AGRICULTURAL POTENTIAL ASSESSMENT FOR THE PHAKWE RICHARDS BAY GAS POWER 3 FACILITY

Richards Bay, KwaZulu-Natal

March 2022

CLIENT

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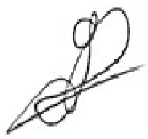
Declaration

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

March 2022

1 Introduction

The Biodiversity Company was commissioned to conduct an agricultural potential assessment for the proposed up to 2000 MW combined cycle (CC) gas to power plant facility and associated infrastructure, located in Richards Bay, KwaZulu-Natal. Phakwe Richards Bay Gas Power 3Phakwe Richards Bay Gas Power 3 (Pty) Ltd intend on developing an up to 2000 MW combined gas to power plant located on various erven within the Richards Bay Industrial Development Zone (RBIDZ) phase 1F, Richards Bay, KwaZulu-Natal. It is worth noting that the proposed development will take place within an area already rezoned for industrial use.

The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 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". The National Web based Environmental Screening Tool has characterised the agricultural biodiversity for the project area as "very high sensitivity".

1.1 Project Description

The power plant will operate at mid-merit or baseload duty and will include the following main infrastructure:

1. A number of gas turbines for the generation of electricity through the use of natural gas (liquid or gas forms), or a mixture of Natural gas and Hydrogen (in a proportion scaling up from 30% H2) as fuel source, operating all turbines at mid-merit or baseload (estimated 16 to 24 hours daily operation).
2. Exhaust stacks associated with each gas turbine.
3. A number of Heat Recovery Steam Generator (HRSG to generate steam by capturing the heat from the turbine exhaust.
4. A number of steam turbines to generate additional electricity by means of the steam generated by the HRSG.
5. The water treatment plant will demineralise incoming water from municipal or similar supply, to the gas turbine and steam cycle requirements. The water treatment plant will produce two parts demineralised water and reject one-part brine, which will be discharged to the R IDZ stormwater system.
6. Steam turbine water system will be a closed cycle with air cooled condensers. Make-up water will be required to replace blow down.
7. Air cooled condensers to condensate used steam from the steam turbine.
8. Compressed air station to supply service and process air.
9. Water pipelines and water tanks for storage and distributing of process water. (Potential sourcing of alternative water outside RB IDZ supply (Municipality))
10. Water retention pond
11. Closed Fin-fan coolers to cool lubrication oil for the gas turbines

12. Gas generator Lubrication Oil System.
13. Gas pipeline supply conditioning process facility. Please note, gas supply will be via dedicated pipeline from the proposed Transnet supply pipeline network of Richards Bay (the location of this network has not yet been confirmed) or, alternatively directly from the Regasification facilities at RB Harbour. The gas pipeline will be separately authorized.
14. Site water facilities including potable water, storm water, wastewater.
15. Fire water (FW) storage and FW system.
16. Diesel emergency generator for start-up operation.
17. Onsite fuel conditioning including heating system.
18. All underground services: This includes stormwater and wastewater.
19. Ancillary infrastructure including:
    - Roads (access and internal);
    - Warehousing and buildings;
    - Workshop building;
    - Fire water pump building;
    - Administration and Control Building;
    - Ablution facilities;
    - Storage facilities;
    - Guard House;
    - Fencing;
    - Maintenance and cleaning area;
    - Operational and maintenance control centre.
20. Electrical facilities including:
    - Power evacuation including GCBs, GSU transformers, MV busbar, HV cabling and 1x275kV or 400kV GIS Power Plant substation;
    - Generators and auxiliaries;
    - Subject to a separate environmental authorisation application:
        - Eskom 275 or 400kV GIS interface Substation;
        - Underground 275 or 400kV power cabling connecting Power Plant GIS substation and Eskom GIS Interface substation; and
        - an overhead 275kV or 400kV power line connecting the ESKOM interface substation to the selected Eskom grid connection point;
21. Service infrastructure including:

- Stormwater channels;
- Water pipelines; and
- Temporary work areas during the construction phase (laydown areas).

22. Fuel supply
    - A dedicated pipeline to connect into an on-site gas receiving and conditioning station will provide the natural gas or the mixture of natural gas and Hydrogen. The pipeline will be connected to the proposed Transnet supply pipeline network of Richards Bay (the location of this network has not yet been confirmed), or it will extend directly to the Regasification facilities in the RB Harbour; and
    - The dedicated pipeline will be separately environmentally authorized.

1.2 Authorisations

Environmental authorisation (Ref 14/12/16/3/3/2/665) was issued by the Department of Environmental Affairs (DEA) on 27 September 2016 for the RBIDF Phase 1F, comprising the installation of the bulk infrastructure. The area has been rezoned to industrial use.

The Department of Water and Sanitation also issued a directive in terms of Section 22 (4) (c) of the National Water Act, 1998 to allow the IDZ to upgrade the railway line to the IDZ 1F, upgrade of Medway Road as 1A and development within the IDZ 1F.

2 Document Structure

The table below provides the NEMA (2014) Requirements for specialist assessments, 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;	Page viii
Appendix 6 (1)(c):	An indication of the scope of, and the purpose for which, the report was prepared;	Section 4
Appendix 6 (1)(cA):	An indication of the quality and age of base data used for the specialist report;	Section 9
Appendix 6 (1)(cB):	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 11
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 1
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 8
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 10

Appendix 6(1)(g):	An identification of any areas to be avoided, including buffers;	Section 14
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 6
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 9, 10 and 11
Appendix 6(1)(k):	Any mitigation measures for inclusion in the EMPr;	Section 12 and 13
Appendix 6(1)(l):	Any conditions for inclusion in the environmental authorisation;	Section 12 and 13
Appendix 6(1)(m):	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 12 and 13
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 13.3 and 14
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 ASSESSMENT FOR THE PHAKWE RICHARDS BAY GAS POWER 3 FACILITY**
Submitted to	savannah environmental
Report Writer	**Ivan Baker** Ivan Baker is Pr. Sci Nat registered (119315) in environmental science with Cand. Sci. Nat recognition in geological science. Ivan is a wetland and soil specialist with vast experience in wetlands, pedology, hydropedology and land contamination and has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC 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. Ivan is also affiliated with the Fertiliser Society of South Africa after the acquiring a certificate of competence following the completion of the FERTASA training course.
Report 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 Scope of Work

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- To conduct a soil 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;
- Using the findings from the soil assessment to determine the existing land capability/potential and current land use of the entire surface area of the relevant portions of the project area;
- To delineate soil resources by means of on-site soil observations;
- To determine the sensitivity of the baseline findings;
- 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.
- Compile an impact assessment to indicate the significance of the expected impacts;
- Discussing the feasibility of the proposed activities;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation; and
- Recommend relevant mitigation measures to limit all associated impacts.

5 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, 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).

5.1 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

6 Literature Review

6.1 Land Capability

According to Smith (2006), the capability of land concerns the wise use of land to ensure economical production on a sustained basis, under specific uses and treatments. The object of land classification is the grouping of different land capabilities, to indicate the safest option for use, to indicate permanent hazards and management requirements. These land capability classes decrease in capability from I to VIII and increase in risk from I to VIII. DAFF (2017) further defines land capability as "*the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of* ***climate, soil*** *and* ***terrain****.*

DAFF (2017) has further modelled the land capability on a rough scale for the entire of South Africa and has divided these results into 15 classes (see Table 6-1). Terrain, climate and soil capability was used as the building blocks for this exercise to ensure a national land capability data set.

