AGRICULTURAL POTENTIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED KALGOLD EXPANSION PROJECT

Ratlou Local Municipality, North-West Province

October 2021

CLIENT

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1 Introduction

The Biodiversity Company was commissioned to compile an agricultural potential Environmental Impact Assessment (EIA) for the Kalgold Expansion project. The existing Harmony Kalgold operation wishes to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month. A pre-feasibility study has been undertaken. The findings of the pre-feasibility study have concluded that the following new activities and expansions must be provided for:

- New Processing Plant;
- New Powerline;
- New Explosives Magazine;
- Increasing the Pit Footprint;
- Expansion of the Spanover Waste Rock Dump (WRD);
- A Series of new Roads;
- A Series of new Pipelines;
- New Trackless Mobile Machine (TMM) Workshop; and
- New Run of Mine (ROM) Pad.

Kalgold mine is an open pit mining operation located some 60km South-West of Mahikeng in the North-West Province. The mine is owned and operated by Harmony Gold, who acquired the mine in 1999. The mine is located in the Kraaipan Greenstone Belt, which is part of the large Amalia-Kraaipan Greenstone terrain. The largest ore body is found in the D-Zone, which was mined out by a single pit operation along a strike length of 1 300 m and to a depth of approximately 290 m below surface. Mining at Kalgold Mine continued at the A-Zone, Windmill and Watertank Open Pits, which are all relatively new opencast operations.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (No. 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 30 October 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation”.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed project.

1.1 Terms of Reference

The Terms of Reference (ToR) for this study include the following:

- Conducting a pedology assessment which includes a description of the physical properties which characterise the soil within the proposed area of development of the relevant portions of the property;
- The findings from the study were used to determine the existing land capability and current land use of the entire surface area of the relevant portions of the project area;
- The soil classification was done according to the Taxonomic Soil Classification System for South Africa, 1991. The following attributes must be included at each observation:
    - Soil form and family (Taxonomic Soil Classification System for South Africa, 1991);
    - Soil depth;
    - Estimated soil texture;
    - Soil structure, coarse fragments, calcareousness;
    - Buffer capacities;
    - Underlying material;
    - Current land use; and
    - Land capability.
- Soils samples were taken from the top-and subsoils relevant to the proposed open cast mining areas and sent off to Nvirotek labs for a standard and textural analysis.

1.2 Project Description

Kalgold mine is an open pit mining operation located some 60 km from Mahikeng in the North West Province. The project area is divided by the N18 national highway and falls in the Ratlou Local Municipality within the Ngaka Modiri Molema District Municipality. The area surrounding the project area consists predominantly of mining activities, secondary roads and agricultural fields. The project layout is shown in Figure 1-1, while the location of the project area is shown in Figure 1-2.

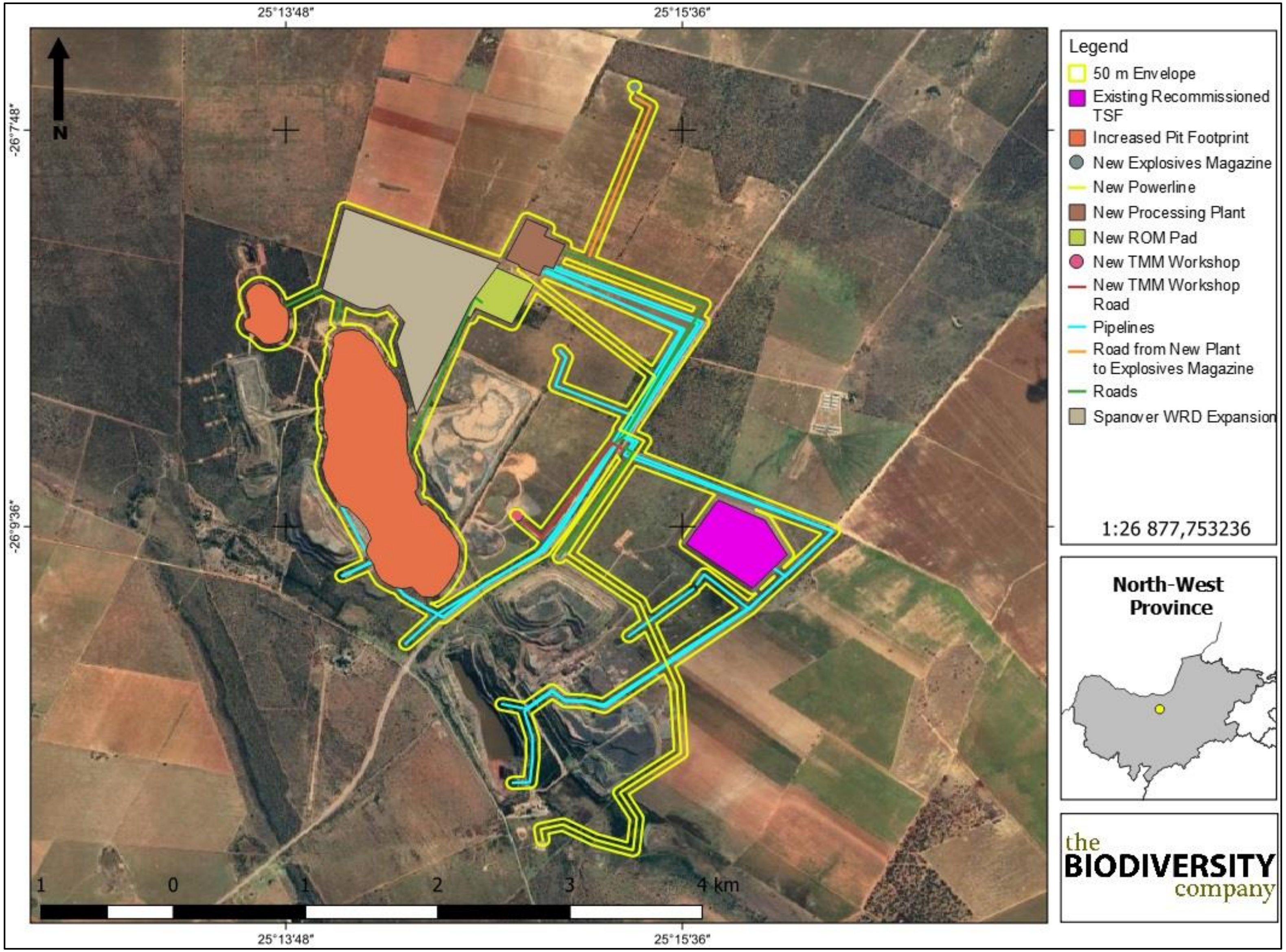

Figure 1-1 Project infrastructure layout

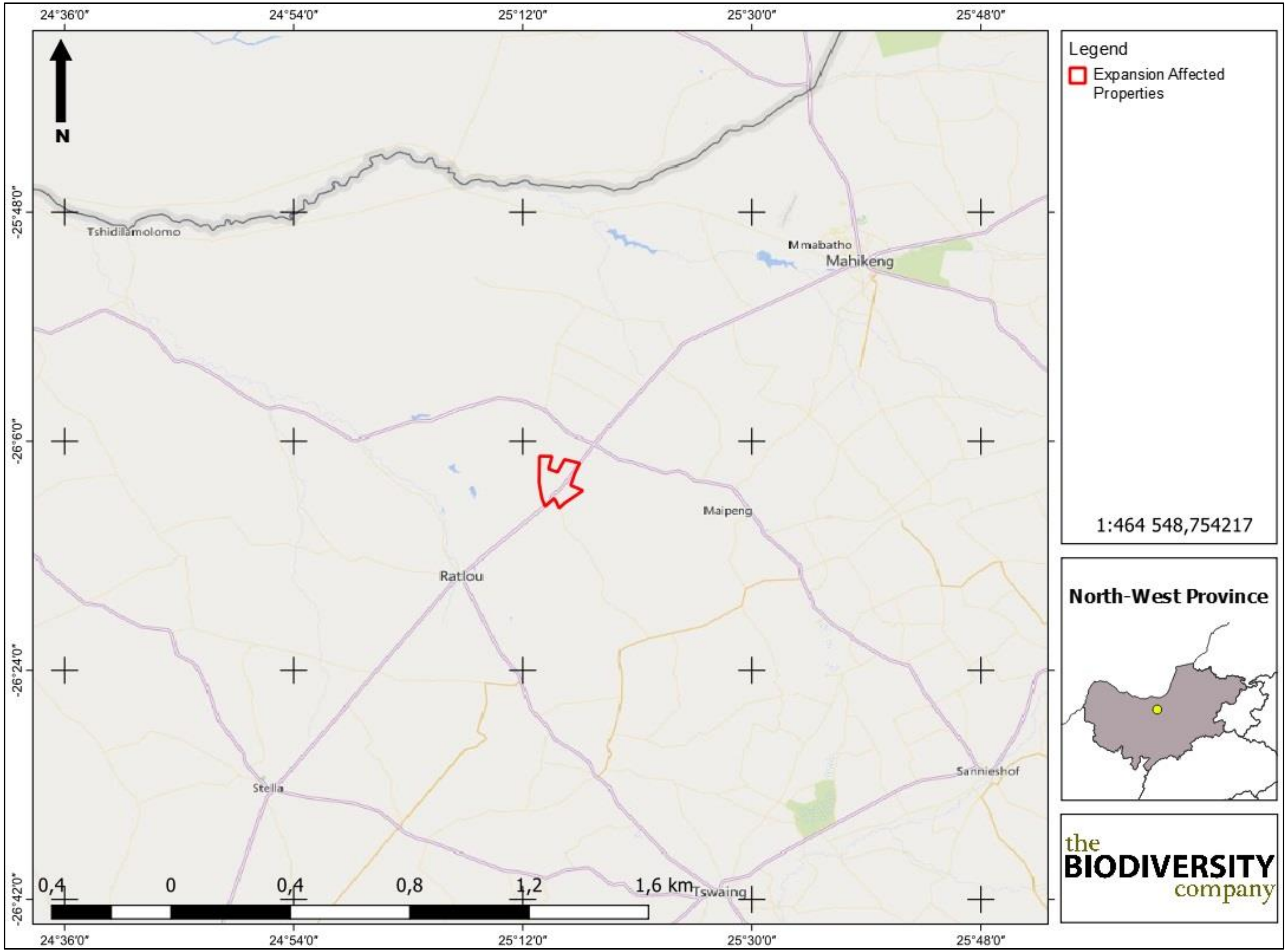

Figure 1-2 Locality of the project area

2 Document Structure

The table below provides the NEMA (2014) Requirements for the assessment, and also the relevant sections in the reports where these requirements are addressed (Table 2-1).

Table 2-1 Report Structure

Environmental Regulation	Description	Section in Report
NEMA EIA Regulations 2014 (as amended)		
Appendix 6 (1)(a):	Details of – (I) The specialist who prepared the report; and (II) The expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 3
Appendix 6 (1)(b):	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix A
Appendix 6 (1)(c):	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
Appendix 6 (1)(cA):	An indication of the quality and age of base data used for the specialist report;	Section 5
Appendix 6 (1)(cB):	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10
Appendix 6 (1)(d):	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5
Appendix 6 (1)(e):	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
Appendix 6(1)(f):	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 9
Appendix 6(1)(g):	An identification of any areas to be avoided, including buffers;	Section 9
Appendix 6(1)(h):	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 9
Appendix 6(1)(i):	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
Appendix 6(1)(j):	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
Appendix 6(1)(k):	Any mitigation measures for inclusion in the empr;	Section 11
Appendix 6(1)(l):	Any conditions for inclusion in the environmental authorisation;	Section 11
Appendix 6(1)(m):	Any monitoring requirements for inclusion in the empr or environmental authorisation;	Section 11
Appendix 6(1)(n):	A reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; (ia) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the empr, and where applicable, the closure plan;	Section 12
Appendix 6(1)(o):	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
Appendix 6(1)(p):	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
Appendix 6(1)(q):	Any other information requested by the competent authority.	N/A

3 Specialist Details

Report Name	**AGRICULTURAL POTENTIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED KALGOLD EXPANSION PROJECT COLLIERY**
Submitted to	EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES
Report and Site Assessment	**Ivan Baker** Ivan Baker is Cand. Sci Nat registered (119315) in environmental science and geological science. Ivan is a wetland and ecosystem service specialist, a hydropedologist and pedologist that has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following IFC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom.
Reviewer	**Andrew Husted** Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

4 Key Legislative Requirements

Currently, various pieces of legislation and related policies exist that guide and direct the land user in terms of land use planning both on a national and provincial level. This legislation includes, but is not limited to:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- Sub-division of Agricultural Land Act (Act 70 of 1970);
- Municipal Structures Act (Act 117 of 1998);
- Municipal Systems Act (Act 32 of 2000); and
- Spatial Planning and Land Use Management Act (Act 16 of 2013 – not yet implemented).

The above mentioned are supported by additional legislation that aims to manage the impact of development on the environment and the natural resource base of the country. Related legislation to this effect includes:

- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Environment Conservation Act (Act 73 of 1989);
- National Environmental Management Act (Act 107 of 1998); and
- National Water Act (Act 36 of 1998).

