Agricultural Potential Assessment in Support of the Environmental Authorisation and Water Use License Application Process for the proposed Rietfontein Housing Development

Rietfontein, Gauteng Province

January 2020

Client

Prepared for:

GA Environment

Prepared by:

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the BIODIVERSITY company

Report Name	**Agricultural Potential Assessment for the proposed Rietfontein Housing Development**
Submitted to	**GA Environment**
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.
Report Reviewer	**Wayne Jackson**
	Wayne Jackson is a Soils Scientist & Hydrologist and has 10 years' experience in the classification of soils, and also the delineation and assessment of wetlands. Wayne completed a B.Sc. degree (Soil Science and Hydrology) from the University of Kwa-Zulu Natal and has 10 years of consulting experience.
Report Writer and Fieldwork	**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 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.
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.

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Document Guide

The table below provides the NEMA (2014) Requirements for Specialist Reports, and also the relevant sections in the reports where these requirements are addressed:

Requirement	Page/ section
1 A specialist report prepared in terms of these Regulations must contain—	
a. details of—	
i. the specialist who prepared the report; and	Page ii
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 4
b. a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page vii
c. an indication of the scope of, and the purpose for which, the report was prepared;	Section 3
• (cA) an indication of the quality and age of base data used for the specialist report;	Section 7
• (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
d. the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
e. a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
f. details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 7 and 8
g. an identification of any areas to be avoided, including buffers;	Section 8 and 9
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;	None
i. a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
j. a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 9
k. any mitigation measures for inclusion in the EMPr;	Section 9
l. any conditions for inclusion in the environmental authorisation;	Section 9
m. any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A
n. a reasoned opinion—	Section 8, 9 and 10
i. whether the proposed activity, activities or portions thereof should be authorised;	Section 9 and 10
(iA) regarding the acceptability of the proposed activity or activities; and	Section 10
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 10
o. a description of any consultation process that was undertaken during the course of preparing the specialist report;	None
p. a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
q. any other information requested by the competent authority.	N/A
2 Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 1

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

January 2020

Executive Summary

The Biodiversity Company was appointed to conduct a pedology (agricultural potential, land capability and land use) baseline and impact assessment for the proposed Rietfontein Housing Development. The development forms part of the Rapid Land Release Programme for the Gauteng Department of Human Settlements

Three different soil forms were identified throughout the project area, namely the Glenrosa, Hutton and Nkonkoni soil forms. Of these soil forms, the latter two were determined to have a land potential class of "2" and "3" respectively with the Glenrosa soil form characterised by a land potential class of "4". The dominant, and only land use was identified as semi-natural grassland. Given the high value of the L2 land potential areas, it is recommended that development take place within the L3 and L4 areas with subsistence farming being promoted for L2.

1 Introduction

The Biodiversity Company (TBC) was appointed to conduct a pedology (agricultural potential, land capability and land use) baseline and impact assessment for the proposed Rietfontein Housing Development. The development forms part of the Rapid Land Release Programme for the Gauteng Department of Human Settlements.

This specialist study is completed to meet the requirements of the associated environmental authorisations, in specific, that of the National Environmental Management Act 107 of 1998, Appendix 6.

This report aims to present and discuss the findings from the soil resources identified on-site, the agricultural and land potential of these resources, the land uses within the project area as well as the risk associated with the housing development.

2 Project Area

The project area is situated south of Lenasia Ext. 10 and 4 km north-west of the N1, Gauteng (see Figure 2-1). The dominant land uses within the project area and the surroundings include informal to formal settlements, grazing as well as various watercourses.

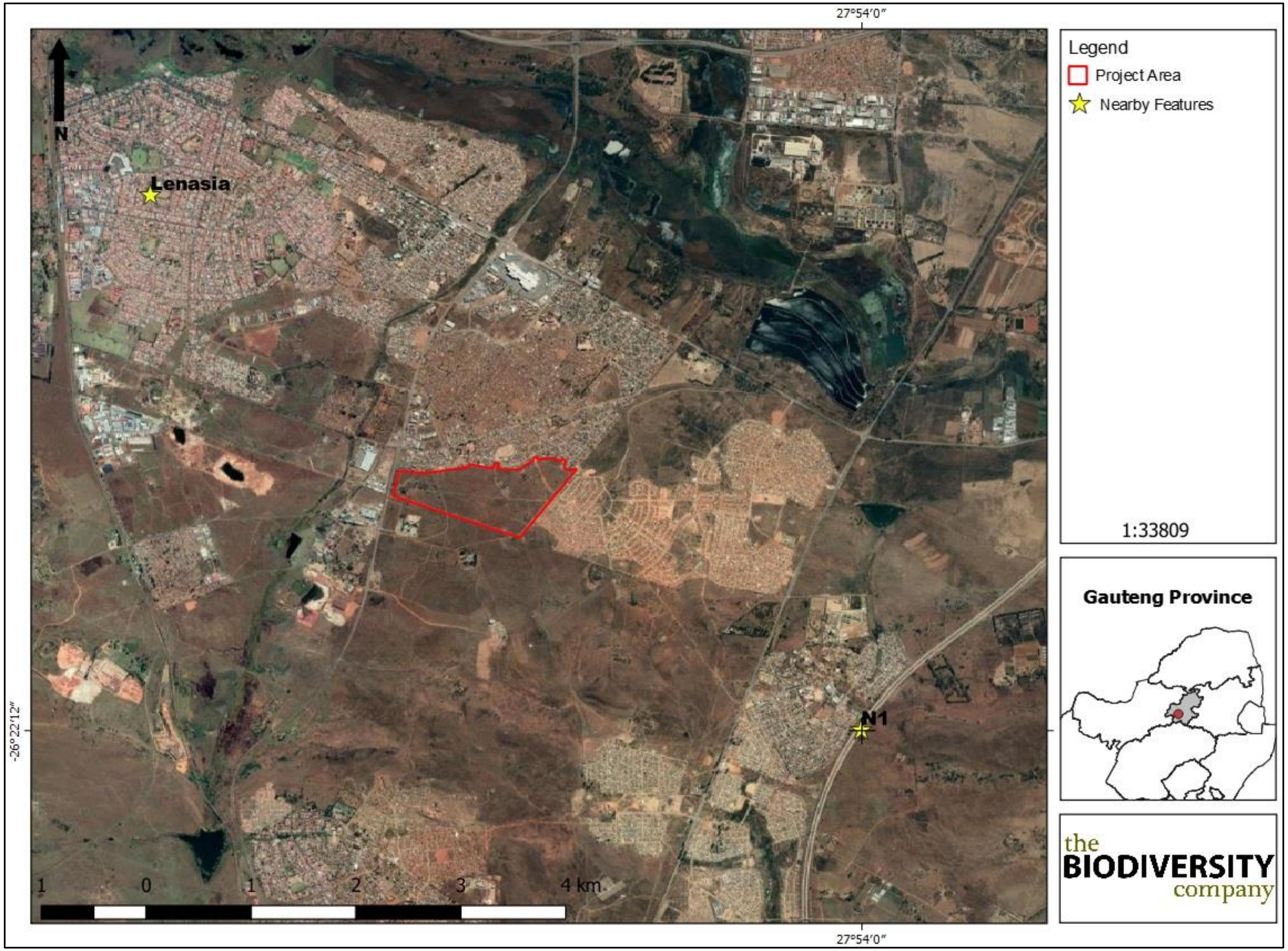

Figure 2-1 General location of the project area

3 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 and current land use of the entire surface area of the relevant portions of the project area;
- Soil resources were analysed in areas where the relief, soil colour and/or physical properties change;
- Assessing crop performance and current agricultural land use on-site;
- Estimating yields for the area;
- Assessing the carrying capacity of the site;
- Recommend suitable crops for the 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.
- Compile a risk assessment to indicate the significance of the expected impacts; and
- Recommend relevant mitigation measures to limit all associated impacts.

4 Limitations

The following limitations are relevant to this agricultural potential assessment;

- No detailed layouts for the proposed activities have been provided;
- It has been assumed that the entire project area will be developed; and

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

5 Expertise of the Specialists

5.1 Andrew Husted

Mr. Andrew Husted is an aquatic ecologist, specializing in freshwater systems and wetlands, who graduated with a MSc in Zoology. He, is Pri Sci Nat registered (SACNASP) (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Mr Husted is an Aquatic, Wetland and Biodiversity Specialist with 12 years' experience in the environmental consulting field. Andrew is an accredited wetland practitioner, recognised by the relevant South African authorities, and also the Mondi Wetlands programme as a competent wetland consultant.

5.2 Wayne Jackson

Wayne Jackson is a Soils Scientist & Hydrologist and has 10 years' experience in the classification of soils, and also the delineation and assessment of wetlands. Wayne completed a B.Sc. degree (Soil Science and Hydrology) from the University of Kwa-Zulu Natal and has 10 years of consulting experience.

5.3 Ivan Baker

Ivan Baker is Cand. Sci Nat registered (SACNASP) (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 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.

6 Methodology

The agricultural assessment was conducted using the Provincial and National Departments of Agriculture recommendations. The assessment was broken into two phases. Phase 1 was a desktop assessment to determine the following:

- Historic climatic conditions;
- The terrain features using 5 m contours;
- The base soils information from the land type database (Land Type Survey Staff, 1972 - 2006); and
- The geology for the proposed project site.

Phase 2 of the assessment was to conduct a soil survey to determine the actual agricultural potential. During this phase the current land use was also surveyed.

6.1 Desktop Assessment

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types.

6.2 Field Survey

A study of the soils present within the project area was conducted during a field visit in January 2020. The site was traversed by vehicle and on foot. 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.