Table 6-1 Land Capability (DAFF, 2017)

Land Capability Class (DAFF, 2017)	Description of Capability
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	

8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

It is worth noting that this nation-wide data set has some constraints of its own. According to DAFF (2017), inaccuracies and the level of detail of these datasets are of concern. Additionally, the scale used to model these datasets are large (1:50 000 to 1:100 000) and is not suitable for farm level planning. Furthermore, it is mentioned by DAFF (2017) that these datasets should not replace any site-based assessments given the accuracies perceived.

7 Methodology

7.1 Desktop Assessment

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

7.2 Field Survey

The site was traversed by vehicle and on foot. A soil auger has been used to determine the soil form/family and depth. The soil will be 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.

7.3 Agricultural Potential Assessment

Land capability and agricultural potential will be 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 7-1 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 7-1 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	
II	W	F	LG	MG	IG	LC	MC	IC		**Arable Land**
III	W	F	LG	MG	IG	LC	MC			

IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						
VI	W	F	LG	MG						**Grazing Land**
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 are determined by combining the land capability results and the climate capability of a region as shown in Table 7-2. The final land potential results are then described in Table 7-2.

Table 7-2 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 7-3 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

7.4 Climate Capability

According to Smith (2006), climatic capability is determined by taking into consideration various steps pertaining to the temperature, rainfall and Class A-pan of a region. The first step in this methodology is to determine the Mean Annual Precipitation (MAP) to Class A-pan ratio.

Table 7-4 Climatic capability (step 1) (Scotney et al., 1987)

Climatic Capability Class	Limitation Rating	Description	MAP: Class A pan Class
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

In the event that the MAP: Class A-pan ratio is calculated to fall within the C7 or C8 class, no further steps are required, and the climatic capability can therefore be determined to be C7 or C8. In cases where the above-mentioned ratio falls within C1-C6, steps 2 to 3 will be required to further refine the climatic capability.

Step 2

Mean September temperatures;

- <10℃ = C6
- 10 - 11℃ = C5
- 11 - 12℃ = C4
- 12 - 13℃ = C3
- >13℃ = C1

Step 3

Mean June temperatures;

- <9℃ = C5
- 9 - 10℃ = C4
- 10 - 11℃ = C3
- 11 - 12℃ = C2

7.5 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.

7.6 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 7-5 with the final erosion classes illustrated in Table 7-6.

Table 7-5 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	

[1] The soil erodibility index

Table 7-6 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

7.7 Impact Assessment Methodology

The assessment of the significance of direct, indirect and cumulative impacts was undertaken using the method as developed by Savannah. The assessment of the impact considers the following:

- Nature of the impact, which shall include a description of what causes the effect, what will be affected, and how it will be affected;
- Extent of the impact, indicating whether the impact will be local or regional;
- Duration of the impact, very short-term duration (0-1 year), short-term duration (2-5 years), medium-term (5-15 years), long-term (> 15 years) or permanent;
- Probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable, probable, highly probable or definite;
- Severity/beneficial scale, indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit); severe/beneficial (long-term impact that could be mitigated/long-term benefit); moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit); slight; or have no effect;
- Significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high;
- Status, which will be described as either positive, negative or neutral;
- Degree to which the impact can be reversed;
- Degree to which the impact may cause irreplaceable loss of resources; and
- Degree to which the impact can be mitigated.

8 Assumptions and Limitations

The following limitations are relevant to this agricultural potential assessment;

- The relevant project area was verified prior to the commencement of the site assessment and reporting;
- No soil samples were taken; and

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m.

9 Results and Discussion

9.1 Desktop Assessment

9.1.1 Vegetation Type

The proposed project area falls within the Maputuland Coastal Belt (CB 1) vegetation type which is distributed throughout the KwaZulu-Natal Province up to Mozambique. This vegetation comprises of a 35 km wide strip along the Indian Ocean's coast from Mozambique in the north to Mtunzi in the south at an altitude between 20 and 120 meters above sea level (Musina & Rutherford, 2006).

The CB 1 vegetation type is characterised by flat coastal plains that once was densely forested and includes dry grasslands. The latter mentioned grasslands include palm veld in special conditions, thicket groups as well as hygrophilous grasslands. This vegetation type today comprises of (in some cases) sugar cane fields, timber plantations, secondary grasslands and thickets (Musina & Rutherford, 2006).

This vegetation type is deemed to be vulnerable, with a target percentage of 25. Only 15% of this vegetation type is conserved in Sileza, Amathikulu and Enseleni Nature Reserve as well as the Greater St. Lucia Wetland Park. More than 30% of this vegetation type has been transformed by urban sprawl and cultivation with alien invasive species including *Lantana camara* and *Chromolaena odorata* populating the plains (Musina & Rutherford, 2006).

9.1.2 Climate

Weak rainfall seasonality towards the coast with summer rainfall occurring towards the inward sections of this vegetation type. Up to 1 200 mm of annual rainfall occurs in the coastal areas with rainfall decreasing significantly towards the interior humidity. The climate of the CB 1 vegetation type is characterised by high temperatures and. The mean minimum and maximum monthly temperatures for Lake St. Lucia are 5.5°C and 35.3°C for June and January respectively with no incidences of frost (Mucina & Rutherford, 2006).

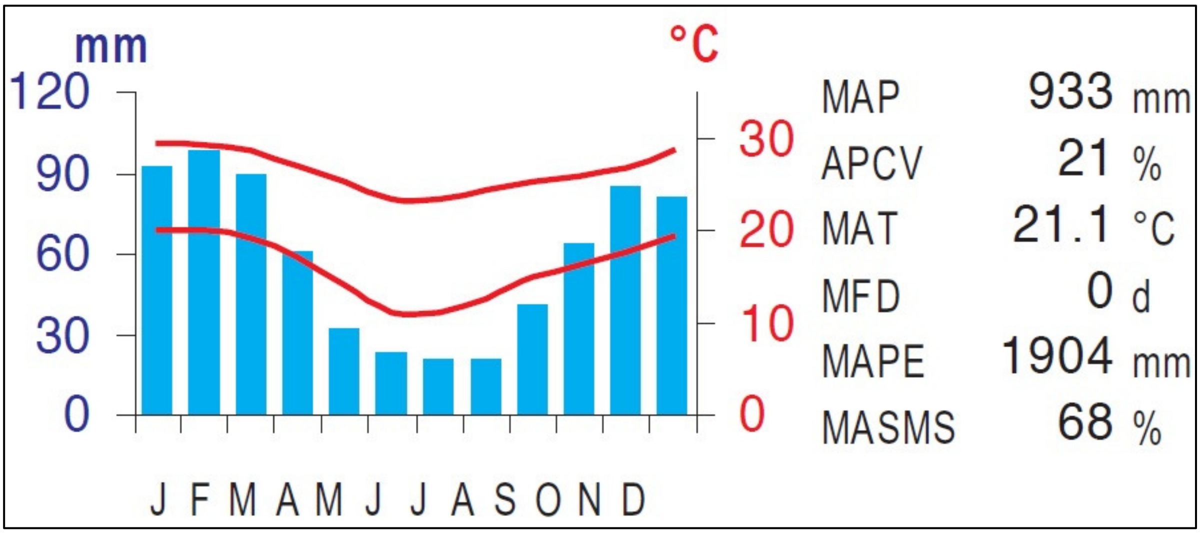


Figure 9-1 Climate for the Maputaland Coastal Belt (CB 1) (Mucina & Rutherford, 2006)

9.1.3 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within Hb 69 land type. The Hb land type is characterised by grey regic sands and other grey soils. The terrain units and expected soil forms for the latter mentioned land type is illustrated in Figure 9-2 and Table 9-1.