5 Methodology

The following approach (or methods) were implemented for the baseline and impact assessment phase of the project.

5.1 Desktop Results

The elevation and slope percentage of the project area was be determined by means of SAGA software, which will be used to determine the agricultural potential of the site.

5.2 Field Survey

The site was traversed by vehicle and on foot between the 20th to the 23rd of September 2021. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 1.5 m. Soil survey positions were recorded as waypoints using a handheld GPS. Soils were identified to the soil family level as per the “Soil Classification: A Taxonomic System for South Africa” (Soil Classification Working Group, 2018). Landscape features such as existing open trenches were also helpful in determining soil types and depth.

5.3 Agricultural Potential Assessment

Land capability and agricultural potential was determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

Land capability is divided into eight classes and these may be divided into three capability groups. Table 5-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 5-1 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing Land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife
W - Wildlife		**MG - Moderate Grazing**			**MC - Moderate Cultivation**					
F- Forestry		**IG - Intensive Grazing**			**IC - Intensive Cultivation**					
LG - Light Grazing		**LC - Light Cultivation**			**VIC - Very Intensive Cultivation**					

The land potential classes have been determined by combining the land capability results and the climate capability of a region as shown in Table 5-2. The final land potential results are then described in Table 5-2.

Table 5-2 The combination table for land potential classification

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

VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 5-3 The Land Potential Classes

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

5.4 Current Land Use

Land use was identified using aerial imagery and then ground-truthed while out in the field. The possible land use categories are:

- Mining;
- Bare areas;
- Agriculture crops;
- Natural veld;
- Grazing lands;
- Forest;
- Plantation;
- Urban;
- Built-up;
- Waterbodies; and
- Wetlands.

5.5 Erosion Potential

Erosion has been calculated by means of the (Smith, 2006) methodology. The steps in calculating the Fb[1] ratings relevant to erosion potential is illustrated in Table 5-4 with the final erosion classes illustrated in Table 5-5.

[1] The soil erodibility index

Table 5-4 Fb ratings relevant to the calculating of erosion potential (Smith, 2006)

Step 1- Initial value, texture of topsoil horizon				
Light (0-15% clay)		**Medium (15-35% clay)**		**Heavy (>35% clay)**
Fine sand	Medium/coarse sand	Fine Sand	Medium/coarse sand	All sands
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment value (permeability of subsoil)				
Slightly restricted		Moderately restricted		Heavily restricted
-0.5		-1.0		-2.0
Step 3- Degree of leaching (excluding bottomlands)				
Dystrophic soils, medium and heavy textures		Mesotrophic soils		Eutrophic or calcareous soils, medium and heavy textures
+0.5		0		-0.5
Step 4- Organic Matter				
Organic topsoil			Humic Topsoil	
+0.5			+0.5	
Step 5- Topsoil limitations				
Surface crusting			Excessive sand/high swell-shrink/self-mulching	
-0.5			-0.5	
Step 6- Effective soil depth				
Very shallow (<250 mm)			Shallow (250-500 mm)	
-1.0			-0.5	

Table 5-5 Final erosion potential class

Erodibility	Fb Rating (from calculation)
Very Low	>6.0
Low	5.0 - 5.5
Moderate	3.5 – 4.5
High	2.5 – 3.0
Very High	<3.0

5.6 Soil Sampling

The topsoil and subsoil of ten soil profiles in selected undisturbed areas (especially focussing on the proposed pit and WRD expansion areas) (see Figure 5-1) were sampled and sent off to the Nvirotek Lab for fertility testing.

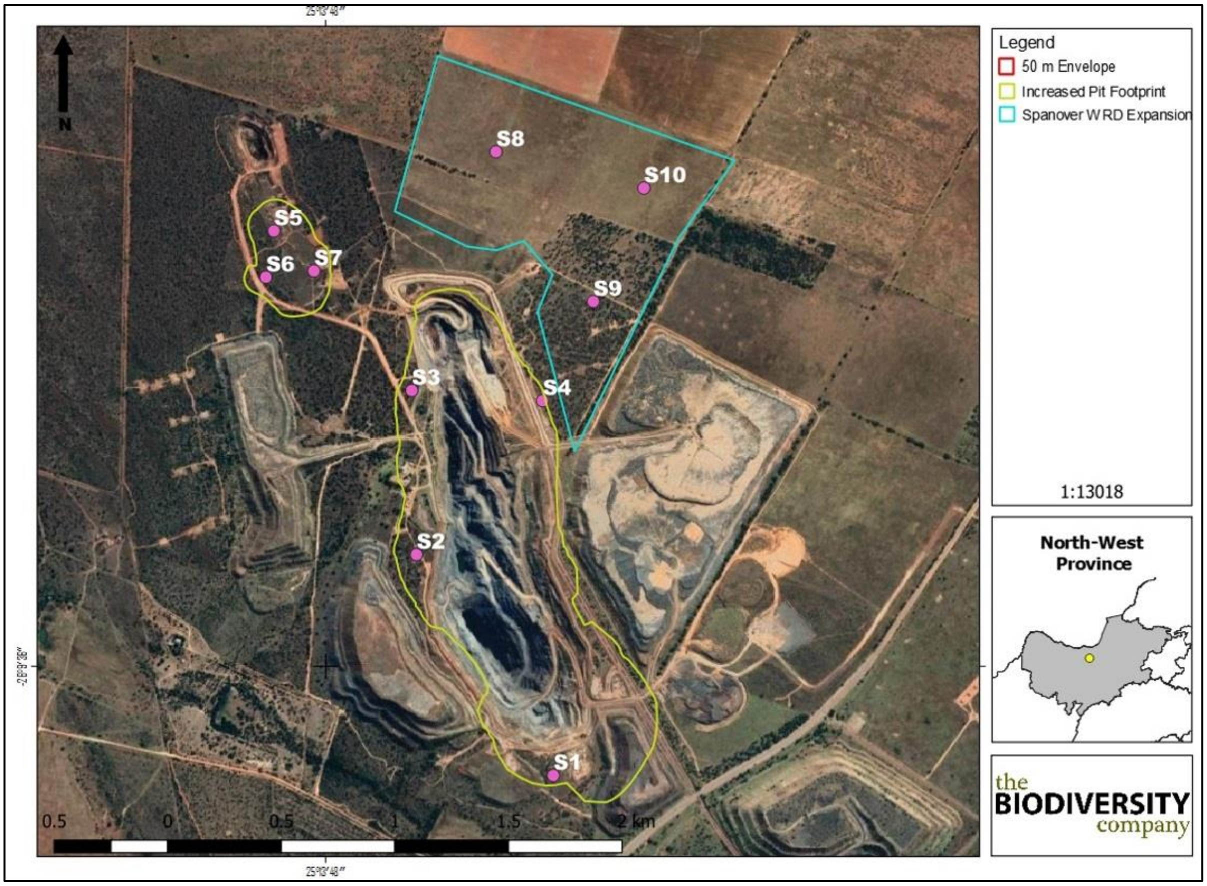

Figure 5-1 Sampling sites relevant to the mining areas

5.7 Limitations

The following limitations should be noted for the study:

- Samples were only taken from areas that will be affected by the expansion of open cast pits and virgin areas that will be covered in overburden/waste rock material.

6 Receiving Environment

6.1 Terrain

The terrain of the project area has been analysed to determine different terrain units within the 50 m envelope area.

6.1.1 Digital Elevation Model

A Digital Elevation Model (DEM) has been created to identify lower laying regions as well as potential convex topographical features which could point towards hydromorphic soils. The 50 m envelope area ranges from 1 140 to 1 275 Metres Above Sea Level (MASL). The lower laying areas (generally represented in dark blue) represent area that will have the highest potential to be characterised as hydromorphic soils (see Figure 6-1).

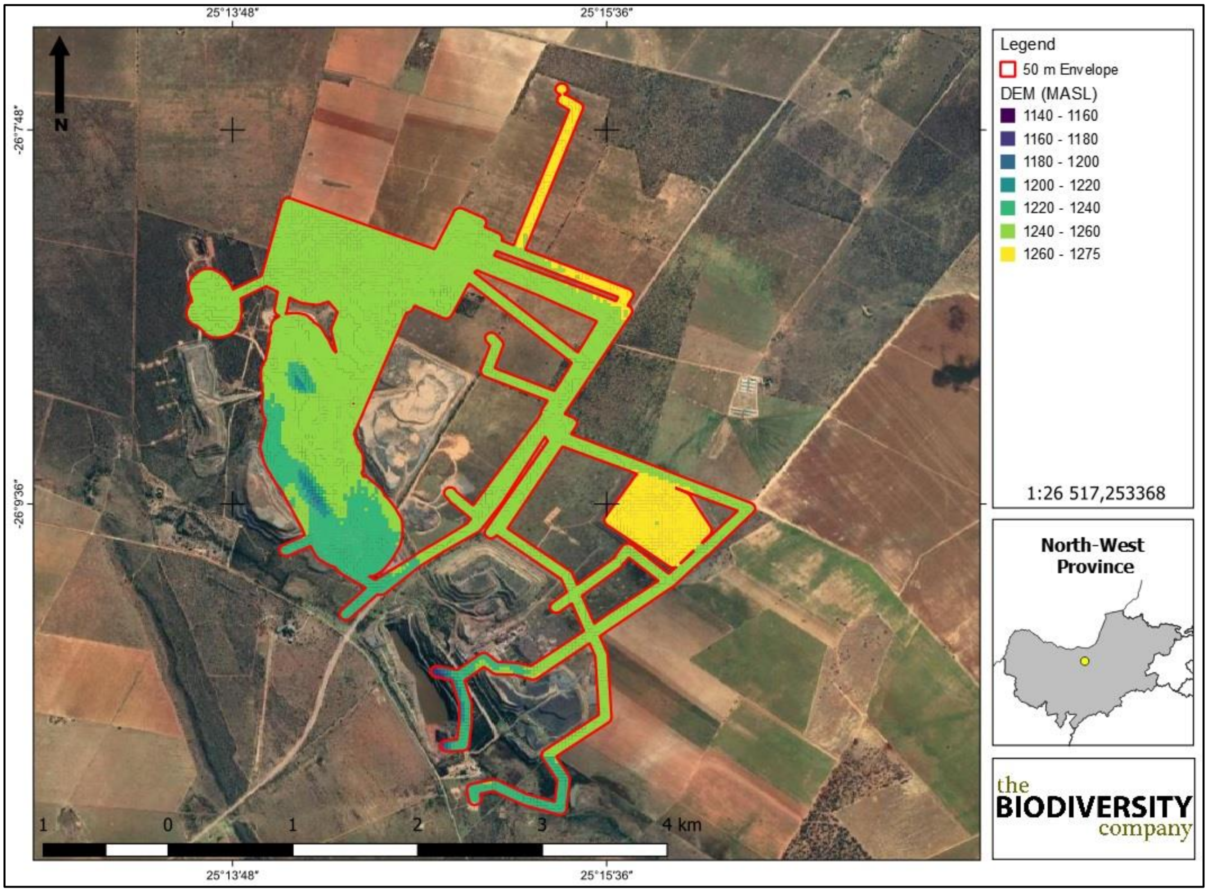

Figure 6-1 Digital Elevation Model of the project area

6.1.2 Slope Percentage

The slope percentage of the 50 m envelope area is illustrated in Figure 6-2. The slope percentage ranges from 0 to 220%, with the majority of the 50 m envelope area being characterised by a gentler slope (between 0 and 5%). Slopes are regarded as one of the most important parameters in soil classification and formation. The extreme slope percentage maximum can be explained by the presence of deep open cast pits.

