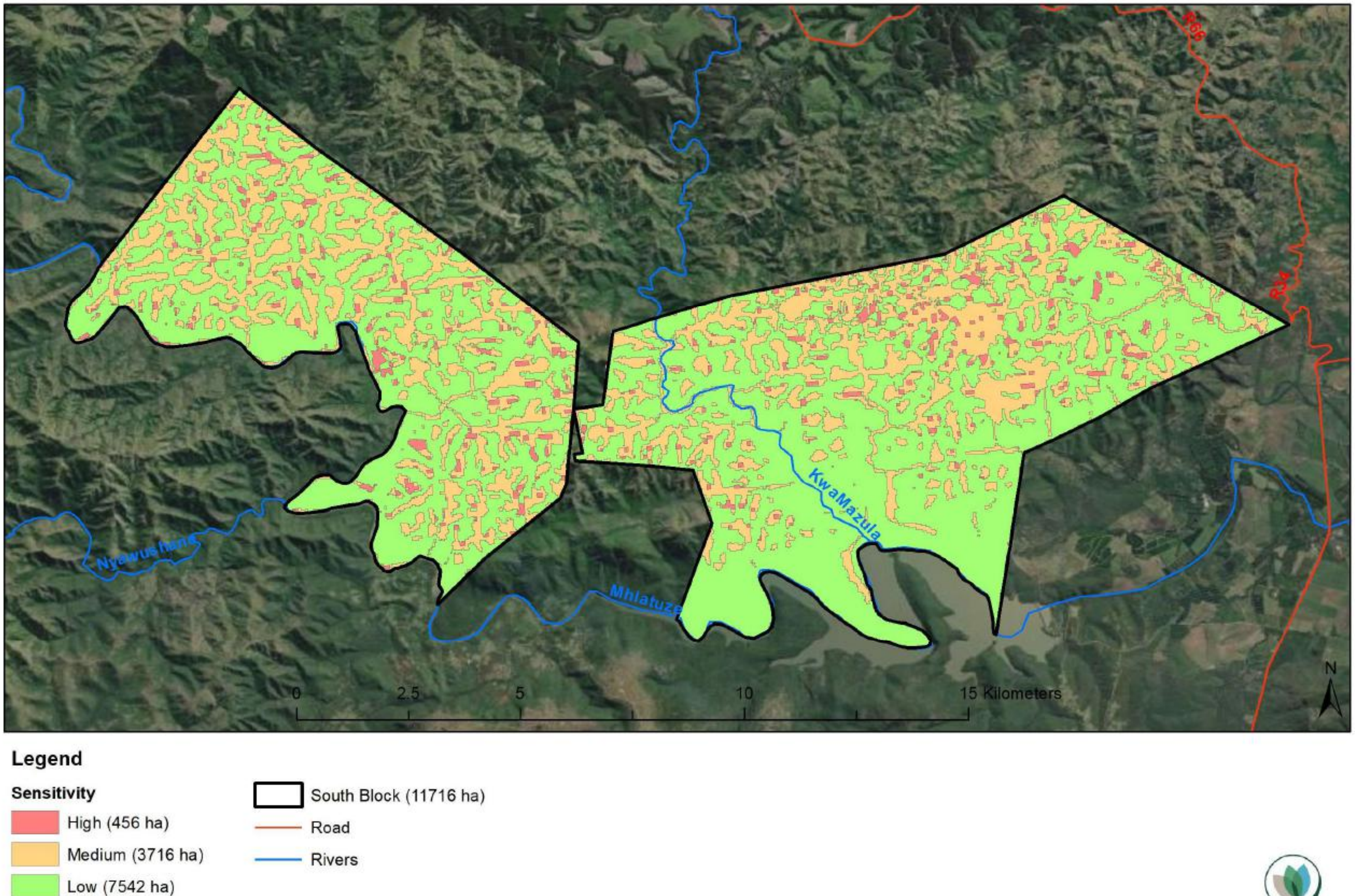

Figure 34 Agricultural sensitivity of the South Block

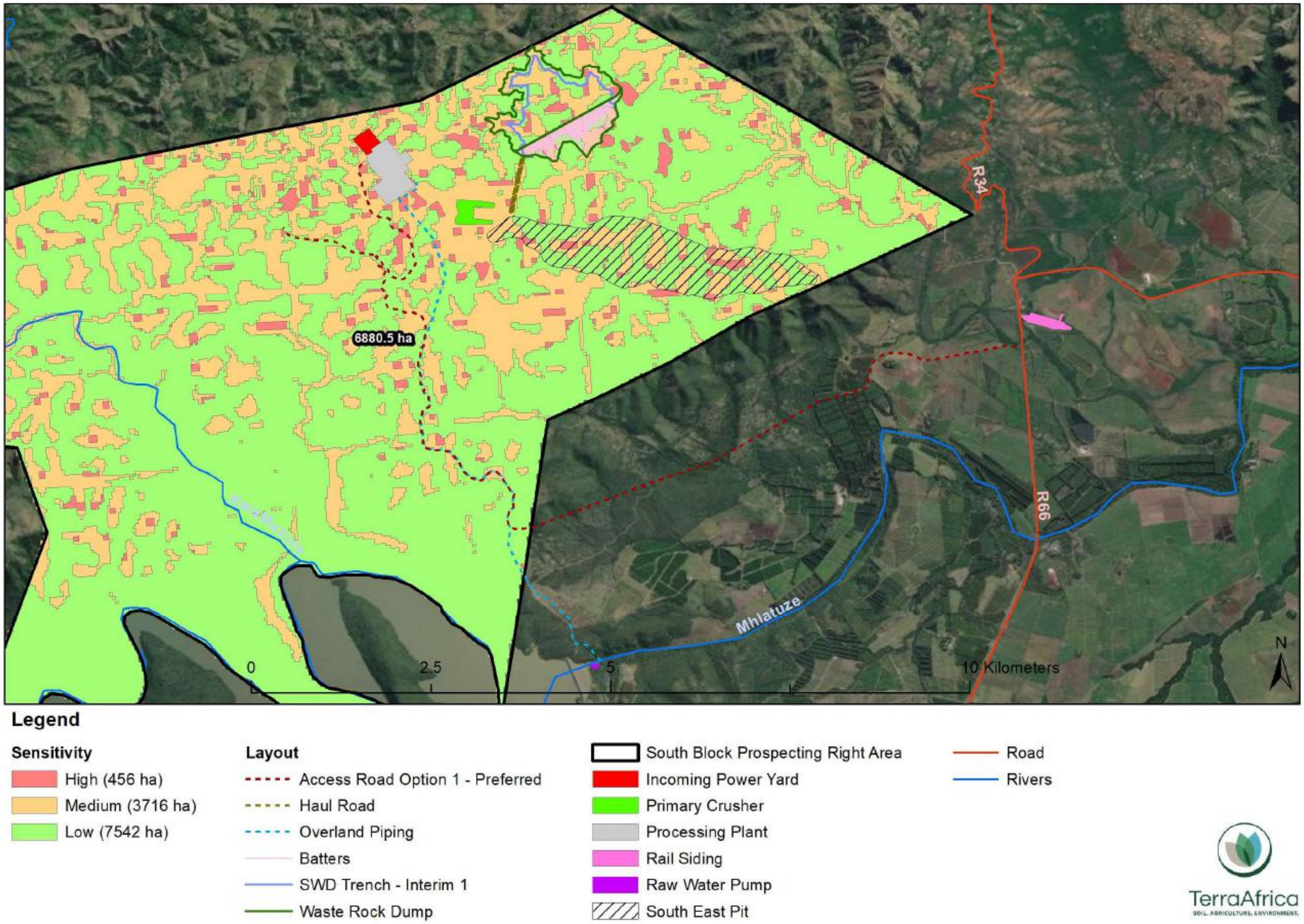

Figure 35 Agricultural sensitivity of the proposed project footprint of the Jindal Melmoth Iron Ore project

10. Impact assessment

10.1 Impact assessment methodology

The method used for the assessment of impacts is set out in Table 9. This assessment methodology enables the assessment of environmental impacts including: cumulative impacts, the intensity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

Table 9: SLR EIA Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High
			VL	L	M	H	VH
			A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
			EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VVH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

***VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.**

10.2 Detailed assessment of potential impacts

10.2.1 Land use change from subsistence farming to mining

a) Description of impact

Wherever the infrastructure footprint of the proposed Jindal Melmoth Iron Ore mine is located within the South Block, the current homesteads will have to be moved to another area, guided by an approved Resettlement Action Plan (RAP). The subsistence farmers that resided in the area will no longer practice agriculture here and the land use within the development footprint will change to mining. This impact will only occur once and once mining is the main land use in the area, it is not foreseen that subsistence agriculture will return to the footprint area, even after decommissioning and closure.

b) Impact assessment

<u>Potential impacts</u>

All project phases

Prior to the construction of the mine infrastructure, the homesteads that will be affected by the development footprint, will need to be relocated somewhere else. No subsistence fields will be cultivated in the footprint area and no further livestock grazing will be possible where mine infrastructure will be constructed. This will change the current land use from subsistence agriculture with small crop fields and livestock herding, to mining. This impact will be permanent as the land use change will remain mining during the operational phase as well as the decommissioning and closure phases. It is not expected that subsistence agriculture will return to the area in the post-closure phase of the mine.