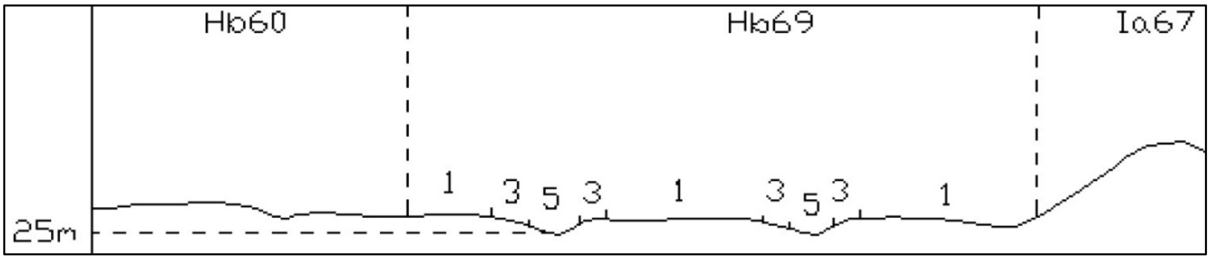


Figure 9-2 Illustration of land type Hb 69 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 9-1 Soils expected at the respective terrain units within the Hb 69 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units					
1 (70%)		**3 (25%)**		**5 (5%)**	
Fernwood	70%	Fernwood	65%	Champagne	50%
Vilafontes	10%	Champagne	10%	Fernwood	35%
Champagne	5%	Vilafontes	10%	Longlands	5%
Clovelly	5%	Hutton	5%	Kroonstad	5%
Hutton	5%	Clovelly	5%	Streambeds	5%
Shepstone	5%	Shepstone	5%		

9.1.4 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 9-3. The majority of the project area is characterised by a slope percentage between 0.5% and 1.0% with some smaller patches within the project area characterised by a slope percentage up to 2.0%. This illustration indicates a non-uniform topography with alternating hillslopes. The elevation of the project area (Figure 9-4) indicates an elevation of 41 to 54 Metres Above Sea Level (MASL).

