www.eco-assist.co.za
info@eco-assist.co.za

# SOILS, LAND CAPABILITY, AND LAND USE SPECIALIST ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF A DONOR HOUSE AND ASSOCIATED INFRASTRUCTURE AT THE UKUWELA NATURE RESERVE, HLUHLUWE, KZN

**Date**
*March 2022*

**Client**
*SiVEST SA (Pty) Ltd*

# SPECIALIST ASSESSMENT DETAILS & DECLARATION OF INDEPENDENCE

| | | |
|---|---|---|
| **Document Title** | **SOILS, LAND CAPABILITY, AND LAND USE SPECIALIST ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF A DONOR HOUSE AND ASSOCIATED INFRASTRUCTURE AT THE UKUWELA NATURE RESERVE, HLUHLUWE, KZN** | |
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| **Report completed by** | **Wayne Jackson** *Cert.Sci.Nat. (Registration 119037)* | |
| **Client** | **SiVEST SA (Pty) Ltd** | |
| **Fieldwork and Report Writing** | **Wayne Jackson** |  |

I, Wayne Jackson, hereby declare that this report has been prepared independently of any influence or prejudice as may be specified by the Department of Environmental Affairs.

Wayne Jackson

Soils & Wetland Specialist

Eco-Assist

16th March 2021

# Specialist Details

| Specialist | Role | Details |
|---|---|---|
| **Wayne Jackson** *Cert.Sci.Nat. (Registration 119037)* | **Field work and author (Soils)** | Wayne Jackson graduated from the University of KwaZulu-Natal, Pietermaritzburg, with a BSc. degree in Soil Science & Hydrology.<br><br>Wayne has 13 years' experience in Wetlands & Soils Scientist with a demonstrated history of working in the environmental services industry. He is skilled in Soil Classification, Wetlands, Hydropedology, and Surface Water Hydrology. He has a strong Environmental mitigation and rehabilitation knowledge. He has also gained experience in large post-mining rehabilitation projects, providing specialist inputs on land capability and soil utilisation. He has extensive exposure to a wide range of projects in many sectors across South Africa, and parts of Africa. He is knowledgeable on how soils, wetlands, and hydrological systems are linked in the landscape and how activities could impact all these aspects.<br><br>Wayne is a registered Natural Scientist with the South African Council for Natural Scientific Professionals (SACNASP) – Registration No. 119037. |

The relevant experience of specialist team members involved in the compilation of this report are briefly summarized above. Curriculum Vitae of the specialist team are available on request.

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# 1 INTRODUCTION

Eco-Assist Environmental Consultants (hereafter Eco-Assist) were appointed by SiVEST SA (Pty) Ltd (hereafter SiVEST) to conduct the Soils, Land Capability, and Land Use Specialist Assessment in relation to the development of the Greater Ukuwela Nature Reserve (GUNR) located in the Big 5 False Bay Local Municipality (KZN273) section of the Umkhanyakude District Municipality (DC27) near the town of Hluhluwe, KwaZulu-Natal.

## 1.1 Background

Wild Tomorrow Fund are proposing the construction of a donor house and associated infrastructure on the GUNR near Hluhluwe, KwaZulu-Natal Province.

The GUNR has been registered as an Ezemvelo KZN Biodiversity Stewardship Site and as such is proclaimed as a Protected Area as defined within the National Environmental Management: Protected Areas Act of 2003 (NEMPAA), as amended.

The proposed development is to include the following components:

- Donor House with associated Decking, Terraces, Landscaping and Walkways
- Managers House
- Reserve Office and FreeMe Complex
- Tented Camp
- Various internal access roads (x3) / tracks for reserve management / game viewing (Gravel Roads Proposed)

In terms of infrastructure requirements, the following is proposed:

- Potable water provision will be via a municipal source;
- On site sewer treatment will be required (Septic Tank and Soakaway System); and
- Electrical supply will be via Eskom.

## 1.2 Project Locality

The GUNR is approximately 1283,1 hectares and is located just north of the Hluhluwe town in Northern KwaZulu Natal (see Figure 1-1). It falls within the uMkhanyakude District Municipality and the Big Five Hlabisa Local Municipality.

Ukuwela is located in the centre of the Maputaland-Pondoland-Albany Hotspot, one of the world's biologically richest and most endangered land-based ecoregions. It is surrounded by prestigious wildlife reserves, including Mkuze, St Lucia, Sodwana Bay, South Africa's first UNESCO World Heritage Site, the iSimangaliso Wetland Park, and the Phinda Private Game Reserve, with which Ukuwela shares a river border (Wild Tomorrow Fund, 2021).

It is accessed off Road R22 and may be entered from either the southern side near the Zulu Croc Centre, or the northern side on the approach to the Mzinene River crossing. The project footprint and layouts are shown in Figure 1-2 to Figure 1-5.

The GUNR consists of three properties. Note that the original extent of the Mfuleni property includes the FreeMe site although the latter is now a separate subdivision. It is also to be noted that the Phinda Game Reserve lies immediately to the north of the area.

The overall GUNR Project consists of developing a stable and functional nature conservation area which will also have educational and training functions. However, the purpose of this investigation is to consider the possible impacts of the proposed project infrastructure on the aquatic environment in its proximity. This infrastructure consists of a donor house, a manager's house, an office complex, a tented camp, and some roads/tracks. In addition, the Fund has offered space to the FreeMe Non-Governmental Organisation (NGO) in which to construct and operate a wildlife trauma and rehabilitation centre.

The proposed development is to include the following components:

- ***Donor House (see* Figure 1-4*):*** Donor House with associated decking, terraces, landscaping and walkways. The Fund is a wildlife conservation charity which receives financial donations from hundreds of people each year. These donations fund the conservation work performed on the GUNR. The Fund would like its major donors to experience the reserve firsthand and to share in the conservation achievements that they made possible. The donor house will be a place for them to stay and learn about the Fund's current and future projects. The major donors will have the chance to invite their friends and family to stay with them. The Fund believes the donor house will be an excellent means to deepen relationships with existing and potential donors and that it will ultimately lead to more funding for conservation. Thus the donor house will be an important source of sustainable revenue for the reserve, bringing both invited and paying guests while creating additional employment for people in the area.
- ***Managers House (see* Figure 1-3*):*** The Fund intends to build a simple two-bedroom house in the GUNR for their General Manager. Having the General Manager reside on-site will increase the output and quality of work from this employee and all other staff. An additional person living fulltime on the reserve will also increase the overall security.
- ***A Reserve Office and FreeMe Complex (see* Figure 1-5*):*** FreeMe is a South African wildlife rehabilitation organization based in Howick, SA. The Wild Tomorrow Fund has entered into a legal agreement where FreeMe will lease four hectares of land from the Fund on the GUNR. The purpose is for FreeMe to create a wildlife rehabilitation centre for the indigenous mammals, birds, reptiles, amphibians and invertebrates in accordance with the Ezemvelo KZN Wildlife permit conditions. FreeMe's rehabilitation centre will fill a much-needed void in the area for a reputable place where injured wildlife can be cared for. Adjacent to the FreeMe rehabilitation centre will be the Reserve Office where Fund employees will work. Having the employees working from one location will increase the productivity and quality of conservation work.
- ***A Tented Camp (see* Figure 1-5*):*** The Wild Tomorrow Fund has a paid volunteer program where local and international people take part in conservation activities on the Greater Ukuwela Nature Reserve for two weeks at a time. There are typically two to three volunteer trips each year. To increase the profits the Fund generates from these trips, they would like their guests to stay on reserve, thus eliminating the need to pay for third-party lodging. These savings will be used to fund their conservation and community projects.
- Various internal access roads and tracks for reserve management / game viewing. These roads will have gravel surfaces and will be constructed with appropriate drainage and watercourse crossing structures as may be required.