While the change in land use will be permanent, it will have moderate intensity and be limited to the mining site area. The probability of this impact occurring is definite and the resulting significance of the impact prior to mitigation, is MEDIUM. However, implementing the mitigation measure of limiting the footprint to its current layout, reduces the intensity of the impact to a minor change and the resulting significance, is LOW (see Table 10)

Table 10: Impact summary - Land use change from subsistence agriculture to mining

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	All	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Very long term/ Permanent (> 20 years)	Very long term/ Permanent (> 20 years)
Extent	Site	Site
Consequence	Medium	Low
Probability	Definite / Continuous	Definite / Continuous
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	*Irreversible: Once the land use of the footprint changes from subsistence farming to mining, it will only be returned if all infrastructure is removed.*	
Degree to which impact may cause irreplaceable loss of resources	*High: It is unlikely that subsistence farming will return to the area*	
Degree to which impact can be avoided	*None: Land use change is unavoidable*	
Degree to which impact can be mitigated	*Medium: Limited mitigation measures available but limiting the footprint can avoid increasing the extent of the impact.*	

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Limit the land use change to the infrastructure footprint of the mine.
- Keep the infrastructure footprint as small as possible.
- Ensure that RAP considers the resettlement of livestock to the areas where the current homestead owners will be resettled.
- The RAP must ensure that the areas where homestead owners will be resettled, have soil that is suitable for subsistence-level crop production near the houses.

No monitoring or reporting on monitoring is required.

10.2.2 Loss and/or reduction of current land capability

a) Description of impact

The infrastructure footprint of the proposed project includes five different land capability classes with Class 09 and Class 08 land capability, suitable for rainfed crop production. The activities of the different project phases will negatively impact soil quality through soil compaction, disturbance of soil horizon organization, soil pollution and increased risk of soil erosion (impacts rated from Section 10.2.3 onwards). The degradation of soil quality will reduce the soil suitability in areas of impact, and this will lower the current land capability or destroy it so that it becomes unsuitable for any agricultural production. The loss and/or reduction of the current land capability is considered a permanent impact that remains the same during all project phases. It is not expected that the pre-mining land capability will be restored after mine closure.

b) Impact assessment

<u>Potential impacts</u>

All phases

During the construction phase, topsoil will be stripped and stockpiled from areas where infrastructure such as the South East pit area, waste rock dumps, office complex, workshops and processing plant will be constructed. The access road will be constructed and the surface of the road graded and compacted. These activities result in soil quality degradation, thereby reducing and possibly destroying the suitability of these soils for rainfed crop production. It is anticipated that the current land capability in some areas such as the access road, pit area and waste rock dump areas, will be completely lost as these areas will also have no suitability for livestock farming.

The reduction in land capability is considered a prominent change in the ability of the natural resources (soil, terrain and climate) to support agricultural production. The impact will be permanent or very long term. However, the extent of the impact is limited to the site. The probability of this impact occurring is definite and the resulting significance of the impact prior to mitigation, is MEDIUM. The implementation of mitigation measures will reduce the significance to LOW (Table 11).

Table 11: Impact summary – Loss and/or reduction of current land capability

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	All	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Very long term/ Permanent (> 20 years)	Very long term/ Permanent (> 20 years)
Extent	Site	Site
Consequence	Medium	Low
Probability	Definite / Continuous	Conceivable
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	*Irreversible: Once the land capability of the site has been reduced or destroyed, it will be difficult to restore the original land capability.*	

Degree to which impact may cause irreplaceable loss of resources	*High: It is unlikely that the pre-mining land capability will be restored.*
Degree to which impact can be avoided	*None: Reduction in soil capability and therefore land capability, is unavoidable during surface mining.*
Degree to which impact can be mitigated	*Medium: Limited mitigation measures available but limiting the footprint can avoid increasing the extent of the impact.*

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Keep the infrastructure footprint as small as possible.
- In areas where infrastructure will be decommissioned and materials removed, topsoil must be put back at depths similar to the pre-mining topsoil depths during the land rehabilitation.
- Once rehabilitation of a section is completed after mining and decommissioning, a land capability audit must be conducted by a suitably qualified person to record the post-mining land capability classification of the mining footprint.

Monitoring

The following monitoring is recommended:

- Once the rehabilitation of a specific area is completed, a SACNASP registered soil or agricultural scientist must conduct a land capability audit of the rehabilitated area.
- A land capability audit is also required after the final land rehabilitation of the mined area following the decommissioning phase.

Reporting

The land capability audit report submitted after the assessment, must include as a minimum the following information:

- Effective soil depths of the rehabilitated area(s).
- Bulk density of the soil.
- Soil texture of the rehabilitated area(s).
- Slope and slope length of the rehabilitated area(s).
- Land capability classification
- Recommendations for soil quality improvement and post-rehabilitation land use

10.2.3 Soil erosion

a) Description of impact

Activities associated with the proposed mining project such as vegetation removal, topsoil stripping, haul road construction, blasting and drilling and topsoil stockpiling, will leave soil surfaces exposed to wind and rain. The uncovered soil particles are easily transported away from their origin by water and wind movement and deposited in other areas. In the case of rain and surface water movement, the soil particles usually end up in toe-slopes and valley bottoms and result in sedimentation of waterways. In the case of soil particle transport by wind, soil particles create dust and the dust deposits settle in other areas, including crop fields. Once the soil particles are lost from the mining area, it result in a material loss from the soil balance available for land rehabilitation. This again increases the cost of land rehabilitation as soil has to be sourced from somewhere else or otherwise, the rehabilitation objectives for soil depth cannot be met. The area where the Jindal Melmoth Iron Ore project will be located, is at high risk of soil erosion because of the steep slopes of the landscape.

b) Impact assessment

Potential impacts

Construction phase

During the construction phase, soil will be stripped from areas where infrastructure will be constructed. These areas include the waste rock dumps, access road, workshops and offices, and the processing plant. Prior to the soil stripping, the vegetation currently growing in these areas will be removed. The bare soil surfaces will be at risk of soil erosion, especially during the rainy season and when there are strong winds. In the area of the Jindal Melmoth Iron Ore project, the onset of soil erosion has the potential to spread quickly into areas outside of the mining footprint because of the high rainfall of the area and steep slopes of the terrain.

The formation of eroded areas and the resulting soil loss is an impact with very high intensity that is permanent. When left unmanaged and unrehabilitated, the erosion can affect the whole site and nearby areas. It is probable that soil erosion can occur as the terrain and high rainfall combined with the sudden nature of the soil impacts associated with surface mining, pose a high risk for soil erosion. The significance of the impact without any mitigation measures is HIGH. The implementation of mitigation measures can reduce the impact to MEDIUM (see Table 12).

Table 12: Impact summary – Soil erosion during construction phase

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Severe change (Very high)	Severe change (Very high)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site	Site
Consequence	High	Medium
Probability	Probable (High)	Possible / frequent (Medium)
Significance	**High -**	**Medium -**
Additional Assessment Criteria		

Degree to which impact can be reversed	*Irreversible: Soil erosion is irreversible and should be prevented. Once soil particles are transported away by wind or water, it cannot be returned.*
Degree to which impact may cause irreplaceable loss of resources	*High: Once soil particles are lost from an area, it cannot be replaced.*
Degree to which impact can be avoided	*Medium: Prevention of erosion is possible but the terrain of the JMIOP will pose difficulties because of steep slope*
Degree to which impact can be mitigated	*Medium: Erosion can be mitigated by effective stormwater control and geotextiles, however, bare soil surfaces during the rainy season will limit mitigation success*

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint.
- Restrict land clearance to demarcated areas as agreed in the final infrastructure layout of the project.
- Revegetation of soils which will be exposed for long periods, such as the topsoil stockpiles.
- The Stormwater Management Plan must be designed to minimise soil erosion at topsoil stockpile areas resulting from surface water runoff.

Monitoring

The following monitoring is recommended:

- Monthly inspections around the constructed infrastructure to detect early signs of soil erosion developing.
- When signs of erosion are detected, the areas must be rehabilitated, using a combination of geo-textiles and re-vegetation to prevent the eroded area(s) from expanding.