6.3 Agricultural Potential Assessment

Land capability and agricultural potential is 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 (Smith, 2006)

Land capability is divided into eight classes and these may be divided into three capability groups. Table 6-1 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 6-1 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 are determined by combining the land capability results and the climate capability of a region as shown in Table 6-2. The final land potential results are then described in Table 6-3.

Table 6-2 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 6-3 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

6.4 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.

6.5 Impact Assessment Methodology

From an agricultural perspective, the loss of high value farm land and / or food security production, as a result of the proposed activities is the primary concern of this assessment. In South Africa there is a scarcity of high potential agricultural land, with less than 14% of the total area being suitable for dry land crop production (Smith, 2006).

The EIA Regulations, 2014, prescribes requirements to be adhered to and objectives to be reached when undertaking Impact Assessments. These are noted in the following sections contained within the EIA Regulations (2014):

- Regulation 982, Appendix 1, Section 2 and Section 3 – Basic Assessment Impact Requirements; and
- Regulation 982, Appendix 2 and Appendix 3 – Environmental Impact Assessment Requirements.

In terms of these Regulations, the following should be considered when undertaking an Impact Assessment:

- A description and assessment of the significance of any environmental impact including:
- Cumulative impacts that may occur as a result of the undertaking of the activity during the project life cycle;
- Nature of the impact;
- Extent and duration of the impact;
- The probability of the impact occurring;
- The degree to which the impact can be reversed;

- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

The overall significance of an impact / affect has been ascertained by attributing numerical ratings to each identified impact. The numerical scores obtained for each identified impact have been multiplied by the probability of the impact occurring before and after mitigation. High values suggest that a predicted impact / effect is more significant, whilst low values suggest that a predicted impact / effect is less significant. The interpretation of the overall significance of impacts is presented in Table 6-4.

Table 6-4 Significance rating of impacts

Scoring Value	Significance
>35	Very high - **The impact is total / consuming / eliminating** - In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. Mitigation may not be possible / practical. Consider a potential fatal flaw in the project.
25 – 35	High - **The impact is profound** - In the case of adverse impacts, there are few opportunities for mitigation that could offset the impact, or mitigation has a limited effect on the impact. Social, cultural and economic activities of communities are disrupted to such an extent that their operation is severely impeded. Mitigation may not be possible / practical. Consider a potential fatal flaw in the project.
20 – 25	Medium high - **The impact is considerable / substantial** - The impact is of great importance. Failure to mitigate with the objective of reducing the impact to acceptable levels could render the entire project option or entire project proposal unacceptable. Mitigation is therefore essential.
7 – 20	Medium low - **The impact is material / important to investigate** - The impact is of importance and is therefore considered to have a substantial impact. Mitigation is required to reduce the negative impacts and such impacts need to be evaluated carefully.
4 - 7	Low - **The impact is marginal / slight / minor** - The impact is of little importance, but may require limited mitigation; or it may be rendered acceptable in light of proposed mitigation.
0 - 4	Low - **The impact is unimportant / inconsequential / indiscernible** – no mitigation required, or it may be rendered acceptable in light of proposed mitigation.

The significance rating of each identified impact / effect was further reviewed by the Agricultural Assessment Specialist by applying professional judgement.

For the purpose of this assessment, the impact significance for each identified impact was evaluated according to the following key criteria outlined in the sub-sections below.

6.5.1 Nature of Impact

The environmental impacts of a project are those resultant changes in environmental parameters, in space and time, compared with what would have happened had the project not been undertaken. It is an appraisal of the type of effect the activity would have on the affected environmental parameter. Its description includes what is being affected, and how.

6.5.2 Spatial Extent

This addresses the physical and spatial scale of the impact. A series of standard terms and ratings used in this assessment relating to the spatial extent of an impact / effect are outlined in Table 6-5.

Table 6-5 Spatial extent of the impact

Rating	Spatial Desscriptor
7	**International** - The impacted area extends beyond national boundaries.
6	**National** - The impacted area extends beyond provincial boundaries.
5	**Ecosystem** - The impact could affect areas essentially linked to the site in terms of significantly impacting ecosystem functioning.
4	**Regional** - The impact could affect the site including the neighbouring areas, transport routes and surrounding towns etc.
3	**Landscape** - The impact could affect all areas generally visible to the naked eye, as well as those areas essentially linked to the site in terms of ecosystem functioning.
2	**Local** - The impacted area extends slightly further than the actual physical disturbance footprint and could affect the whole, or a measurable portion of adjacent areas.
1	**Site Related** - The impacted area extends only as far as the activity e.g. the footprint; the loss is considered inconsequential in terms of the spatial context of the relevant environmental or social aspect.

6.5.3 Severity / Intensity / Magnitude

This provides a qualitative assessment of the severity of a predicted impact / effect. A series of standard terms and ratings used in this assessment which relate to the magnitude of an impact / effect are outlined in Table 6-6.

Table 6-6 Magnitude of impact

Rating	Magnitude Descriptor
7	**Total / consuming / eliminating** - Function or process of the affected environment is altered to the extent that it is permanently changed.
6	**Profound / considerable / substantial** - Function or process of the affected environment is altered to the extent where it is permanently modified to a sub-optimal state.
5	**Material / important** - The affected environment is altered, but function and process continue, albeit in a modified way.
4	**Discernible / noticeable** - Function or process of the affected environment is altered to the extent where it is temporarily altered, be it in a positive or negative manner.
3	**Marginal / slight / minor** - The affected environment is altered, but natural function and process continue.
2	**Unimportant / inconsequential / indiscernible** - The impact temporarily alters the affected environment in such a way that the natural processes or functions are negligibly affected.
1	**No effect / not applicable**

6.5.4 Duration

This describes the predicted lifetime / temporal scale of the predicted impact. A series of standard terms and ratings used in this assessment are included in Table 6-7.

Table 6-7 Temporal scale of the impact

Rating	Temporal Descriptor
7	**Long term** – Permanent or more than 15 years post decommissioning. The impact remains beyond decommissioning and cannot be negated.
3	**Medium term** – Lifespan of the project. Reversible between 5 to 15 years post decommissioning.

1	**Short term** – Quickly reversible. Less than the project lifespan. The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the project phases or within 0 -5 years.

6.5.5 Irreplaceable Loss of Resources

Environmental resources cannot always be replaced; once destroyed, some may be lost forever. It may be possible to replace, compensate for or reconstruct a lost resource in some cases, but substitutions are rarely ideal. The loss of a resource may become more serious later, and the assessment must take this into account. A series of standard terms and ratings used in this assessment are included in Table 6-8.

Table 6-8 Degree of loss impact

Rating	Resource Loss Descriptor
7	**Permanent** – The loss of a non-renewable / threatened resource which cannot be renewed / recovered with, or through, natural process in a time span of over 15 years, or by artificial means.
5	**Long term** – The loss of a non-renewable / threatened resource which cannot be renewed / recovered with, or through, natural process in a time span of over 15 years, but can be mitigated by other means.
4	**Loss of an 'at risk' resource** - one that is not deemed critical for biodiversity targets, planning goals, community welfare, agricultural production, or other criteria, but cumulative effects may render such loss as significant.
3	**Medium term** – The resource can be recovered within the lifespan of the project. The resource can be renewed / recovered with mitigation or will be mitigated through natural process in a span between 5 and 15 years.
2	**Loss of an 'expendable' resource** - one that is not deemed critical for biodiversity targets, planning goals, community welfare, agricultural production, or other criteria.
1	**Short-term** – Quickly recoverable. Less than the project lifespan. The resource can be renewed / recovered with mitigation or will be mitigated through natural process in a span shorter than any of the project phases, or in a time span of 0 to 5 years.

6.5.6 Reversibility / Potential for Rehabilitation

The distinction between reversible and irreversible impacts is a very important one and the irreversible impacts not susceptible to mitigation can constitute significant impacts in an EIA (Glasson et al, 1999). The potential for rehabilitation is the major determinant factor when considering the temporal scale of most predicted impacts. A series of standard terms and ratings used in this assessment are included Table 6-9.

Table 6-9 The potential for the impact to be reversed

Rating	Reversibility Descriptor
7	**Long term** – The impact / effect will never be returned to its benchmark state.
3	**Medium term** – The impact / effect will be returned to its benchmark state through mitigation or natural processes in a span shorter than the lifetime of the project, or in a time span between 5 and 15 years.
1	**Short term** – The impact / effect will be returned to its benchmark state through mitigation or natural processes in a span shorter than any of the phases of the project, or in a time span of 0 to 5 years.

6.5.7 Probability

The assessment of the probability / likelihood of an impact / effect has been undertaken in accordance with ratings and descriptors provided in Table 6-10.

Table 6-10 The probability of the impact occurring

Rating	Probability Descriptor
1.0	Absolute certainty / will occur
0.9	Near certainty / very high probability
0.7 – 0.8	High probability / to be expected
0.4 – 0.6	Medium probability / strongly anticipated
0.3	Low probability / anticipated
0.2	Possibility
0.0 – 0.1	Remote possibility / unlikely

7 Spatial Context of the Project Area

7.1 Climate

The project area is characterised by warm-temperate summer rainfall with an overall mean annual precipitation of approximately 593 mm (Mucina & Rutherford, 2006). Severe frost frequently occurs within winter months with high temperatures within the summer months (see Figure 7-1).