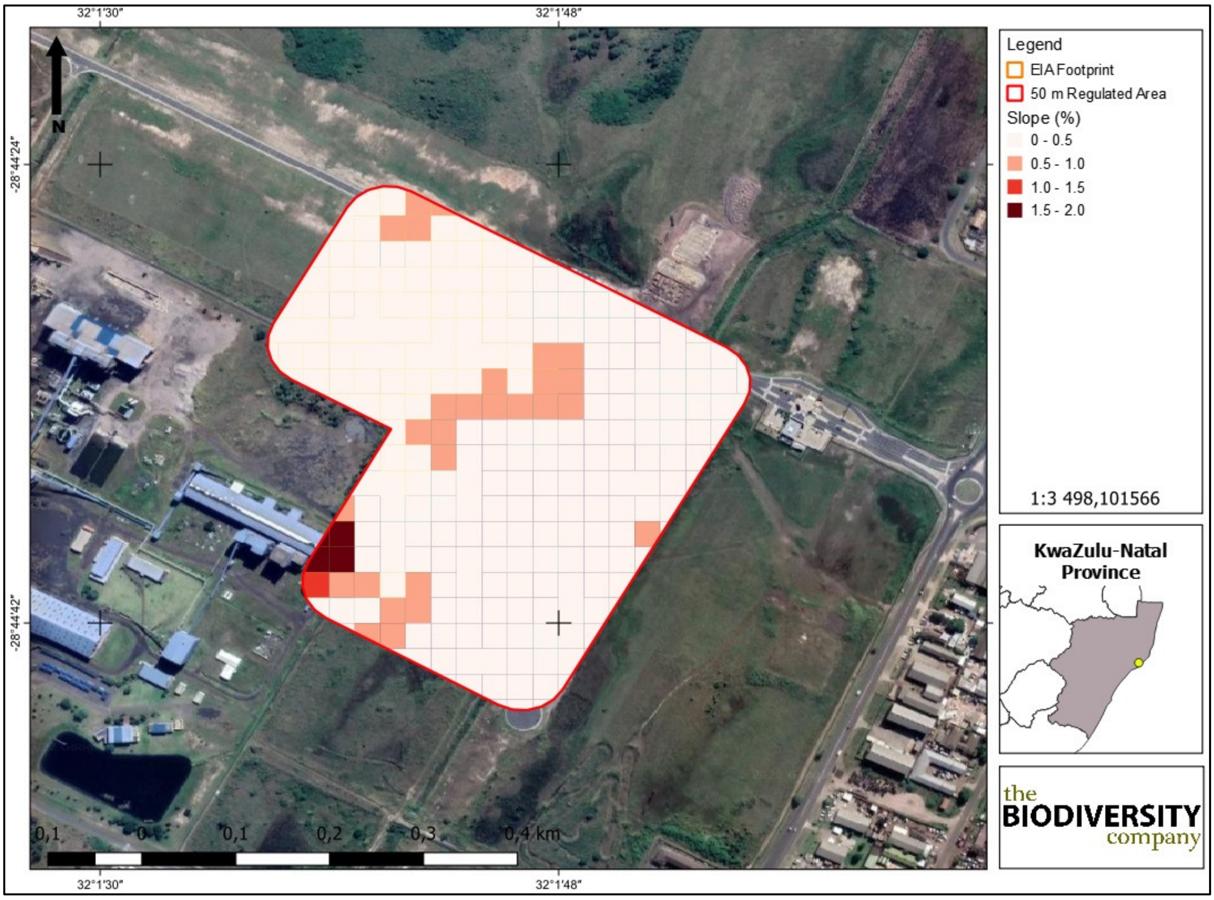


Figure 9-3 Slope percentage map for the project area

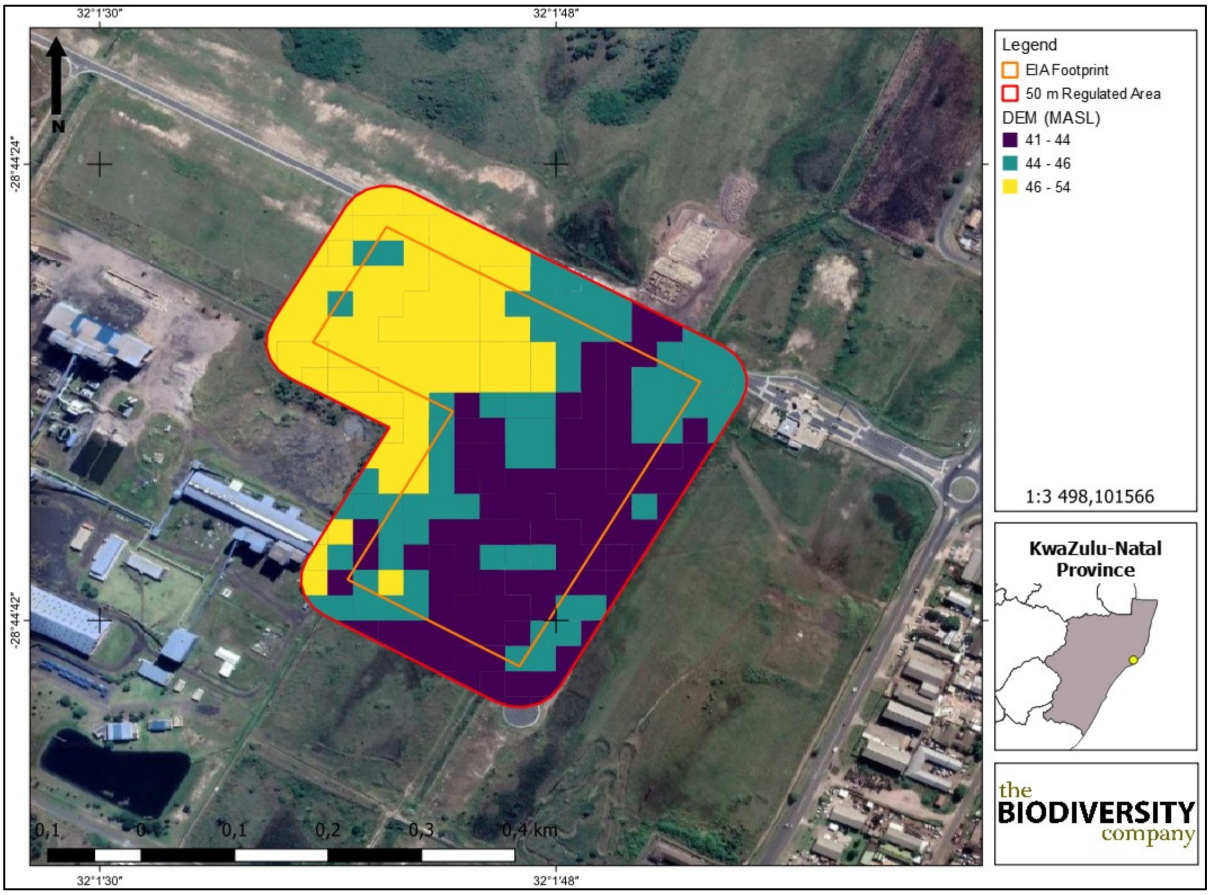


Figure 9-4 Elevation of the project area (metres above sea level)

9.2 Baseline Findings

9.2.1 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 9-5):

- Orthic topsoil;
- Organic topsoil; and
- Albic horizon.

9.2.1.1 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 topsoil to another (i.e. colouration, structure etc) (Soil Classification Working Group, 2018).

9.2.1.2 Organic Topsoil

According to (SASA, 1999), the Organic topsoil contains a high concentration of organic carbon, hence the dark colour of the soil type. This soil type forms under prolonged periods of saturation, which decreases the decomposition rate and ensures the formation of hemic or fibrous material.

9.2.1.3 Albic Horizon

Albic horizons are often characterised by uniform white-greyish colours from the residual clay and quartz particles making up the matrix of the horizon. The main characteristic of this diagnostic horizon is a bleached colouration, which is a resultant product of distinct redox and ferrolysis pedological processes combined with eluvial processes. According to the Soil Classification Working Group (2018), albic horizons often receive lateral sub-surface flows from hillslope processes.

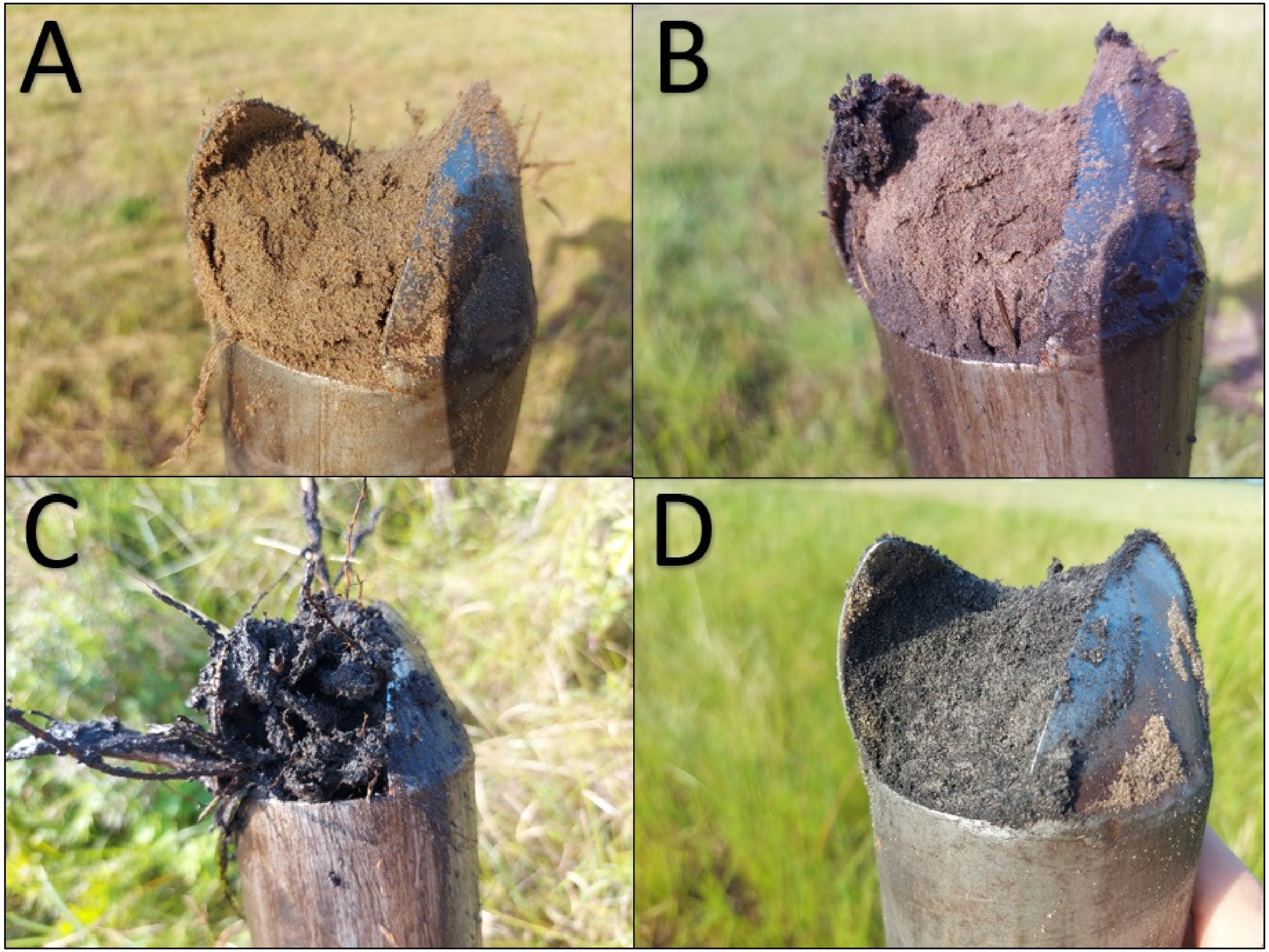


Figure 9-5 Soils identified during the site assessment. A) Orthic topsoil. B and D) Albic horizon. C) Organic topsoil.

9.2.2 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 9-6 and is described in Table 9-2 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 9-3.