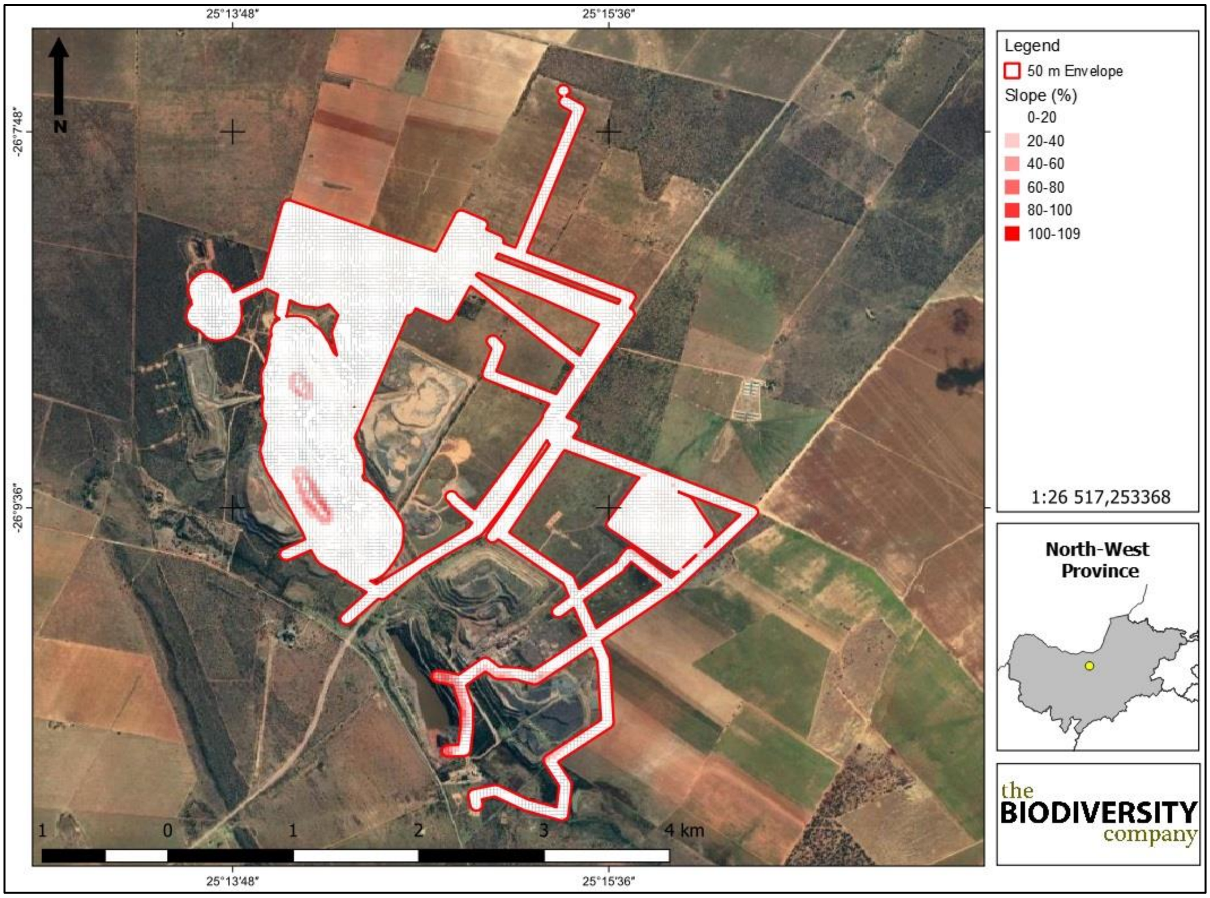

Figure 6-2 Slope percentage of the 50 m envelope area

6.2 Climate

The project area is characterised by summer rainfall with very dry winters. The mean annual precipitation (MAP) is about 400–480 mm. There is frost frequent in winter, Mucina & Rutherford (2006), see Figure 6-3.

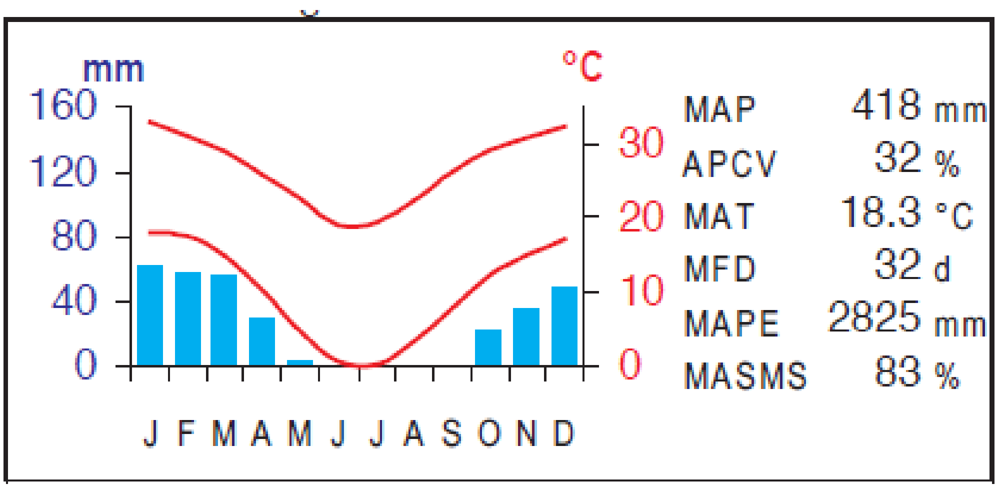

Figure 6-3 Climate diagram for the region, Mucina & Rutherford (2006).

6.3 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae29, Ah17 and Ai3 land types (Figure 6-7). The Ae land type consists of red-yellow apedal soils which are freely drained. The soils tend to have a high base status and is deeper than 300 mm. The Ah land type is characterised by freely drained red-yellow apedal soils with a high base status. The soils within this land type are characterised by less than 15% clay. The Ai land type is characterised by red and yellow-apedal, freely drained soils. These soils are characterised by a high base status usually with a clay percentage of lower than 15.

For the Ae 29 land type, Figure 6-4 illustrates the respective terrain units relevant to the Bb21 land type with the expected soils illustrated in Table 6-1. The figures and tables to follow illustrate these findings for the Ah17 and Ai3 land types respectively.

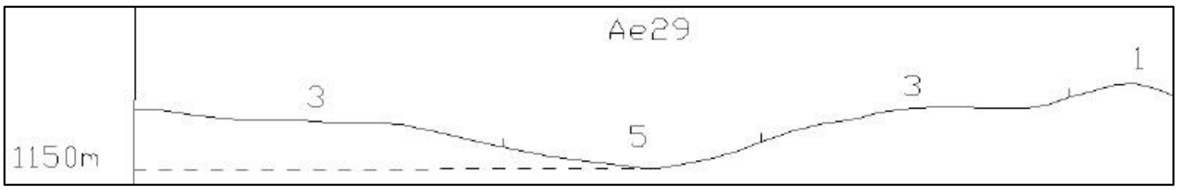

Figure 6-4 Illustration of the Ae 29 land type terrain units (Land Type Survey Staff, 1972 - 2006)

Table 6-1 Soils expected at the respective terrain units within the Ae 29 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units					
1 (1%)		**3 (80%)**		**5 (19%)**	
Bare Rock	100%	Hutton	98%	Willowbrook	35%
		Shortlands	2%	Rensburg	25%
				Streambeds	25%
				Milkwood	15%

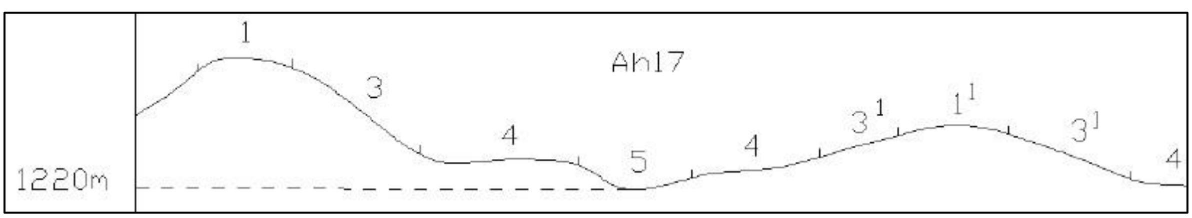

Figure 6-5 Illustration of the Ah 17 land type terrain units (Land Type Survey Staff, 1972 - 2006)

Table 6-2 Soils expected at the respective terrain units within the Ah 17 land type (Land Type Survey Staff, 1972 - 2006)

Terrain units			
1 (22%)	**3 (31%)**	**4 (42%)**	**5 (5%)**

Hutton	100%	Hutton	50%	Clovelly	88%	Milkwood	55%
		Clovelly	47%	Avalon	12%	Willowbrook	25%
		Avalon	3%			Streambeds	20%

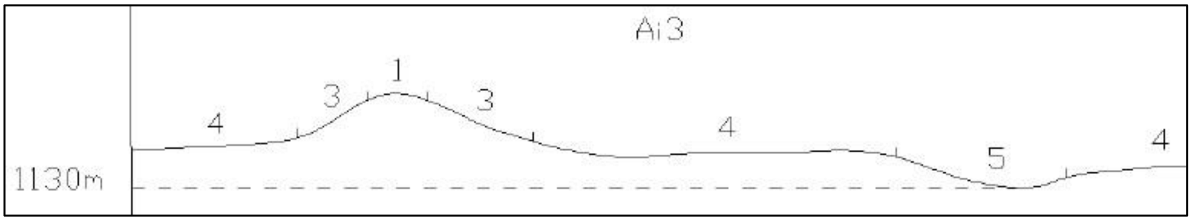

Figure 6-6 Illustration of the Ai 3 land type terrain units (Land Type Survey Staff, 1972 - 2006)

Table 6-3 Soils expected at the respective terrain units within the Ai 3 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units			
4 (42%)		**5 (5%)**	
Clovelly	64%	Milkwood	60%
Fernwood	30%	Fernwood	30%
Hutton	6%	Hutton	10%

According to Mucina & Rutherford (2006), the geology and soils aspect of this region is characterised by red to yellow sandy soils of the Ba and Bb land type. The geology of this region includes sandstone and shale of the Madzaringwe Formations (Karoo Supergroup).

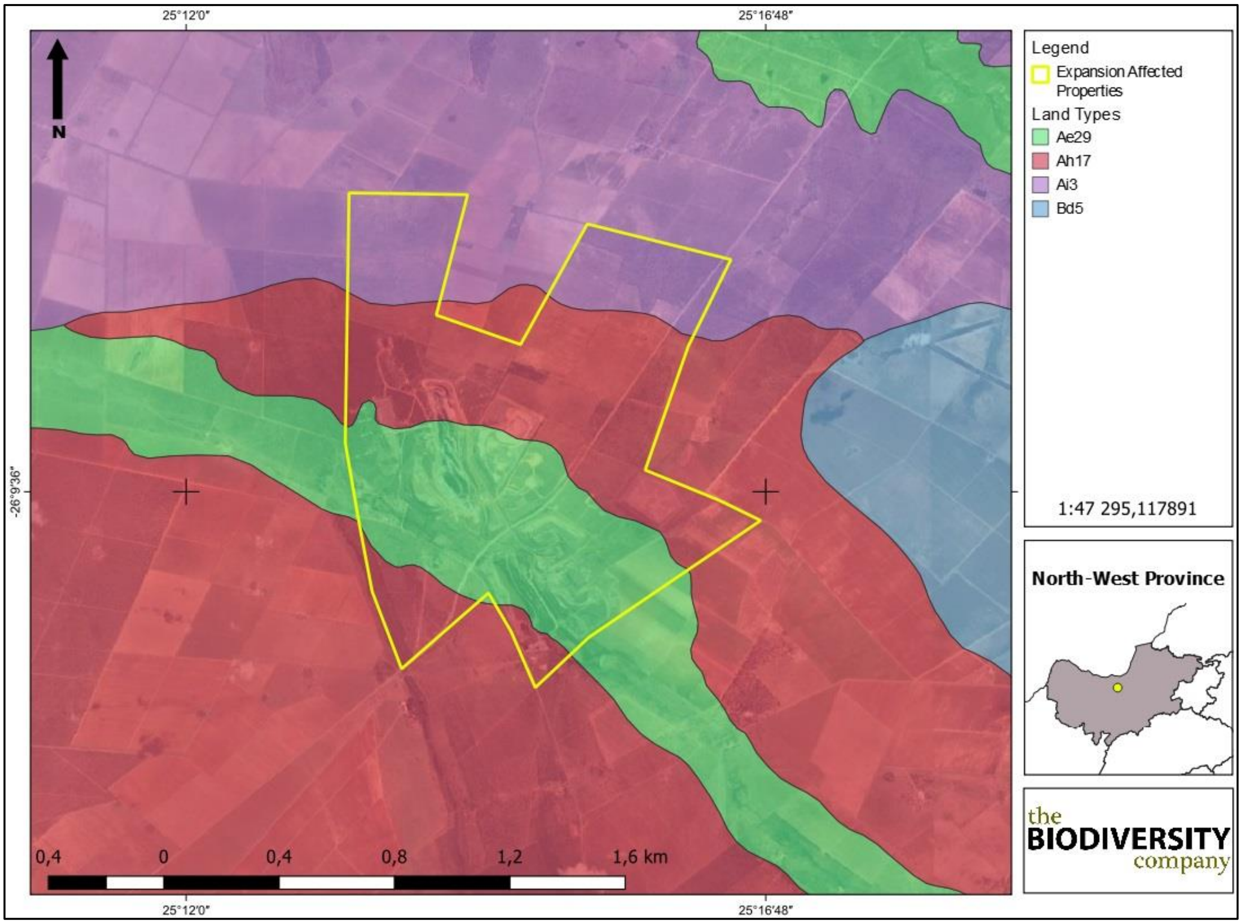

Figure 6-7 The land types associated with the project area

6.4 Vegetation Types

The site is situated in the Savanna biome. The savanna vegetation of South Africa represents the southernmost extension of the most widespread biome in Africa (Mucina & Rutherford, 2006). The savanna biome comprises many different vegetation types. The project area is situated within one vegetation type, namely the Mafikeng Bushveld according to Mucina & Rutherford (2006).

Mafikeng Bushveld is found in the North West province, in Aeolian Kalahari sand of Tertiary to Recent age on flat sandy plains. This vegetation type has well developed tree and shrub layers, dense stands of *Terminalia sericea*, *Acacia luederitzii* and *A. erioloba* in certain areas. The grass layer is also well developed in this vegetation type (Mucina & Rutherford 2006).