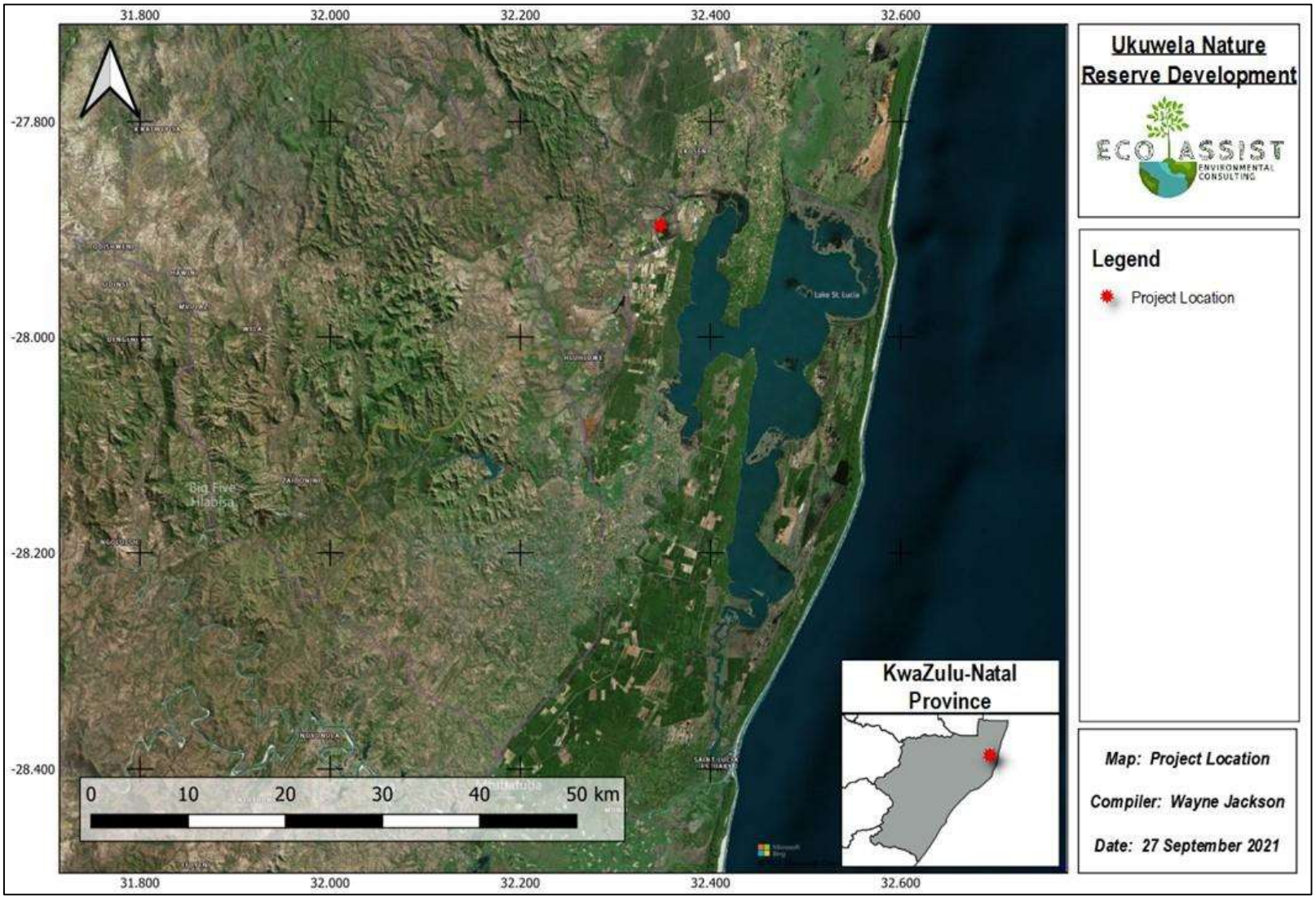


*Figure 1-1: Local setting of the study.*

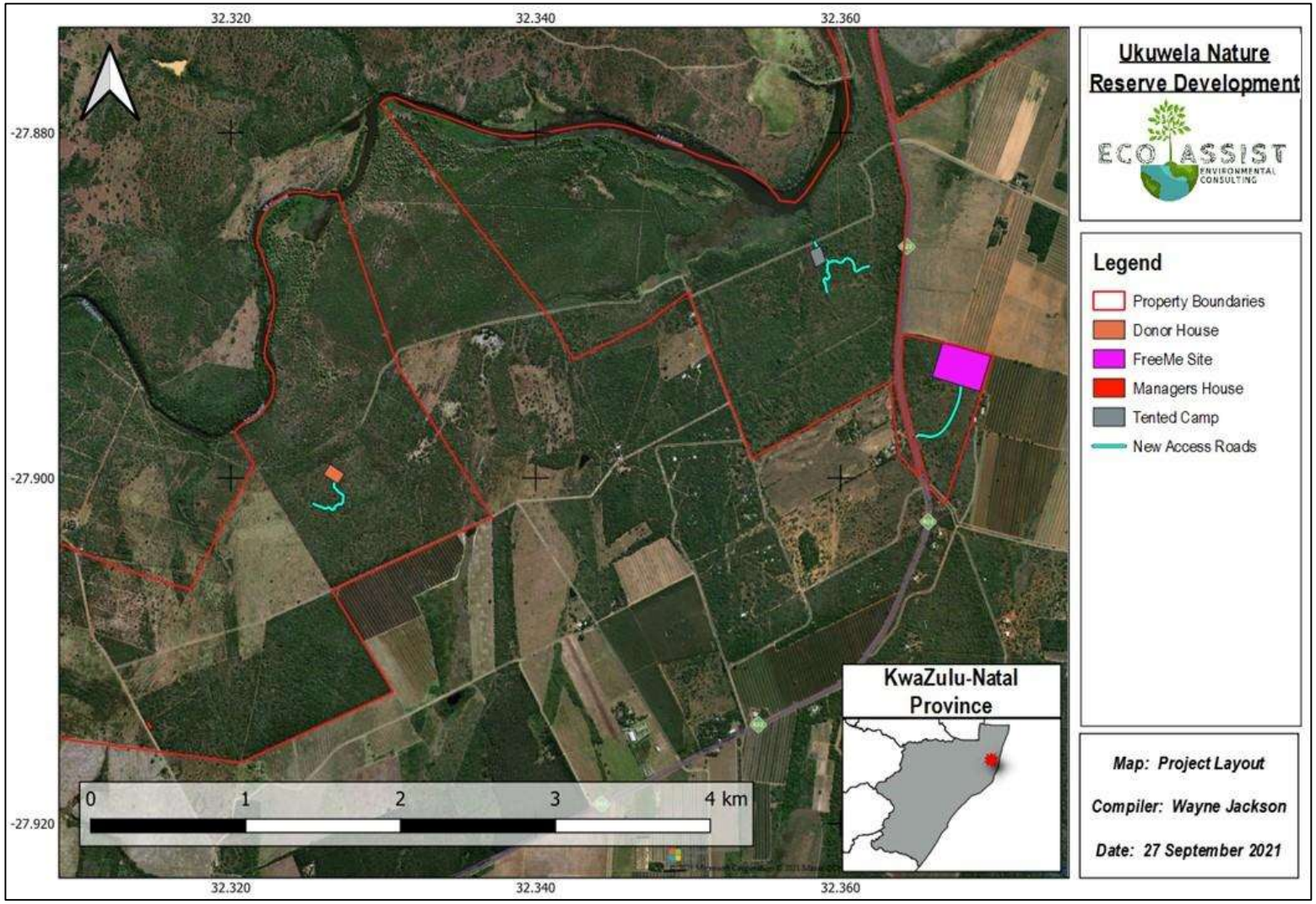


*Figure 1-2: Project layout.*

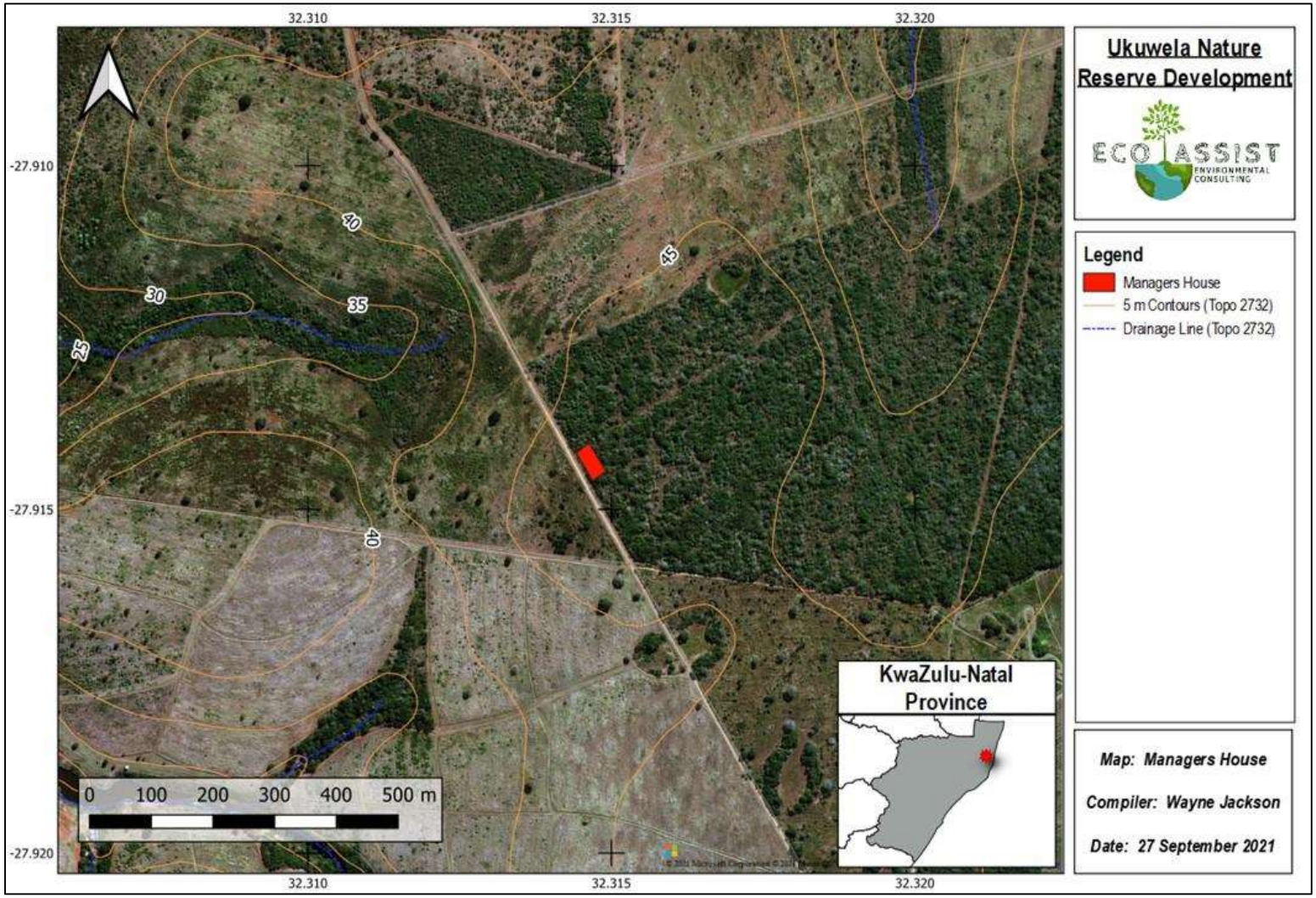


*Figure 1-3: Managers house layout.*

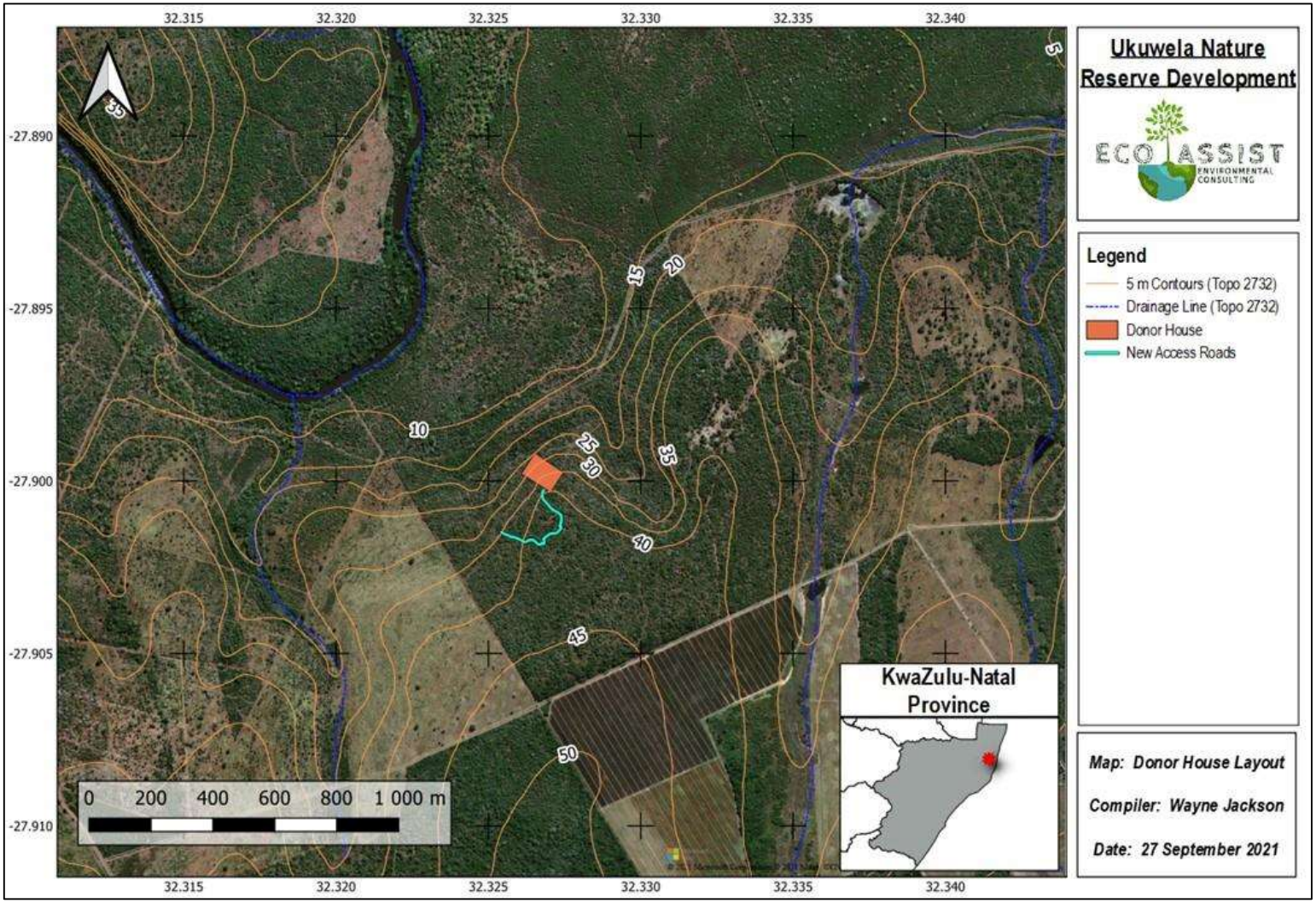


*Figure 1-4: Donor house layout.*

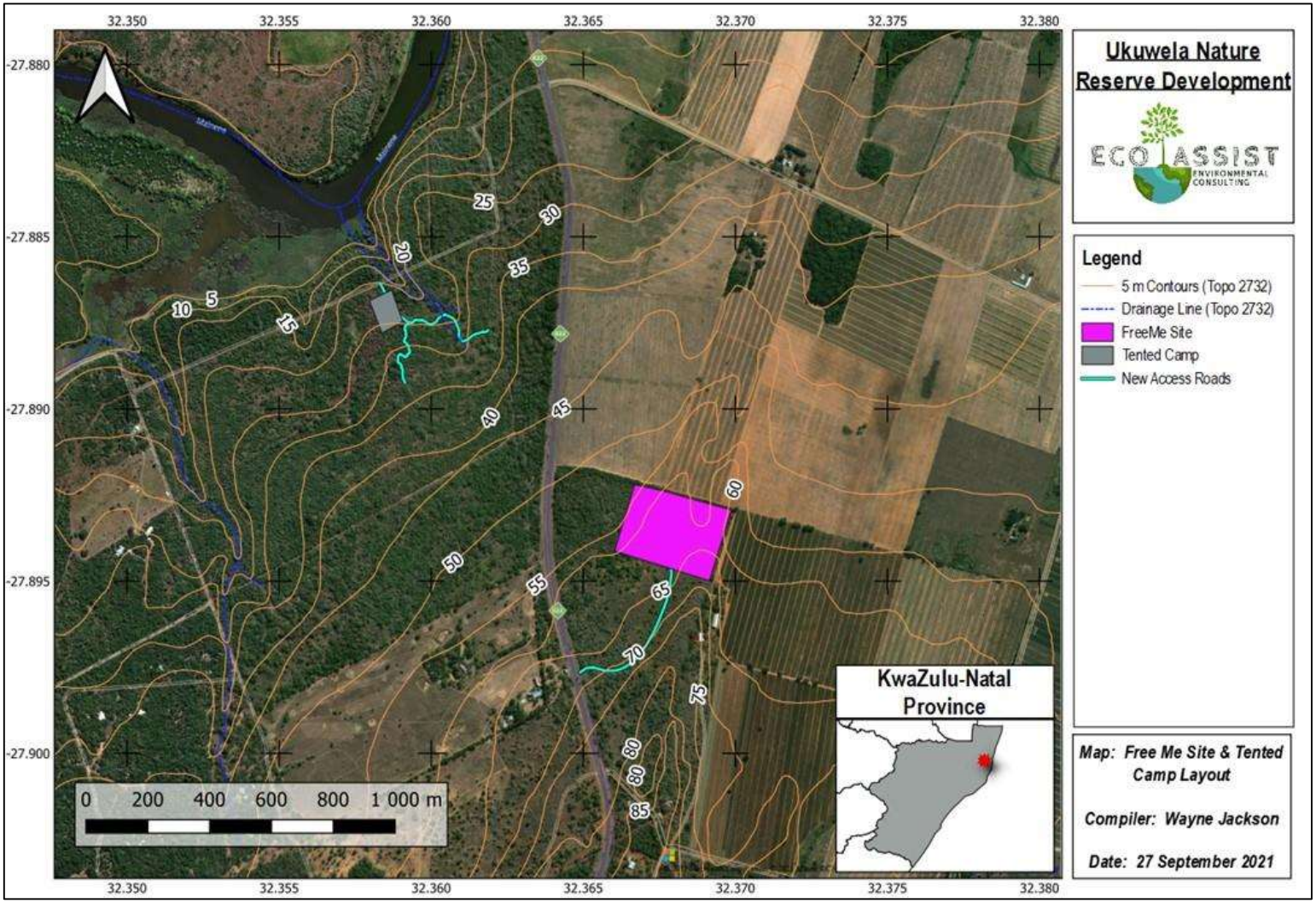


*Figure 1-5: Tented camp and Free Me site layout.*

# 2 TERMS OF REFERENCE

SiVEST requires that a soil survey be conducted and that the following be assessed as per the Provincial and National Departments of Agriculture recommendations:

- Assess and discuss historic climate statistics;
- Assess and discuss geological information;
- Assess and discuss the terrain features using 5m contours;
- Source best recent satellite or aerial imagery and georeferenced;
- Assess and discuss current agricultural land use on site and comment on crop performance and estimated yields (if any);
- Conduct soil assessment as described in the methodology;
- Assess and discuss agricultural land potential (eight class scale);
- Discuss the impact of the proposed land use change on loss of agricultural land production (If any);
- Recommend best location for proposed development to reduce any impacts;
- Compile informative reports and maps on current land use and agricultural land potential;
- Discuss the impact of the proposed land use change on loss of agricultural land production; and
- A basic soil management guideline will be completed.