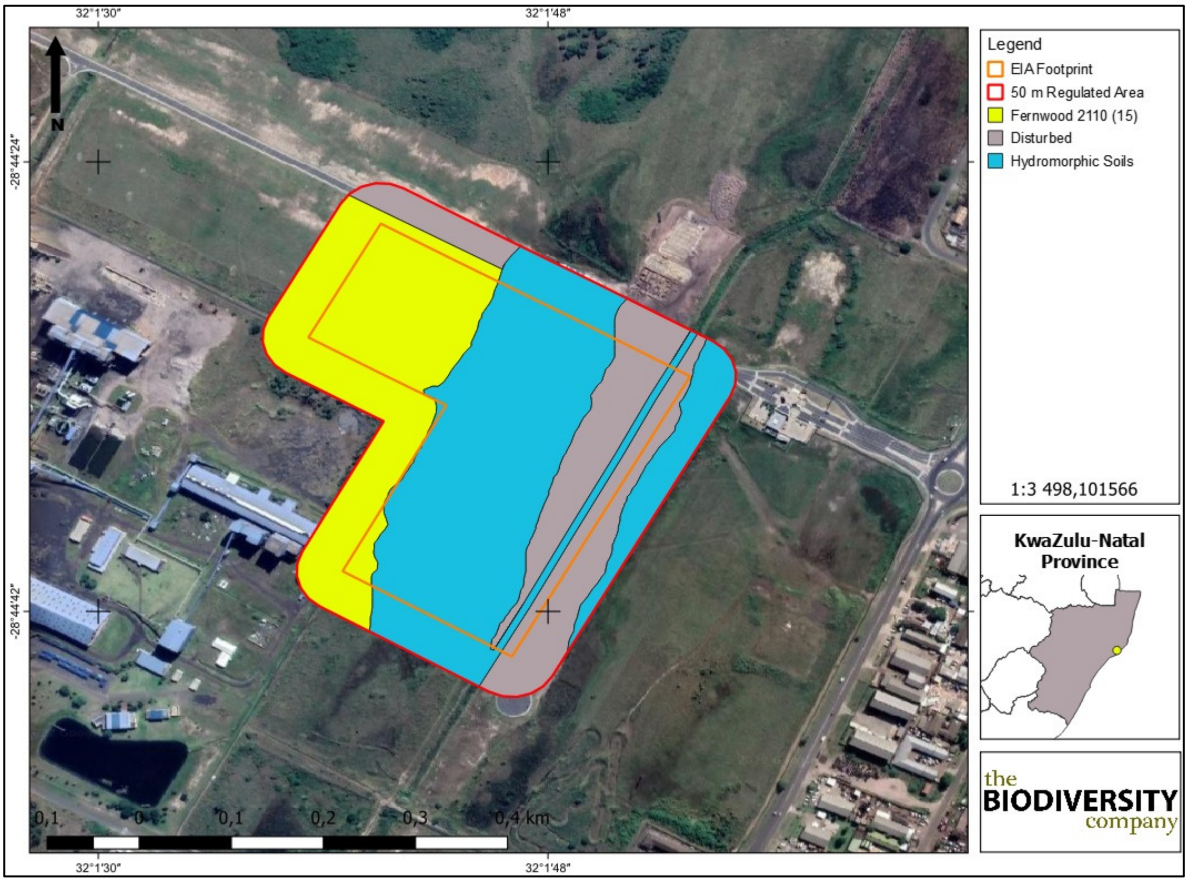


Figure 9-6 Soil delineations within the 50 m regulated area

Table 9-2 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 %
Fernwood 2110(15)	0-300	0-15	None	0	None	300 to 1200	0-15	None	0	N/A			
Hydromorphic	N/A					N/A				N/A			
Disturbed	N/A					N/A				N/A			

Table 9-3 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Albic Colour	Occurrence of Lamellae
Fernwood 2110(15)	Grey/Bleached Topsoil	Grey When Moist	Lamellae Absent
Hydromorphic	N/A		
Disturbed	N/A		

9.2.3 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.

9.2.3.1 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 9-4).

Table 9-4 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 “C3” for the project area, the following steps will further refine the climatic capability taking into consideration the mean annual September and June temperatures.

Step 2- Mean September Temperatures

Table 9-5 Mean September temperatures for the project area

Mean Temperature	Refined Climatic Capability Class	Applicability
<10℃	C6	
10-11℃	C5	
11-12℃	C4	
12-13℃	C3	
>13℃	C1	✔

Step 3- Mean June Temperatures

Table 9-7 Mean June Temperatures for the project area

Mean Temperature	Refined Climatic Capability Class	Applicability
<9C	C5	
9-10℃	C4	
10-11℃	C3	
11-12℃	C2	✔

Given the fact that the C3 climatic capability from the second step hasn't been upgraded by means of the third step, the second step's C1 will still apply. Therefore, the climatic capability of the project area will be C1.

9.2.3.2 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%, 3-8%, 8-15%, 16-25% and >25%) to determine the land capability of each soil form. The delineated soil forms were then grouped together in four different land capability classes (land capability 3, 4, 5 and 6). As per example, the Fernwood soil form will classify as a Land Capability (LC) II within the first slope class (0-3%), a LC III in the second slope class (3-8%) and a LC IV within the third (8-15%) slope class (see

Table 9-5).

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 9-3 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 9-6 and illustrated in Figure 9-8.

Table 9-5 Land capability calculations as per the slope classes relevant to the project area for the Fernwood soil form

Soil Form	Slope Class	Calculated Land Capability
	0-3%	LC II
Fernwood	3-8%	LC III
	8-15%	LC IV

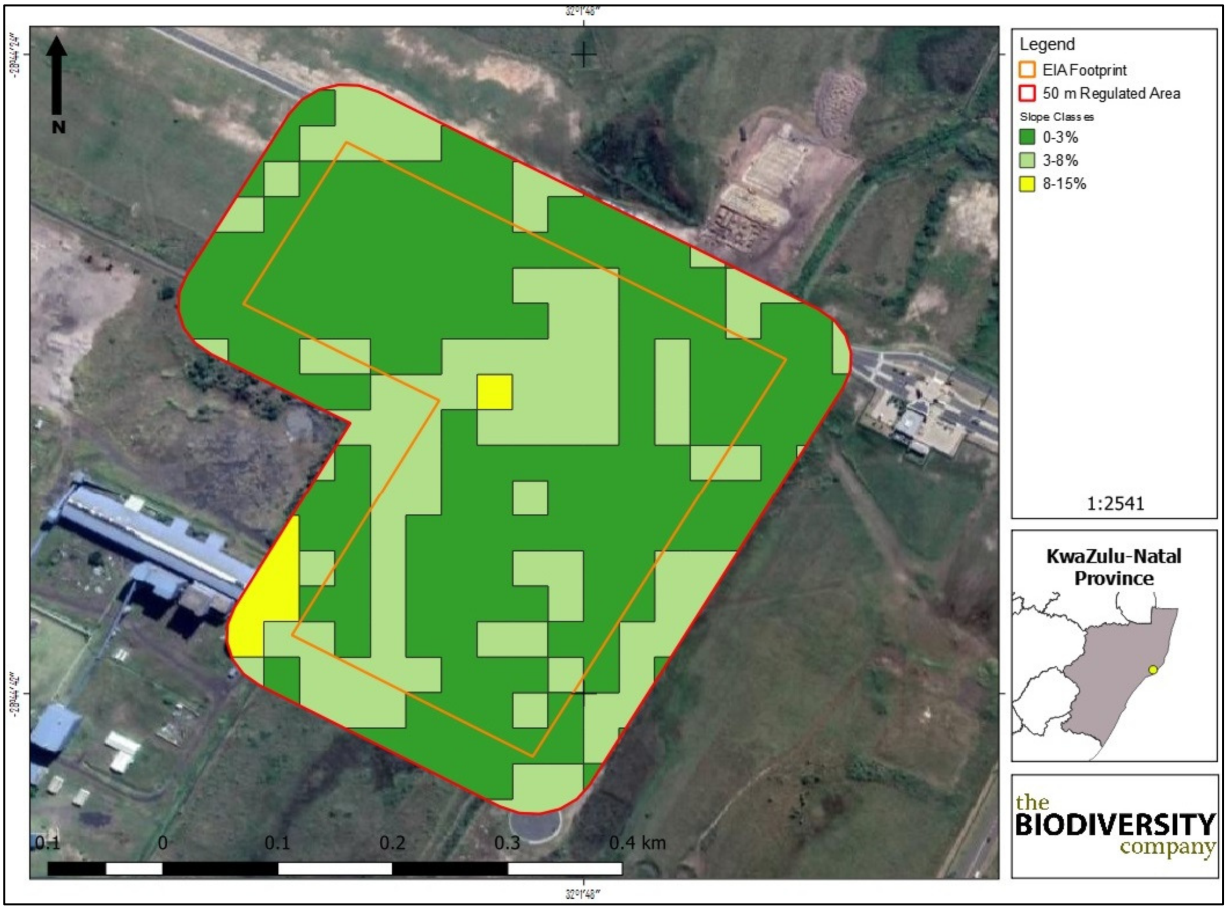


Figure 9-7 Three slope classes relevant to the land capability calculation methodology