The vegetation type is listed as Vulnerable (Mucina & Rutherford, 2006). The conservation target is at 16%. No section of this vegetation type is conserved in statutory conservation areas, but very small area conserved in the Mmabatho Recreation Area. About 25% already transformed, mainly for cultivation and urban development.

7 Baseline Findings

7.1 Description of Soil Profiles and Diagnostic Horizons

Soil profiles were studied up to a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. The following diagnostic horizons were identified during the site assessment (also see Figure 7-1):

- Orthic topsoil;
- Alluvial deposits;
- Lithocutanic horizon;
- Red apedal horizon; and
- Yellow-brown apedal horizon.

7.1.1 Orthic Topsoil

Orthic topsoils are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one Orthic A topsoil to another (i.e. colouration, structure etc) (Soil Classification Working Group, 2018).

7.1.2 Stratified Alluvium

The stratified alluvium horizon is formed via alluvial or colluvial processes. This soil type is stratified and closely resembles the parent material of this soil type. Stratified alluvium generally is fertile and is often therefore used for cultivation purposes.

7.1.3 Lithocutanic Horizon

For the lithocutanic horizon, i*n situ* weathering of rock underneath a topsoil results in a well-mixed soil-rock layer. The colour, structure and consistency of this material must be directly related to the parent material of the weathered rock. The Lithocutanic horizon is usually followed by a massive rock layer at shallow depths. Hard rock, permeable rock and horizontally layered shale usually is not associated with the weathering processes involved with the formation of this diagnostic horizon.

7.1.4 Yellow-Brown Apedal Horizon

The yellow-brown apedal horizon is similar to that of the Red Apedal horizon in all aspects except for the colour and the iron-oxide processes involved with the colouration thereof. This diagnostic soil horizon rarely occurs in parent rock high in iron-oxides and will rather be associated with Quartzite, Sandstone, Shale and Granites.

7.1.5 Red Apedal Horizon

The red apedal diagnostic soil horizon has no well-formed peds, but rather small porous aggregates. The poor structure associated with this diagnostic profile is a result of weathering processes under well drained oxidising conditions. Iron-oxide precipitations form on the outside of soil particles (hence the red colour) and non-swelling clays dominate the clay particles. This diagnostic soil horizon is widely spread across South Africa and can be associated with any parent material expected (Soil Classification Working Group, 1991).

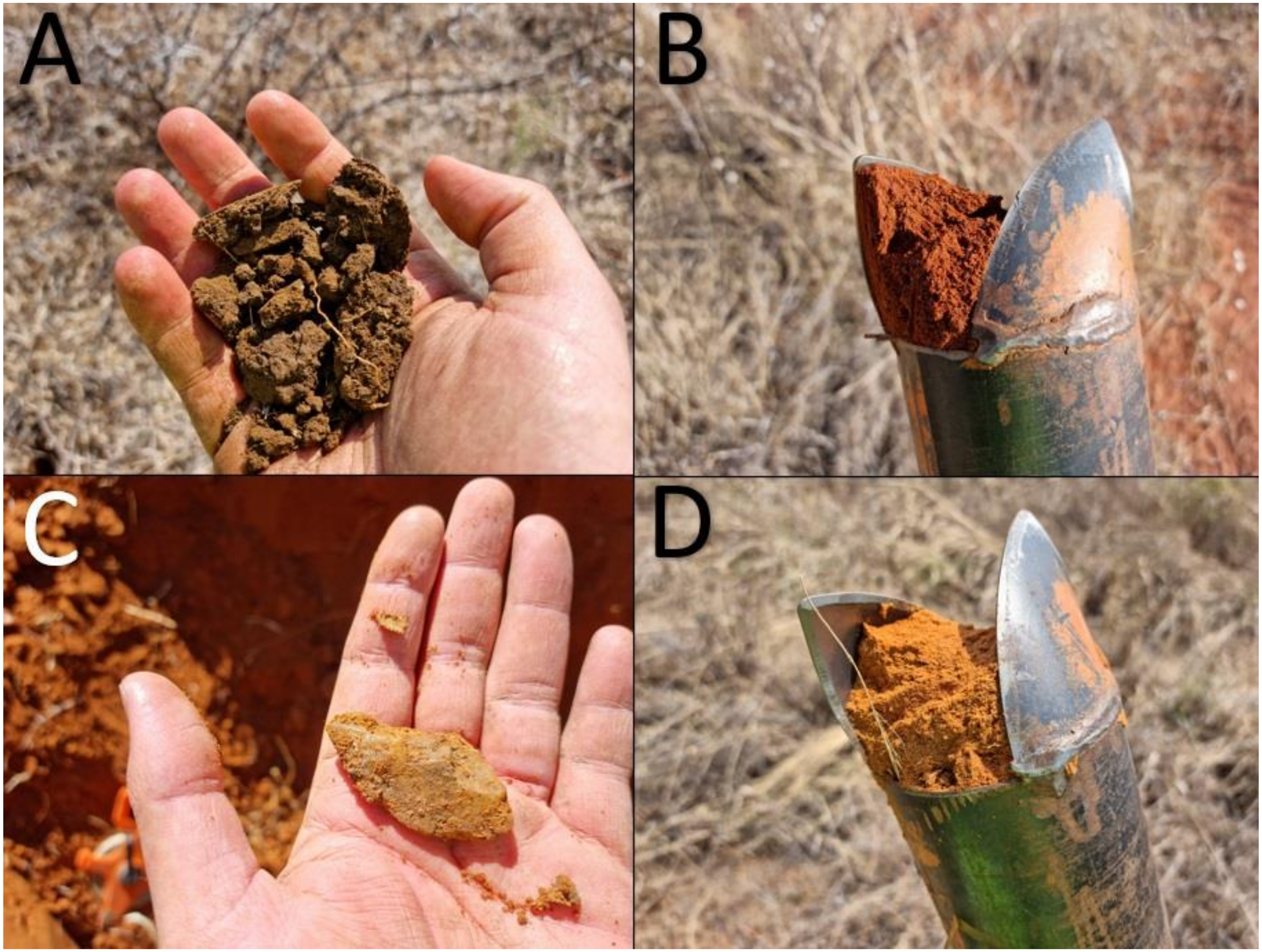

Figure 7-1 Dominant soils identified during the site assessment . A) Compacted alluvial deposits. B) Red apedal horizon. C) Quartzite from the lithic horizon. D) Yellow brown apedal horizon.

7.1.6 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified. These soil forms have been delineated and are illustrated in Figure 7-2 and is described in Table 7-1 according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock. The soil forms are followed by the soil family and in brackets the maximum clay percentage of the topsoil. Soil family characteristics are described in Table 7-2.

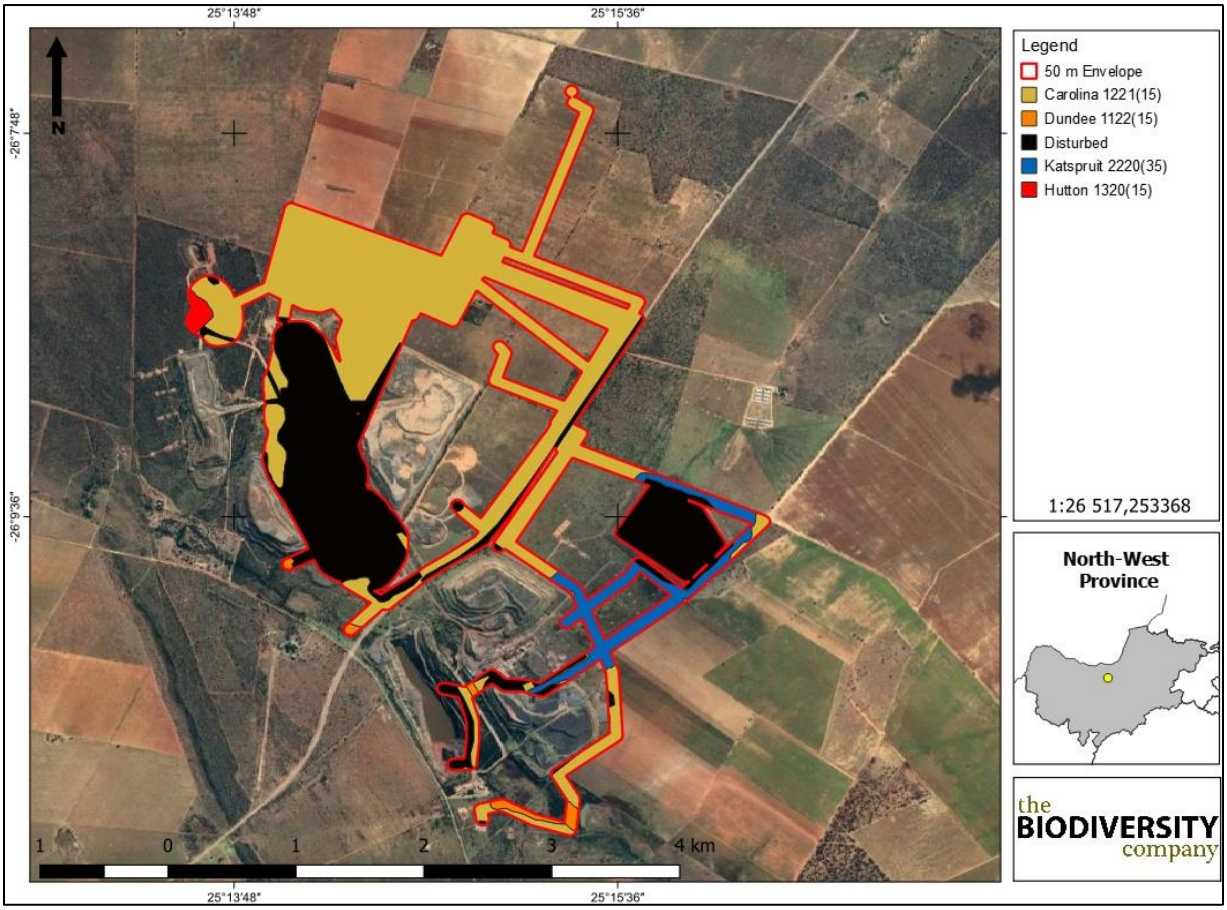

Figure 7-2 Soil delineations within the 50 m envelope area

Table 7-1 Summary of soils identified within the project area

	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Depth (mm)	Clay (%)	Signs of wetness	Rock %
Katspruit 2220(35)	0-300	15-35	Throughout	0	None	300-1 200 (+)	>35	None	0	N/A			
Dundee 1122(15)	0-300	0-15	None	0	High	300-1 200 (+)	15-35	None	0	N/A			
Hutton 1320(15)	0-300	0-15	None	0	None	300-1 200 (+)	0-15	None	0	N/A			
Carolina 1121(15)	0-300	0-15	None	0	None	300-1 200 (+)	0-15	None	0	N/A			

Table 7-2 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Occurrence of Lime	Colour of Alluvial Horizon	Base Status	Consistency of Gley	Alluvial Wetness	Textural Contrast	Extent of Rock Weathering
Carolina 1121(15)	Dark Topsoil	N/A	N/A	Mesotrophic	N/A	N/A	Luvic	Fractured Rock
Hutton 1320(15)	Dark Topsoil	N/A	N/A	Eutrophic	N/A	N/A	Luvic	N/A
Dundee 1122(15)	Dark Topsoil	Present	Brown	N/A	N/A	Present	N/A	N/A
Katspruit 2220(35)	Dark/Chromic	Absent	N/A	N/A	Slightly Firm	N/A	N/A	N/A

7.2 Agricultural Potential

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions.

The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

7.2.1 Climate Capability

The climatic capability has been determined by means of the Smith (2006) methodology, of which the first step includes determining the climate capability of the region by means of the Mean Annual Precipitation (MAP) and annual Class A pan (potential evaporation) (see Table 7-3).

Table 7-3 Climatic capability (step 1) (Scotney et al., 1987)

Central Sandy Bushveld region				
Climatic Capability Class	**Limitation Rating**	**Description**	**MAP: Class A pan Class**	**Applicability to site**
C1	None to Slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.	0.75-1.00	
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.	0.50-0.75	
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.	0.47-0.50	
C4	Moderate	Moderately restricted growing season due to the occurrence of low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.	0.44-0.47	
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.	0.41-0.44	
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops that frequently experience yield loss.	0.38-0.41	
C7	Severe to Very Severe	Severely restricted choice of crops due to heat and moisture stress.	0.34-0.38	
C8	Very Severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.	0.30-0.34	✓

According to Smith (2006), the climatic capability of a region is only refined past the first step if the climatic capability is determined to be between climatic capability 1 and 6. Given the fact that the climatic capability has been determined to be “C8” for the project area, no further steps will be taken to refine the climate capability.

7.2.2 Land Capability

The land capability was determined by using the guidelines described in “The farming handbook” (Smith, 2006). The delineated soil forms were clipped into the four different slope classes (0-3%, 3-7%, 7-12% and >12%) to determine the land capability of each soil form. The delineated soil forms were then grouped together in three different land capability classes (land capability 3, 4 and 5). As per example, the Hutton soil form will classify as a Land Capability (LC) 3 within the first slope class (0-3%) and the second slope class (3-7%) and a LC4 within the third class (7-12%) and fourth (>12%) slope class (see Table 7-4).