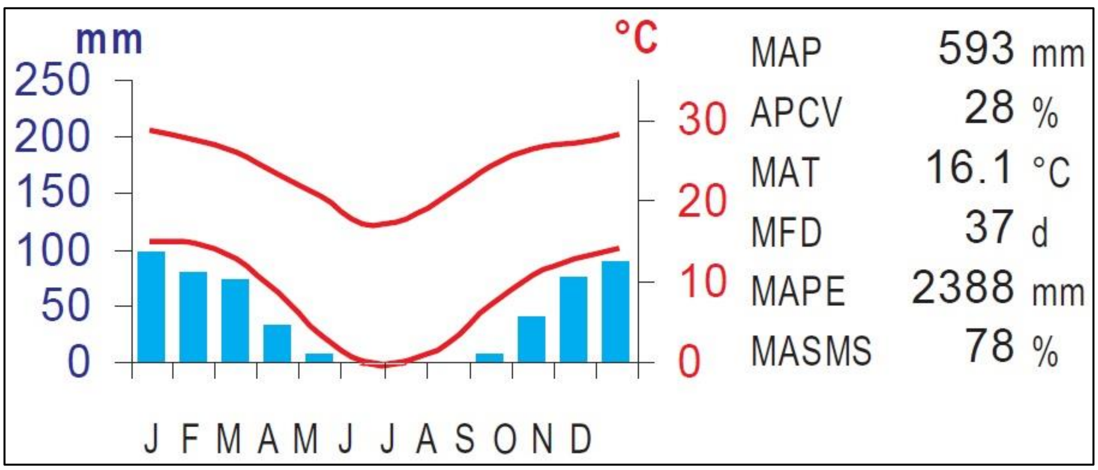

Figure 7-1 Climate diagram for the region (Mucina & Rutherford, 2006)

7.2 Soils and Geology

The geology of this area is characterised by chert and dolomite from the Transvaal Supergroup's Malmani Subgroup which mainly supports shallow soil forms, including Glenrosa and Mispah from the Fa land type. Other soil forms that are likely to occur within this region include deep red apedal soil types of Yellow-Brown Apedal soil types from the Ab land type (Mucina and Rutherford, 2006).

According to the land type database (Land Type Survey Staff, 1972 - 2006) the proposed project area is located within the Ab7 land type. The Ab land type is characterised by freely drained Red, Yellow Apedal soils. Red, dystrophic and/or mesotrophic soils are abundant. Figure 7-2 illustrates the respective terrain units relevant to the Ab7 land type with the expected soils illustrated in Table 7-1.

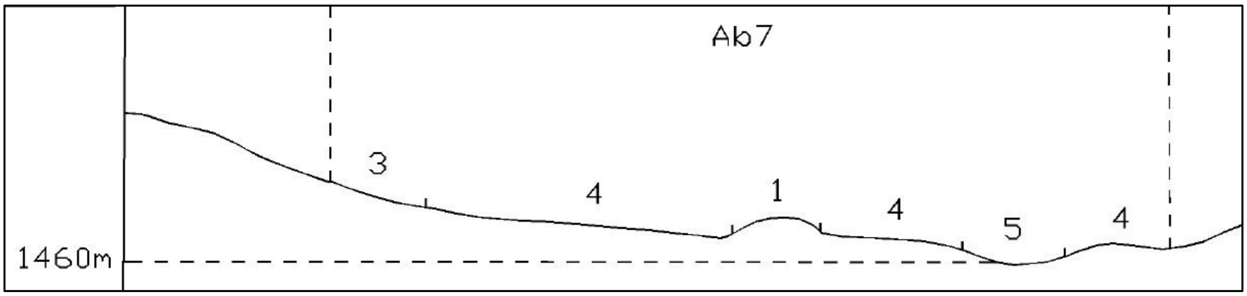

Figure 7-2 Illustration of land type Ab7 terrain units

Table 7-1 Soils expected at the respective terrain units within the Ab7 land type

Terrain Units							
1 (2%)		3 (10%)		4 (82%)		5 (6%)	
Soil	Percentage	Soil	Percentage	Soil	Percentage	Soil	Percentage
Glenrosa	70	Hutton	68	Hutton	97	Hutton	50
Rock	15	Glenrosa	30	Rock	1	Longlands	33
Hutton	15	Rock	2	Glenrosa	1	Glenrosa	16
						Mispah	1

7.3 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 7-3. The majority of the project area is characterised by a slope percentage between 0 and 1 %, with some smaller patches within the project area characterised by a slope percentage between 1 and 2 %. This illustration indicates a gentle slope with a few smaller heaps characterised by a slightly steeper (but still fairly gentle, < 3%) slope.

The elevation of the project area (Figure 7-4) indicates an elevation of 1580 – 1620 Metres Above Sea Level (MASL). The majority of the project area however is characterised by an elevation of 1590 to 1610 MASL.