Table 9-6 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
2	Slight limitations. High arable potential. Low erosion hazard.	Adequate run-off control.	Annual cropping with special tillage or ley (25%)	23	Arable	High
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	7	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	2	Arable	Moderate

5	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	46	Grazing	Low
Disturbed		N/A		22	Wilderness	Very Low

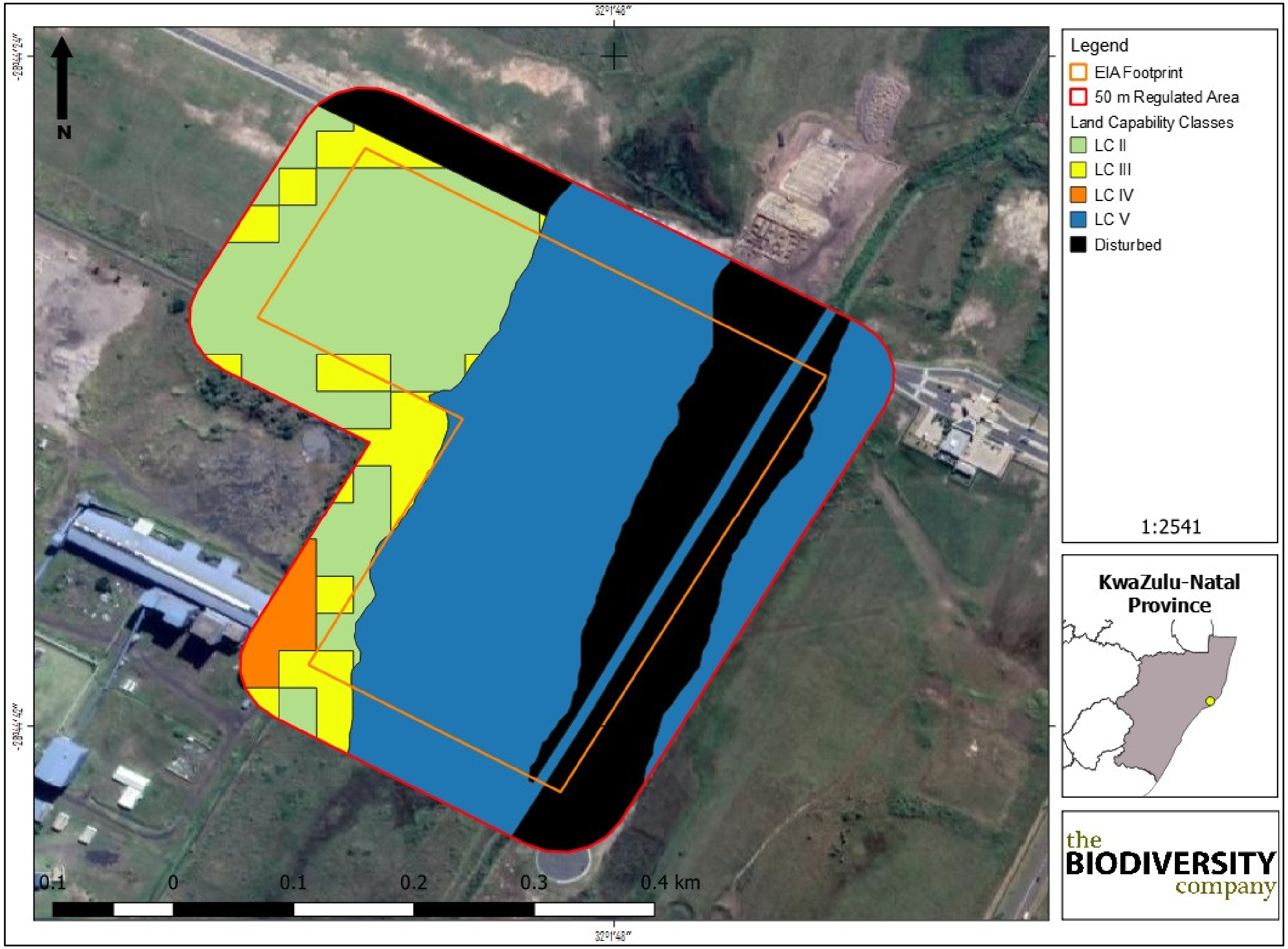


Figure 9-8 Land capability classes for the project area

9.2.4 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 9-7 and Table 9-8. From the five land capability classes, three land potential levels have been determined by means of the Guy and Smith (1998) methodology. The land capability class II has been allocated a land potential level L1 due to C1 climatic conditions. The land capability classes III and IV have been assigned a land potential level of L2. The land capability class V has been allocated a land potential "Vlei" considering its hydromorphic characteristics.