It is however worth noting, that even though the slope percentage of an area plays a considerable role in the formation and morphology of soil forms, the slope class is not the only parameter used to determine land capability. All parameters listed in Table 7-2 are also used to calculate land capability together with slope percentage. Key parameters used to determine the land capability include topsoil texture, depth and the permeability class of a soil form. The land capabilities for the project area are described in Table 7-5 and illustrated in Figure 7-4.

Table 7-4 Land capability calculations as per the slope classes relevant to the project area for the Hutton soil form

Soil Form	Slope Class	Calculated Land Capability
Hutton	0-3%	LC3
	3-7%	LC3
	7-12%	LC4
	>12%	LC4

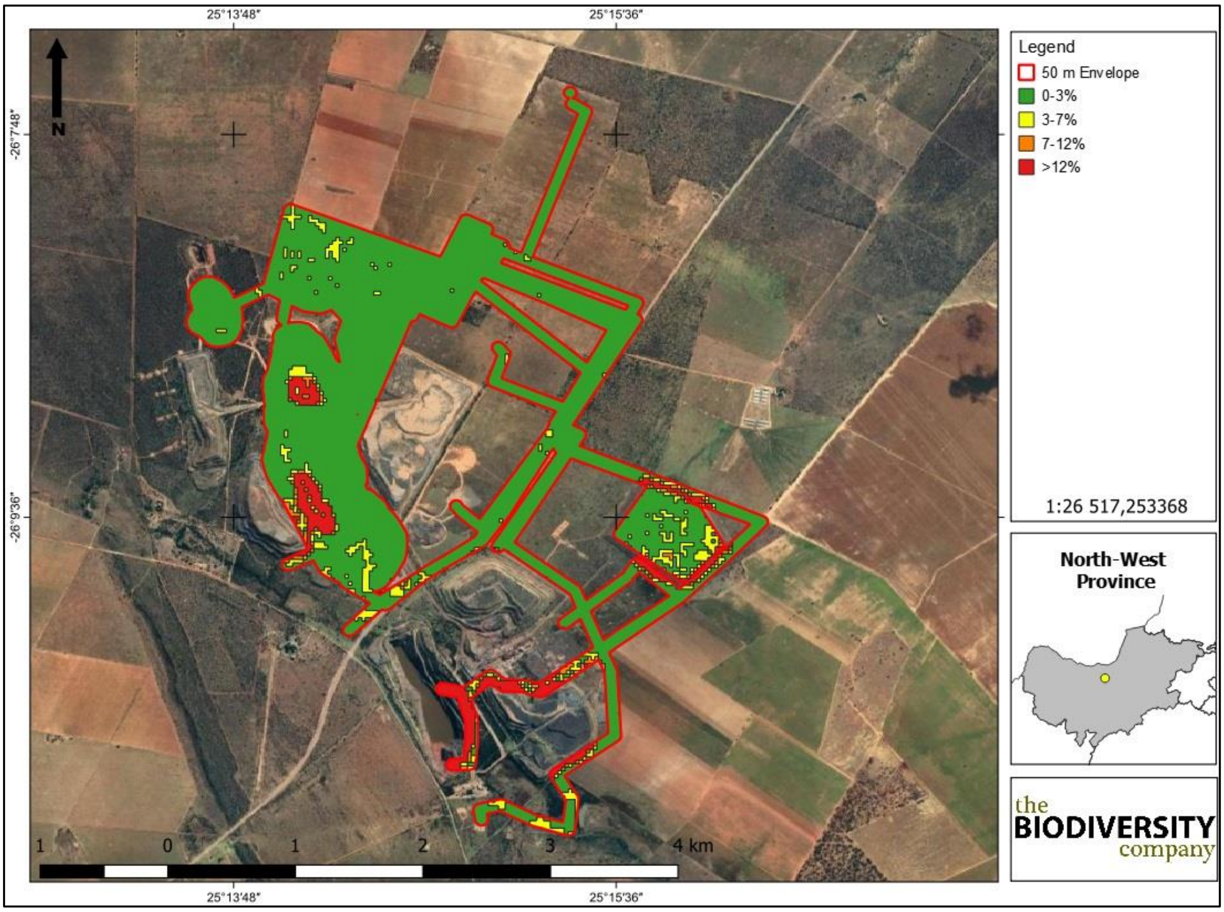

Figure 7-3 Four slope classes relevant to the land capability calculation methodology

Table 7-5 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage of Land Capability within Project Area	Land Capability Group	Sensitivity
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	56.5%	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	0.9%	Arable	Moderate
5	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	7%	Grazing	Low
Disturbed				35.6%	None	None

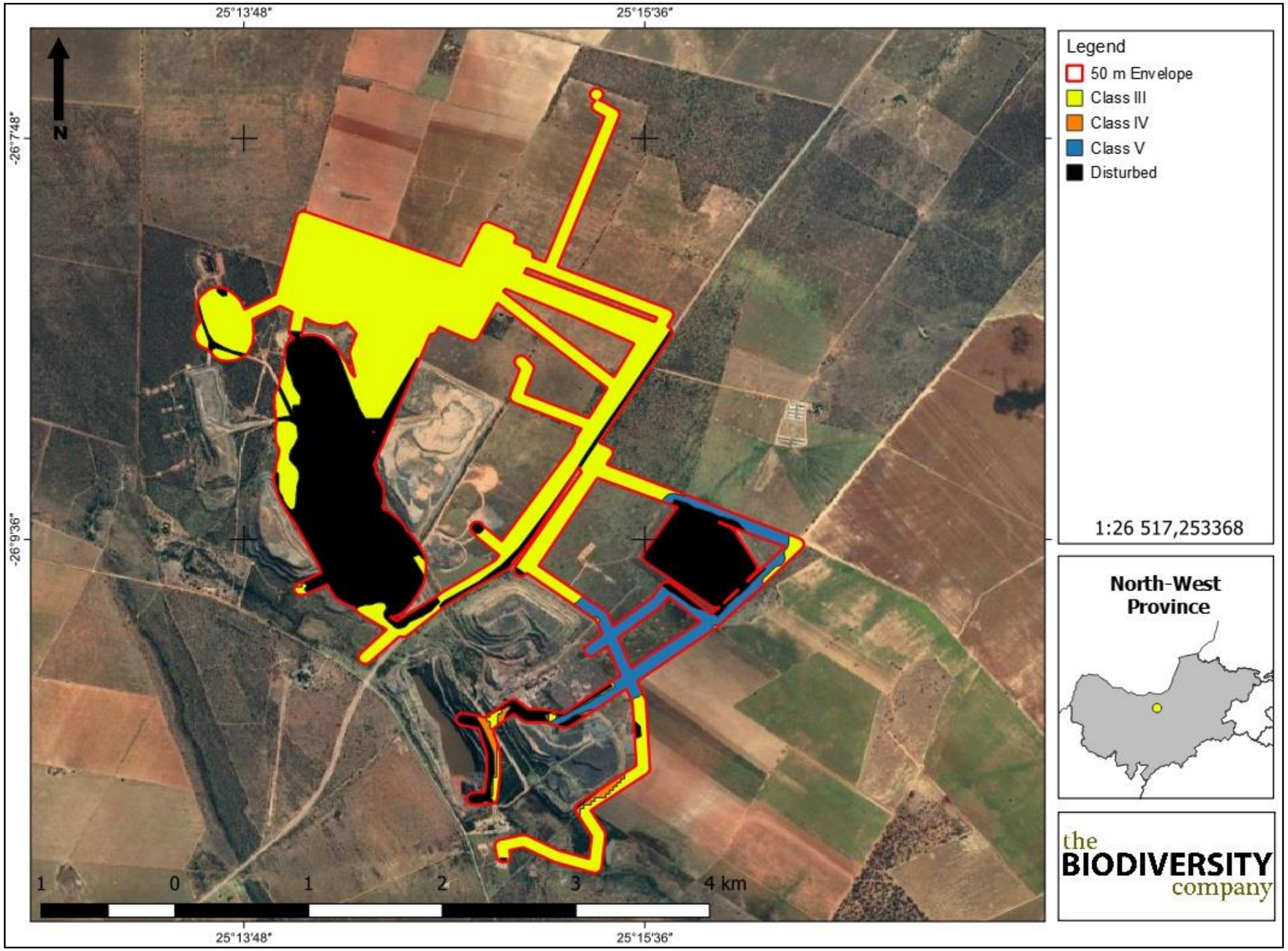

Figure 7-4 Land capability classes for the project area

7.3 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 7-6 and Table 7-7. From the three land capability classes, two land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability III and IV have been reduced to a land potential level L6 due to climatic limitations. The land capability V has been allocated a land potential "Vlei" considering its hydromorphic characteristics.

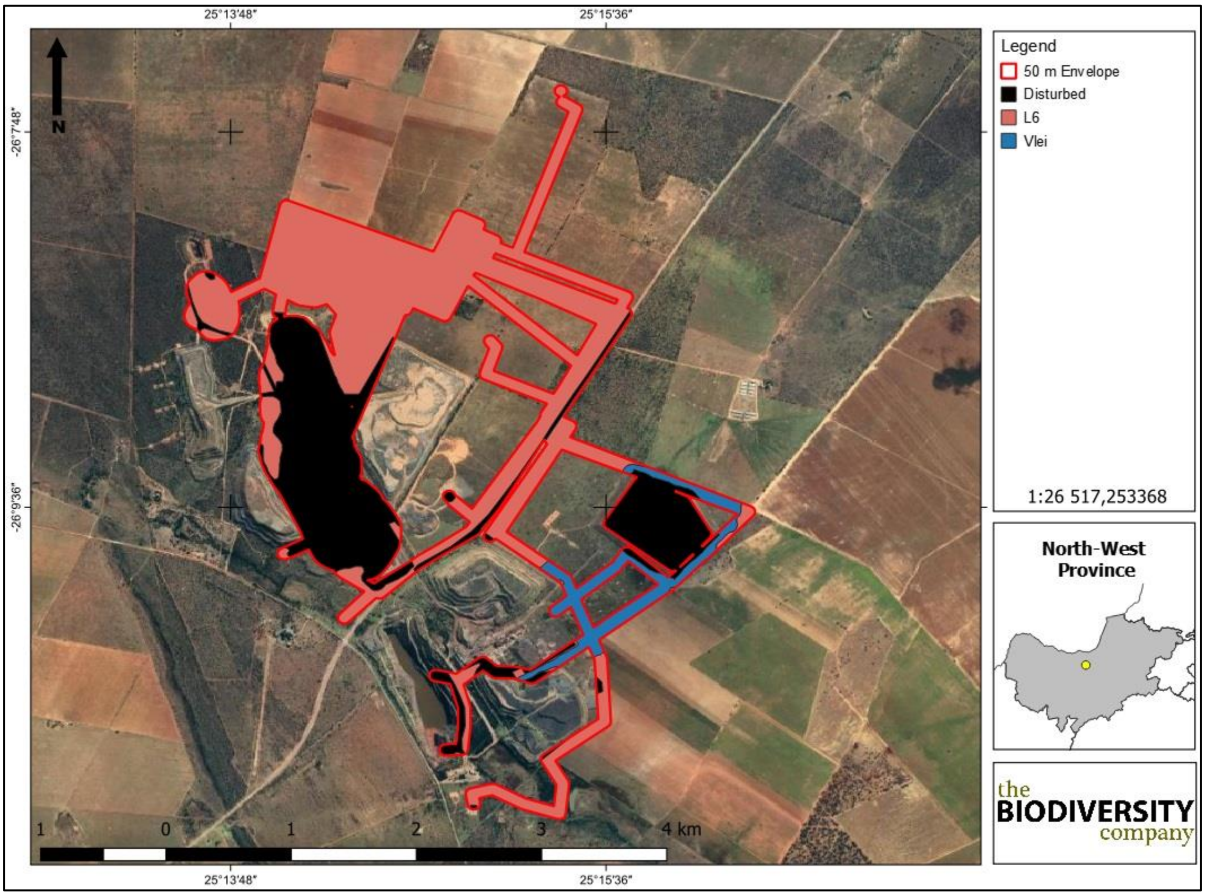

Figure 7-5 Land potential of the 50 m envelope area

Table 7-6 Land potential from climate capability vs land capability (Guy and Smith, 1998)

Land Capability Class	Climatic Capability Class							
	C1	C2	C3	C4	C5	C6	C7	C8
LC1	L1	L1	L2	L2	L3	L3	L4	L4
LC2	L1	L2	L2	L3	L3	L4	L4	L5
LC3	L2	L2	L2	L2	L4	L4	L5	L6*
LC4	L2	L3	L3	L4	L4	L5	L5	L6*
LC5	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei*
LC6	L4	L4	L5	L5	L5	L6	L6	L7
LC7	L5	L5	L6	L6	L7	L7	L7	L8
LC8	L6	L6	L7	L7	L8	L8	L8	L8

*Land potential level applicable to climatic and land capability

Table 7-7 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Percentage	Description of Land Potential Class	Sensitivity
6	57.4	**Very restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
Vlei	7	Wetland (grazing and wildlife)	Low
Disturbed	35.6	N/A	None

7.4 Land Use

Four different land uses have been identified within the proposed project area, namely "Secondary Grassland", "Disturbed Areas/Mining", "Bushveld" and "Wetlands" (Figure 7-6).