Reporting

No additional monitoring reporting is required.

Operational phase

During the operational phase, topsoil will be removed from the pit area and stockpiled in designated areas. The topsoil stockpiles will be exposed to wind and rain and will be prone to erosion. Stormwater runoff from the access road surface will increase the risk of soil erosion in the areas directly next to the access road.

Erosion during the operational phase will be a moderate change that will be permanent. When left unmanaged and unrehabilitated, the erosion can affect the whole site. It is probable that soil erosion can occur especially during periods of intense rainfall or wind. The significance of the impact without any mitigation measures is MEDIUM. The implementation of mitigation measures can reduce the impact to VERY LOW (see Table 13).

Table 13: Impact summary – Soil erosion during operational phase

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Very long term/ Permanent (> 20 years)	Very long term/ Permanent (> 20 years)
Extent	Whole site	Site
Consequence	Medium	Low
Probability	Probable	Possible / frequent
Significance	**Medium -**	**Very Low -**
Additional Assessment Criteria		
Degree to which impact can be reversed	*Irreversible: Soil erosion is irreversible and should be prevented. Once soil particles are transported away by wind or water, it cannot be returned.*	
Degree to which impact may cause irreplaceable loss of resources	*High: Once soil particles are lost from an area, it cannot be replaced.*	
Degree to which impact can be avoided	*Medium: Prevention of erosion is possible but the terrain of the JMIOP will pose difficulties because of steep slope*	
Degree to which impact can be mitigated	*Medium: Implementation of mitigation measures can effectively limit soil erosion during the operational phase.*	

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Regularly maintain the Stormwater Management Plan, especially around areas with bare soil surfaces such as the access road and topsoil stockpiles.
- Revegetate any areas where soil surfaces remained bare around buildings after the construction phase such as around workshops and offices.

Monitoring

The following monitoring is recommended:

- Monthly inspections around surfaced areas and topsoil stockpiles to detect early signs of soil erosion developing.

- When signs of erosion are detected, the areas must be rehabilitated, using a combination of geo-textiles and re-vegetation to prevent the eroded area(s) from expanding.

Reporting

No additional monitoring reporting is required.

Decommissioning and Closure Phase

During the decommissioning and closure phases, most of the infrastructure will be removed such as the workshops and offices as well as the processing plant. Once the material is removed from the surface, the soil underneath will be exposed to erosion. The areas where topsoil was stockpiled will also be exposed to soil erosion as well as the newly rehabilitated surfaces of the pit area. It is expected that the haul road surface will remain bare and surface runoff from the road, will increase the risk of erosion in areas directly next to the road.

The formation of eroded areas after mining has ceased, is an impact with high intensity that is permanent. When left unmanaged and unrehabilitated, the erosion can affect the whole site. It is probable that soil erosion can occur, especially with newly exposed bare soil surfaces. The significance of the impact without any mitigation measures is HIGH. The implementation of mitigation measures can reduce the impact to MEDIUM (see Table 14).

Table 14: Impact summary – Soil erosion during decommissioning and closure phase

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Prominent change (High)	Severe change (Very high)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site	Site
Consequence	High	Medium
Probability	Probable (High)	Possible / frequent (Medium)
Significance	**High -**	**Medium -**
Additional Assessment Criteria		
Degree to which impact can be reversed	*Irreversible: Soil erosion is irreversible and should be prevented. Once soil particles are transported away by wind or water, it cannot be returned.*	
Degree to which impact may cause irreplaceable loss of resources	*High: Once soil particles are lost from an area, it cannot be replaced.*	
Degree to which impact can be avoided	*Medium: Prevention of erosion is possible but the terrain of the JMIOP will pose difficulties because of steep slope*	

Degree to which impact can be mitigated	*Medium: Erosion can be mitigated by effective stormwater control and geotextiles, however, bare soil surfaces during the rainy season will limit mitigation success*

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Revegetation of all bare surfaces should be done as soon as infrastructure is removed.
- No additional areas outside of the demarcated footprint must be affected by vegetation removal during decommissioning of infrastructure.
- Final landform of sloped areas such as waste rock dumps must have concave areas and longer footslopes, to limit sedimentation of nearby areas.

Monitoring

The following monitoring is recommended:

- Soil audit after decommissioning and prior to closure to detect any eroded areas and bare surfaces that has the potential risk of soil erosion.
- When signs of erosion are detected, the areas must be rehabilitated, using a combination of geo-textiles and re-vegetation to prevent the eroded area(s) from expanding.

Reporting

The following reporting will be required once the soil audit is completed:

- One soil audit report after decommissioning the records all areas that are eroded and all bare surfaces that are at risk of soil erosion. The soil audit must include recommendations for restoration of eroded areas and a revegetation plan.

10.2.4 Soil compaction

a) Description of impact

Soil compaction is the increased density of soil resulting from applied pressure. In some areas, such as where buildings and haul roads are constructed, soils are deliberately compacted for surface stability. All activities on the mine that require the movement of vehicles and equipment over the soil surface, contribute to soil compaction. The applied pressure resulting from the weight of the waste rock dumps and topsoil stockpiles, also contribute to soil compaction. Compacted soils limit root growth and are at higher erosion risk as it lacks a continuous macropore network that allow plant root growth, water movement and aeriation. The absence of soil structure from the compacted soils also have reduced hydraulic conductivity. Compacted soils are difficult to alleviate and soil compaction remains throughout all project phases.

b) Impact assessment

All Phases

During the construction phase, the areas where the workshops and offices will be constructed will be resurfaced and compacted to ensure the stability of the road surface and the buildings that are constructed. During this phase topsoil will also be stripped from the waste rock dump areas as well as a part of the pit area. These soils will be stockpiled in demarcated areas for topsoil stockpiles. Vehicles and equipment will traverse over the soil surface and the applied pressure will cause soil compaction. During the operational phase, soil will be stripped from the sections of the pit area where the ore are mined, and the topsoil are transported to the stockpile areas where it increases the weight of the topsoil stockpiles. The movement of ore trucks and vehicles over the haul roads continue to add pressure to the already compacted soils of the haul roads. During the decommissioning and closure phases, the removal of materials and infrastructure from site and the levelling of topsoil in areas that are rehabilitated, adds pressure to the soil surface.

Potential impacts

Table 15: Impact summary – Soil compaction during all phases

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	All	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Severe change (Very high)	Prominent change (High)
Duration	Permanent (> 20 years)	Long-term (10 to 20 years)
Extent	Whole site and nearby surroundings	Part of site/property
Consequence	High	Medium
Probability	Definite / Continuous (Very high)	Probable (High)
Significance	**High -**	**Medium -**
Additional Assessment Criteria		
Degree to which impact can be reversed	*Partially reversible: Soil compaction can be alleviated through deep ripping but the negative impact on water infiltration and root development remains for years*	
Degree to which impact may cause irreplaceable loss of resources	*Low: Soil is not lost, but the functionality is compromised.*	
Degree to which impact can be avoided	*None: Soil compaction is unavoidable, especially in areas of haul roads and laydown areas*	
Degree to which impact can be mitigated	*Low: Some areas will have to be compacted for surface stability*	
Extent to which a cumulative impact may arise	*Possible*	

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Do not allow vehicle and equipment movement or parking outside of demarcated areas.
- Materials must be off-loaded and stored in designated laydown areas; Use specific tracks for tipping trucks; and
- Rip all compacted areas such as roads and stockpiles areas, during the last phases of site rehabilitation.

Monitoring

The following monitoring is recommended:

- The bulk density of rehabilitated areas must be measured once the rehabilitation of a specific area is completed as well as before the final closure of the mine.
- The bulk density measurement must be included as a parameter in the land capability audit (see Section 10.2.2).
- The audit must be completed by a SACNASP registered soil or agricultural scientist.
- A land capability audit is also required after the final land rehabilitation of the mined area following the decommissioning phase.
- If the bulk density exceeds 1.5 $kg.m^{-3}$, deep ripping must be applied to the compacted surface after the audit.
- In areas where bulk density exceeded 1.5 $kg.m^{-3}$, a follow-up assessment must be conducted six months after deep ripping to determine whether the action was successful in alleviating the compaction.

Reporting

The following report is required:

- The results of the bulk density measurements must be submitted as part of the land capability audit report.
- The report must indicate all areas where deep ripping is required.
- Any areas where deep ripping was done, must be re-audited within six months after deep ripping and the report submitted to the environmental management team of the mine.