The results will be mapped in GIS format and will include the following maps:

- A soil distribution map;
- A current land use map; and
- An agricultural potential map.

An Impact assessment of the proposed development will be conducted, and the recommendations can be used in the Environmental Management Programme (EMPr).

# 3 KEY LEGISLATION

Relevant environmental legislation pertaining to the soil/agricultural resources in South Africa is listed below, but is not limited to:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- Sub-division of Agricultural Land Act (Act 70 of 1970);
- Municipal Structures Act (Act 117 of 1998);
- Municipal Systems Act (Act 32 of 2000); and

- Spatial Planning and Land Use Management Act, (Act 16 of 2013).

The above is 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 but is not limited to:

- 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).

# 4 SENSITIVITY ANALYSIS BASED ON THE ENVIRONMENTAL SCREENING TOOL

The result of the Department of Forestry, Fisheries and the Environment (DFFE) screening tool for the Agricultural sensitivities for the proposed sites are shown in Figure 4-1 to Figure 4-3. The screening tool was accessed on the 27th of September 2021 by Wayne Jackson.

The results show that none of the development sites are within any crop boundaries, which are designated by hashed polygons. These crop boundaries have High to Very High sensitivities. The remaining area ranges from Medium to High sensitivity. The Managers house and the Free Me site are within a High sensitivity area. The Donor house and the Tented camp site are within a Medium sensitivity area.

The DFFE screening tool is a guideline, and it is up to the specialists to verify these results in the field. The screening tool is based on coarse datasets and the areas may not be accurate.

The sensitivity analysis has identified the project area to have a Medium to High sensitivity and as such an Agro-Ecosystem Assessment is required.

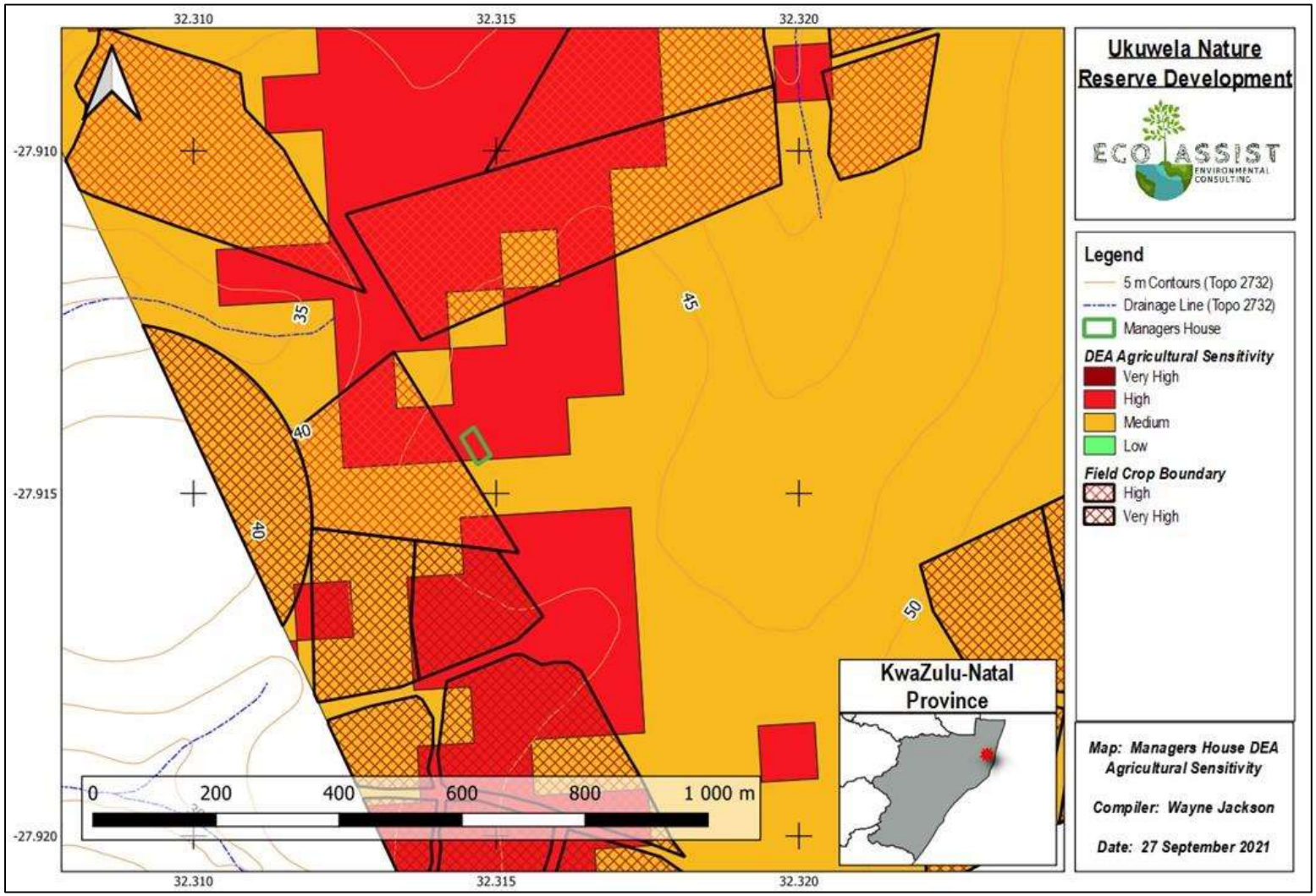


*Figure 4-1: DFFE screening tool results for the agricultural sensitivity theme at the Managers House site.*

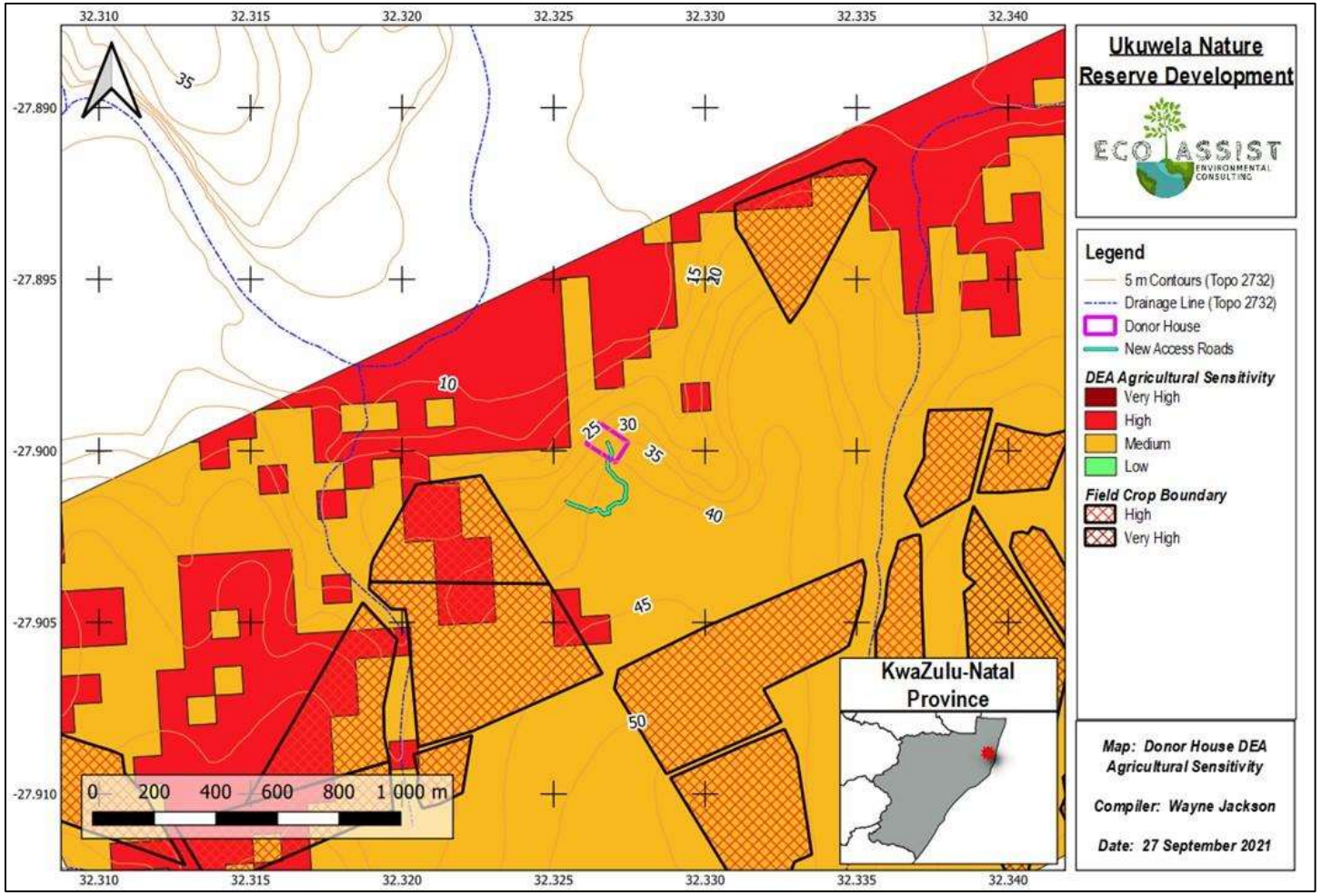


*Figure 4-2: DFFE screening tool results for the agricultural sensitivity theme for the Donor House site.*

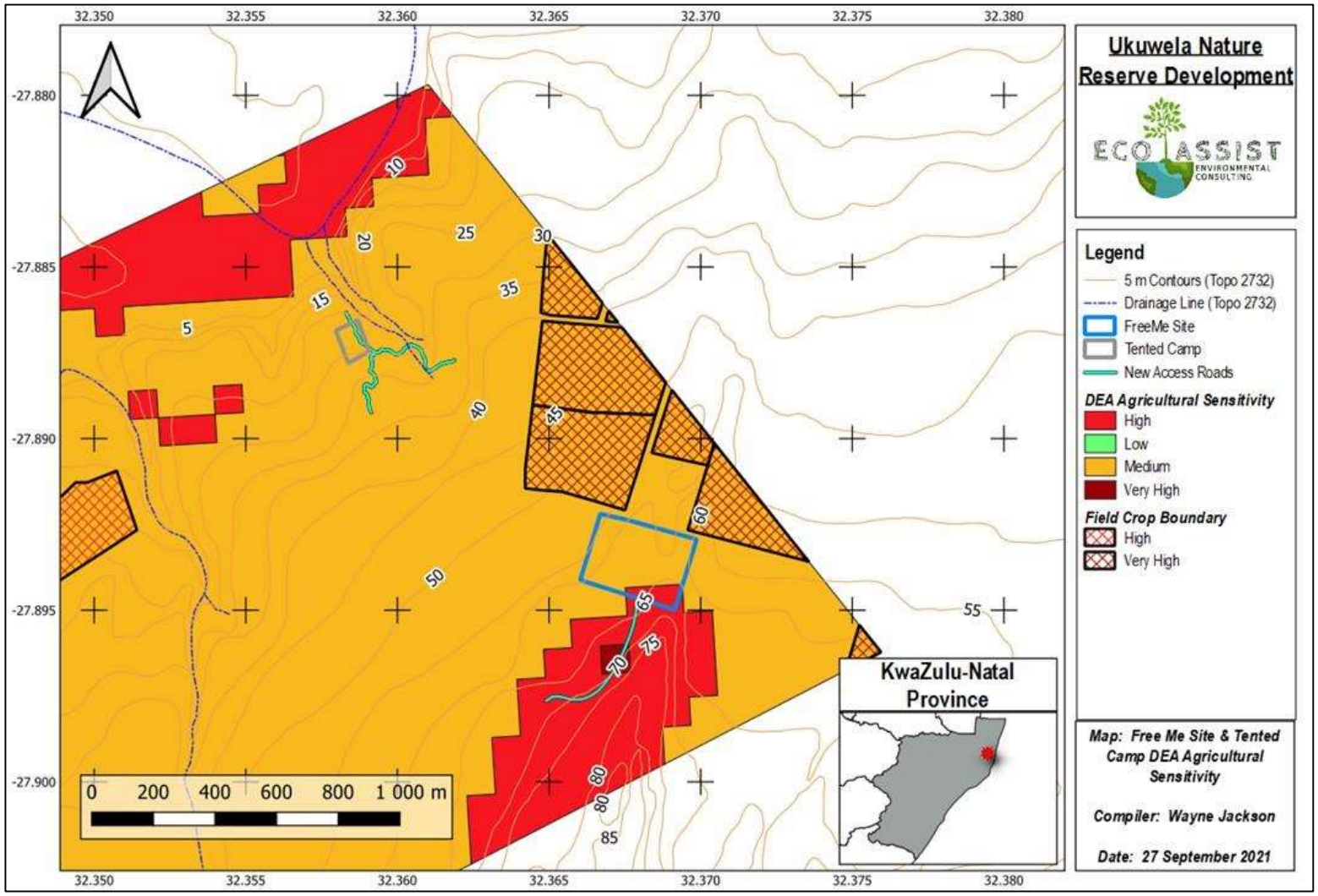


*Figure 4-3: DFFE screening tool results for the agricultural sensitivity theme at the Free Me and Tented Camp Site.*

# 5 METHODOLOGY

## 5.1 Desktop Assessment

The following data layers were assessed to determine whether the development could have an impact on important national & provincial feature:

- Aerial imagery (Google Earth™);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- Topographical data;
- Contour data (5 m);
- National land capability evaluation raster data layers (Department of Agriculture, Forestry and Fisheries, 2017); and
- Heritage Impact Assessment for the Proposed Developments at the Greater Ukuwela Game Reserve, Hluhluwe, KZN (Anderson, 2021).