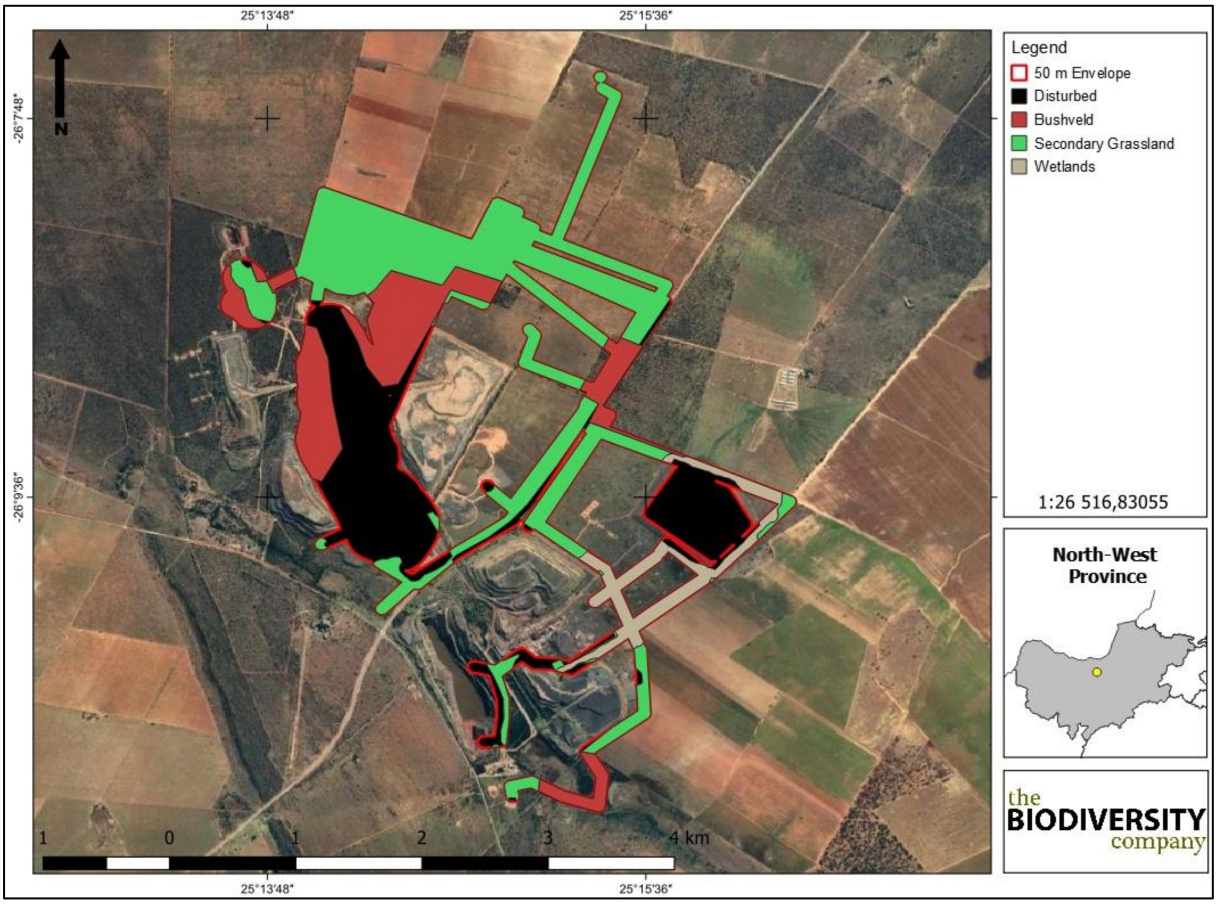

Figure 7-6 Different land uses within the proposed project area

7.5 Erosion Potential

The erosion potential of the identified soil forms has been calculated by means of the (Smith, 2006) methodology. In some cases, none of the parameters are applicable, in which case the step was skipped.

7.5.1 Carolina

Table 7-8 illustrates the values relevant to the erosion potential of the Carolina soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Moderate” potential for erosion.

Table 7-8 Erosion potential calculation for the Avalon soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted	**Moderately Restricted**	**Heavily Restricted**		
-0.5	-1.0	-2.0		
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures	**Mesotrophic Soils**	**Eutrophic or Calcareous Soils, Medium and Heavy Textures**		
+0.5	**0**	-0.5		
Step 4- Organic Matter				
Organic Topsoil	**Humic Topsoil**			
+0.5	+0.5			
Step 5- Topsoil Limitations				
Surface Crusting	**Excessive Sand/High Shrink/Self-Mulching**			
-0.5	-0.5			
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)	**Shallow (<250-500 mm)**			
-1.0	-0.5			

7.5.2 Hutton

Table 7-9 illustrates the values relevant to the erosion potential of the Hutton soil forms. The final erosion potential score has been calculated at 3.5, which indicates a “Moderate” potential for erosion.

Table 7-9 Erosion potential calculation for the Hutton soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	**4.0**	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted	**Moderately Restricted**	**Heavily Restricted**		
-0.5	-1.0	-2.0		
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures	**Mesotrophic Soils**	**Eutrophic or Calcareous Soils, Medium and Heavy Textures**		
+0.5	0	**-0.5**		
Step 4- Organic Matter				

Organic Topsoil	Humic Topsoil
+0.5	+0.5
Step 5- Topsoil Limitations	
Surface Crusting	Excessive Sand/High Shrink/Self-Mulching
-0.5	-0.5
Step 6- Effective Soil Depth	
Very Shallow (<250 mm)	Shallow (<250-500 mm)
-1.0	-0.5

7.5.3 Dundee

Table 7-10 illustrates the values relevant to the erosion potential of the Dundee soil forms. The final erosion potential score has been calculated at 3.0, which indicates a "High" potential for erosion.

Table 7-10 Erosion potential calculation for the Dundee soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		Medium (15-35% Clay)		Heavy (>35% Clay)
3.5	**4.0**	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		Moderately Restricted		Heavily Restricted
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		Mesotrophic Soils		Eutrophic or Calcareous Soils, Medium and Heavy Textures
+0.5		0		**-0.5**
Step 4- Organic Matter				
Organic Topsoil				Humic Topsoil
+0.5				+0.5
Step 5- Topsoil Limitations				
Surface Crusting				Excessive Sand/High Shrink/Self-Mulching
-0.5				-0.5
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)				Shallow (250-500 mm)
-1.0				-0.5

7.5.4 Katspruit

Table 7-11 illustrates the values relevant to the erosion potential of the Katspruit soil forms. The final erosion potential score has been calculated at 5.5, which indicates a "Low" potential for erosion.

Table 7-11 Erosion potential calculation for the Katspruit soil forms

Step 1- Initial Value, Texture of Topsoil		
Light (0-15% Clay)	Medium (15-35% Clay)	Heavy (>35% Clay)

3.5	4.0	4.5	5.0	**6.0**
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted	**Moderately Restricted**	**Heavily Restricted**		
-0.5	**-1.0**	-2.0		
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures	**Mesotrophic Soils**	**Eutrophic or Calcareous Soils, Medium and Heavy Textures**		
+0.5	0	-0.5		
Step 4- Organic Matter				
Organic Topsoil	**Humic Topsoil**			
+0.5	+0.5			
Step 5- Topsoil Limitations				
Surface Crusting	**Excessive Sand/High Shrink/Self-Mulching**			
-0.5	-0.5			
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)	**Shallow (<250-500 mm)**			
-1.0	-0.5			

8 Soil Chemical and Physical Properties

According to the Chamber of Mines South Africa/Coaltech (2007), one of the main objectives for rehabilitation is to restore the disturbed area back to the land capability conditions prior to mining activities. The land capability of the surrounding area has therefore been determined as the reference land capability. Additionally, samples were taken from the surrounding areas to be sent away for fertility tests. These results will also be used as reference for post-rehabilitation targets. It is worth noting that these samples are only relevant to the extension of the open cast pit and the construction of the new stockpiles due to the intensity of these components. These reference conditions will assist the responsible party in the rehabilitation process. The reference conditions should be achieved during rehabilitation to ensure that the conditions prior to development be restored.

8.1 Soil Physical Properties

Physical properties are defined by particle size distribution (soil textural classes) which refers to the percentage clay, silt and sand. All of the samples taken were sent for analysis. The average soil texture for all the soil samples is illustrated in Table 8-1.

Table 8-1 Results for physical properties for the surrounding land uses

Sample Site	Horizon	Clay %	Silt %	Sand %
1	Topsoil	12	3	85
	Subsoil	14	3	83
2	Topsoil	8	1	91
	Subsoil	10	1	89
3	Topsoil	10	2	88
	Subsoil	12	1	87
4	Topsoil	10	2	88
	Subsoil	12	1	87
5	Topsoil	12	2	86
	Subsoil	16	3	81
6	Topsoil	10	5	85
7	Topsoil	16	4	81
	Subsoil	12	3	85
8	Topsoil	14	3	83
	Subsoil	14	2	84
9	Topsoil	10	1	89
	Subsoil	8	12	80
10	Topsoil	10	1	89
	Subsoil	14	2	84

8.2 Soil Chemical Properties

Guidelines for relevant chemical properties are illustrated in Table 8-2, (Fertilizer Society of South Africa, 2007). The results from the chemical analysis are illustrated in Table 7-3. It is vital that the disturbed area be rehabilitated in such a way that not only the reference conditions be reached but that the recommended values described below be reached. This will ensure that vegetation be established with greater ease flourish.

Table 8-2 Guidelines for soil chemical properties

Guidelines (mg/kg)			
	Low Values	**Recommended Values**	**High Values**
Calcium (Ca)	<200		>3000
Magnesium (Mg)	<50		>300
Potassium (K)	<40		>250
Phosphorus (Ph)	<5		>35

pH (KCl)					
Very Acidic	Acidic	Slightly Acidic	Neutral	Slightly Alkaline	Alkaline
<4	4.0-5.9	6-6.7	6.8-7.2	7.3-8	>8

Phosphate (P) Pbray 1 (mg/kg)				
Very Low	Low	Moderate	High	Very High
<5	5-10	10-17	17-25	>25

Percentage Acid Saturation				
Ideal	Slightly High	Moderately High	High	Very High
0	0-8	8-20	20-40	**>40**

Na:K (cmol(+)/kg	
Ideal	High Na Concentration
<1	>1

Table 8-3 Chemical property results from the surrounding land uses

Site	Horizon	Phosphorus (Bray 1) (mg/kg)	Acid Saturation (%)	pH (KCl)	Exchangeable Cations			
					Na/K Cmol(+)/kg	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)
1	A	2	0	5	0,19	145	385	68
	B	1	0	4,6	0,5	61	330	151
2	A	2	0	4,9	0,24	97	199	53
	B	2	0	4,8	0,27	98	197	64
3	A	5	0	4,6	0,22	108	327	64
	B	2	0	5	0,36	70	318	90
4	A	2	0	5	0,15	150	194	56
	B	1	0	5,1	0,66	41	181	109
5	A	2	0	5,1	0,22	111	315	88
	B	2	0	5,1	0,57	45	321	152

6	A	2	10,52	4,1	0,21	134	196	73
	B	2	0	4,6	0,18	143	394	187
7	A	2	0	4,6	0,16	181	291	88
	B	2	0	4,9	0,2	141	366	146
8	A	4	20,52	4	0,47	60	218	67
	B	17	41,44	4	0,5	64	123	26
9	A	2	0	5,2	0,22	121	261	81
	B	1	0	5,2	0,19	147	385	132
10	A	11	0	5,1	0,16	179	344	110
	B	4	3,3	4,5	0,28	104	317	115

Phosphorus (Bray 1)

According to the Fertilizer Handbook (Fertilizer Society of South Africa, 2007), the recommended phosphorus value will be between 10 mg/kg and 17 mg/kg, which is classified as moderate. Anything higher or lower than that will be defined as low or high. The majority of sampling sites within the project area is characterised by very low (<5) phosphorus levels. It is however worth noting that these low phosphorus levels are expected due to extremely low phosphorus levels generally being present in South African soils. Phosphorus also is mobile of nature and is easily fixated, which makes the low levels of phosphorus even less available to plants.

Plants use phosphorus as a source of energy used to assist the process of photosynthesis as well as respiration, (Hazelton & Murphy, 2007.) therefore, by increasing the phosphate levels by means of ameliorants and/or fertiliser, an increase in plant growth could be expected which will add significance to the rehabilitation process.

The following samples are characterised by normal phosphorus values;

- Sample site 8 (subsoil); and
- Sample site 10 (topsoil).

The reason for these two anomalies can be explained by the fact that sample site is located in a previously cultivated area, which could have resulted in over fertilisation of phosphor rich fertiliser at sample site 8. A typical phosphorus cycle explaining potential inputs and losses of phosphorus is depicted in Figure 8-1.