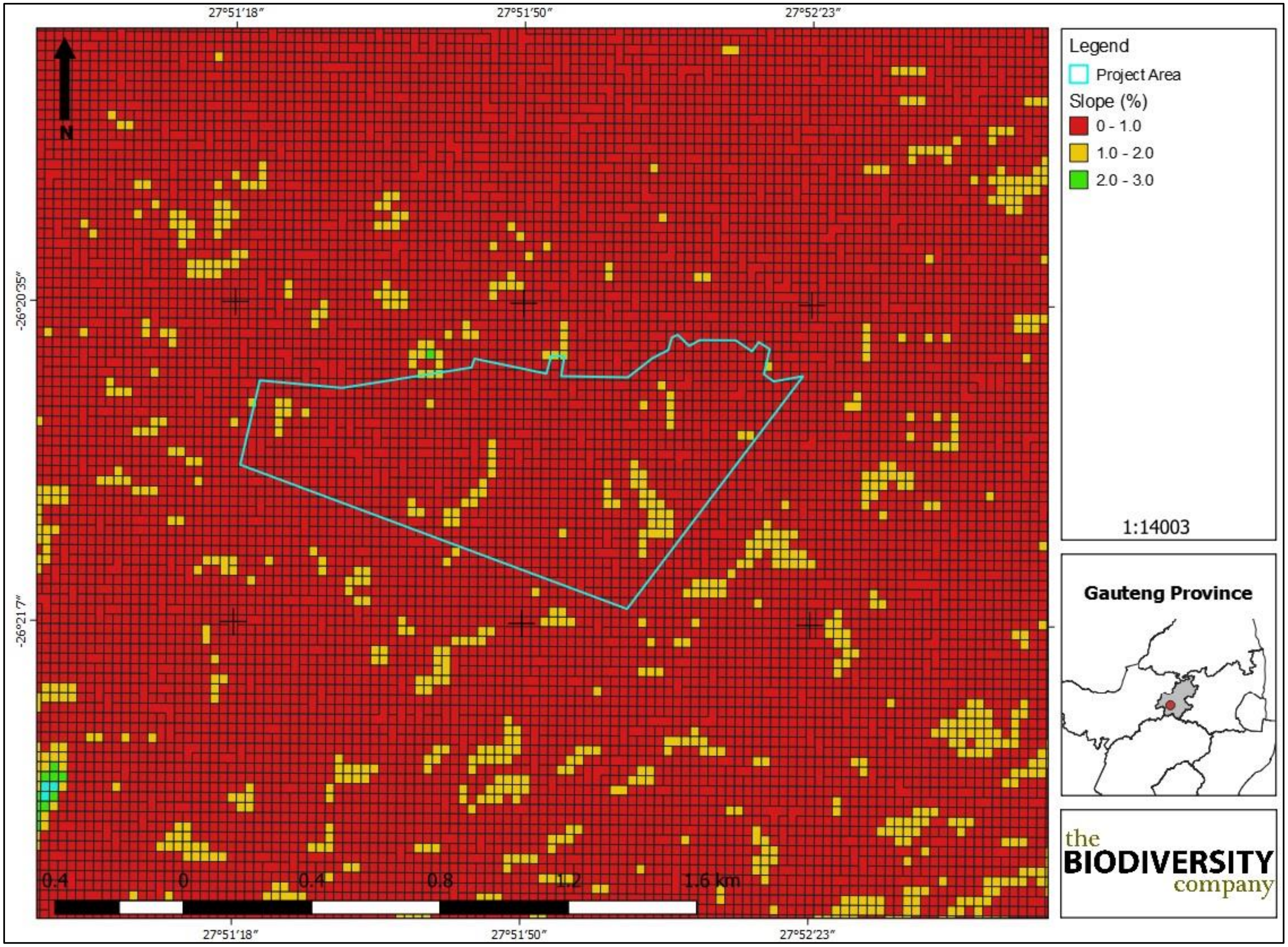

Figure 7-3 Slope percentage map for the project area

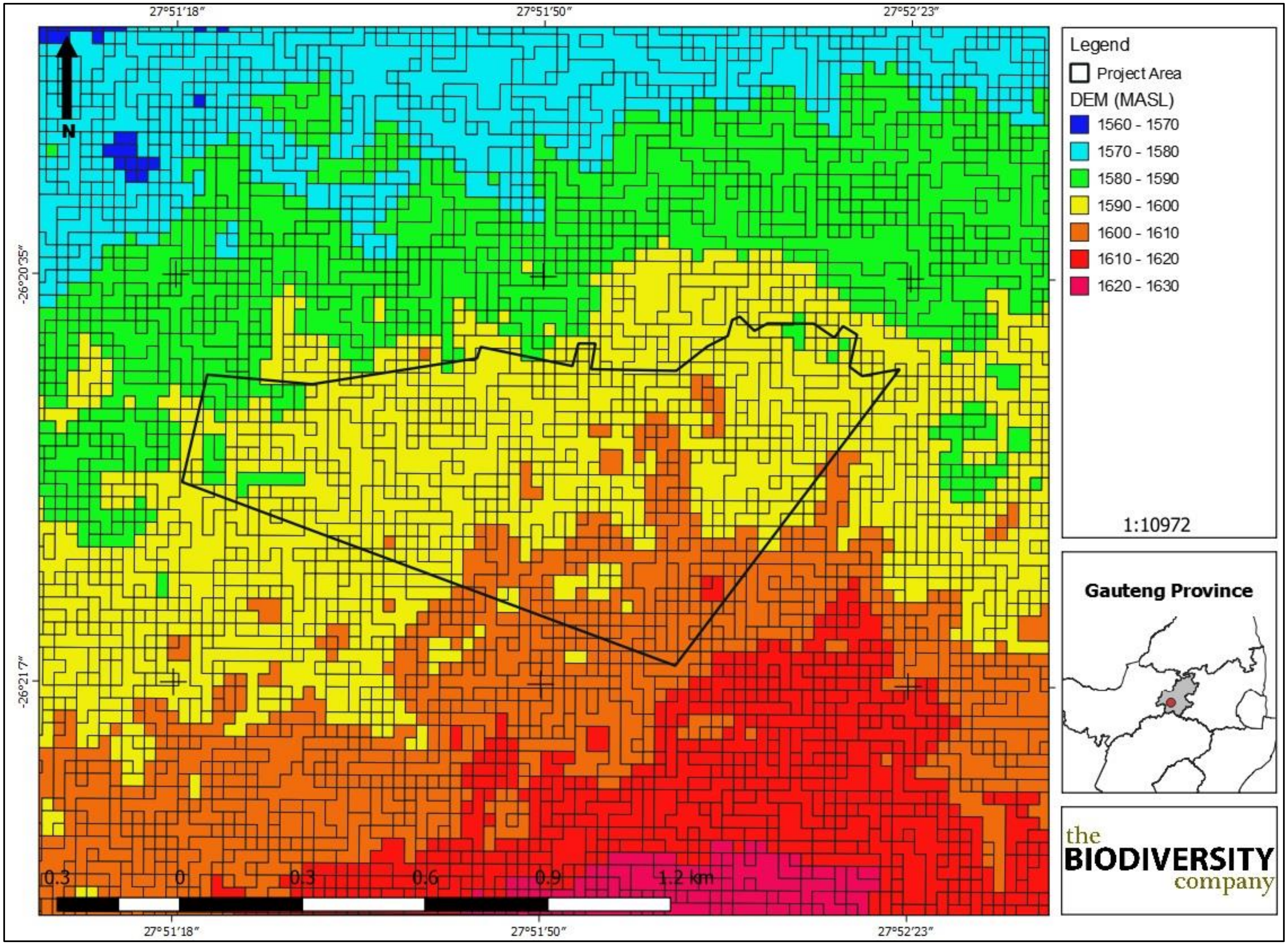

Figure 7-4 Elevation of the project area (metres above sea level)

8 Results and Discussion

The following sections include desktop results and the results from field observations relevant to the agricultural potential of the study area.

8.1 Description of Identified Soil Profiles and Diagnostic Horizons

Soil profiles were studied up to a depth of 1.5 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;

- Orthic topsoil;
- Red Apedal horizon; and
- Lithic horizon.

8.1.1 Orthic Topsoil

This diagnostic soil type is termed as a “normal” soil given the fact that this soil horizon does not have any diagnostic properties related to other diagnostic soil horizons. The Orthic A-horizon does not have specific characteristics regarding colour, texture, base status etc. due to this diagnostic soil horizon’s wide range throughout South African Landscapes (Soil Classification Working Group, 1991).

8.1.2 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.

8.1.3 Lithic 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.

8.2 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 8-1 and described in Table 8-1 according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock.

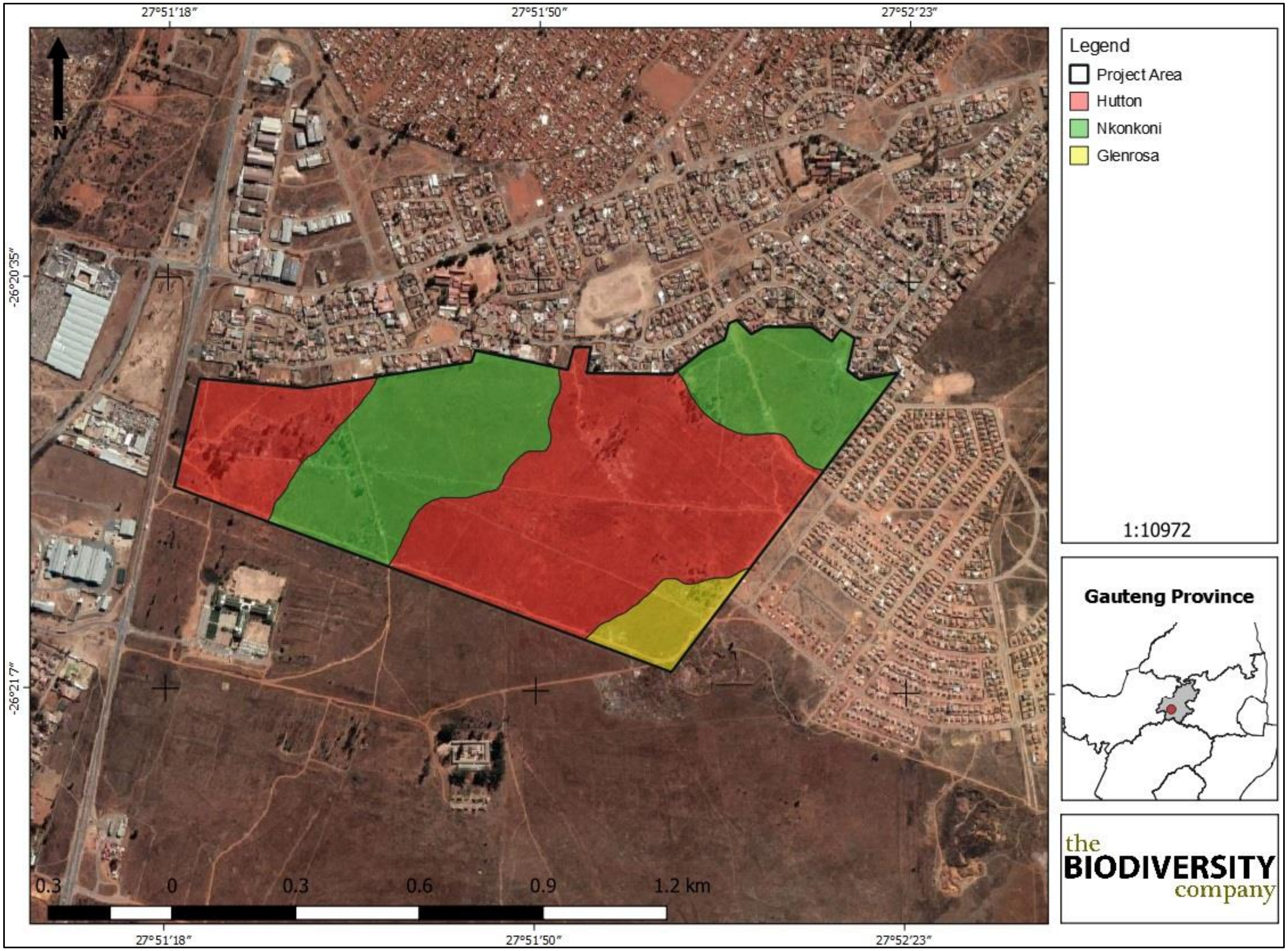

Figure 8-1 Soil delineations within the project area

Table 8-1 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 %
Glenrosa	300	0 - 15	None	10-20	None		N/A (Lithic horizon impermeable)					N/A			
Nkonkoni	300	0-15	None	0	None		300 - 700	0-15	None	10-20		N/A (Lithic horizon impermeable)			
Hutton	300	0 - 15	None	0	None		300 – 1 400	0 - 15	None	0		N/A			