## 5.2 Field Procedure

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 GPS device.

Soils were identified to the soil family level as per the "Soil Classification: A Natural and Anthropogenic System for South Africa" (Soil Classification Working Group, 2018). Landscape features such as existing open trenches were also helpful in determining soil types and depth.

## 5.3 Land Capability 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 (8) classes, and these may be divided into three (3) capability groups. Table 5-1 shows how the land classes and groups which are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

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

| Land Capability Class | Increased Intensity of Use | | | | | | | | | Land Capability Groups |
|---|---|---|---|---|---|---|---|---|---|---|
| I | W | F | LG | MG | IG | LC | MC | IC | VIC | Arable Land |
| II | W | F | LG | MG | IG | LC | MC | IC | | |
| III | W | F | LG | MG | IG | LC | MC | | | |
| IV | W | F | LG | MG | IG | LC | | | | |
| V | W | N/A | LG | MG | | | | | | Grazing Land |

| Land Capability Class | Increased Intensity of Use | | | | | | | | | Land Capability Groups |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 5-2. The final land potential results are then described in Table 5-3.

*Table 5-2: The combination table for land potential classification.*

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

*Table 5-3: The Land Potential Classes.*

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

# 6 LIMITATIONS

The following aspects were considered as limitations of the assessment:

- Hand augers were used, and the limiting layer was the depth to which the auger could drill;
- The assessment is based on the design and layout information provided by the client;
- It has been assumed that the extent of the development area provided by the applicant is accurate;
- The GPS used for ground truthing is accurate to within five meters. Therefore, the observation site's delineation plotted digitally may be offset by up to five meters to either side; and
- Only a soil auger was used for this assessment, no open pits were dug.

# 7 RESPONSES TO INTERESTED AND AFFECTED PARTIES

To this point no concerns have been raised as yet. If any concerns are raised with regards to the agricultural impact assessment, it will be addressed in this report.

# 8 RESULTS FROM DESKTOP ASSESSMENT

## 8.1 Climate

The climate for the area is mainly summer rainfall with some rain in winter. MAP about 550–800 mm. Mist of the warm Indian Ocean contributes to precipitation. No incidence of frost in the area. Mean monthly maximum and minimum temperatures 39.5°C and 3.1°C for January and July, respectively (Mucina, et al., 2006).

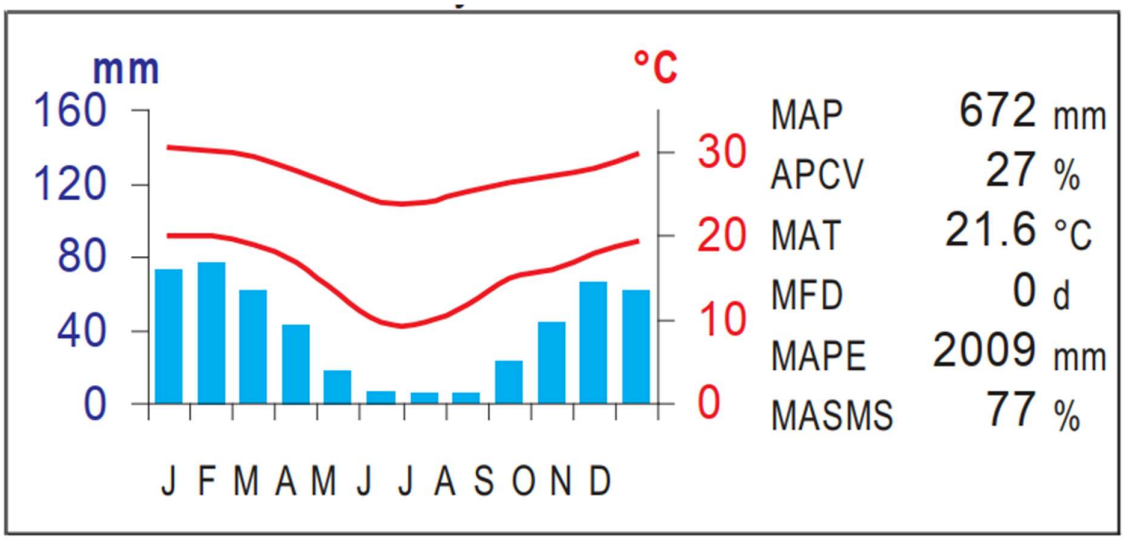

*Figure 8-1: Climate summary for the area (Mucina, et al., 2006).*

The land capability evaluation 2016 data layer is a refined and updated spatial modelled data layer depicting the land capability evaluation values for the country. The climate capability data layer is a sub-set data layer that contributes to the land capability data layer. It includes both the spatial as well as attributes description of the climate capability values (Department of Agriculture, Forestry and Fisheries, 2017). The climate capability as per Figure 8-2 shows a Moderate-High rating for the project area.

The climate class was determined to be C3 – with a light to moderate limitation rating (Smith, 2006). The climate class has a slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for moderate range of adapted crops.

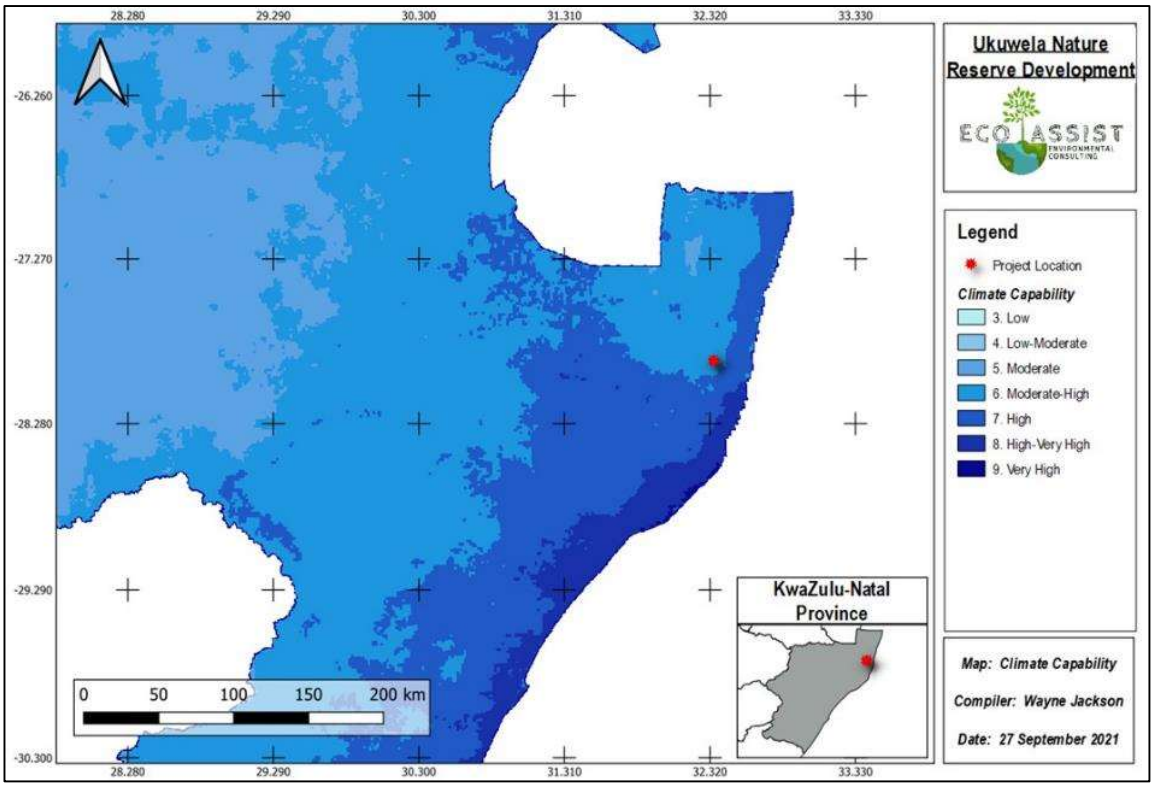


*Figure 8-2: Climate capability (Department of Agriculture, Forestry and Fisheries, 2017).*

## 8.2 Terrain

The terrain analysis was conducted using the processing tools within the QGIS mapping software. The SAGA terrain analysis tools were used to determine the Digital Elevation Model (DEM) (see Figure 8-3).

The project relief shows that the elevation ranges from approximately 15 masl to about 120 masl. The slopes are shallow ranging between 0% and 15%. The project area is north facing and situated on a midslope landscape unit (Figure 8-4).

In land capability modelling terrain plays an important role not only from a plants' physiological growth requirements but also from a sensitivity and accessibility perspective (Department of Agriculture, Forestry and Fisheries, 2017). Two main terrain modelling concerns were included in the terrain capability modelling exercise namely:

- Plant physiology; and
- Terrain sensitivity.

The terrain capability was determined to be as follows for each site (see Figure 8-5 below);

- Managers house = Moderate-High (class 6) to High (class 7). This is mainly due to the shallow slopes and the landscape position.
- Donor house = Low-Moderate (class 4) to Moderate (class 5). This is mainly due to the steeper slopes.
- Tented Camp = Low-Moderate (class 4) to Moderate (class 5). This is mainly due to the steeper slopes.
- Free Me site = Moderate-High (class 6) to High (class 7). This is mainly due to the shallow slopes and the landscape position.

This forms part of the overall desktop land capability determination.