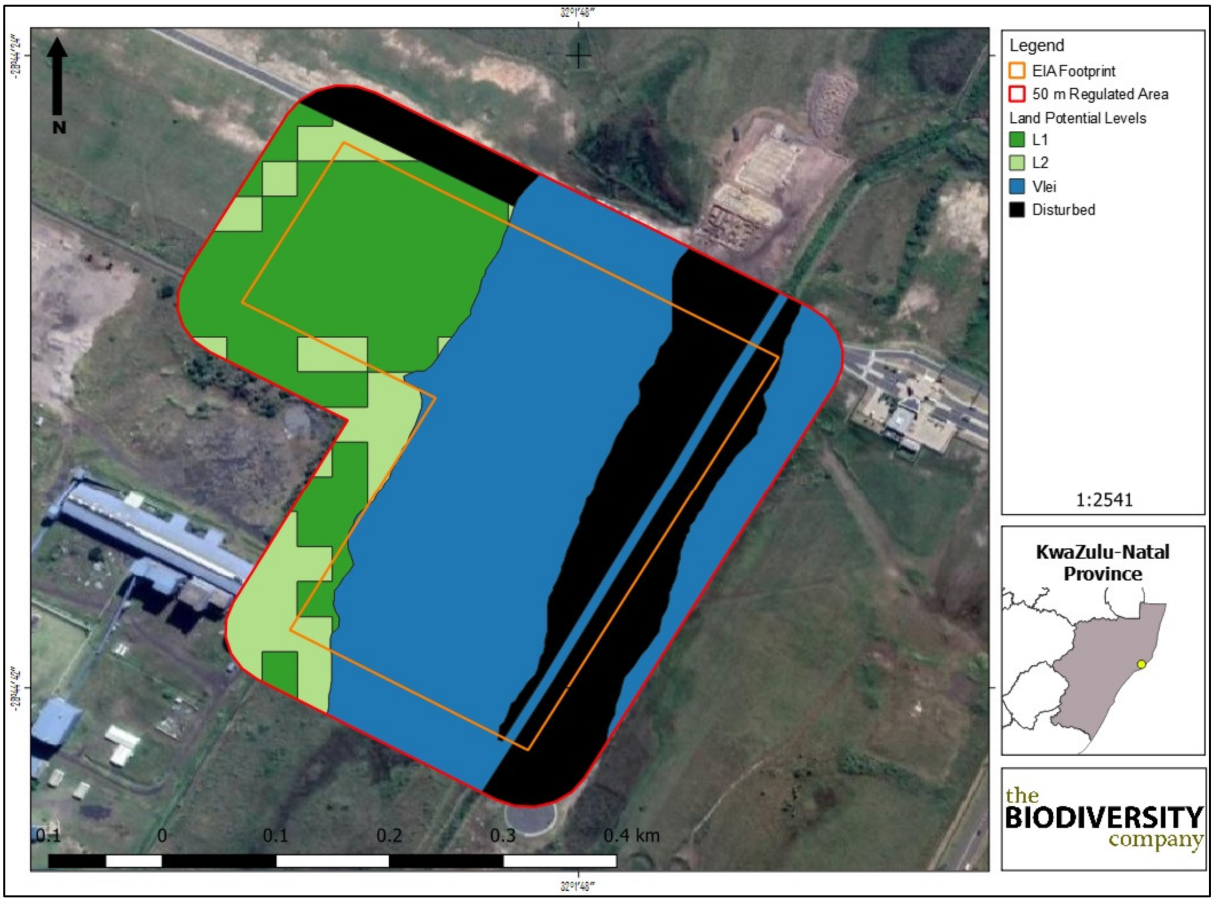


Figure 9-9 Land potential of the 50 m regulated area

Table 9-7 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 9-8 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Percentage	Description of Land Potential Class	Sensitivity
1	23	**Very high Potential**. No limitations exist for this land potential level whilst appropriate contour protection must still be implemented and inspected.	Very High
2	9	**High potential.** Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.	High
Vlei	46	Wetland (grazing and wildlife)	Low
Disturbed	22	N/A	

9.2.5 Land Use

Four different land uses have been identified within the proposed project area, namely "Disturbed", "Degraded Fields", "Watercourses" and "Development Fringes" (Figure 9-10).

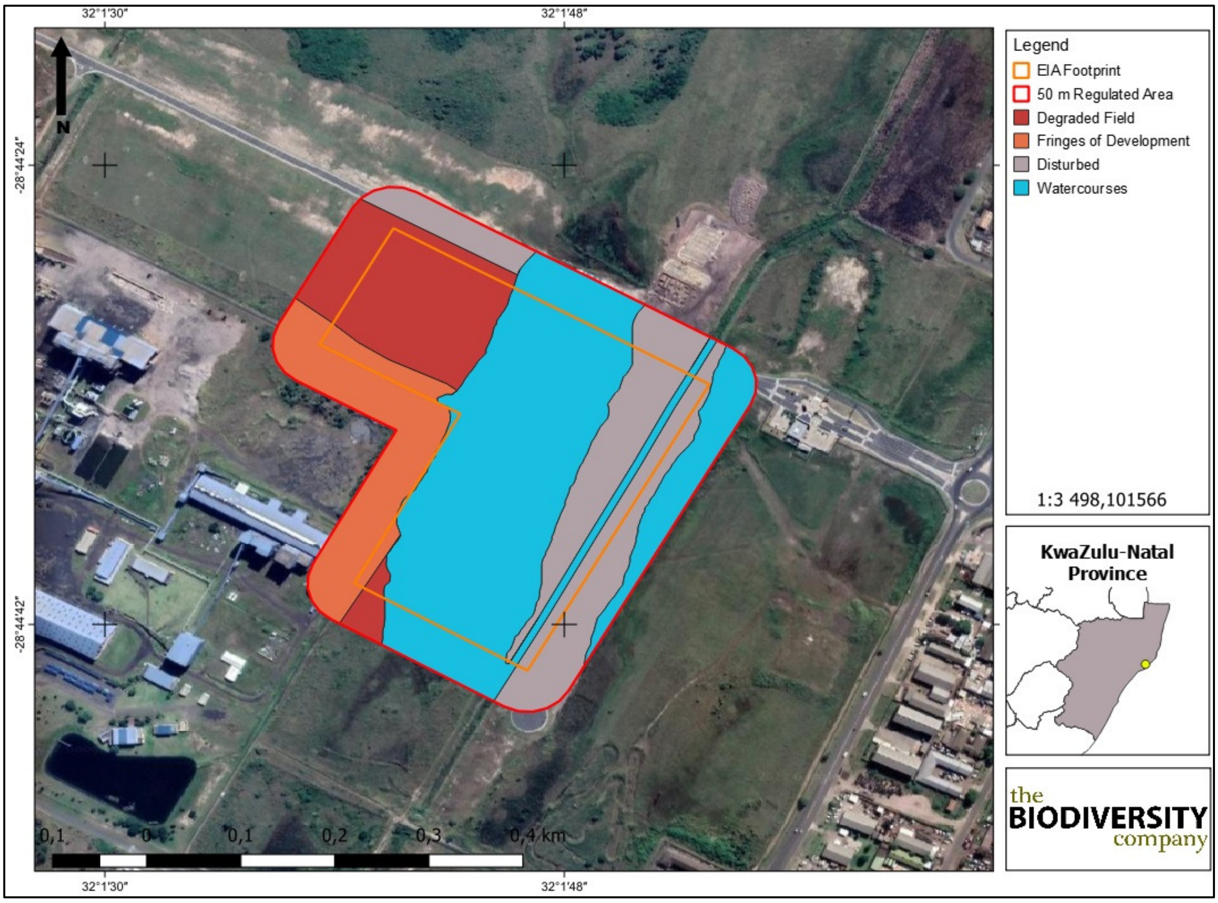


Figure 9-10 Different land uses within the proposed project area

9.2.6 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.

9.2.6.1 Fernwood

Table 9-9 illustrates the values relevant to the erosion potential of the Fernwood soil forms. The final erosion potential score has been calculated at 4.0, which indicates a “Moderate” potential for erosion.

Table 9-9 Erosion potential calculation for the Fernwood 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

9.2.6.2 Hydromorphic Soils

Table 9-10 illustrates the values relevant to the erosion potential of the hydromorphic soil forms. The final erosion potential score has been calculated at 4.5, which indicates a "Moderate" potential for erosion.

Table 9-10 Erosion potential calculation for the hydromorphic 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

10 Sensitivity Verification

10.1 Land Capability Sensitivity

According to DAFF (2017), two classes of land capability sensitivity are located within the project area, namely a class comprising of land capability 9 to 10 (moderately high sensitivity) and land capability 11 to 15 (high to very high sensitivity) (see Figure 10-1). The baseline conditions observed within the 50 m regulated area concur with the DAFF (2017) findings in respect to the sensitivities identified. The DAFF (2017) information however neglects to identify hydromorphic properties and disturbed area which is characterised by lower sensitivities.