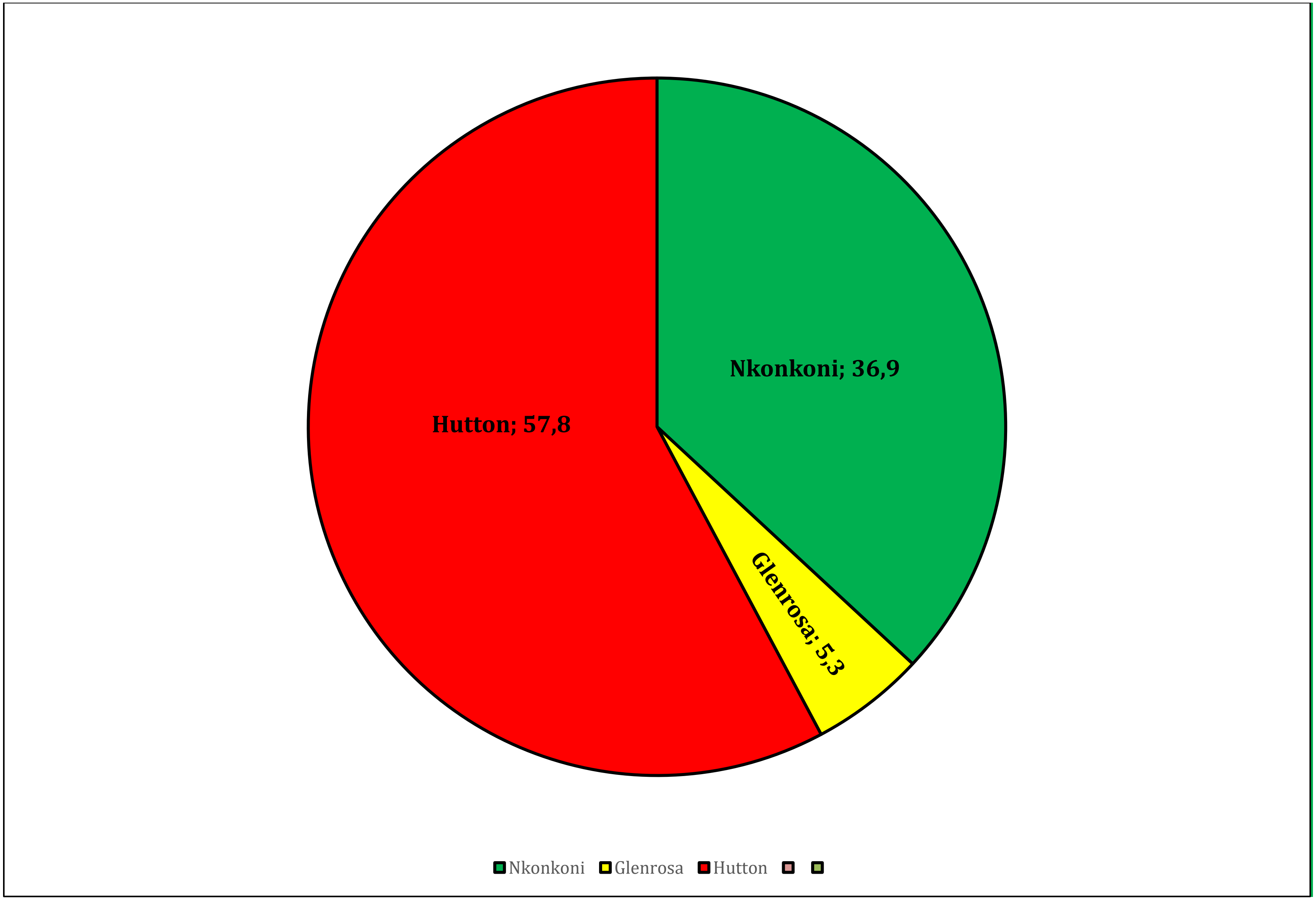

Figure 8-2 Soil form coverage (%) within the project area

8.2.1 Glenrosa

The Glenrosa soil form consists of an Orthic topsoil on top of a Lithocutanic horizon. The soil family group identified for the Glenrosa soil form on-site has been classified as the “1120” soil family due to the non-calcareous nature, the dark colours of the topsoil and the geolithic properties of the Lithic horizon.

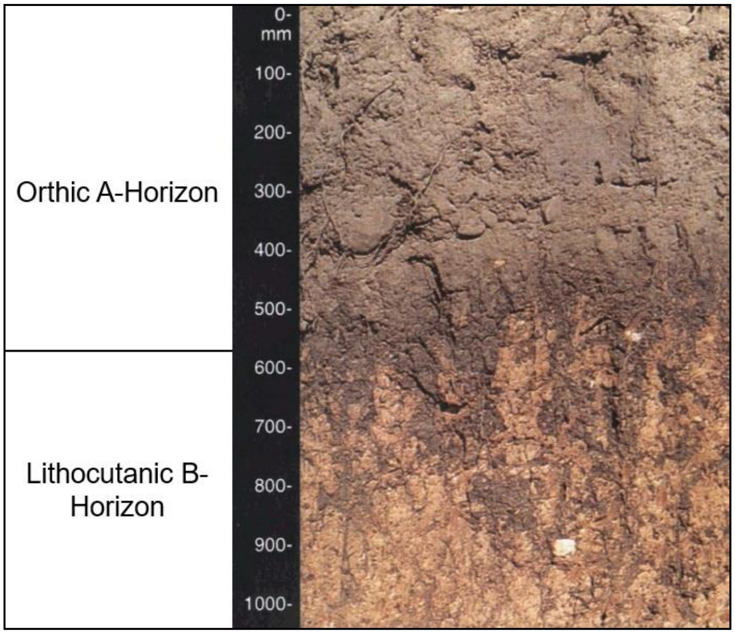

Figure 8-3 Example of a Glenrosa soil form, (SASA, 1999)

8.2.2 Hutton

The Hutton soil form consists of an Orthic topsoil on top of a Red Apedal horizon. The soil family group identified for the Hutton soil form on-site has been classified as the “1210” soil family given the soil’s expected mesotrophic nature, the dark colours of the topsoil and the aluvic nature of the Red Apedal horizon.

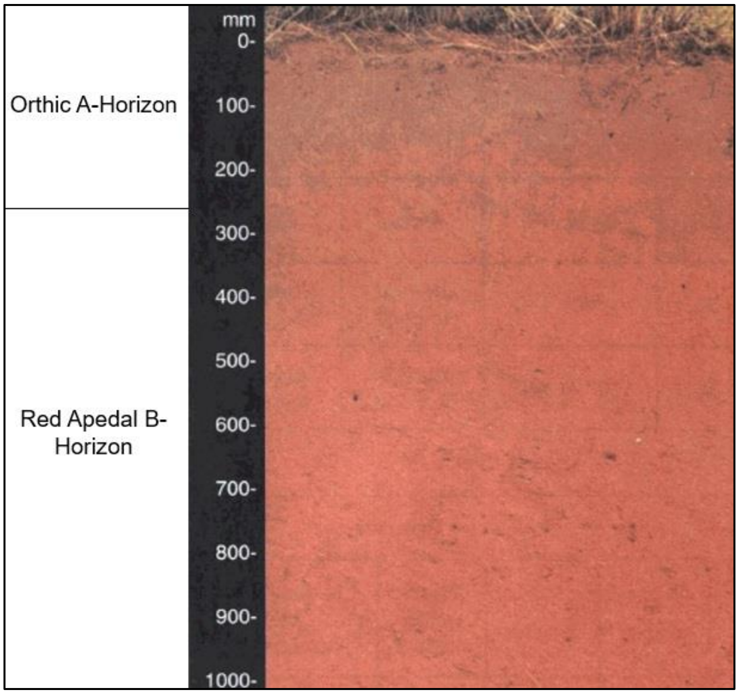

Figure 8-4 Example of a Hutton soil form, (SASA, 1999)

8.2.3 Nkonkoni

The Nkonkoni soil form consists of an Orthic topsoil on top of a Red Apedal horizon, which in turn overlays a Lithic horizon. The soil family group identified for the Nkonkoni soil form is "1212" due to the dark colours of the topsoil, the geolithic properties of the Lithic horizon, the aluvic nature of the Red Apedal horizon and the expected Mesotrophic conditions of the soil form.

Figure 8-5 Example of a Nkonkoni soil form with diagnostic horizon pictures from the Rietfontein site

8.3 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.

8.3.1 Climate Capability

The climate capability for this region was determined to be C2 classification. The C2 climate capability class is characterised by a slightly restricting growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops (Smith, 2006).

8.3.2 Land Capability

The land capability was determined by using the guidelines described in "The farming handbook" (Smith, 2006). A breakdown of the land capability classes is shown in Table 6-1. The land capability for the project area is illustrated in Figure 8-6 and described in Table 8-2.

Table 8-2 Land capability for the soils within the project area

Soil Forms	Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage Within Project Area	Land Capability Group
Hutton	Class III	Moderate limitations with some degree of erosion expected.	Special conservation practice and tillage methods need to be implemented.	Rotation of crops and ley (50%).	57,8	Arable
Nkonkoni	Class IV	Severe limitations are expected with low arable potential. High erosion hazards are foreseen.	Intensive conservation practice is required.	Long term leys (75%).	36,9	
Glenrosa	Class VI	Limitations preclude cultivation. Suitable only for natural vegetation	Protection measures for establishment, e.g. sod-seeding	Veld, pasture and afforestation	5,3	Grazing