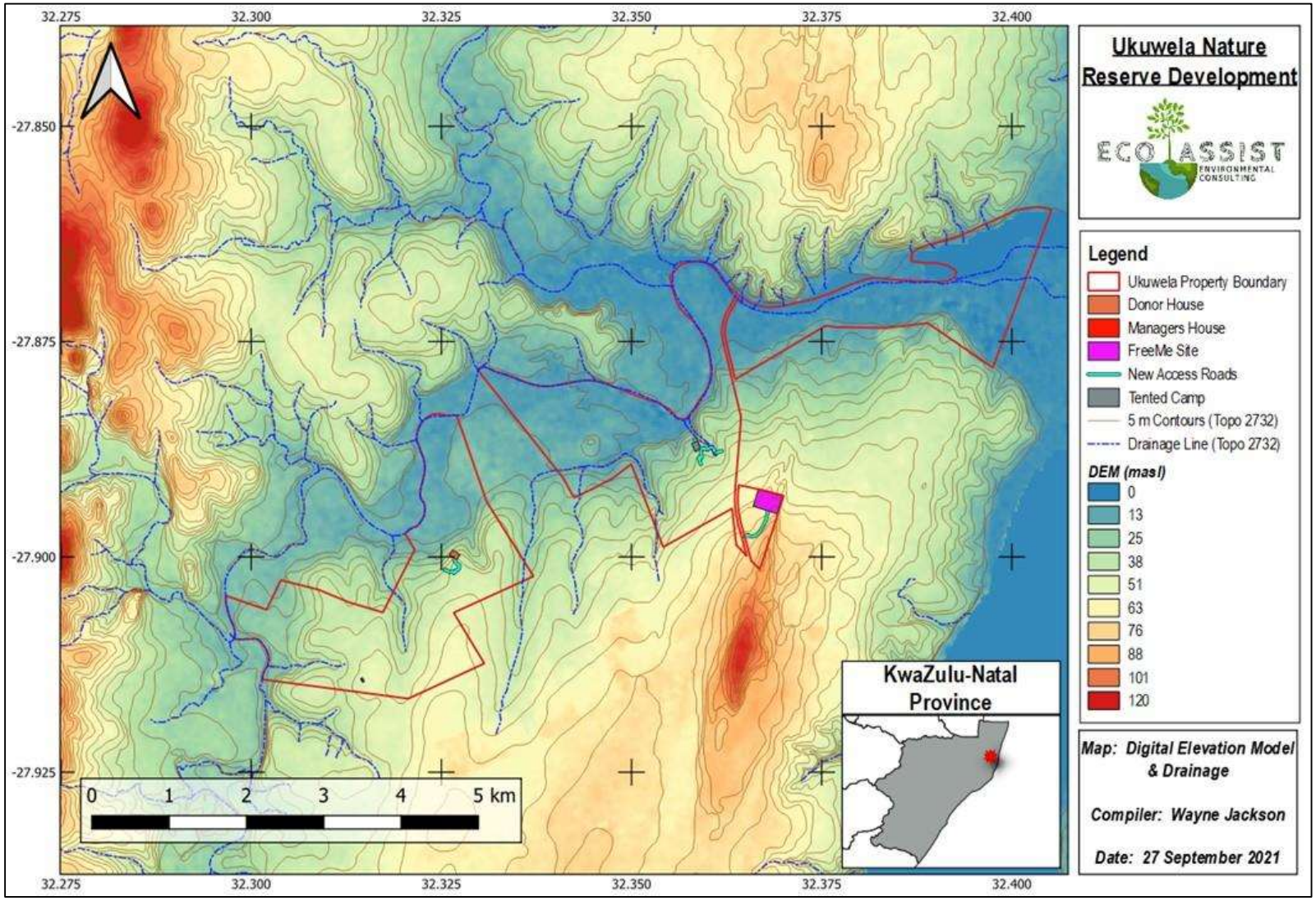


*Figure 8-3: The DEM for the project area.*

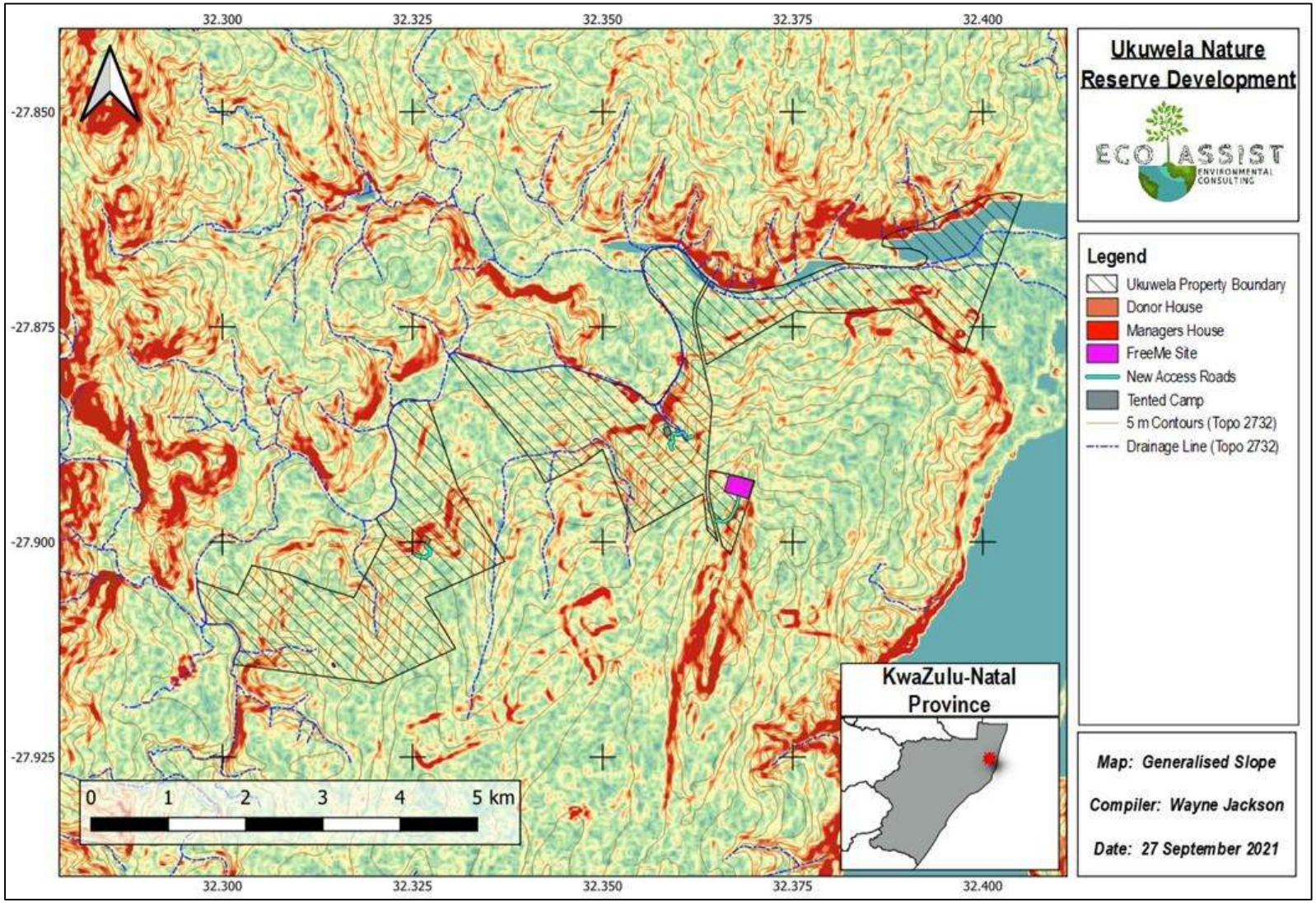


*Figure 8-4: The generalised slopes for the project area.*

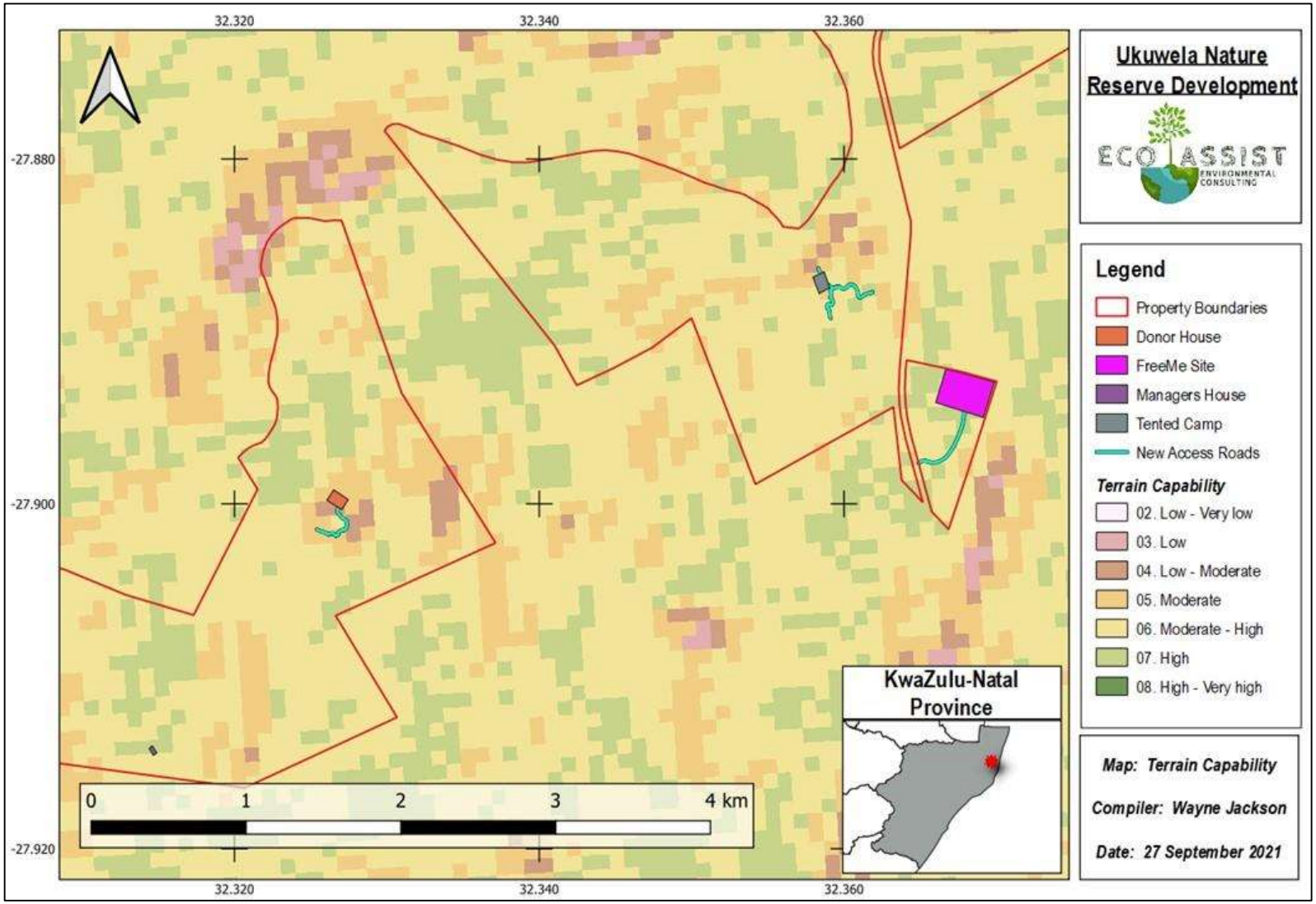


*Figure 8-5: The terrain capability (Department of Agriculture, Forestry and Fisheries, 2017).*

## 8.3 Desktop Soils & Geology

### 8.3.1 Geology

The project area (according to Mucina and Rutherford, 2006) has an underlying geology comprising Cretaceous shallow-marine and coastal sediments, siltstones and conglomerates of the Zululand Group and minor rhyolites of the Jozini Formation (Karoo Supergroup). These geological features are shown in Figure 8-6.

The land type database describes the geology for land types Db113 and Ai9 as siltstone, with concretionary and shelly horizons, of the St. Lucia Formation, marine siltstone with shelly concretions of the Mzinene Formation, Zululand Group, and argillaceous sand of the Muzi Formation. The land type database describes the geology for land type Ae153 as mainly red dune cordon sand of the Berea Formation (Land Type Survey Staff, 1972 - 2006).

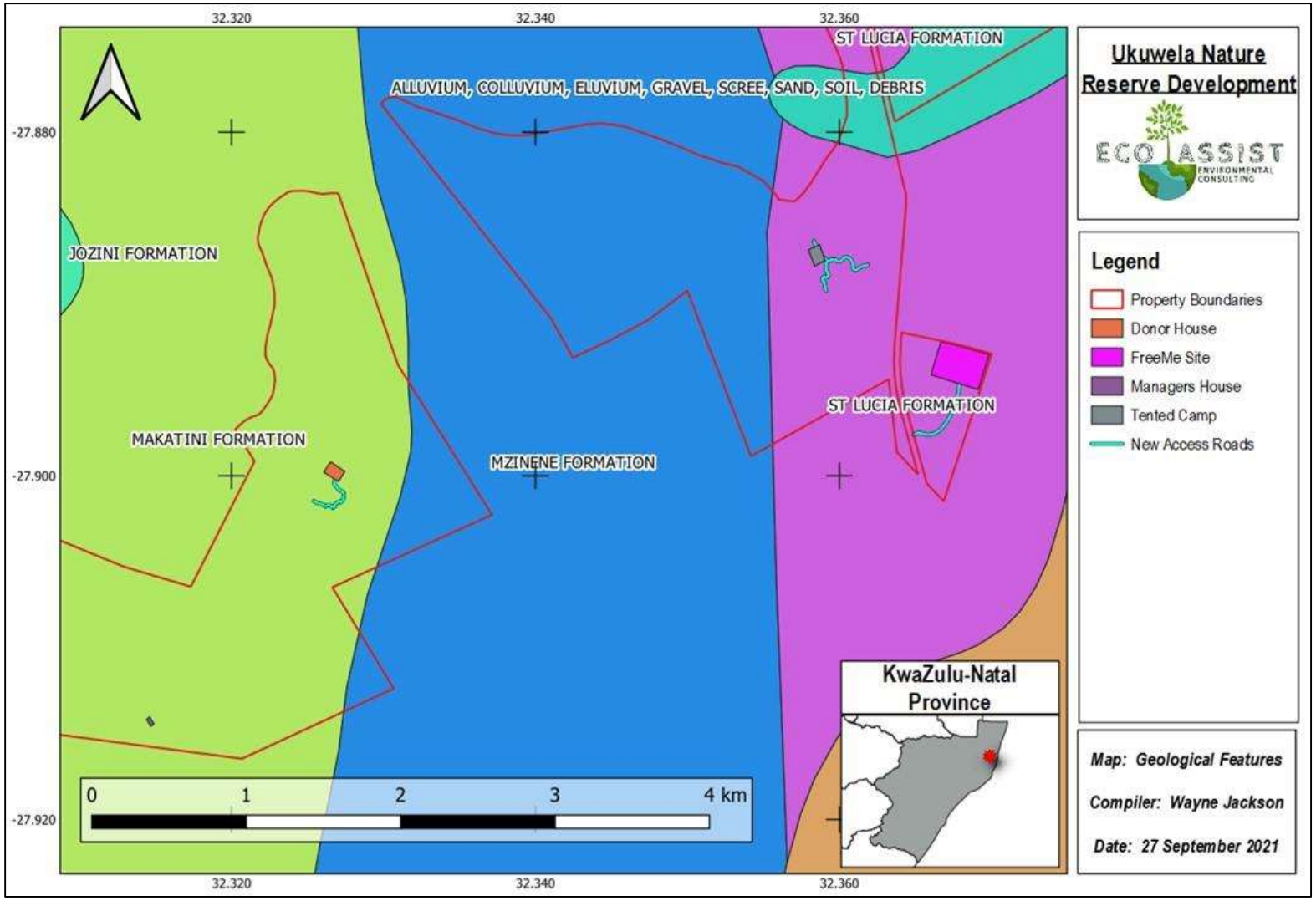


*Figure 8-6: Regional geology for the project area.*

### 8.3.2 Land Types

According to Mucina and Rutherford (2006) the Donor House and the Managers house soil attributes are dominated by zonal soils comprising of red sandy clay loam to red clay soils (Hutton, Bainsvlei and Shortlands soil forms) and nonduplex brown calcimorphic soils comprising yellow-brown sandy clay, sandy loam to sandy clay loams (Valsrivier and Avalon soil forms). These are generally fertile soils, characterised by a moderate to high clay content (20–60%) in the A-horizon. Land types Ea, Ae, Dc, Ia and Db (Mucina, et al., 2006).