10.2.5 Soil pollution

a) Description of impact

Activities associated with the proposed mining project such as vehicles and equipment traversing the area during topsoil stripping and infrastructure construction, dust suppression on haul roads, ore crushing and processing and storage of chemicals, lubricants and fuel on site, can all be sources of soil pollution. During the decommissioning phase, the materials that are in contact with the soil surface when infrastructure is demolished, can contaminate the soil surface. The potential contaminants include trace elements that are part of the iron ore complex, petroleum hydrocarbons and volatile organic compounds.

b) Impact assessment

All Phases

During the construction phase, vehicles and equipment will traverse the mine site when soil will be stripped from areas where infrastructure will be constructed. The emissions from the vehicles and equipment are a source of soil contamination, including any fuel and/or oil spillage from the vehicles. Materials and products such as concrete, paints and solvents will be used during construction, and these are all potential sources of soil contamination. Once the haul roads have been constructed, dust will be suppressed on these roads. The chemicals used for dust suppression, as well as the water itself, can be a source of contamination. During the decommissioning phase, the demolition of infrastructure can result in soil contamination through the emissions from vehicle movement as well as the demolished materials itself. Contamination of the soil surface can also affect groundwater and surface water resources as the pollutant particles can enter water resources when rainwater seeps through the soils.

The risk of potential soil pollution is an impact with high intensity that will result in a prominent change. When left unmanaged and unrehabilitated, the soil pollution can negatively affect areas beyond the site, especially if contaminants enter water resources on site. Without any mitigation measures, soil pollution can definitely occur and the significance of the impact without any mitigation measures is HIGH. The implementation of mitigation measures can reduce the impact to LOW (Table 16).

Potential impacts

Table 16: Impact summary – Soil pollution during all phases

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	All	
Criteria	Without Mitigation	With Mitigation
Intensity	Prominent change (High)	Minor change (Low)
Duration	Very long term/ Permanent (> 20 years)	Short-term (1 and 5 years)
Extent	Beyond site	Regional/National
Consequence	High	Medium
Probability	Definite / Continuous	Conceivable
Significance	High -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	*Fully reversible - Soil pollution can be reversed when detected early enough while the polluted area is still small and can be contained. There are specialised service providers that can assist with pollution clean up and remediation once it is detected.*	

Degree to which impact may cause irreplaceable loss of resources	*Low - Soil is not lost, but the functionality is compromised.*
Degree to which impact can be avoided	*Medium - Soil pollution can be avoided, especially in areas of haul roads and laydown areas*
Degree to which impact can be mitigated	*High – With regular monitoring and regular maintenance of vehicles and equipment, the significance of soil pollution can successfully be reduced.*
Extent to which a cumulative impact may arise	*Possible*

Mitigation/ Enhancement Measures

The following measures should be implemented:

- Regular monitoring of all vehicles and equipment to ensure vehicle emissions are within acceptable limits and to prevent oil and fuel spills.
- Materials must be off-loaded and stored in designated laydown areas.
- No solvents, chemicals and paints must be stored outside designated store rooms and workshops.
- Fuel must be stored in a bunded area.

Monitoring

The following monitoring is recommended:

- Appoint a SACNASP registered soil scientist to conduct an annual soil pollution audit.
- The audit must include a site visit to the mine during which soils will be sampled using a soil auger. The site visit must include a site walkover in the areas of existing mining activities as well as around the fringes, to determine if there are soil impacts not anticipated in the Environmental Authorization process.
- Topsoil must be sampled in areas of likely impact on soil quality as well as at two reference points that can be used for calculation of the Contamination Factor.
- It is recommended that no fewer than eight soil samples be analysed for each monitoring cycle. The samples must be submitted to a soil laboratory and be analysed for the following parameters:
    - pH
    - EC
    - Water-soluble anions (sulphate, phosphate, nitrate, chloride, fluoride)
    - Total Petroleum Hydrocarbons
    - BTEX (benzene, toluene, ethylbenzene and xylene)

Reporting

The following report is required:

- Once the analysis results are received, a report must be compiled to describe the current soil physical and chemical conditions of soils within and around the mining footprint.
- The report must include recommendations for future sampling and considerations for remediation (if any issues have been detected).

11. Cumulative Impacts

11.1 Introduction

Apart from the direct impacts associated with the Jindal Melmoth Iron Ore project (as assessed in Section 10 above), the project is also considered together with the Tailings Storage Facility and Return Water Dam that is planned for a site south-east of the mine site. These additional components of the mining project will be located on approximately 1000 ha of land in the Nkwalini Valley. The additional infrastructure is currently the only similar projects that will be contribute to cumulative impacts. While rail will be used to transport ore between the mine site and the Richards Bay port, this is an existing rail and will therefore not contribute to cumulative impacts on soil and agriculture.

11.2 Cumulative impact: land use change from agriculture to mining

While the impact on land use change caused by the Jindal Iron Ore project is considered an impact with medium significance that can be mitigated to an impact of low significance, the cumulative impact of land use change, has high negative significance. The area currently proposed for the Tailings Storage Facility and Return Water Dam, is part of a larger farming area in the Nkwalini Valley where the main land use is irrigated agriculture. Farmers in the Nkwalini Valley mostly produce high value horticultural crops such as citrus, macadamias, passion fruit and sugar cane. The climate of the Nkwalini valley is highly suitable for crop production with high rainfall and warm winters.

The construction and operation of the Tailings Storage Facility and Return Water Dam in this area will be a permanent and severe change of land use that will occur as all production on the 1000 ha will immediately stop. It is also not anticipated that the infrastructure will be decommissioned after mining has ceased and therefore, agricultural production will never be restored on the specific site. While mitigation measures can prevent impacts outside of the site's boundaries such as soil pollution and erosion, the impact of the land use change cannot be mitigated.

11.3 Cumulative impact: increased areas with reduction in soil quality

The 1000 ha that will be affected by the Tailings Storage Facility and Return Water Dam, will experience definite soil compaction. The areas around these infrastructure components will be at risk of soil pollution and soil erosion. This expansion of infrastructure into a nearby area cumulatively increases the likelihood of degraded soils in areas outside of the direct mining footprint.

12. Conclusion

The soil and agricultural properties and sensitivities of the proposed Jindal Melmoth Iron Ore project site were the subject of the Agricultural Agro-Ecosystem Assessment conducted. The South Block was the primary focus of the study as this is where the current mining activities are proposed.

Eight soil associations are found within the South Block. The eight associations are named after the most prevalent soil form in the group following the land type data. The soil associations are Glenrosa, Hutton, Katspruit, Dundee, Mispah, Oakleaf, Swartland and Valsrivier. Seven of the eight soil associations are present within and around the infrastructure footprint. The Valsrivier association is outside of the development footprint, on the far eastern side of the South Block. The Glenrosa group is the most prevalent in the South Block, followed by the Hutton group and then the Mispah group. Much smaller areas of the Katspruit, Dundee, Oakleaf, Swartland and Valsrivier groups are present in mainly valley bottom areas. The texture of the topsoil are Sandy Clay Loam, Clay Loam and Clay. The subsoils have Sandy Clay Loam, Clay and Clay Loam texture.

The South Block area has five different land capability classes. The proposed infrastructure of the Jindal Melmoth Iron Ore project will affect land of all five of the land capability classes. The most prevalent land capability class is Class 5 (Low) where a combination of shallower soil profiles and steep slope limit the crop production potential of the land. Small areas consisting of Class 04 (Low-Very low) land capability, are the areas where the very shallow Mispah soils are present. Several small, narrow areas with Class 6 (Low-Moderate) land capability, are associated with the Katspruit, Swartland and Valsrivier soils. Larger areas of Class 8 (Moderate) land capability are present where the Hutton, Dundee and Oakleaf soil groups occur in areas with lower terrain capability (Class 3 and Class 4). The small areas with Class 10 (Moderate-High) land capability that are the areas where the Hutton, Dundee and Oakleaf soil groups coincide with better terrain capability (Class 5, Class 6 and Class 7).

The main land use of the South Block, including the proposed development footprint, is subsistence farming. The subsistence farming consists of livestock grazing and crop cultivation. However, the crop fields are small and scattered alongside the homesteads. No large commercial agricultural fields are present within the South Block. However, rainfed crops and horticultural crops are cultivated outside the South Block. The most prominent production area located southeast of the south-eastern boundary of the South Block, is the Nkwalini valley. In this area, a variety of horticultural crops are produced under irrigation that include citrus, macadamias, bananas and passion fruit. Other areas consist of irrigated sugar cane. Irrigation systems used in the area include micro and drip irrigation as well as centre pivot irrigation used for sugar cane.