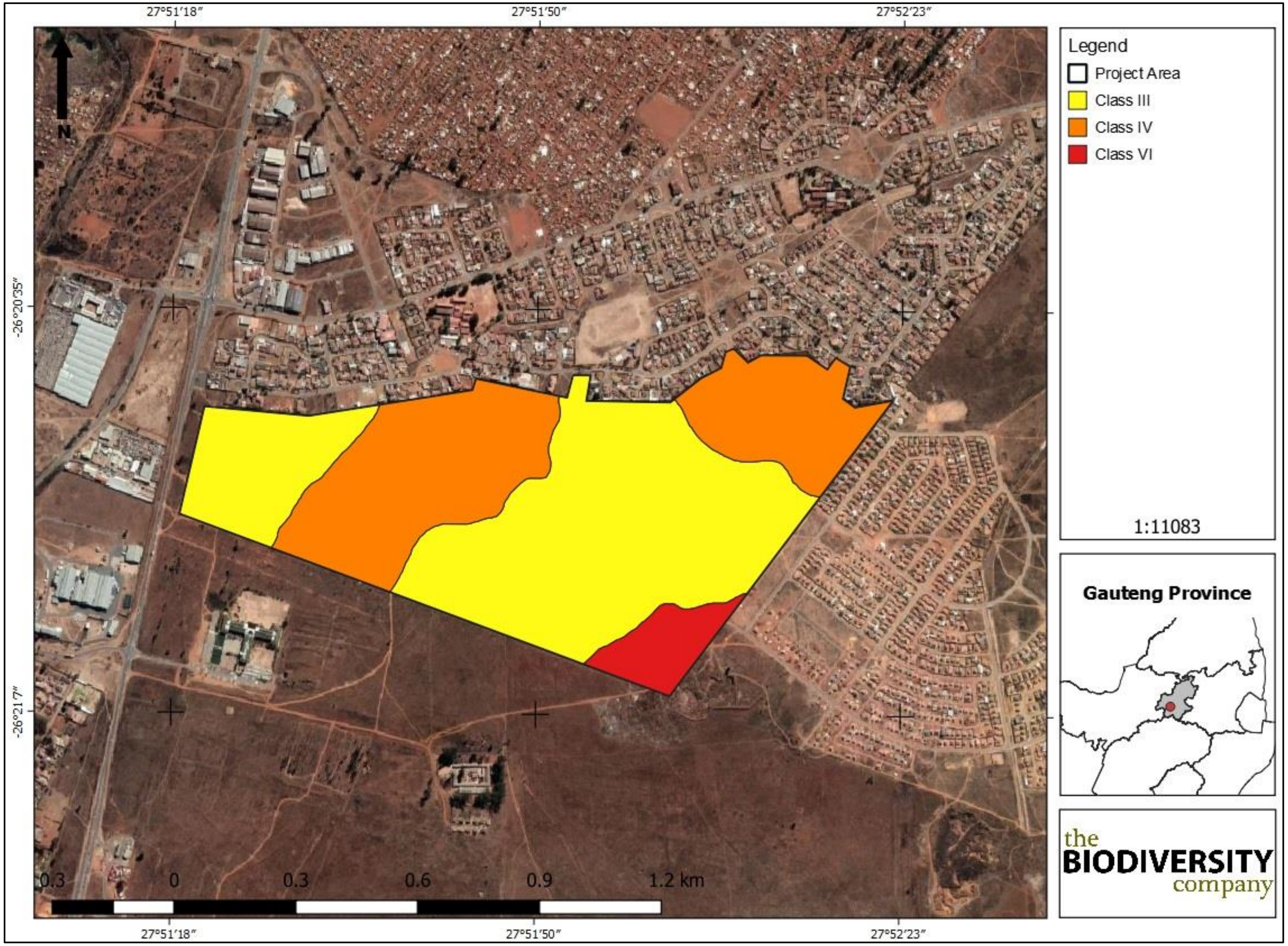

Figure 8-6 Land capability classes for the project area

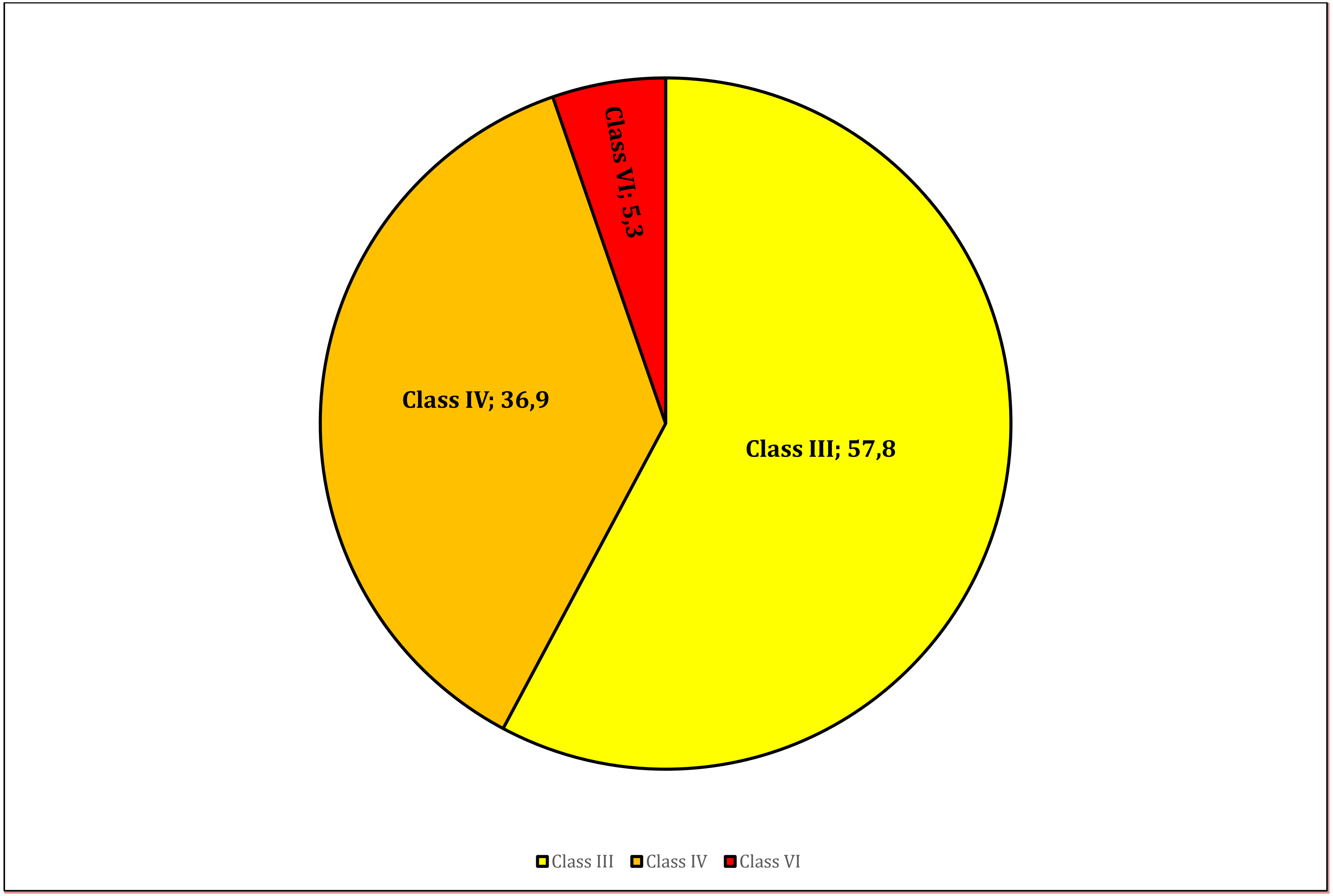

Figure 8-7 Land capability coverage (%) of the project area

8.3.3 Land Potential

The land potential of the project area is illustrated in Figure 8-8 and described in Table 8-3. The class III and IV land capability units have been determined to have a land potential of “L2” and “L3” respectively with the land capability class VI having a land potential of “L4”.

Table 8-3 Land potential for the soils within the project area

Soil Forms	Land Capability Class	Land Potential	Percentage	Description of Land Potential Class
Hutton	**Class III**	**L2**	57.8	This land potential class is characterised by very infrequent and/or minor limitations due to the slope, soil, temperates and/or rainfall. Appropriate cotour inspection must be implemented and inspected. This land type has high potential.
Nkonkoni	**Class IV**	**L3**	36.9	This land potential class has infrequents or moderate limitations due to soil, temperatures, slope or rainfall. Appropriate cotour inspection must be implemented and inspected. This land type has good potential.
Glenrosa	**Class VI**	**L4**	**5,3**	This land potential class has moderately regular and/or severe to moderate limitations due to slope, soil, rainfall and/or temperatures. Appropriate permission is required before ploughing virgin land. This land potential class has restricted potential.

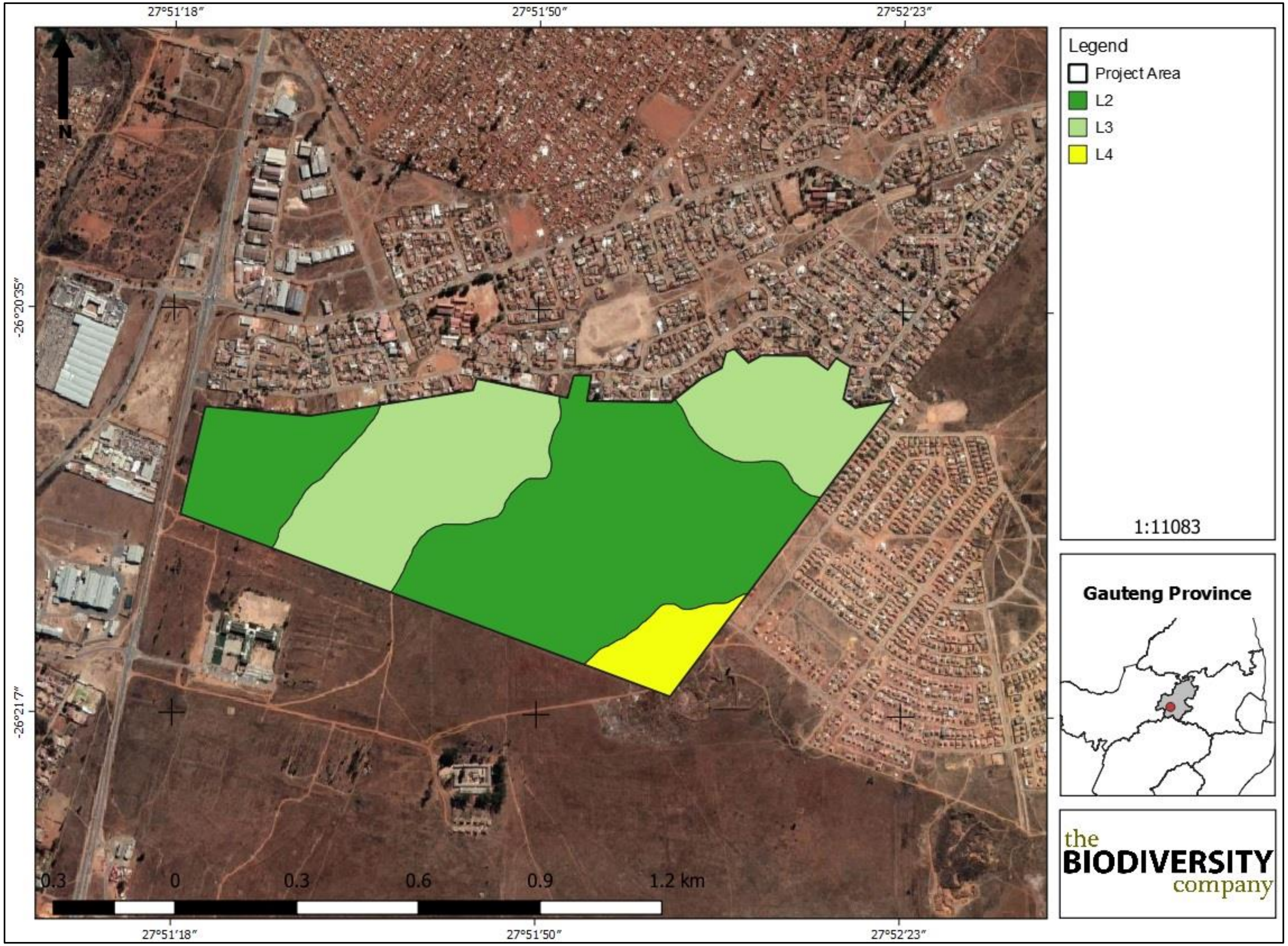
27°51'18"
27°51'50"
27°52'23"
-26°20'35"
-26°21'7"
N
Legend
Project Area
L2
L3
L4
1:11083
Gauteng Province
0.3
0
0.3
0.6
0.9
1.2 km
the
BIODIVERSITY
company