The eastern sections of the project area according to Mucina and Rutherford (2006), which include the Tented camp and the Free Me site, are mainly dominated by system of old (5–3 million years) and younger (125 000 years) grey regic to reddish redistributed sand dunes of marine origin. Nutritionally the sandy soils are very poor and well leached. In some depressions, duplex soils can be found (Mucina, et al., 2006).

The Land Type data was used to obtain generalised soil patterns and terrain types for the site. Land Type data exists in the form of published 1:250 000 maps. These maps indicate delineated areas of similar terrain types, pedosystems (uniform terrain and soil pattern) and climate (Land Type Survey Staff, 1972 - 2006).

The development footprints fall within three (3) land types;

- Db113 (Managers House & Donor House);
- Ai9 (Tented Camp & Free me site); and
- Ae153 (Free me site).

The Managers house and Donor house sites fall into the Db113 land type (see Figure 8-10). This land type is dominated by the midslope and valley bottom landscape positions (see Figure 8-7) and consists largely of the structured Valsrivier and Sterkspruit soil forms. There are areas with Albic properties which include the Fernwood and Kroonstad soil forms. The average slope for this land type ranges from 1% to 12%. Clay content in the structured soils is estimated to be between 15% and 25% in the A-Horizon and increases to 25% and 55% in the deeper horizons. The Albic soils clay content is slightly lower in the A-Horizon at 6% to 15%. The shape of the landscape catena is shown in Figure 8-7.

The Tented camp and the Free Me sites fall into the Ai9 land type (see Figure 8-10). This land type is dominated by the midslope and valley bottom landscape positions, with some crest landscape positions (see Figure 8-8). The land type consists largely of the sandy Fernwood and Clovelly soil forms. The average slope for this land type is fairly flat and ranges from 0% to 2%. Clay content is estimated to be between 0% and 6% but can be as high as 35 % in areas of clay accumulation. The shape of the landscape catena is shown in Figure 8-8.

The Free Me sites also partially falls into the Ae153 land type (see Figure 8-10). This land type is dominated by the midslope and valley bottom landscape positions, with some crest landscape positions (see Figure 8-9). The land type consists largely of the freely drained Hutton and Fernwood soil forms. The average slope for this land type is fairly flat and ranges from 1% to 4%. Clay content is estimated to be between 0% and 10% but can be as high as 15 % in areas of clay accumulation. The shape of the landscape catena is shown in Figure 8-9.

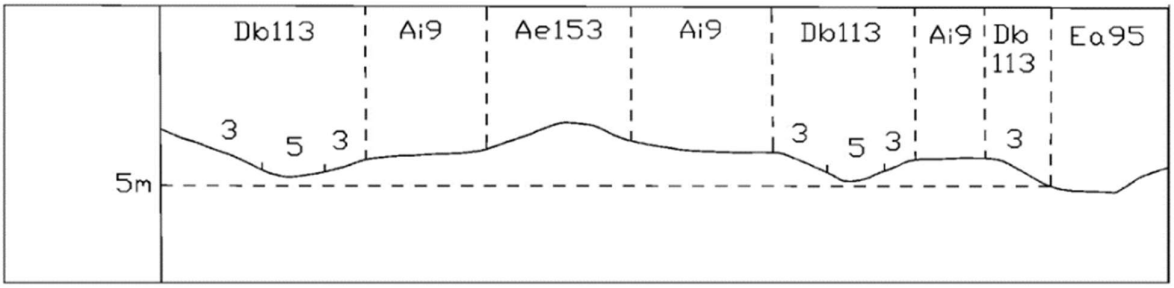


*Figure 8-7: Hillslope catena for land type Db113.*

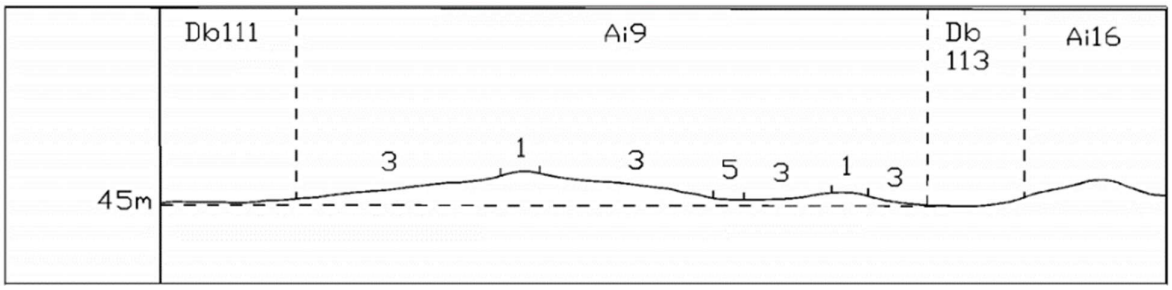


*Figure 8-8: Hillslope catena for land type Ai9.*

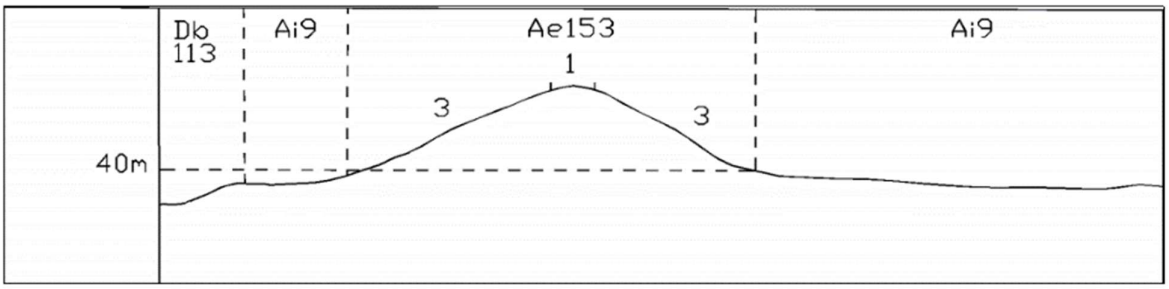


*Figure 8-9: Hillslope catena for land type Ae153.*

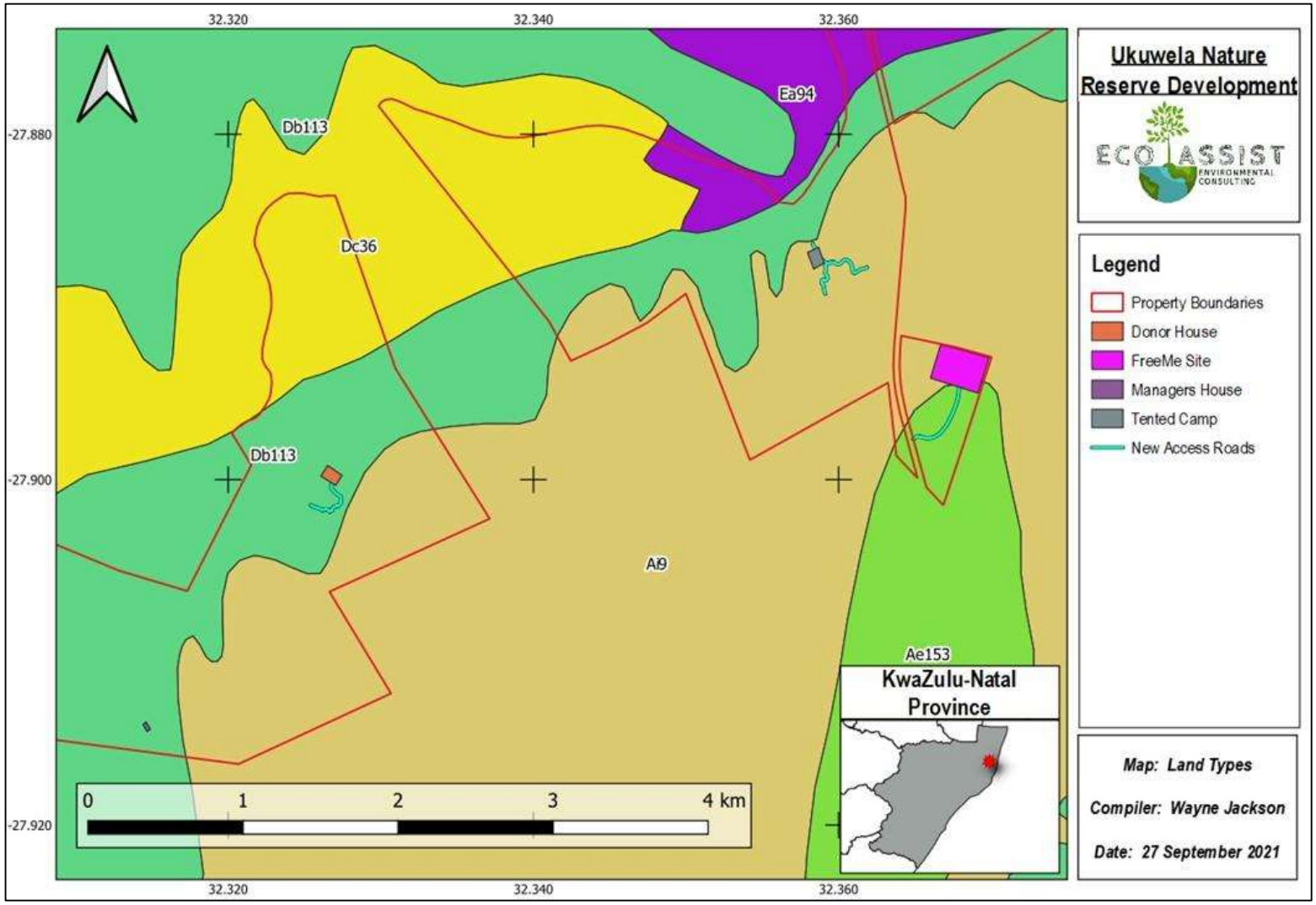


*Figure 8-10: Land Types within the project area.*

### 8.3.3 Soil Capability

Soil capability takes into consideration all aspects pertaining to the characteristics of the soil and their contributions towards plant production (Department of Agriculture, Forestry and Fisheries, 2017).

Three databases were used a part of the soil capability modelling:

- Land type data modelled and mapped into topographical units (Beukes). The data were modelled and rasterised form the original land type data base and the 90 m SRTM DEM. All the soil attributes are linked to fixed boundary zones. The soil concerns, issues and data are therefore aimed at an attribute rather than a spatial level;
- The land type soil attribute data base (ARC); and
- Soil fertility data (DAFF).

Three main modelling concerns formed part of the soil capability modelling:

- Plant available water;
- Soil sensitivity; and
- Soil fertility.

The soil capability was rated as Low-Moderate for the Tented camps and the FreeMe site. The soil capability for the Donor house and the Managers house was rated as Moderate (see Figure 8-11).