The entire South Block area is dominated by land with Low agricultural sensitivity (a total area of 7542 ha), followed by land with Medium agricultural sensitivity (3716 ha) and with High agricultural sensitivity delineated for a total area of 456 ha. The areas with High sensitivity include areas where deep soils from the Hutton soil association is present on terrain with suitable slope for cultivation. It also includes the areas where there are homesteads with subsistence agricultural fields near them. Areas with Moderate (Class 08) and Low-Moderate (Class 06) land capability, has Medium agricultural sensitivity. The rest of the areas where there is Low (Class 05) and Low-Very low (Class 04) land capability, has Low agricultural sensitivity. The proposed infrastructure layout of the Jindal Melmoth Iron Ore project includes areas of all three sensitivity classes.

The main impacts of the Jindal Melmoth Iron Ore project from the perspective of agriculture, centres around the permanent change in land use from subsistence agriculture to mining, the permanent reduction of the land capability of the area as well as degradation of soil quality through soil erosion and compaction. The impacts on land use and land capability have medium significance when not mitigated but with mitigation measures, can be reduced to low significance. The impacts on soil quality are high but mitigation measures can reduce the significance of these impacts to medium, low, or very low.

From the perspective of soil and agricultural potential, the proposed Jindal Melmoth Iron Ore project is considered acceptable within the current development footprint as outlined in the layout maps presented in the report. While there will be impacts as indicated, an important mitigation measure is to keep this footprint within the demarcated areas and limit the impacts to the site only.

From the perspective of agricultural potential, the main concern with about the proposed project, is the cumulative impacts that will result from the additional infrastructure that will be constructed outside of the South Block. A Tailings Storage Facility and Return Water Dam is currently planned for a 1000 ha site located southeast of the South Block. This site is within the Nkwalini Valley, where irrigated horticultural production is the main land use. The cumulative impact of expanding the mine infrastructure into this area will have high significance and is considered an irreversible negative impact on agricultural production

13. Reference list

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Land Type Survey Staff, 1972 – 2006. *Land Types of South Africa data set*. ARC – Institute for Soil, Climate and Water. Pretoria.

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The Soil Classification Working Group (SCWG), 1991. *Soil Classification: A Taxonomic System for South Africa.* Dept. of Agricultural Development., Pretoria.

The Soil Classification Working Group, 2018. *Soil Classification: A Natural and Anthropogenic System for South Africa.* ARC – Institute for Soil, Climate and Water, Pretoria.

Appendix 1: Declaration of independence

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

JINDAL MELMOTH IRON ORE PROJECT, KWAZULU-NATAL PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	TerraAfrica Consult CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Mariné Pienaar			
Specialist Qualifications:	MSc. Environmental Science (Wits) ; BSc. (Agric) Plant Production (UP)			
Professional affiliation/registration:	SACNASP Registration No:400274/10 Soil Science Society of South Africa ; IAIAsa			
Physical address:	Farm Strydpoort 403, Ottosdal, 2610			
Postal address:	P.O. Box 433, Ottosdal			
Postal code:	2610	Cell:	082 828 3587	
Telephone:	082 828 3587	Fax:	N/A	
E-mail:	mpienaar@terraafrica.co.za			

2. DECLARATION BY THE SPECIALIST

I, Mariné Pienaar, declare that –

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

Signature of the Specialist

TerraAfrica Consult

Name of Company:

2023-04-25

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

TERRA AFRICA CONSULT CC

Name of Company

25/04/2023

Date

Signature of the Commissioner of Oaths

25 April 2023

Date

25/04/2023

Commissioner of Oaths (RSA)
Stephanus Francois Kasselman
59 Kruger street Wolmaransstad 2630
T: 018 596 1320 F: 018 596 1395

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Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

Appendix 2: CV of specialist

MARINÉ PIENAAR
Specialist Scientist

+2782-828-3587

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linkedin.com/in/marinepienaar

Wolmaransstad,
South Africa

EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution
Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment
Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

MARINÉ PIENAAR
Specialist Scientist

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

◆

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

◆

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

MARINÉ PIENAAR
Specialist Scientist

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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Appendix 3: Land Type Inventory Sheets for Disaggregated Land Types

LAND TYPE / *LANDTIPE* .... : **Ac62**
CLIMATE ZONE / *KLIMAATSONE* .... : 471S
Area / *Oppervlakte* .... : 2700 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 75 ha

1 2

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*
2830 Richards Bay (2700 ha)

Inventory by / *Inventaris deur :*
D P Turner

Modal Profiles / *Modale profiele :*
None / Geen

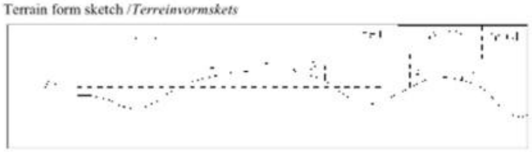
Terrain unit / *Terreineenheid*	1	3	5
% of land type / *% van landtipe*	60	35	5
Area / *Oppervlakte (ha)*	1620	945	135
Slope / *Helling (%)*	2 - 8	6 - 10	6 - 10
Slope length / *Hellingslengte (m)*	200 - 600	150 - 300	5 - 25
Slope shape / *Hellingsvorm*	Y-X	Y-X	Y-X
MB0, MB1 (ha)	1539	898	54
MB2 - MB4 (ha)	81	47	81

3 4 5

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Trevanian Gs17	200-450	0	535	33	331	35			865	32.1	15-25			A	meSaLm-SaClLm	so,S
Hutton Hu16	800-1200	0	405	25	236	25			641	23.8	15-35		15-35	B	meSaLm-SaClLm	so,S
Farningham Hu17	800-1200	0	243	15	142	15			385	14.3	25-45		35-45	B	SaCl	so,S
Cleveland Gf11, Griffin Gf12	800-1200	0	162	10	94	10			256	9.5	25-45		25-45	B	SaClLm-SaCl	so,S
Clovelly Cv17	600-1000	0	81	5	47	5			128	4.8	25-35		35-45	B	SaCl	so,S
Oatsdale Cv16	600-1000	0	81	5	47	5			128	4.8	15-35		15-35	B	meSaLm-SaClLm	so,S
Mispah Ms10	100-300	3	81	5	47	5			128	4.8	6-20			A	meSa-SaLm	R
Katspruit Ka10	300-600	0					40	30	40	1.5	10-25			A	LmmeSa-SaClLm	gc,gs
Kipipiri Kp10	900-1200	0	32	2					32	1.2	15-35		15-35	B	meSaLm-SaClLm	so,S
Dundee Du10	600-1000	0					14	10	14	0.5	6-20			A	meSa-SaLm	U,R
Stream beds/Stroombeddings		4					81	60	81	3.0						

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : B2
Terrain form sketch / *Terreinvormskets*



Geology: Sandstone of the Natal Group.

Geologie: Sandsteen van die Groep Natal.

10 November 2006 1

LAND TYPE / *LANDTIPE* : Ae63

CLIMATE ZONE / *KLIMAATSONE* : 471S

Area / *Oppervlakte* : 3930 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 80 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2830 Richards Bay (3930 ha)

Inventory by / *Inventaris deur* :

D P Turner

Modal Profiles / *Modale profiele* :

None / Geen

Terrain unit / *Terreineenheid*	1	3	5
% of land type / *% van landtipe*	15	80	5
Area / *Oppervlakte (ha)*	590	3144	196
Slope / *Helling (%)*	6 - 15	10 - 20	10 - 20
Slope length / *Hellingslengte (m)*	100 - 300	100 - 400	5 - 20
Slope shape / *Hellingsvorm*	X-Y	X-Y	X-Y
MB0, MB1 (ha)	542	2892	118
MB2 - MB4 (ha)	47	252	79

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Rock / Rots		4	12	2	63	2			75	1.9						
Farningham Hu17, Hutton Hu16	600-1000	0	266	45	1415	45			1680	42.8	25-55		25-55	B	SaClLm-SaCl	so,R
Williamson Gs16, Trevanian Gs17	200-450	0	88	15	472	15			560	14.3	15-35			A	fi/meSaLm-SaClLm	so,R
Saintfaiths Gs19	300-450	0	71	12	377	12			448	11.4	35-45			A	SaCl	so,R
Griffin Gf12	600-900	0	59	10	314	10			373	9.5	25-45		35-55	B	SaCl	so,R
Clovelly Cv17	600-900	0	59	10	314	10			373	9.5	25-45		35-55	B	SaCl	so,R
Mispah Ms10	100-300	3	35	6	189	6			224	5.7	10-25			A	Lmme/coSa-SaClLm	R
Katspruit Ka10	300-600	0					118	60	118	3.0	15-25			A	fi/meSaLm-SaClLm	gc,gs
Stream beds/Stroombeddings		4					78	40	79	2.0						

Terrain type / *Terreintipe* : D4

Terrain form sketch / *Terreinvormskets*

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Mainly granite, with small areas of sandstone of the Natal Group.

Geologie: Hoofsaaklik graniet, met klein oppervlaktes van sandsteen van die Groep Natal.