Figure 8-8 Land potential determined for the project area

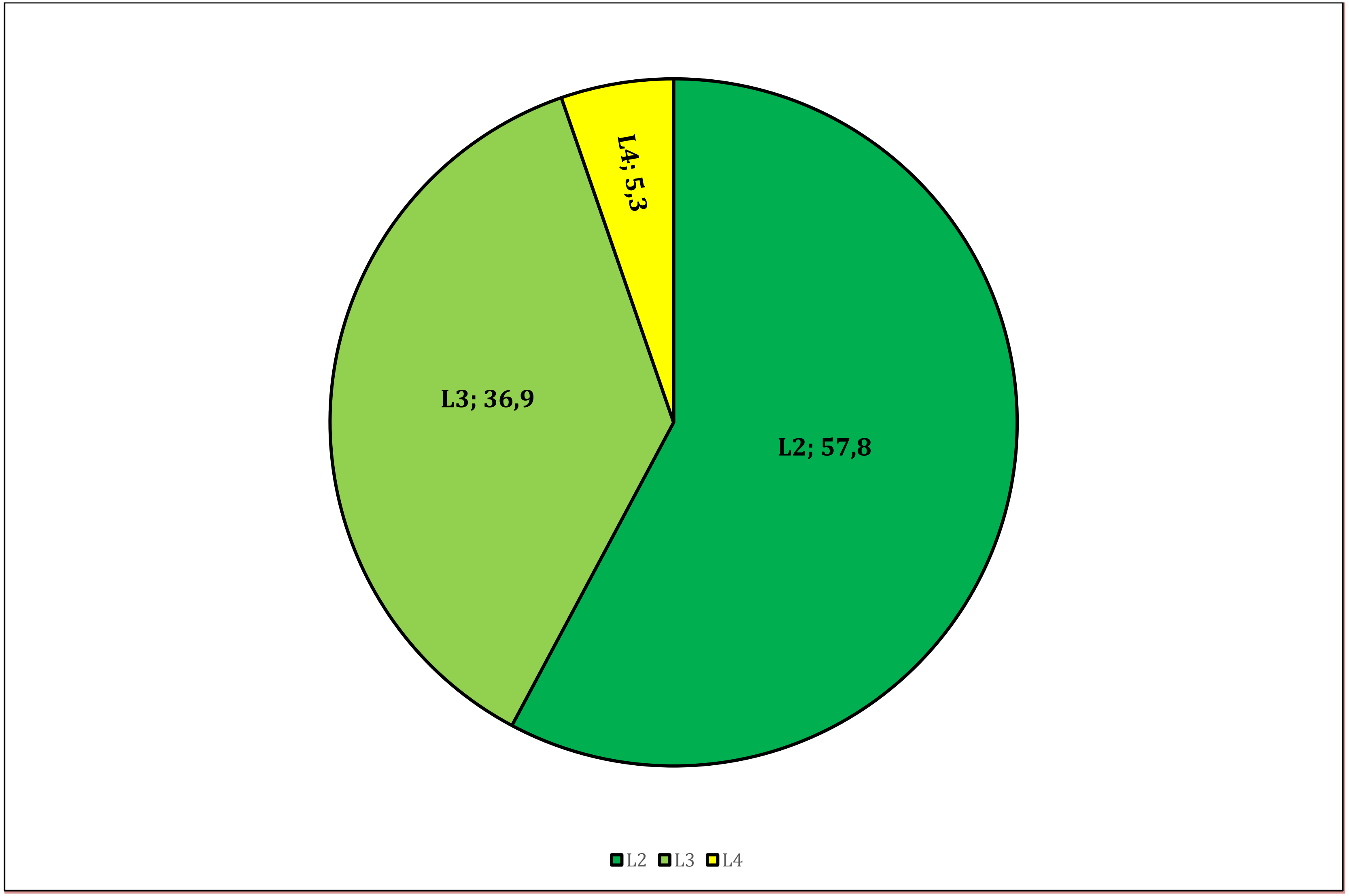

Figure 8-9 Land potential coverage (%) of the project area

8.4 Current Land Use

The land use of the project area is characterised by one large portion of semi-natural grassland, with no other major land uses located within the project area Figure 8-11.

Figure 8-10 Semi-natural grassland land use identified within the project area

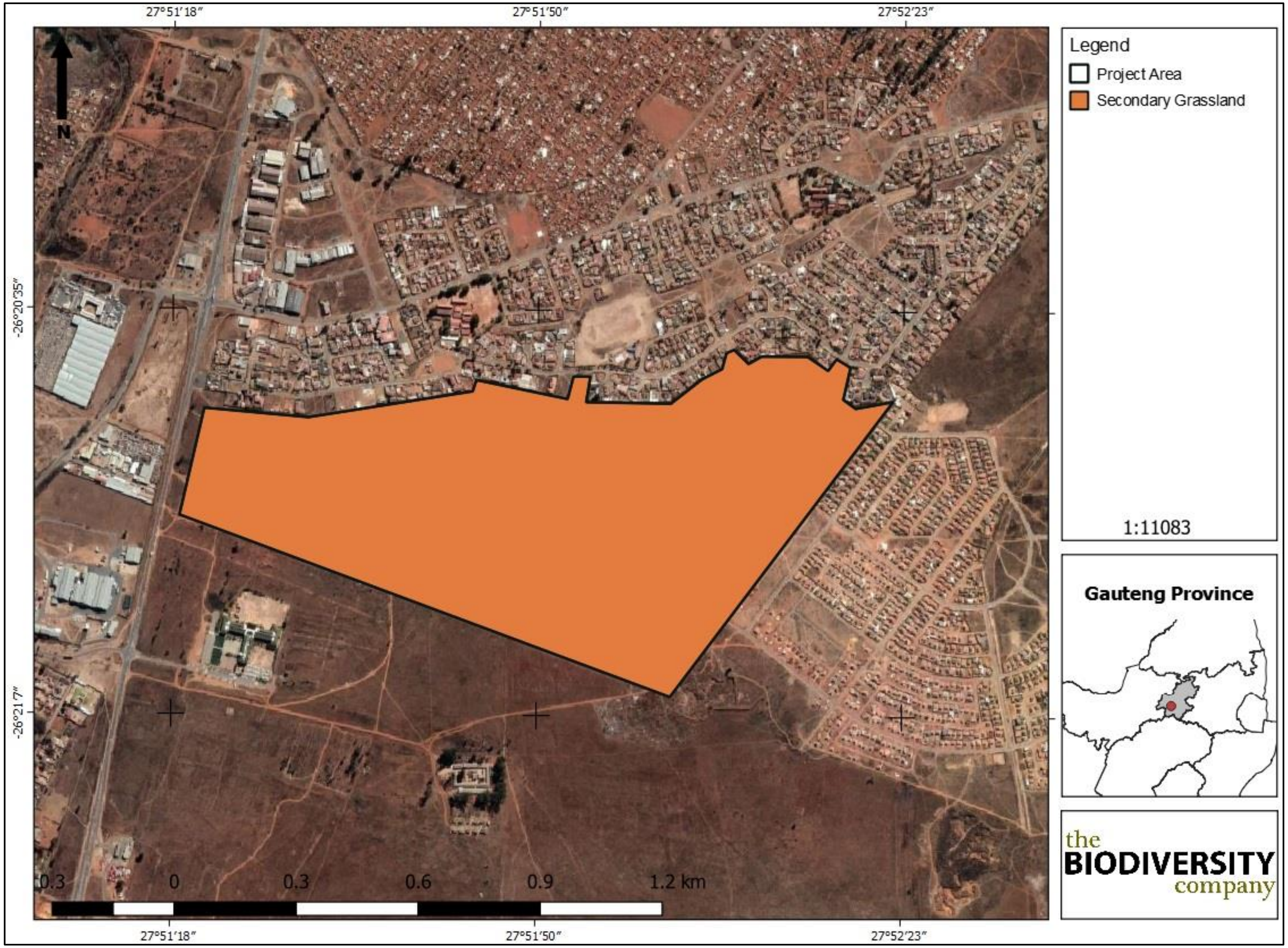

Figure 8-11 Land use for the project area (secondary grassland/semi-natural grassland)