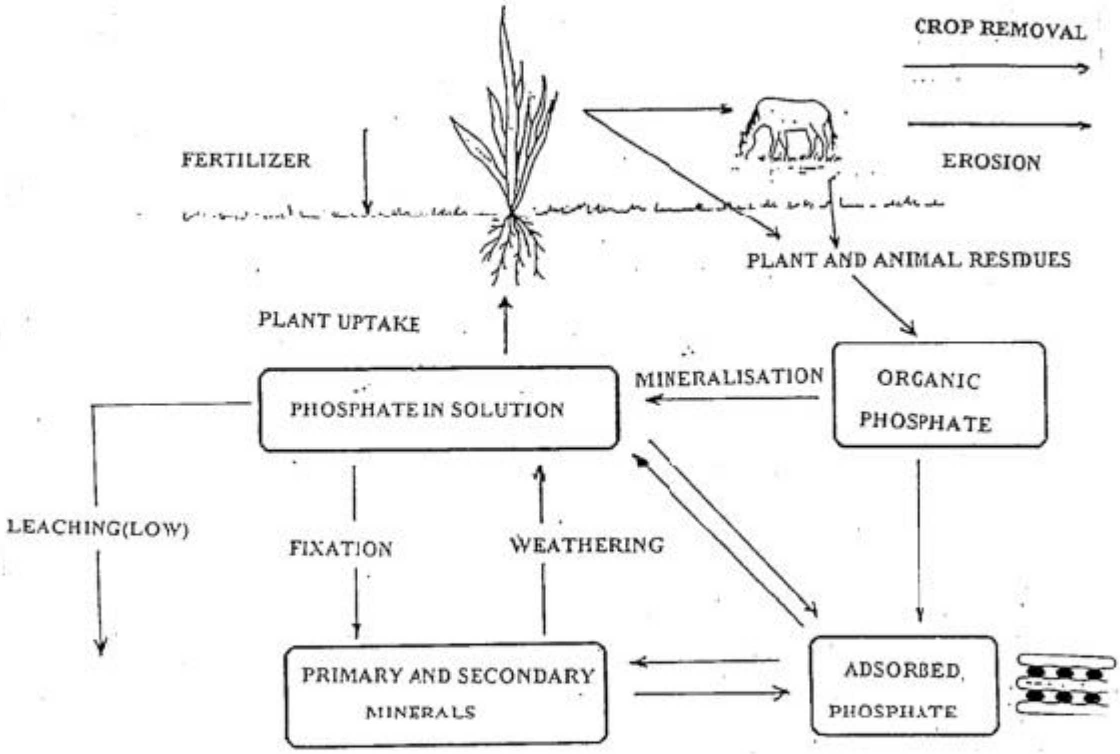

Figure 8-1 Typical phosphorus cycle (Joubert, 2021).

pH (KCl)

The recommended pH level will be between 6.8 and 7.2, (Fertilizer Society of South Africa, 2007). Reaching this value will be very difficult and, in some cases, impractical, therefore, it is recommended that a pH of at least 5.5 be reached seeing that this level of pH will decrease most of the risks involved with an acidic soil. Acidic soils are characterised by nutrient deficiency and lacks organic matter which is vital to healthy soil (Fertilizer Society of South Africa, 2007).

It is worth noting that the majority of sample sites' acidity is caused naturally. Therefore, it is recommended that the pH of these soils be reached once rehabilitation takes place after decommissioning. Sample site 8 is characterised by lower pH levels, which potentially indicates acidification due to historic ammonia fertilisers. It is therefore recommended that a pH of at least 5 be maintained during rehabilitation for the entire area associated with the pit extension and the construction of the two new stockpiles. An ideal pH (for closure purposes) will however be 5.5 to ensure productive plant growth.

Percentage Acid Saturation

The percentage acid saturation indicates the presence of exchangeable anions, which are likely to cause acidic conditions. An acid saturation worth more than 0% indicates that lime will be required to obtain optimal plant production conditions.

Four sample sites were determined to require liming;

- Sample site 6 (topsoil);
- Sample site 8 (topsoil and subsoil); and
- Sample site 10 (subsoil).

Sample site 10 is characterised by a lightly high acid saturation percentage, which indicates a ned for lime, but does not pose any significant threats for now. Sample site 6 is characterised by a moderately high acid saturation, which indicates that lime is required and that this area is at the limit for crop production. Sample site 8 is characterised by high and very high acid saturation values. This indicates a too low pH which ultimately renders this area unsuitable for crop production.

Sample site 8 and 10 is located in a previously cultivated area. Large concentrations of anions most likely remains from fertiliser applications. As for sample site 6, the slightly high acid saturation can be explained by potential run-off from the road which could have dissolved anions within the road’s extent from dust suppression.

Sodium (Na)

The sodium concentrations within soil should always be lower than potassium. If sodium levels exceed that of potassium, the sodium cations will replace that of potassium on a Cation Exchange Capacity point of view seeing that plants require large amounts of potassium compared to other elements (Fertilizer Society of South Africa, 2007). The Na:K relationships for all sample sites are suitable, ultimately indicating low sodium concentrations.

Potassium (K)

The recommended potassium levels are between 40 mg/kg and 250 mg/kg (Fertilizer Society of South Africa, 2007). Potassium is vital for healthy plant growth due to the integral role this element plays in the size, shape, strength and colour of plants (Fertilizer Society of South Africa, 2007). All sample sites are characterised by suitable potassium concentrations.

Calcium (Ca)

According to Fertilizer Society of South Africa (2007) the recommended calcium levels range between 200 mg/kg and 3000 mg/kg. Calcium plays an integral part in rectifying acidity and is vital for plants as a basic need. Calcium should be present within the root zone for easy abstraction by roots and pods (Fertilizer Society of South Africa, 2007).

The following sites are characterised by too low calcium levels;

- Sample site 2 (topsoil and subsoil);
- Sample site 4 (topsoil and subsoil);
- Sample site 6 (topsoil); and
- Sample site 8 (subsoil).

Magnesium (Mg)

According to (Fertilizer Society of South Africa, 2007), the recommended magnesium concentrations range between 50 mg/kg and 300 mg/kg. Only sample site 8 (subsoil) is characterised by a too low magnesium concentration.

9 Sensitivity

9.1 Methodology

As part of the EIMS environmental mapping methodology, specialists are required to identify all features in terms of the specific field of expertise within the study area. This methodology includes the compilation of detailed shapefiles with specific attributes. Three main components form part of this methodology, namely;

- Feature layer;
- Overall sensitivity layer; and
- Legislative constraint layer.

All identified features will be rated according to the sensitivity of the feature as well as threats posed by proposed activities. These sensitivity rankings are described and illustrated in Table 9-1.

Table 9-1 Sensitivities relevant to the EIMS methodology

	Sensitivities				
	Least Concern	Low	Medium	High	No-Go
Broad Class Description	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for the project or infrastructure placement.	The proposed development will have not had a significant effect on the inherent feature status and sensitivity.	The proposed development will negatively influence the current status of the feature.	The proposed development will negatively significantly influence the current status of the feature.	The proposed development cannot legally or practically take place.
Scoring	0	1	2	3	+99

9.2 Feature Layer

Various soils forms have been identified within the mining boundaries, which all have been grouped into three main land potential levels, namely Land Potential level 6 and “Vlei” (see Figure 9-1). These features were used to determine the sensitivity of resources relevant to this assessment.

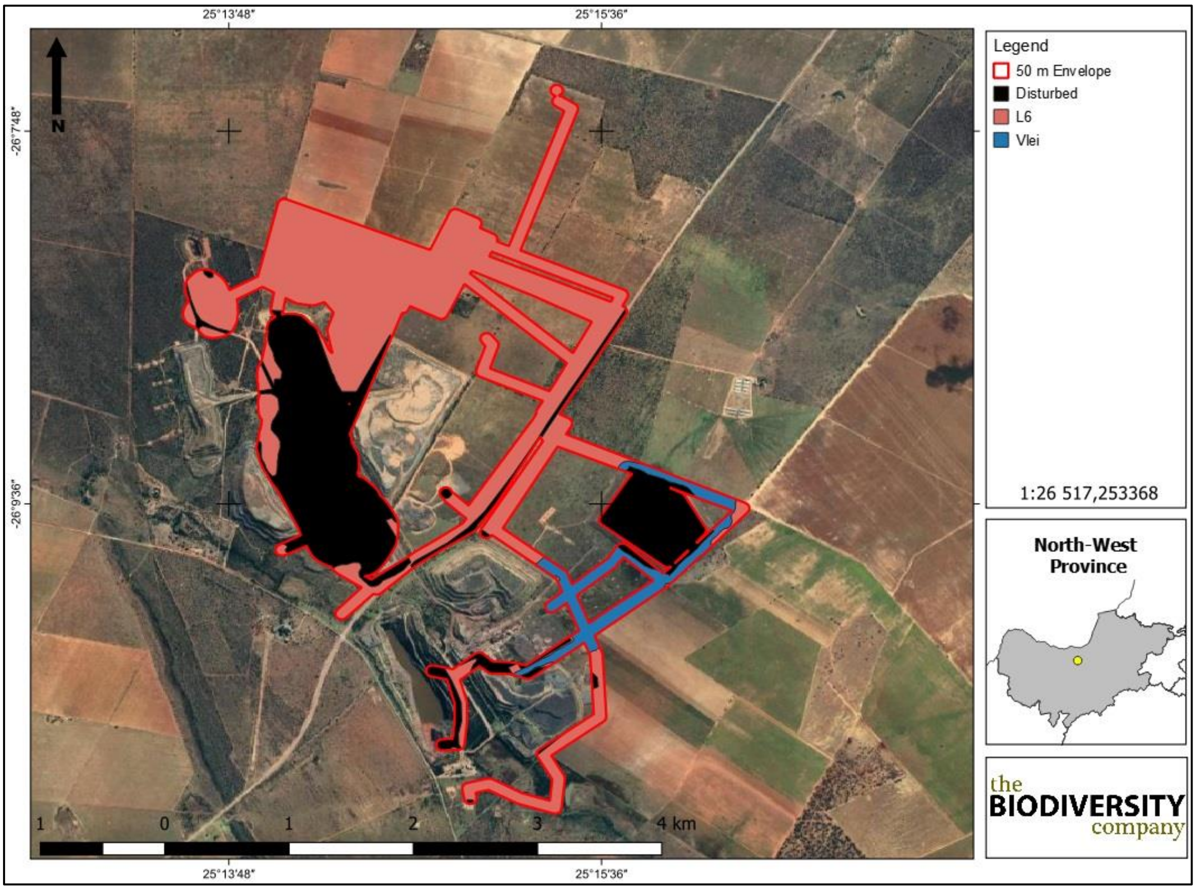

Figure 9-1 Feature layers within the mining boundaries

9.3 Overall Sensitivity

All features mentioned in Section 9.2- “Feature Layer” have been scored a sensitivity rating as per the EIMS methodology. All land potential categories will be impeded upon to some extent by the proposed mining activities (and ancillary infrastructure). The land potential level 6 and “Vlei” were scored “Low” sensitivities with the disturbed areas determined to have no sensitivity (least concern) (see Figure 9-2).

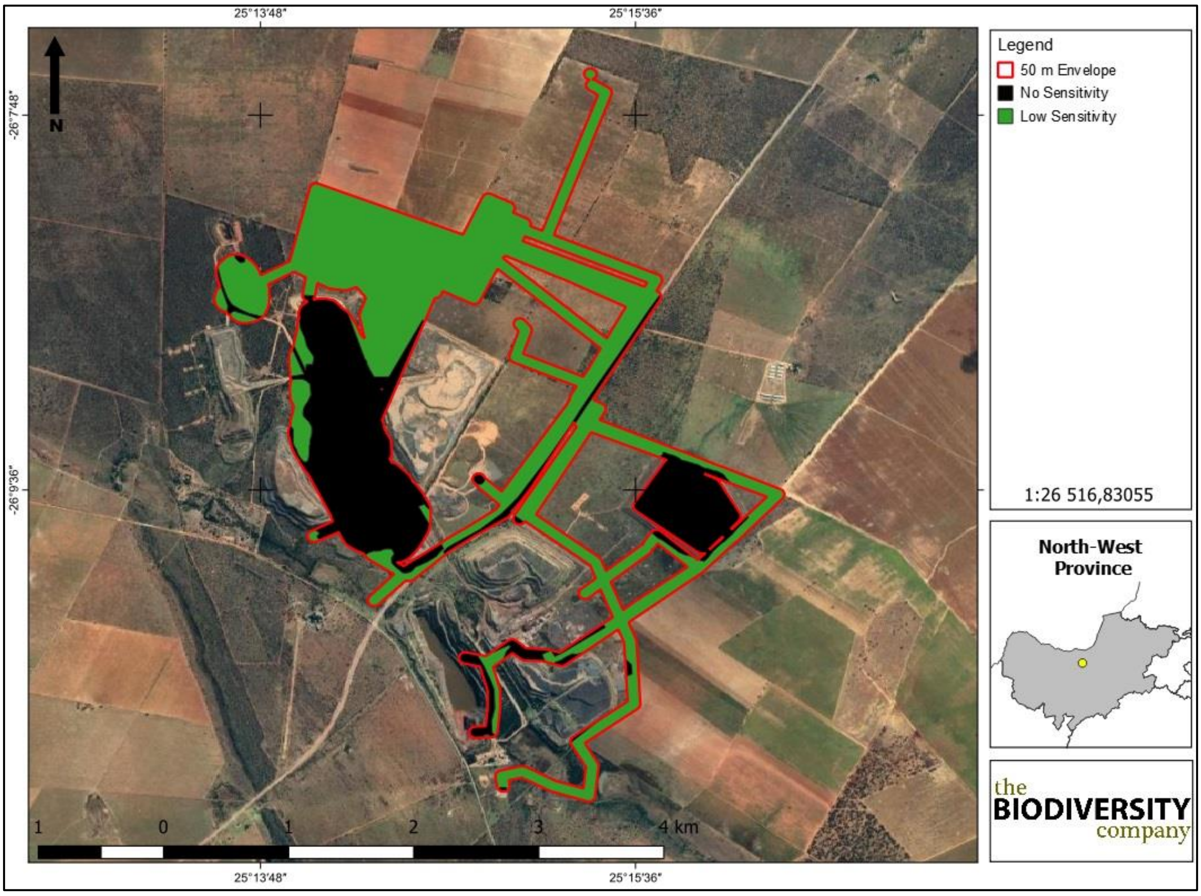

Figure 9-2 Overall sensitivity of identified features

9.4 Legislative Constraints

9.4.1 Land Capability Sensitivity

According to DAFF (2017), three sensitivity classes are located within the 50 m envelope area, namely "Low", "Medium" and "High". It is however worth noting that these predictions are rough estimates from large scale modelling exercises. Even though the land capability identified within the area correlates well with these findings, the climate capability renders the overall land potential low. Therefore, it is evident that the ground truthed findings differ significantly from that of DAFF (2017).