10 November 2006

LAND TYPE / *LANDTIPE* .... : **Db151**

CLIMATE ZONE / *KLIMAATSONE* .... : 475S

Area / *Oppervlakte* .... : 5190 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 15 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2830 Richards Bay (5190 ha)

Inventory by / *Inventaris deur* :

H Grundling

Modal Profiles / *Modale profiele* :

None / Geen

Terrain unit / *Terreineenheid* .... :	1	3	5
% of land type / *% van landtipe* .... :	5	90	5
Area / *Oppervlakte (ha)* .... :	260	4671	260
Slope / *Helling (%)* .... :	1 - 6	1 - 13	1 - 3
Slope length / *Hellingslengte (m)* .... :	25 - 900	100 - 1400	5 - 100
Slope shape / *Hellingsvorm* .... :	Y	X-Y	X
MB0, MB1 (ha) .... :	112	3830	254
MB2 - MB4 (ha) .... :	148	841	5

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Swartland Sw31, Nyoka Sw41	300-600	1	39	15	701	15			740	14.3	20-30		25-45	B	SaClLm-SaCl	vp,so,R
Hogsback Sw32, Omdraai Sw42	300-600	1	26	10	607	13			633	12.2	25-35		30-55	B	SaClLm-SaCl	vp,so,R
Arniston Va31, Lindley Va41	300-600	0			561	12	13	5	573	11.1	20-30		25-45	B	SaClLm-SaCl	vp,U
Chalumna Va32, Sheppardvale Va42	300-600	0			467	10	13	5	480	9.3	25-35		55-70	B	Cl	vp,U
Doveton Hu27	850-1200	0	8	3	374	8	8	3	389	7.5	20-45		35-55	B	SaCl	so,R
Msinga Hu26	850-1200	0	8	3	374	8	5	2	387	7.5	15-30		15-35	B	fi/meSaLm-SaClLm	so,R
Williamson Gs16	100-350	3	52	20	327	7			379	7.3	20-35			A	SaClLm	lc,R
Mispah Ms10	100-350	3	39	15	234	5			272	5.3	20-45			A	SaClLm-SaCl	R
Devon We22, Sibasa We13	300-600	1	5	2	234	5			239	4.6	10-30		15-50	B	fi/meSaLm-SaCl	sp,R
Argent Sd11	850-1200	0			187	4			187	3.6	30-50		35-55	B	SaCl	so,R
Saintfaiths Gs19	100-350	3	39	15	140	3			179	3.5	35-45			A	SaCl	lc,R
Jozini Oa36	800-1200	0			140	3	39	15	179	3.5	15-30		15-35	B	fi/meSaLm-SaClLm	so,R
Trevanian Gs17	100-350	3	18	7	140	3			158	3.1	15-35			A	meSaLm-SaClLm	lc,R
Koedoesvlei Oa37	800-1200	0			93	2	39	15	132	2.6	20-35		35-55	B	SaCl	so,R
Rydalvale Ar30, Arcadia Ar40	300-600	0			93	2	13	5	106	2.1	35-65		45-70	A	SaCl-Cl	R
Katspruit Ka10, Killarney Ka20	300-600	0					65	25	65	1.3	20-35			A	SaClLm	gc
Fernwood Fw11	1000-1200	0	26	10			13	5	39	0.8	0-10			A	meSa	R
Dundee Du10	1000-1200	0					26	10	26	0.5	20-35			A	SaClLm	U
Phoenix Rg10, Rensburg Rg20	300-600	0					13	5	13	0.3	35-65			A	SaCl-Cl	gc
Velddrif Kd11, Umtentweni Kd21	400-800	0					8	3	8	0.2	0-15	0-6	10-50	E	me/coSa	gc,R
Stream beds/Stroombeddings		4					5	2	5	0.1						

10 November 2006

1

LAND TYPE / *LANDTIPE*......................: Fa108

CLIMATE ZONE / *KLIMAATSONE* ....: 433S

Area / *Oppervlakte* ....: 66000 ha

Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 120 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2830 Richards Bay (66000 ha)

Inventory by / *Inventaris deur* :

B L Plath

Modal Profiles / *Modale profiele* :

None / Geen

Terrain unit / *Terreineenheid* ....:	1	3	5
% of land type / *% van landtipe* ....:	10	80	10
Area / *Oppervlakte (ha)* ....:	6600	52800	6600
Slope / *Helling (%)* ....:	2 - 20	20 - 100	10 - 60
Slope length / *Hellingslengte (m)* ....:	100 - 1000	200 - 1000	5 - 20
Slope shape / *Hellingsvorm* ....:	Y	X-Y	X
MB0, MB1 (ha) ....:	2838	35904	4290
MB2 - MB4 (ha) ....:	3762	16896	2310

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Rock / Rots		4 :	198	3	1584	3			1782	2.7						
Msinga Hu26, Doveton Hu27	600-1200	0 :	264	4	15840	30	660	10	16764	25.4	20-40		20-40	B	SaClLm-SaCl	so
Argent Sd11, Richmond Sd12	600-1200	0 :	264	4	10560	20	660	10	11484	17.4	35-55		45-60	B	SaCl-Cl	so
Williamson Gs16	300-450	3 :	1650	25	7920	15			9570	14.5	15-35			A	fiSaLm-SaClLm	so
Mispah Ms10, Msinga Hu26	400-600	0 :	990	15	2640	5			3630	5.5	20-35		20-30	B	SaClLm	so
Argent Sd11, Richmond Sd12	400-600	0 :	990	15	2640	5			3630	5.5	25-55		35-60	B	SaCl-Cl	so
Saintfaiths Gs19	300-450	3 :	660	10	2640	5			3300	5.0	35-40			A	SaCl	so
Msinsini My11	300-450	3 :	660	10	2640	5			3300	5.0	35-45			A	SaCl	so
Glengazi Bo31	700-1200	0 :			1056	2	660	10	1716	2.6	35-55		35-55	A	SaCl-Cl	vp,U
Mayo My10	300-450	3 :	330	5	1056	2			1386	2.1	15-35			A	fiSaLm-SaClLm	so
Stanger Bo11	700-1200	0 :			1056	2	330	5	1386	2.1	35-55		35-55	A	SaCl-Cl	so
Klipfontein Ms11	200-350	3 :	264	4	1056	2			1320	2.0	10-25			A	LmfiSa-SaClLm	hp
Skilderkrans Sw11	300-400	0 :	198	3	1056	2			1254	1.9	25-40		35-55	B	SaCl-Cl	so
Breidbach Sw12	300-400	0 :	132	2	1056	2			1188	1.8	35-50		55-60	B	SaCl-Cl	so
Leeufontein Oa16, Highflats Oa17	600-1200	0 :					660	10	660	1.0	25-45		25-45	B	SaClLm-SaCl	U,R
Jozini Oa36, Koedoesvlei Oa37	800-1200	0 :					660	10	660	1.0	25-45		25-45	B	SaClLm-SaCl	U,R
Dundee Du10	800-1200	0 :					660	10	660	1.0	0-15			A	fi/meSa-SaLm	U,R
Stream beds/Stroombeddings		4 :					2310	35	2310	3.5						

10 November 2006

1

LAND TYPE / *LANDTIPE* .... : **Fa126**
CLIMATE ZONE / *KLIMAATSONE* .... : 472S
Area / *Oppervlakte* .... : 16290 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 25 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2830 Richards Bay (16290 ha)

Inventory by / *Inventaris deur* :
A L Smith-Baillie S L J Vivian

Modal Profiles / *Modale profiele* :
None / Geen

Terrain unit / *Terreineenheid* .... :	1	2	3	5
% of land type / *% van landtipe* .... :	7	10	77	6
Area / *Oppervlakte (ha)* .... :	1140	1629	12543	977
Slope / *Helling (%)* .... :	2 - 12	>100	6 - 90	6 - 90
Slope length / *Hellingslengte (m)* .... :	20 - 300	55 - 400	250 - 1000	5 - 35
Slope shape / *Hellingsvorm* .... :	Y	X	X-Y	Y
MB0, MB1 (ha) .... :	319	0	6021	342
MB2 - MB4 (ha) .... :	821	1629	6523	635