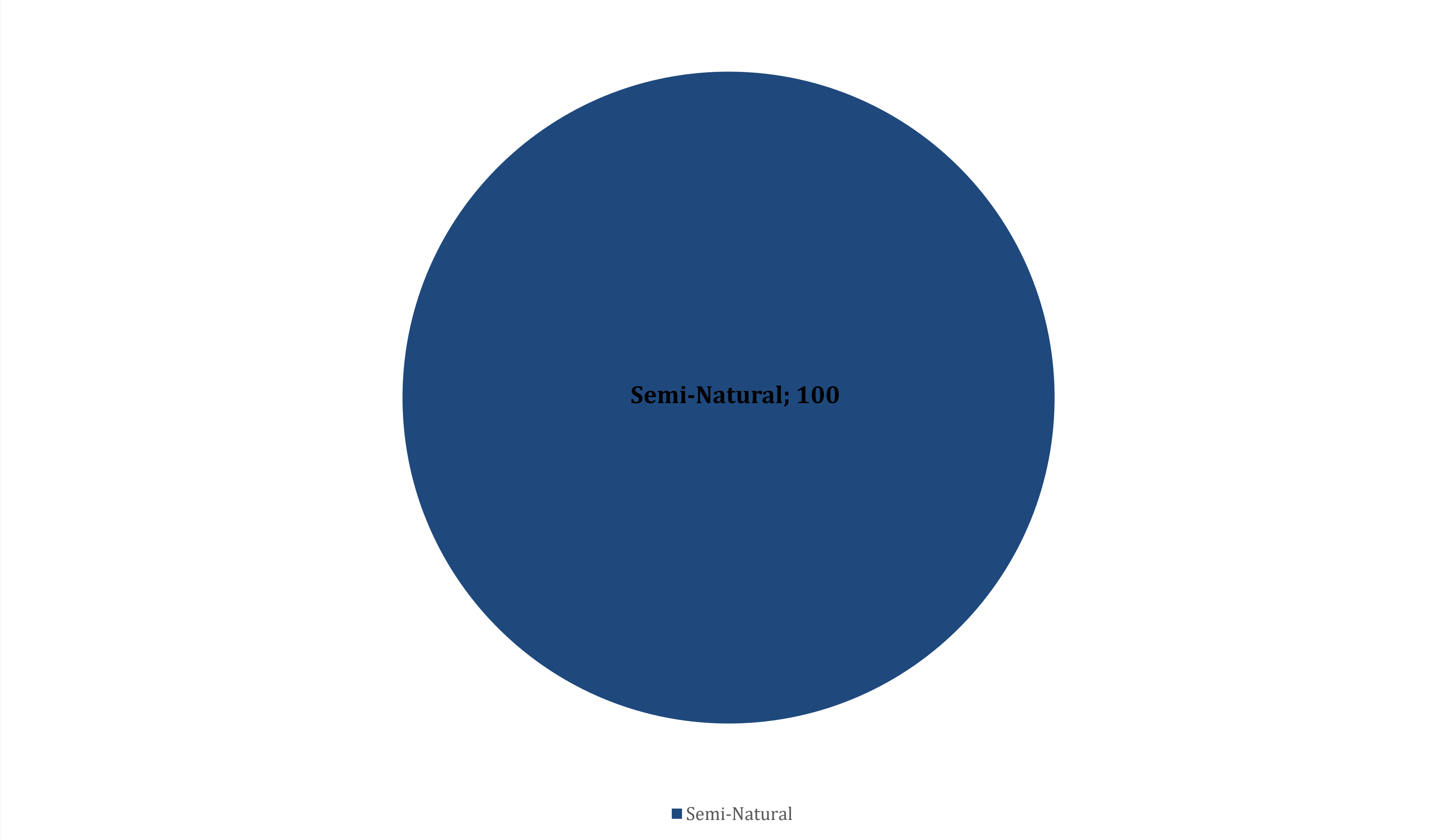

Figure 8-12 Land use coverage (%) of the project area

8.5 Current Crop Performance

No crops are being grown within the project area and the yield estimates have only taken into account the production of maize and soya beans. These are the most popular crops grown and contribute to food security.

The yield calculation has only taken into acount the Hutton soil form as this is the most suitable soil within the area for crop growth. The remaining soils are to shallow.

8.6 Estimated Yields

The Yield estimates shown below are below average and if this area is considered for agriculture, then alternative crops with high end management practices would need to be looked at. In addition the yield could be increased through irrigation, but the cropped area would need to be close to a water source.

Table 8-4 Estimated yields for dryland Maize and Soya Beans

Crop	Estimated Yield
Maize	2.1518784
Soya Beans	1.00420992

8.7 Carrying Capacity of the Project Area

The grazing capacity of the area (83 Ha) is calculated using the guidelines in Smith, 2006.

The effective rainfall in the area is 284mm during the October to March months, this calculation also takes into account the rainfall lost through runoff or deep drainage. The veld condition was estimated to have an average rating of 60%. It is estimated that this area can produce 852 kg of dry mass per ha. An animal unit can utilise half of this, which leaves 426kg per Ha.

The region is clasified as sourveld with the consumption per animal unit being 2500kg per year.Therefor, the carrying capacity for this area is 5.9 Ha per animal unit. A maximum of 14 animal units may graze this area.

8.8 Suitable Crops for the Project Area

It is not recommended that agriculture take place here, as the soils are marginal and the management levels required to make this a feasable agricultural unit would be high.

9 Impact Assessment & Mitigation

The proposed activity includes the construction and operation of a residential area (including roads). From an agricultural perspective, the loss of high value farm land and / or food security production, as a result of the proposed activities, is the primary concern of this assessment. In South Africa there is a scarcity of high potential agricultural land, with less than 14% of the total area being suitable for dry land crop production (Smith, 2006). It is assumed that the proposed development will be permanent and that decomissioning will therefore not be considered. No decommissioning phase has been considered for the assessment.

Table 9-1 Expected impacts

Phase	Activity	Aspect	Impact
Construction	Construction of the proposed housing development	Traffic (light and heavy motor vehicles)	• Erosion; • Compaction; • Degradation of soil; • Loss of nutrients; and • Loss of land capibility.
		Stripping and Stockpiling	
		Heavy machinery leaks	
		Increased overland flow	
		Construction of laydown yards	
Operation	Operation of the proposed housing development	Increased overland flow	
		Traffic	
		Operation of infrastructure	

Table 9-2 and Table 9-3 presents the impact assessment findings in relation to the proposed construction activities. The major concern regarding the loss of agricultural land and/or the loss of agricultural potential is centred around the compaction of soil resources.

All significance ratings during the construction phase can be decreased by means of applying relevant mitigation measures. One of the aspects during the construction phase is expected to drop in significance score (from “Low” to “Very Low”). The rest of the aspects are expected to be classified by “Low” and “Moderate” scores without the possibility of these classes dropping in significance by means of relevant mitigation measures.

As for the operational phase, none of the aspects are expected to drop in significance ratings by means of mitigation measures. The reason for this phenomenon can be explained by the permanent loss of soil resources during the operation of the houses and roads.

Table 9-2 The impact assessment findings (pre-mitigation)

Phase	Aspect	Spatial Extent	Severity / Intensity / Magnitude	Duration	Resource Loss	Reversibility	Probability	Significance Score	Significance Rating
Construction	Traffic	1	4	2	4	3	0.8	**10.4**	**Medium Low**
	Stripping and Stockpiling	1	5	2	5	3	0.8	**12.8**	**Medium Low**
	Heavy machinery leaks	1	3	2	3	3	0.5	**6**	**Low**
	Increased overland flow	1	4	2	4	3	0.5	**7**	**Low**
	Construction of laydown yards	1	4	2	4	3	0.8	**11.2**	**Medium Low**
Operational	Increased overland flow	1	6	7	5	3	0.8	**17.6**	**Medium Low**
	Traffic	1	6	7	6	3	1.0	**23**	**Medium High**
	Operation of infrastructure	1	6	7	6	7	1.0	**27**	**High**

Table 9-3 The impact assessment findings (post-mitigation)

Phase	Aspect	Spatial Extent	Severity / Intensity / Magnitude	Duration	Resource Loss	Reversibility	Probability	Significance Score	Significance Rating
Construction	Traffic	1	3	2	3	3	0.7	**8.4**	**Medium Low**
	Stripping and Stockpiling	1	4	2	4	3	0.7	**9.8**	**Medium Low**
	Heavy machinery leaks	1	2	2	2	3	0.3	**3**	**Very Low**
	Increased overland flow	1	3	2	3	3	0.4	**4.8**	**Low**
	Construction of laydown yards	1	3	2	3	3	0.7	**8.4**	**Medium Low**

Operational	Increased overland flow	1	4	7	4	3	0.7	**13.3**	**Medium Low**
	Traffic	1	6	7	6	3	1.0	**23**	**Medium High**
	Operation of infrastructure	1	6	7	6	7	1.0	**27**	**High**

10 Recommendations

It is recommended that mitigation is applied to reduce the impacts as much as possible. These recommendations have been made considering a complete development of the site. The following recommendations are vital in reducing the impact scores illustrated in Table 9-2;

- Ensure that proper stormwater management designs are set in place;
- In cases of erosion, erosion berms must be implemented to minimize any further erosion. All stormwater management plans must be in effect before the operational phase to minimise any erosion;
- Compacted areas are to be ripped to loosen the soil structure;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Gardens should be promoted and maintained to ensure infiltration of water and the sustainability of soil resources;
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks;
- All excess soil (soil that are stripped and stockpiled to make way for foundations) must be sold for topsoil instead of wasted; and
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.

10.1 Specialist Recommendation

57,8% of the project area is characterised by a land potential of 2, whereas 36,9% is characterised by a land potential of 3. It is recommended that development take place within the L3 and L4 land potential types with the L2 and potential area being conserved for agricultural purposes. It is recommended that the L2 areas be used for subsistence farming by the residents occupying the built-up areas (L3 and L4).

11 Conclusion

Three different soil forms were identified throughout the project area, namely the Glenrosa, Hutton and Nkonkoni soil forms. Of these soil forms, the latter two were determined to have a land potential class of “2” and “3” respectively with the Glenrosa soil form characterised by a land potential class of “4”. The dominant, and only land use was identified as semi-natural grassland. Given the high value of the L2 land potential areas, it is recommended that development take place within the L3 and L4 areas with subsistence farming being promoted for L2.

12 References

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