9.4.2 Crop Boundary Sensitivity

A set of historic crop fields are illustrated by the DEA screening tool (2021) and have been classified as having "High" sensitivity. These areas were assessed during the site assessment to ascertain whether or not the sensitivity of these features resemble the current land potential of the area in regard to potential yield. The majority of these crop fields are characterised by deep Carolina soil forms, which constitutes (in this case) a land potential class of 6, which resembles "Very Poor" conditions for cultivation.

10 Impact Assessment

The sensitivity of land potential features was considered for the impact assessment, with "Low" sensitivity being the highest rated sensitivity within the 50 m envelope area. Impacts were assessed in terms of the construction/operational, decommissioning/ rehabilitation and closure phases. Mitigation measures were only applied to impacts deemed relevant.

10.1 Impact Assessment Methodology

An impact assessment methodology was provided by EIMS to determine the environmental risk associated with various aspects related to the proposed expansion alternatives. This impact assessment takes the following components into consideration.

- The nature of the associated impact (positive or negative);
- The extent of the proposed activities;
- The duration of the proposed activities;
- The magnitude of the effects caused by the proposed activities;
- The reversibility of associated impacts; and
- The probability of relevant aspects affecting sensitive receptors.

Each one of the above-mentioned components are given a rating, which cumulatively provides the specialist with a pre-mitigation environmental risk rating. These components are then scored again taking into consideration mitigating factors. The cumulative impact and irreplaceable loss to sensitive receptors are then scored to ultimately indicate a "Priority Factor" score.

10.2 Agricultural Potential Impact Assessment

The anticipated impacts are derived from the main activities associated with the expansion which include:

- New Processing Plant;
- New Powerline;
- New Explosives Magazine;
- Increasing the Pit Footprint;
- Expansion of the Spanover Waste Rock Dump (WRD);
- A Series of new Roads;
- A Series of new Pipelines;
- New Trackless Mobile Machine (TMM) Workshop; and
- New Run of Mine (ROM) Pad.

10.2.1 Unplanned Events

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need management.

Table 10-1 is a summary of the findings of an unplanned event assessment from a pedology perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 10-1 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment	Contamination of soils.	A spill response kit must be available at all times. The incident must be reported on and if necessary. Spills must be contained and cleaned up.
Acid Mine Drainage	Contamination of soils	Water treatment, post closure water and soil monitoring and water level management.
TSF Failing or TSP Pipeline burst	Contamination of soils.	Monitoring of TSF structure and follow legislative guidelines. Regular monitoring for leaks, cracks and faults in the pipeline

10.2.2 Planning Phase Impacts

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This would include preparations and desktop work in support of waste management plans, environmental and social screening assessments, finalising drill sites and facilities and consultation with various contractors involved with a diversity of proposed project related activities going forward. It is assumed all existing servitudes will be used for access and existing plans are implemented, so based on this no impacts have been considered for the planning phase.

10.2.3 Construction Phase/Operational Phase Impacts

The following potential impacts were considered on agricultural potential. This phase refers to the period when construction of the additional proposed infrastructure is built/installed. This phase usually has the largest direct impact on land uses.

10.2.3.1 Loss of Land Capability

The proposed expansion will result in the stripping of topsoil and alterations to the existing land uses. These changes are likely to result in changes in the land use from agricultural to mining (or transformed). The proposed activities will impact on areas expected to be high agricultural potential, with some aspects affecting medium to low sensitivity areas. It is possible that suitable agricultural land could become fragmented, resulting in these smaller portions no longer being deemed feasible to farm.

10.2.3.1.1 Mitigation Measures

See section 11.

10.2.3.1.2 Cumulative Impacts

The cumulative impact rating has been scored “Medium” given the extent of existing mining activities as well as the expected degradation of the soil resources as a result of mining activities.

10.2.3.1.3 Irreplaceable Loss of Resources

The construction and operational phases of the relevant activities could result in a loss of natural resources.

10.2.3.1.4 Impacts on Alternatives Considered

No alternatives were provided.

10.2.3.2 Increased erosion

The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. The soils in the project area are generally characterised by excessive drainage and also high erodibility. This could result in further loss of topsoil, and soil forms suitable for agriculture.

10.2.3.2.1 Mitigation Measures

Please see section 11.

10.2.3.2.2 Cumulative Impacts

The cumulative impact rating has been scored “Medium” given the extent of existing mining activities as well as the expected degradation of the soil resources as a result of mining activities.

10.2.3.2.3 Irreplaceable Loss of Resources

The erosion stemming from the construction and operational phases of the relevant activities could result in a loss of natural resources.

10.2.3.2.4 Impacts on Alternatives Considered

No alternatives were provided.

10.2.4 Decommissioning and Rehab/Closure Phase

This phase is when the scaling down of activities ahead of temporary or permanent closure, cessation of mining or production is initiated. During this phase, the operational phase impacts will persist until of the activity reduces and the rehabilitation measures are implemented.

10.2.4.1 Loss of Land Capability

The spread of alien invasive species will result in the loss of habitat and water for indigenous fauna and flora. Overall, the fauna assemblage will be changed. Erosion will also disrupt the vegetation in the surrounding areas and result in habitat loss.

10.2.4.1.1 Mitigation Measures

Please see section 11.

10.2.4.1.2 Cumulative Impacts

The cumulative impact rating has been scored “Medium” given the extent of existing mining activities as well as the expected degradation of the soil resources as a result of mining activities.

10.2.4.1.3 Irreplaceable Loss of Resources

The improper stockpiling and care / management of soils, and also continued erosion stemming from the project could result in a loss of natural resources.

10.2.4.1.4 Impacts on Alternatives Considered

No alternatives were provided.

10.2.5 Assessment of Significance

Table 10-2 shows the significance of potential impacts associated with the proposed expansion, on agricultural potential before and after the implementation of mitigation measures as well as cumulative and irreplaceable loss.

Table 10-2 Assessment of significance of potential impacts on agricultural potential associated with the project

Impact	Aspect	Pre-mitigation ER	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
			Construction Phase					
Loss of land capability - TSP, Pit, WRD	Alternative 1	-20	-12	Medium	2	3	1.50	-18.00
Loss of land capability - Linear servitudes and Magazine	Alternative 1	-18.75	-12	Medium	2	3	1.50	-18.00
Loss of land capability – Processing Plants	Alternative 1	-20	-12	Medium	2	3	1.50	-18.00
Erosion	Alternative 1	-13	-8.25	Medium	2	3	1.50	-12.38
			Operational Phase					
Loss of land capability	Alternative 1	-16	-9	Medium	2	3	1.50	-13.50
Erosion	Alternative 1	-13	-8.25	Medium	2	3	1.50	-12.38
			Decommissioning and Rehab Phase					
Loss of land capability	Alternative 1	-13	-8.25	Medium	2	3	1.50	-12.38
			Closure Phase					
Loss of land capability	Alternative 1	-12	-8.25	Medium	2	3	1.50	-12.38

11 Specialist Management Plan

Table 11-1 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators for the study. The mitigations within this section have been taken into consideration during the impact assessment in cases where the post-mitigation environmental risk is lower than that of the pre-mitigation environmental risk.

Table 11-1 Mitigation measures including requirements for timeframes, roles and responsibilities for the study

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Proper planning of mining sequences	Planning	Applicant, Project manager, Environmental Officer	Development footprint	During Phase
Acquire stripping and stockpiling guideline	Planning	Applicant, Project manager, Environmental Officer	Development footprint	During Phase
Acquire rehabilitation and monitoring plans	Planning	Applicant, Project manager, Environmental Officer	Rehabilitation	During Phase
Detailed investigation into ideal locations for the construction of all the infrastructure on site	Planning	Applicant, Project manager, Environmental Officer	Development footprint	During Phase
Clearing of vegetation	Construction/Operational Phase	Project manager, Environmental Officer	Development footprint	On a needs basis
Assign all access, pipeline and powerline routes	Planning	Project manager, Environmental Officer	Servitudes	During Phase
Stripping and stockpiling of topsoil	Construction/Operational Phase	Project manager, Environmental Officer	Development footprint	On a needs basis
Stockpile the stripped soils in designated stockpile areas	Construction/Operational Phase	Project manager, Environmental Officer	Soil stockpiles	Applicant Eco Environmental authority
Vegetate these stockpiles according to the rehabilitation plan	Construction/Operational Phase	Project manager, Environmental Officer	Soil stockpiles	Ongoing
Continuously monitor erosion on site	Life of Project	Project manager, Environmental Officer	Development footprint	Ongoing
Monitor compaction on site	Life of Project	Project manager, Environmental Officer	Development footprint	Ongoing
Manage, maintain and care for soil stockpiles	Construction/Operational Phase	Project manager, Environmental Officer	Soil stockpiles	Ongoing
Implement proper storm water management plans	Life of Project	Applicant, Hydrologist, Project manager, Environmental Officer.	Project Infrastructure	Ongoing
Topsoil to be replaced for rehabilitation purposes	Post Construction/Closure Phase/Rehabilitation phase	Project manager, Environmental Officer	Rehabilitation	Ongoing, concurrent rehabilitation
All rehabilitated areas should be assessed for signs of compaction, fertility and erosion.	Post Construction/Closure Phase/Rehabilitation phase	Project manager, Soil Scientist, Environmental Officer	Rehabilitation Areas	Ongoing, from the rehabilitation phase
The soils fertility must be assessed by a soil specialist yearly (during the dry season so that recommendations	Post Construction/Closure Phase/Rehabilitation phase	Project manager, Soil Scientist, Environmental Officer	Rehabilitation Areas	On a needs basis

can be implemented before the start of the wet season) as to correct any nutrient deficiencies;				
Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;	Closure Phase/Rehabilitation phase	Project manager, Environmental Officer	Development footprint	On a needs basis
If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place.	Life of Project	Project manager, Environmental Officer	Project Area	On a needs basis

12 Conclusion

Four main soil types were identified within the 50 m envelope area, which have been classed into three different land capability classes (class 3, 4 and 5). These land capability classes were then classified under two main land potential classes by combining the land capability and climate capability of the area, namely land potential 6 and “Vlei”. These two land potential classes were both determined to have “Low” sensitivities.

The impact assessment indicated various aspects that were scored “Moderate” post-mitigation significance ratings, predominantly due to the intensity of open cast mining and compaction of stockpile dumps.

12.1 Targets

Even though the current land capability is suitable for arable land, it is the specialist’s opinion that the disturbed areas will not be suitable for cultivation once rehabilitation is completed due to the poor climatic capability. It is therefore recommended that the post-mining land use of grazing rather be targeted. In addition, the fertility of the rehabilitated area must at least represent the current fertility, including reaching a pH (KCl) of at least 5.

12.2 Specialist Opinion

Considering the low sensitivities pertaining to the poor land potential of soil resources within the 50 m envelope area, it is the specialist’s opinion that no high value cultivatable land will be lost due to impacts from any of the proposed components. It is however important to adhere to all the recommendations and mitigations prescribed throughout this report to avoid any unnecessary indirect impacts. To conclude, it is recommended that the proposed activities proceed as have been planned as no fatal flaws or any concerning environmental risks were detected during the impact assessment.

13 References

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14 Appendices

Appendix A Specialist declarations

DECLARATION

I, Ivan Baker, 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 71 and is punishable in terms of Section 24F of the Act.

Ivan Baker

Soil Specialist

The Biodiversity Company

October 2021