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB	ha	%	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Soil-rock complex																		
Grond-rotskompleks:																		
Rock/Rots		4	91	8	326	20	502	4			919	5.6						
Trevanian Gs17	200-350	3	285	25	652	40	2509	20			3445	21.2	15-35			A	meSaLm-SaClLm	so,R
Mispah Ms10	100-300	3	205	18	489	30	1881	15			2575	15.8	10-30			A	Lmme/coSa-SaClLm	R
Williamson Gs16	200-350	3	114	10	81	5	1254	10			1450	8.9	15-35			A	fiSaLm-SaClLm	so,R
Milkwood Mw11	200-350	3	11	1	49	3					60	0.4	35-45			A	SaCl-Cl	R
Mayo My10	200-400	3	23	2	33	2					55	0.3	15-35			A	fiSaLm-SaClLm	so,R
Trevanian Gs17	200-350	1	171	15			2509	20			2680	16.5	15-35			A	meSaLm-SaClLm	so,R
Williamson Gs16	200-350	1	68	6			1254	10			1323	8.1	15-35			A	fiSaLm-SaClLm	so,R
Cartref Cf21, Cranbrook Cf22	400-500	0					627	5			627	3.9	6-20	6-20		E	LmmeSa-SaClLm	so,R
Mispah Ms10	100-300	3	91	8			376	3			468	2.9	10-30			A	Lmme/coSa-SaClLm	R
Msinga Hu26, Doveton Hu27	600-1200	0	46	4			376	3			422	2.6	15-40		20-45	B	SaClLm-SaCl	R
Dumasi Bo30	600-850	0					376	3	29	3	406	2.5	15-35		20-55	A	fi/meSaLm-SaClLm	vp,U
Mayo My10, Msinsini My11	250-400	0	23	2			251	2			274	1.7	15-45			A	fiSaLm-SaCl	so,R
Argent Sd11, Richmond Sd12	500-1000	0					251	2			251	1.5	35-55		35-60	B	SaClLm-Cl	R
Glendale Sd21, Shortlands Sd22	800-1000	0					251	2			251	1.5	35-55		35-60	B	SaClLm-Cl	R
Dundee Du10	600-1200	0							195	20	195	1.2	10-30			A	Lmfi/meSa-SaClLm	U
Kiora Bo10	600-850	0					125	1	20	2	145	0.9	15-35		20-55	A	fi/meSaLm-SaClLm	vp,U
Jozini Oa36	600-1200	0							98	10	98	0.6	15-35		15-35	B	fi/meSaLm-SaClLm	vp,U
Milkwood Mw11, Dansland Mw10	200-350	0	11	1							11	0.1	15-45			A	fiSaLm-SaCl	R
Stream beds/Stroombeddings		4							635	65	635	3.9						

LAND TYPE / *LANDTIPE*	: **Fa127**		
CLIMATE ZONE / *KLIMAATSONE*	: 338S		
Area / *Oppervlakte*	: 3990 ha		
Estimated area unavailable for agriculture / *Beraamde oppervlakte onbeskikbaar vir landbou* :	10 ha		

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2830 Richards Bay (3990 ha)

Inventory by / *Inventaris deur* :
D P Turner

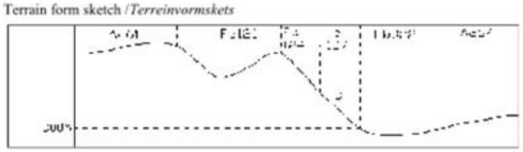
Modal Profiles / *Modale profiele* :
None / Geen

Terrain unit / *Terreineenheid* :	3	5
% of land type / *% van landtipe* :	95	5
Area / *Oppervlakte (ha)* :	3790	200
Slope / *Helling (%)* :	12 - 45	12 - 45
Slope length / *Hellingslengte (m)* :	500 - 1000	5 - 20
Slope shape / *Hellingsvorm* :	X-Y	X-Y
MB0, MB1 (ha) :	0	0
MB2 - MB4 (ha) :	3790	199

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Rock / Rots		4	379	10			379	9.5						
Trevanian Gs17, Williamson Gs16	150-300	3	1137	30			1137	28.5	15-30			A	fi/meSaLm-SaClLm	so,R
Mispah Ms10	100-200	3	1137	30			1137	28.5	6-20			A	fi/meSa-SaLm	R
Platt Gs14, Kanonkop Gs13	150-300	3	758	20			758	19.0	6-15			A	fi/meSa-SaLm	so,R
Zwartfontein Hu34, Shorrocks Hu36	200-400	3	379	10			379	9.5	10-25		10-25	B	LmmeSa-SaClLm	so,R
Katspruit Ka10	200-400	3			120	60	120	3.0	10-25			A	Lmfi/meSa-SaClLm	gs,R
Stream beds/Stroombeddings		4			80	40	80	2.0						

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : D4
Terrain form sketch / *Terreinvormskets*



Geology: Quartzofeldspathic rocks of the Tugela Complex.

Geologie: Kwartsveldspatiese gesteentes van die Kompleks Tugela.

LAND TYPE / *LANDTIPE* .... : **Fb320**

CLIMATE ZONE / *KLIMAATSONE* .... : 473S

Area / *Oppervlakte* .... : 2000 ha 1

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 5 ha

2

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2830 Richards Bay (2000 ha)

Inventory by / *Inventaris deur* :

L J Vivian

Modal Profiles / *Modale profiele* :

None / Geen

Terrain unit / *Terreineenheid*	:	1	3	5
% of land type / *% van landtipe*	:	8	72	20
Area / *Oppervlakte (ha)*	:	160	1440	400
Slope / *Helling (%)*	:	1 - 5	3 - 30	2 - 25
Slope length / *Hellingslengte (m)*	:	50 - 300	200 - 800	10 - 50
Slope shape / *Hellingsvorm*	:	Y	Y-Z	X
MB0, MB1 (ha)	:	19	360	200
MB2 - MB4 (ha)	:	141	1080	200

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	**MB**	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Rock / Rots		4	16	10	72	5			88	4.4						
Trevanian Gs17, Robmore Gs18	300-500	3	40	25	432	30			472	23.6	20-40			A	SaClLm-SaCl	so,R
Mispah Ms10	200-300	3	64	40	360	25			424	21.2	10-30			A	Lmme/coSa-SaClLm	R
Msinga Hu26, Doveton Hu27	600-1200	0	6	4	216	15			222	11.1	15-35		20-45	B	SaClLm-SaCl	R
Glenrosa Gs15	300-500	3	16	10	144	10			160	8.0	15-35			A	LmcoSa-SaClLm	so,R
Dundee Du10	700-1200	0					100	25	100	5.0	10-30			A	meSa-LmSa	U
Vimy Hu28	600-1200	0	10	6	72	5			82	4.1	50-65		55-65	B	SaCl-Cl	R
Mayo My10, Msinsini My11	300-600	2	5	3	72	5			77	3.8	20-45			A	SaClLm-SaCl	so,R
Arniston Va31, Lindley Va41	700-1200	0					60	15	60	3.0	25-45		35-55	B	SaCl	vp
Stanger Bo11	800-1200	0			29	2	20	5	49	2.4	35-60		40-70	A	SaCl-Cl	vp
Cartref Cf21	500-800	0	3	2	43	3			46	2.3	5-20	6-15		E	meSa-LmSa	so,R
Jozini Oa36	700-1200	0					20	5	20	1.0	10-30		15-35	B	meSaLm-SaClLm	U
Stream beds/Stroombeddings		4					200	50	200	10.0						

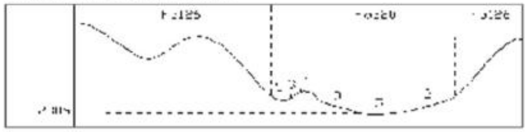
3

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : A3

Terrain form sketch / *Terreinvormskets*



Geology: Granite.

Geologie: Graniet.

10 November 2006

LAND TYPE / *LANDTIPE* .... : **Fb321**
CLIMATE ZONE / *KLIMAATSONE* .... : 473S
Area / *Oppervlakte* .... : 1440 ha 1
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 5 ha 2

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2830 Richards Bay (1440 ha)

Inventory by / *Inventaris deur* :
L J Vivian & A L Smith-Baillie

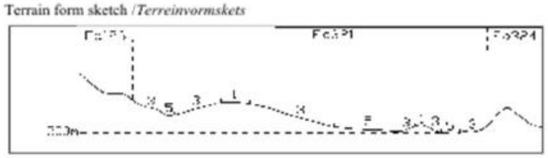
Modal Profiles / *Modale profiele* :
None / Geen

Terrain unit / *Terreineenheid* .... :	1	3	5
% of land type / *% van landtipe* .... :	5	75	20
Area / *Oppervlakte (ha)* .... :	72	1080	288
Slope / *Helling (%)* .... :	1 - 3	3 - 12	2 - 6
Slope length / *Hellingslengte (m)* .... :	100 - 300	200 - 600	5 - 120
Slope shape / *Hellingsvorm* .... :	Y	Y-Z	X
MB0, MB1 (ha) .... :	10	400	158
MB2 - MB4 (ha) .... :	62	680	130