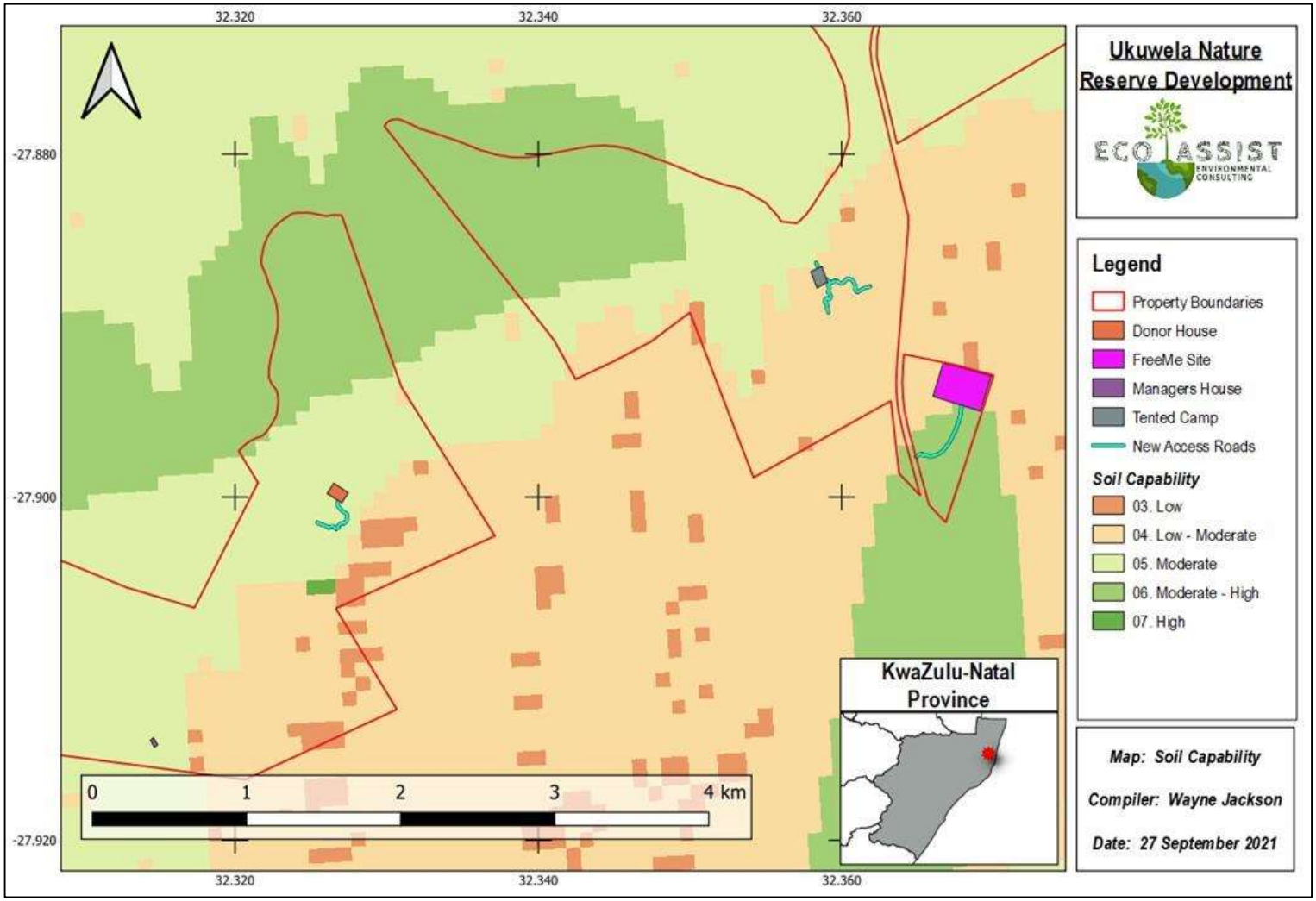


*Figure 8-11: Soil capabilities within the project area (Department of Agriculture, Forestry and Fisheries, 2017).*

## 8.4 Land Capability

Land capability is defined as the most intensive long-term use of land for purposes of rainfed farming determined by the interaction of climate, soil, and terrain.

To represent the distribution of the land capability evaluation values in the country, used as one of the input data layers to determine and demarcate all high value agricultural land for ensuring that these areas, pending availability, are preserved for continued agricultural production, thereby ensuring long-term national food security (Department of Agriculture, Forestry and Fisheries, 2017).

The data layer is a seamless data layer and does not exclude permanently transformed areas (built up; waterbodies; mining etc.).

The land capability ratings show that the overall desktop land capability ranged from Low-Moderate to Moderate-High (see Figure 8-12). The result is based on the combination of the climate capability, the soil capability, and the terrain capabilities described earlier.

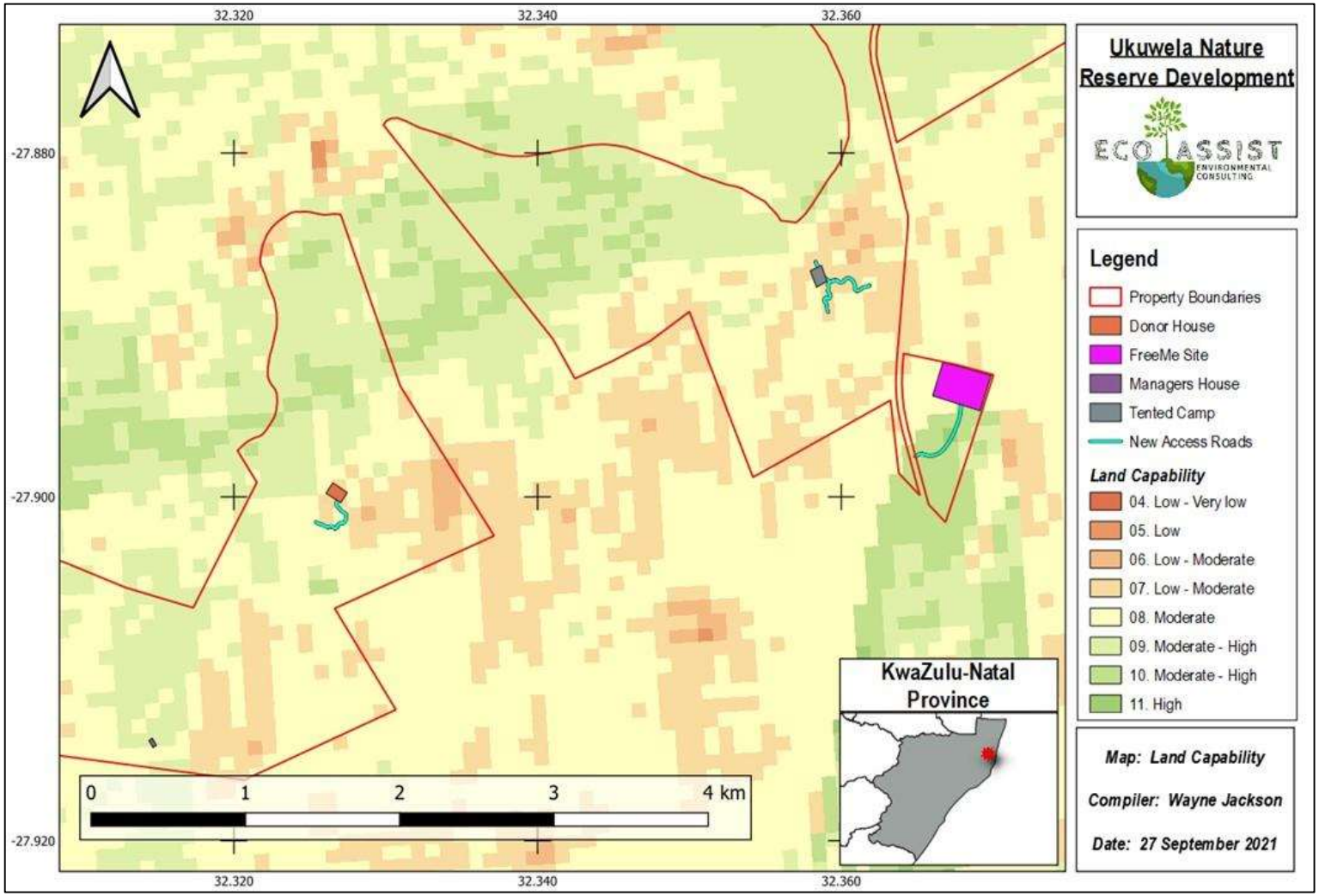


*Figure 8-12: Land capabilities within the project area (Department of Agriculture, Forestry and Fisheries, 2017)*

## 8.5 Grazing Capacity

The long-term production potential of the herbaceous layer (grasses and forbs) of an area of vegetation that is required to maintain an animal with a weight of 450 kg (1 Large Stock Unit (LSU)) with an average fodder intake of 10 kg dry mass per day over a period that vegetation is suitable for grazing (mostly 1 year) without degrading the natural resources (vegetation and soil) and is measured in “Hectares per Large Stock Unit” (ha/LSU) (South Africa (Republic), 2018).

The long-term sustainable grazing capacity for the project area was rated as 6 ha per large stock unit (see Figure 8-13).

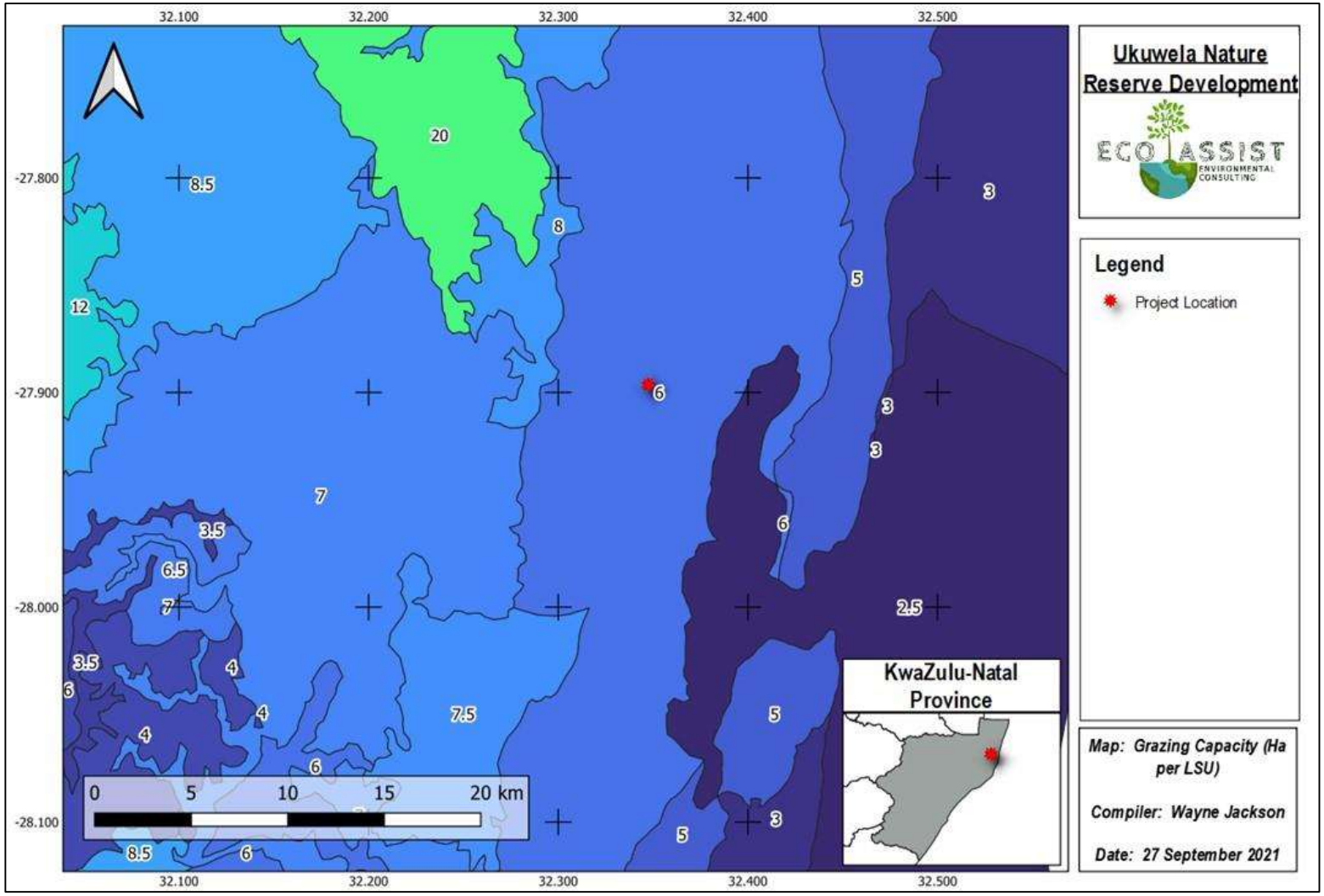


*Figure 8-13: The grazing capacity within the project area (South Africa (Republic), 2018).*

## 8.6 Historic Land Use

The historic land use was determined by reviewing Google Earth™ Historical imagery. The historic land use is important to determine if any agricultural activities has taken place in the past.

The desktop review showed that none of the sites were actively used for agriculture as the 2009 google imagery has indicated (see Figure 8-14 to Figure 8-17). The FreeMe site borders agricultural activities but also has not been utilised as the 2016 imagery shows (see Figure 8-16) they are as adjacent or near to these sites that are being utilised for agriculture.

The land use for these areas is that of nature conservation and recreational game viewing. Therefore there has been no change in land use for these proposed sites in the last 13 years.


*Figure 8-14: 2009 aerial imagery showing land use as being game farm/conservation area at the Managers house site (Google Earth™).*


*Figure 8-15: 2009 aerial imagery showing land use as being game farm/conservation area at the Donor house site (Google Earth™).*


*Figure 8-16: 2016 aerial imagery showing land use as being game farm/conservation area at the Free Me site (Google Earth™).*


*Figure 8-17: 2009 aerial imagery showing land use as being game farm/conservation area at the tented camp site (Google Earth™).*

# 9 SITE ASSESSMENT RESULTS

A semi-detailed soil survey was conducted for the project areas in August 2021 using a hand-held auger and a GPS to log all information in the field. The soils were classified to the family level as per the "Soil Classification: A Natural and Anthropogenic System for South Africa" (Soil Classification Working Group, 2018). The soil forms found are described in the subsequent sections and the extent is shown in Figure 9-4 and Figure 9-5.

## 9.1 Soil Forms

The following soil forms were identified on-site;

- Oakleaf (Orthic topsoil over a Neocutanic B-horizon, with a Lithic C-horizon) (See Figure 9-3);
- Tukulu (Orthic topsoil over a Neocutanic B-horizon, with signs of wetness in the C-horizon);
- Clovelly (Orthic topsoil over a thick Yellow-Brown Apedal horizon, with a lithic C-horizon) (See Figure 9-1);
- Fernwood (Orthic topsoil over a thick Albic horizon) (See Figure 9-2); and
- Longlands (Orthic topsoil over an Albic horizon, with Soft plinthic C-horizon).