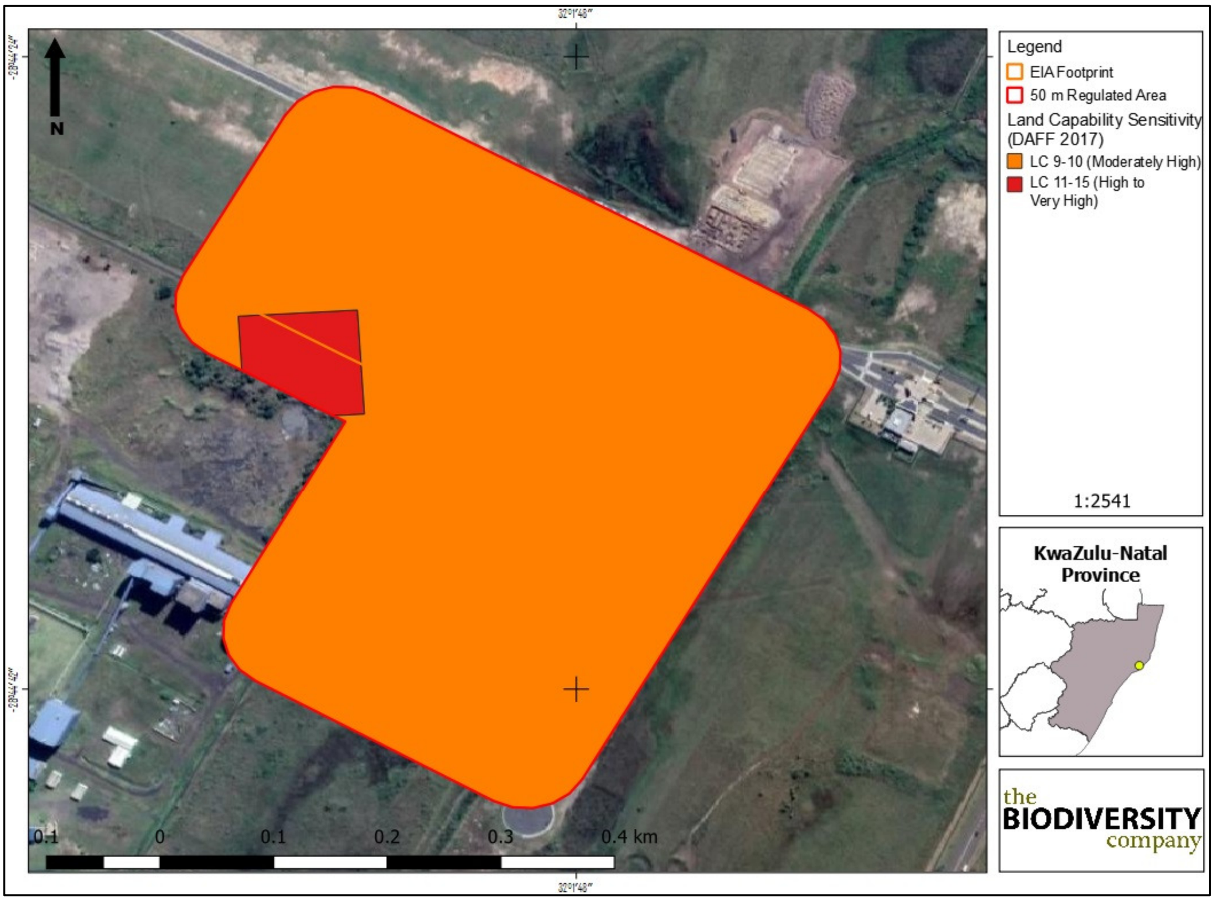


Figure 10-1 Land capability sensitivity of the project area (DAFF, 2017)

11 Impact Assessment

The impact assessment will consider the calculated sensitivities associated with the soil resources expected to be impacted upon by the relevant components. All proposed activities are expected to be long term (> 15 years) and have been considered "permanent" on this basis, which renders the decommissioning phase irrelevant. The proposed facility will be located within "Very High" sensitivity land potential resources. The proposed activities are infrastructure-related and includes various components (also listed in Section 1.1- "Project Description". These components will all have very similar impacts towards land potential resources in respect to covering soil resources with infrastructure.

11.1 Construction Phase

During the construction phase, high intensity construction activities will be carried out. This includes soil stripping, digging foundations, compacting soil, removing vegetation and the use of heavy machinery.

It is evident from the impact calculations in Table 11-1 that in a pre-mitigation state, moderate impacts are expected. This score is unlikely to be decreased to "Low" considering the high sensitivity of the soil as well as the high intensity of the proposed construction activities. In most cases, highly functioning soil resources will be transformed from high arable potential to completely disturbed.

Table 11-1 Impact assessment related to the loss of land capability during the proposed construction phase

Nature: Loss of land capability		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: **See Section 12**		
Residual Impacts:		
Significant residual impacts are foreseen considering the fact that the residual land use will be characterised by "developed" or "disturbed" areas as opposed to high potential arable soil		

11.2 Operational Phase

During the operational phase, those impacts associated with the construction phase are expected to be prolonged, specifically in regard to compaction of the soil and the continues alteration of land use.

Table 11-2 Impact assessment related to the loss of land capability during the operational phase

Nature:* *Loss of land capability		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
***Mitigation:* See Section 12**		
Residual Impacts:		
Significant residual impacts are foreseen considering the fact that the residual land use will be characterised by "developed" or "disturbed" areas as opposed to high potential arable soil		

11.3 Cumulative Impacts

Cumulative impacts within the proposed gas power area and its surroundings have been determined to be high. Soil resources in the area have been impacted upon by means of built-up areas, yet, not to such an extent that the larger utilisation of such resources in respect to forestry and/or cultivation has been affected.

Table 11-3 Impact assessment related cumulative impacts

Nature:* *Loss of land capability		
	Cumulative impact of the project and other projects in the area	**Cumulative impact of the project and other projects in the area**
Extent	Moderate (3)	Moderate (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
***Mitigation:* See Section 12**		

12 Specialist Management Plan

Table 12-1 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators. The implementation of these strategies are aimed at limiting the extent and intensity of construction activities as well as minimising the potential for indirect impacts in the form of land contamination.

Table 12-1 Mitigation measures, including requirements for timeframes, roles and responsibilities

		Action plan		
Phase	**Management action**	**Timeframe for implementation**	**Responsible party for implementation**	**Responsible party for monitoring/audit/review**
Planning phase	Investigate the possibility of avoiding large concrete areas	At least 6 months prior to the implementation of soil stripping or any other disturbances	Developer	Developer's Environmental Officer (dEO)
Construction	Demarcate all access routes	This activity should be finished at least two weeks prior to any construction activities	Developer Contractor	Environmental Control Officer (ECO)
	Vegetate all stockpiles after stripping/removing soils	During construction phase	Contractor	ECO
	Storage of potential contaminants in bunded areas	During construction phase	Contractor	ECO
	All contractors must have spill kits available and be trained in the correct use thereof.	During construction phase	Contractor	ECO
	All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".	During construction phase	Contractor	ECO
	No cleaning or servicing of vehicles, machines and equipment in water resources.	During construction phase	Contractor	ECO
	Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.	During construction phase	Contractor	ECO
Operation	Continuously monitor erosion on site	During the timeframe assigned for the life of the gas power facility	Operator	dEO
	Monitor compaction on site	During the timeframe assigned for the life of the gas power facility	Operator	dEO

13 Conclusion and Impact Statement

13.1 Baseline Ecology

Various soil forms have been identified which have been divided into four main land capability classes according to depth, texture, hydromorphic properties etc. (namely land capability class II, III, IV and V). From these four classes as well as the ideal climatic capability of "C1", three land potential levels were calculated, namely land potential 1, 2 and "vlei". Therefore, the overall land potential ranges from "Low" (for the wetland areas characterised by non-arable conditions) to "Very High".

13.2 Specialist Opinion

The 50 m regulated area comprises of land potential resources characterised by "Very High" arable potential under natural conditions, owing to the ideal climatic conditions of the region as well as the physical properties of the classified soil forms. The high sensitivity of these soils emphasises the potential loss of highly valued land. It is worth noting that the agricultural land use in the surrounding area needs to be considered holistically.

High potential arable land is only useful to agricultural land use, with limited significance outside of such a land use. It is worth considering the locality of the proposed project area being on the outskirts of the Richards Bay CBD. Therefore, regardless of whether or not the proposed activities proceed, the soil will not be used for agriculture due to the zoning of the area. Therefore, it is the specialist's opinion that even though significant impacts towards soil resources are expected, no impacts towards agricultural land use are foreseen. The soil resources will ultimately never be of value to farming practices reliant on high potential arable land. Therefore, the proposed activities should proceed as have been planned.

14 References

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