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** **(mm)**	**MB**:	**ha**	**%**	**ha**	**%**	**ha**	**%**	**Total** / ***Totaal*** **ha**	**%**	**Clay content %** / ***Klei-inhoud %*** **A**	**E**	**B21**	**Hor**	**Texture** / ***Tekstuur*** **Class / *Klas***	**Depth limiting material** / ***Diepte-beperkende materiaal***	
Rock / Rots		4 :	9	12	32	3			41	2.9							
Trevanian Gs17, Williamson Gs16	300-500	3 :	22	30	378	35			400	27.8	15-35			A	fi/meSaLm-SaClLm	so,R	3
Mispah Ms10	200-300	3 :	28	39	216	20			244	17.0	10-30			A	meSaLm-SaClLm	R	
Cartref Cf21	700-1200	0 :	7	10	162	15			169	11.8	5-20	6-15		A	meSa-LmSa	so,R	
Swartland Sw31	200-400	0 :	3	4	65	6	17	6	85	5.9	15-35		35-55	B	SaCl	so,R	4
Arniston Va31, Lindley Va41	300-500	0 :			32	3	43	15	76	5.3	15-35		35-55	B	SaCl	vp	
Fernwood Fw11	700-1200	0 :			65	6			65	4.5	0-10			A	meSa	R	
Platt Gs14	300-500	3 :	4	5	54	5			58	4.0	6-15			A	meSa-LmSa	so,R	
Mkambati Kd14	700-1200	0 :			43	4			43	3.0	5-20	6-15	15-40	E	meSa-LmSa	gc	
Dundee Du10	700-1200	0 :					35	12	35	2.4	5-20			A	meSa-SaLm	U,R	
Jozini Oa36	700-1200	0 :					35	12	35	2.4	10-30		15-35	B	SaCl	so,R	
Doveton Hu27	500-700	0 :			32	3			32	2.3	35-55		35-55	B	SaCl	so,R	
Katspruit Ka10	200-400	0 :					17	6	17	1.2	10-30			A	LmmeSa-SaClLm	gc	
Koedoesvlei Oa37	700-1200	0 :					12	4	12	0.8	25-40		30-45	A	SaCl	R	
Stream beds/Stroombeddings		4 :					130	45	130	9.0							

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : A3
Terrain form sketch / *Terreinvormskets*



Geology: Mainly sandstone of the Natal Group, with small areas of alluvium and dolerite.

Geologie: Hoofsaaklik sandsteen van die Groep Natal, met klein oppervlaktes van alluvium en doleriet.

LAND TYPE / *LANDTIPE* .... : **Fb322**

CLIMATE ZONE / *KLIMAATSONE* .... : 338S

Area / *Oppervlakte* .... : 3380 ha 1

Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 10 ha 2

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*
2830 Richards Bay (3380 ha)

Inventory by / *Inventaris deur :*
H Grundling

Modal Profiles / *Modale profiele :*
None / Geen

Terrain unit / *Terreineenheid* .... :	1	3	5
% of land type / *% van landtipe* .... :	10	87	3
Area / *Oppervlakte (ha)* .... :	338	2941	101
Slope / *Helling (%)* .... :	1 - 7	1 - 12	1 - 5
Slope length / *Hellingslengte (m)* .... :	100 - 300	100 - 300	50 - 200
Slope shape / *Hellingsvorm* .... :	Y	X-Y	X-Z
MB0, MB1 (ha) .... :	135	1411	71
MB2 - MB4 (ha) .... :	203	1529	30

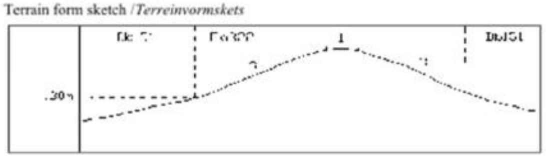
Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB:	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Williamson Gs16	150-350	3 :	135	40	1029	35			1164	34.5	15-35			A	fiSaLm-SaClLm	so,R
Mispah Ms10	150-350	3 :	51	15	441	15			492	14.6	15-35			A	fi/meSaLm-SaClLm	R
Vimy Hu28, Marikana Hu38	800-1200	0 :	34	10	294	10	5	5	333	9.9	45-60		55-65	B	Cl	so,R
Doveton Hu27, Makatini Hu37	800-1200	0 :	34	10	294	10	5	5	333	9.9	30-50		35-55	B	SaCl	so,R
Jozini Oa36	400-1000	1 :			176	6	10	10	187	5.5	15-35		20-35	B	SaClLm	R
Swartland Sw31, Hogsback Sw32	300-600	1 :	34	10	147	5	5	5	186	5.5	20-40		35-65	B	SaCl-Cl	so,R
Argent Sd11	800-1200	0 :	17	5	147	5	3	3	167	4.9	35-55		35-55	B	SaCl	so,R
Cartref Cf21, Cranbrook Cf22	600-1000	1 :	17	5	147	5	2	2	166	4.9	6-20	6-20		E	meSa-SaClLm	so,R
Nyoka Sw41, Omdraai Sw42	300-600	1 :			147	5	5	5	152	4.5	20-40		35-65	B	SaCl-Cl	so,R
Saintfaiths Gs19	150-350	3 :	17	5	59	2			76	2.2	35-45			A	SaCl	so,R
Lindley Va41, Sheppardvale Va42	300-600	0 :			29	1	10	10	40	1.2	20-40		35-65	B	SaCl-Cl	vp,R
Arniston Va31, Chalumna Va32	300-600	0 :			29	1	10	10	40	1.2	20-40		35-65	B	SaCl-Cl	vp,R
Katspruit Ka10	300-600	0 :					15	15	15	0.5	15-35			A	SaClLm	gc,R
Stream beds/Stroombeddings		4 :					30	30	30	0.9						

3 4

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe* : C2

Terrain form sketch / *Terreinvormskets*



Geology: Mainly tillite of the Dwyka Formation, with small areas of shale of the Pietermaritzburg Formation, Ecca Group.

Geologie: Hoofsaaklik tilliet van die Formasie Dwyka, met klein oppervlaktes van skalie van die Formasie Pietermaritzburg, Groep Ecca.

10 November 2006

LAND TYPE / *LANDTIPE* .... : **Fb323**

CLIMATE ZONE / *KLIMAATSONE* .... : 338S

Area / *Oppervlakte* .... : 1290 ha 1

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 8 ha

2

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2830 Richards Bay (1290 ha)

Inventory by / *Inventaris deur :*

L J Vivian

Modal Profiles / *Modale profiele :*

None / Geen

Terrain unit / *Terreineenheid* :	1	3	5
% of land type / *% van landtipe* :	13	80	7
Area / *Oppervlakte (ha)* :	168	1032	90
Slope / *Helling (%)* :	1 - 8	3 - 50	2 - 25
Slope length / *Hellingslengte (m)* :	100 - 300	200 - 700	5 - 75
Slope shape / *Hellingsvorm* :	Y	Y-Z	X
MB0, MB1 (ha) :	3	144	50
MB2 - MB4 (ha) :	164	888	41

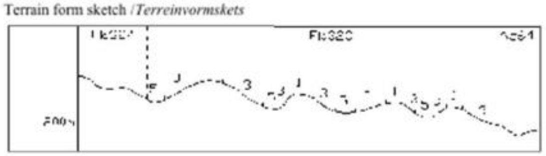
Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Rock / Rots		4	25	15	103	10			128	10.0						
Williamson Gs16	300-500	3	84	50	475	46			559	43.3	15-35			A	LmfiSa-SaClLm	so,R
Mispah Ms10	200-300	3	42	25	206	20			248	19.3	15-25			A	Lmfi/meSa-SaClLm	R
Trevanian Gs17	300-500	3	8	5	52	5			60	4.7	15-35			A	LmmeSa-SaClLm	so,R
Arniston Va31, Lindley Va41	700-900	0			41	4	18	20	59	4.6	25-45		35-55	B	SaCl	vp,U
Saintfaiths Gs19	300-500	3	5	3	52	5			57	4.4	35-45			A	SaCl	so,R
Jozini Oa36	700-900	0			52	5	4	5	56	4.4	15-35		15-35	B	fi/meSaLm-SaClLm	U,R
Swartland Sw31, Nyoka Sw41	400-700	0			31	3			31	2.4	25-35		35-55	B	SaCl	so,R
Dundee Du10	700-1200	0					27	30	27	2.1	6-15			A	fi/meSa-SaLm	U
Doveton Hu27	500-800	0	3	2	21	2			24	1.9	35-55		35-55	B	SaCl	R
Stream beds/Stroombeddings		4					40	45	41	3.2						

For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Terrain type / *Terreintipe :* C4

Terrain form sketch / *Terreinvormsket*s



Geology: Tillite of the Dwyka Formation.

Geologie: Tilliet van die Formasie Dwyka.

10 November 2006

1