The Managers house site was dominated by the deep Tukulu soil form. The soil profile is slightly bleached with a sandy matrix (5% to 10% clay).

The Donor house was dominated by red well drained Oakleaf soils. The clay content of these soils ranged from 5% to 15%.

The Free Me site was dominated by the deep sandy Clovelly soil form. The clay content was low at between 0% and 5%.

The Tented camp site was dominated by the Fernwood and Longlands soil forms. These are bleached Albic horizon soils, which indicate lateral flows.

*Figure 9-1: Shows the Clovelly soils in the project area.*

*Figure 9-2: Shows the sandy and bleached properties of the Fernwood and Longlands soil forms in the project area.*

*Figure 9-3: Shows the red Neocutanic horizon of the Oakleaf soils.*

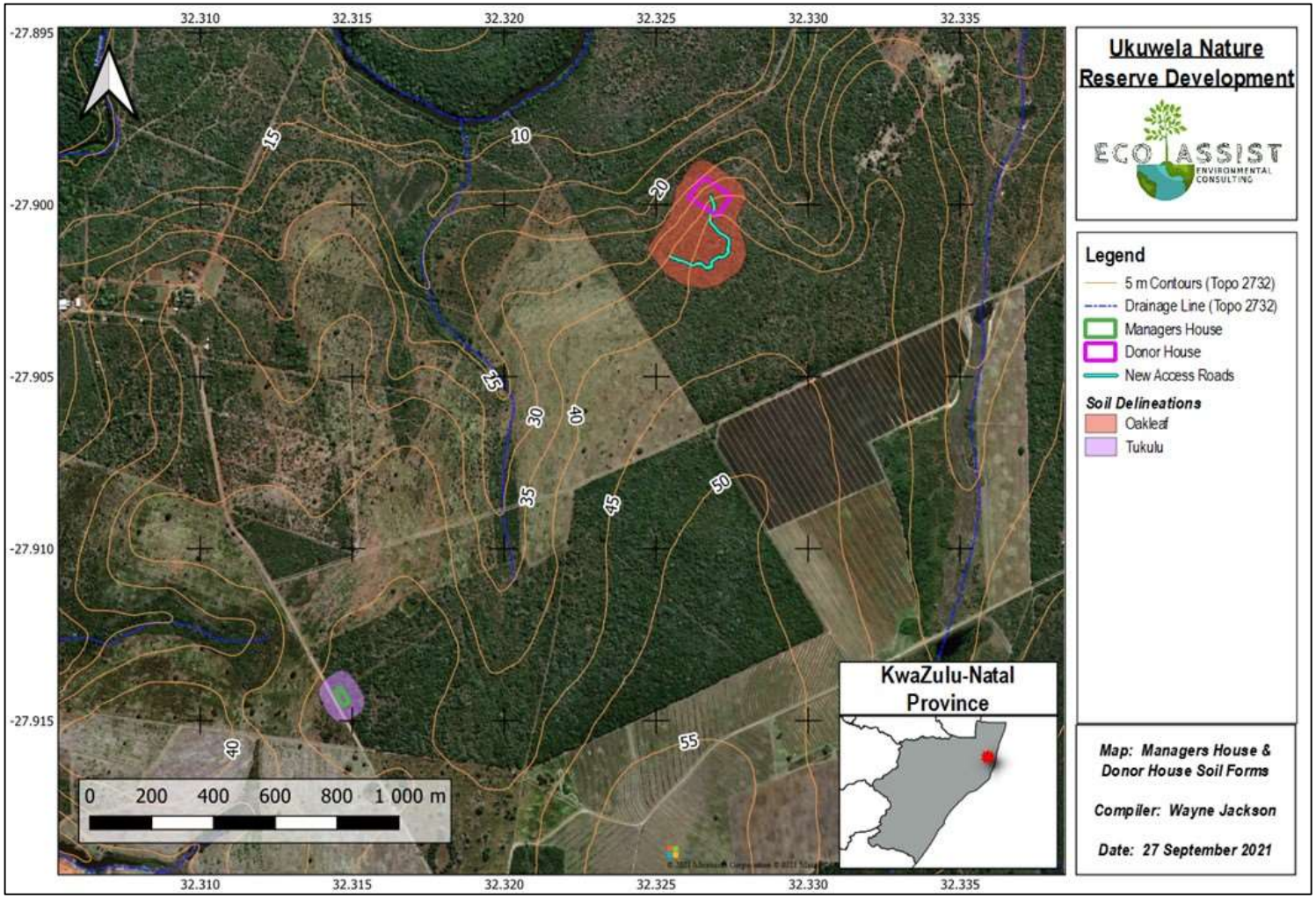


*Figure 9-4: The soil delineation for the Managers house and the Donor house sites.*

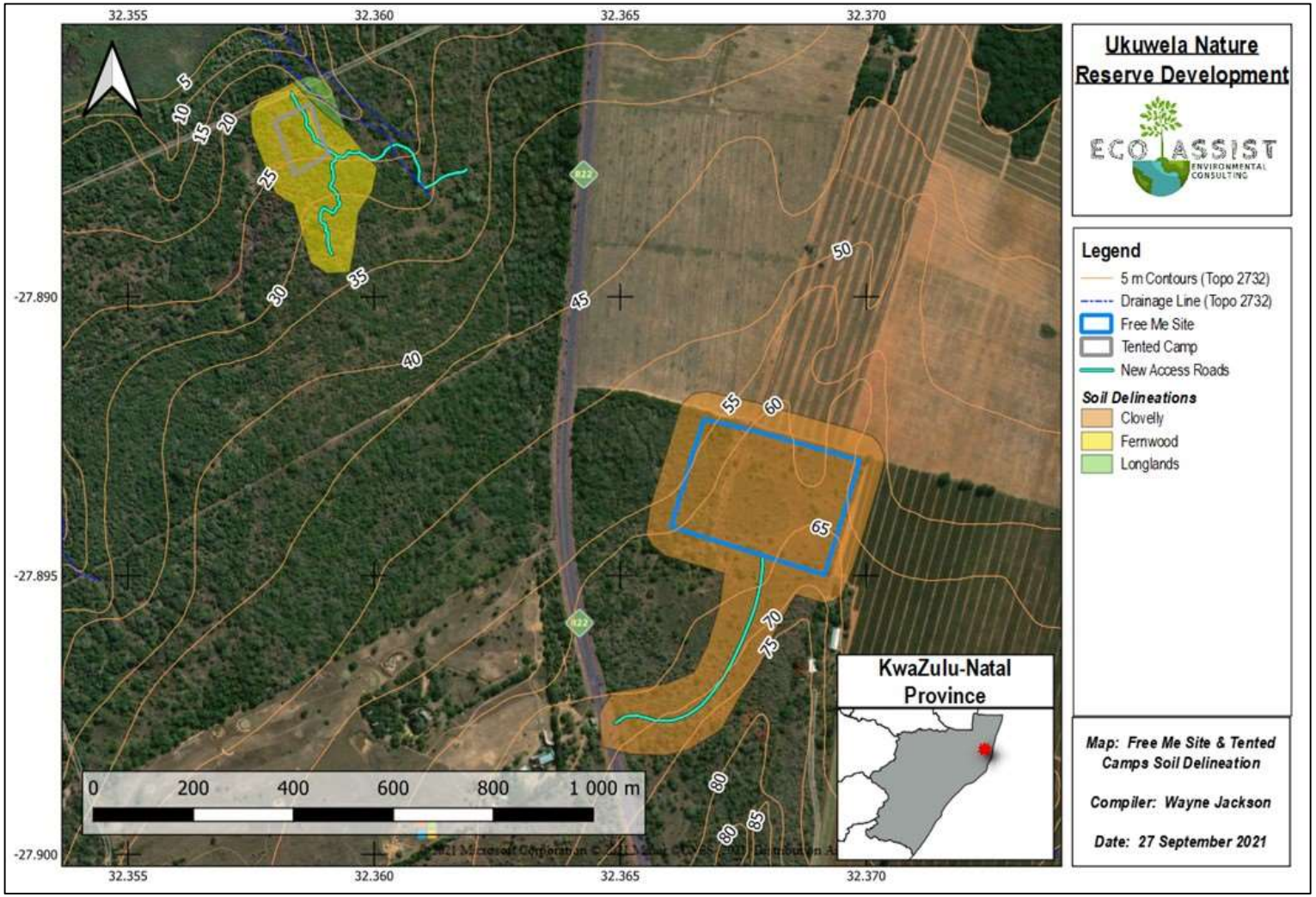


*Figure 9-5: The soil delineation for the Tented camp and the Free Me sites.*

## 9.2 Land Capability Classification

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.

**The land capability** is determined by using the guidelines described in "The farming handbook" (Smith, 2006). A breakdown of the land capability classes is shown in Table 5-1.

The land capability for the project area is shown in Figure 9-6 and Figure 9-7. The classification of the soil forms to the associated land capabilities is shown in Table 9-1.

The Clovelly, Oakleaf and Tukulu soil forms were classified as being arable with a moderate cultivation rating (class III). The Fernwood was classified as being arable with a light cultivation rating (class IV). The Longlands was classified as being non-arable with a moderate grazing capability (class VI).

*Table 9-1: Soil forms and their associated land capability within the Ukuwela project sites.*

| Soil Form | Land Capability |
|---|---|
| Oakleaf | Class III |
| Clovelly | Class III |
| Tukulu | Class III |
| Longlands | Class VI |
| Fernwood | Class IV |

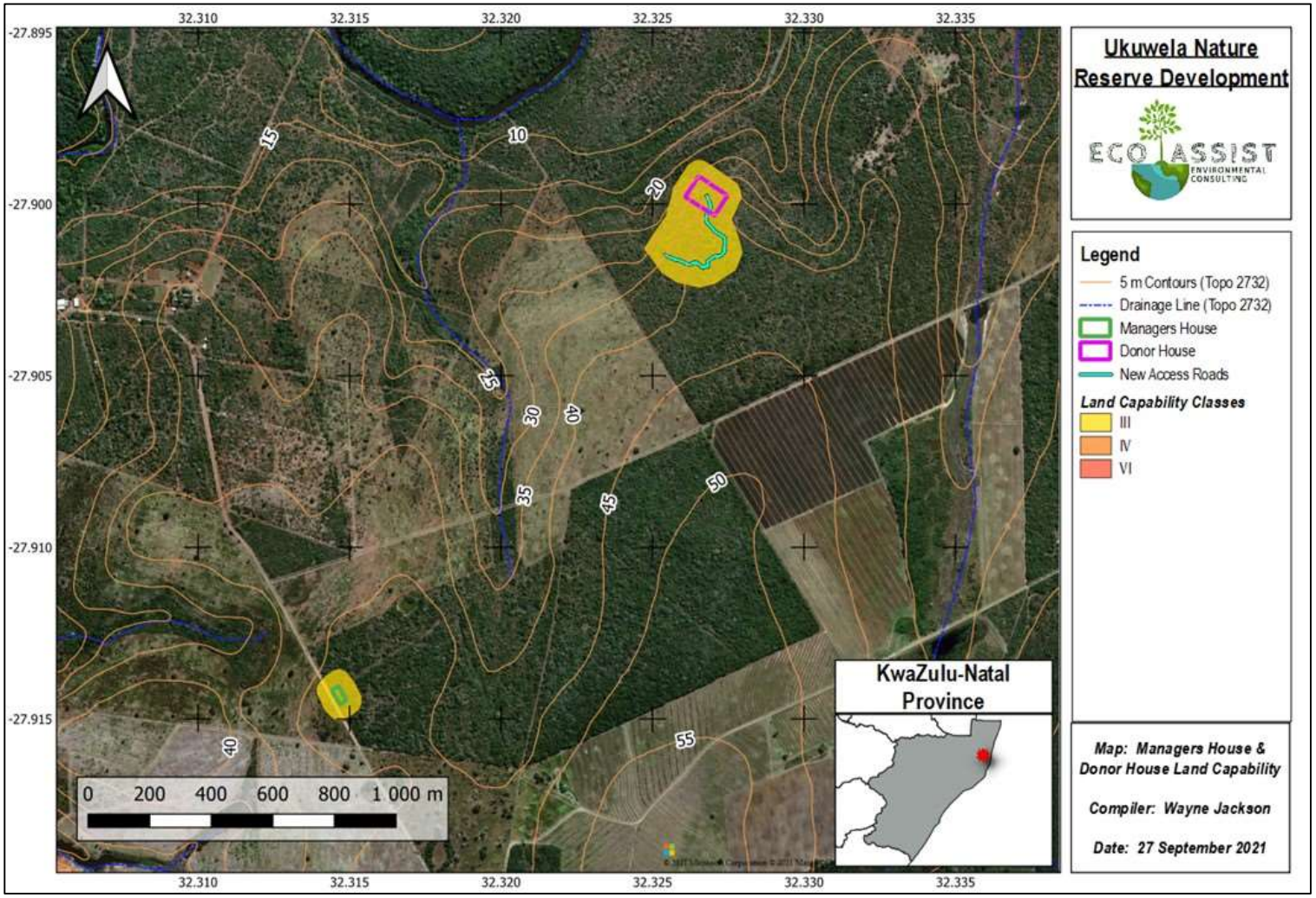


*Figure 9-6: The land capability for the Managers house and the Donor house sites.*

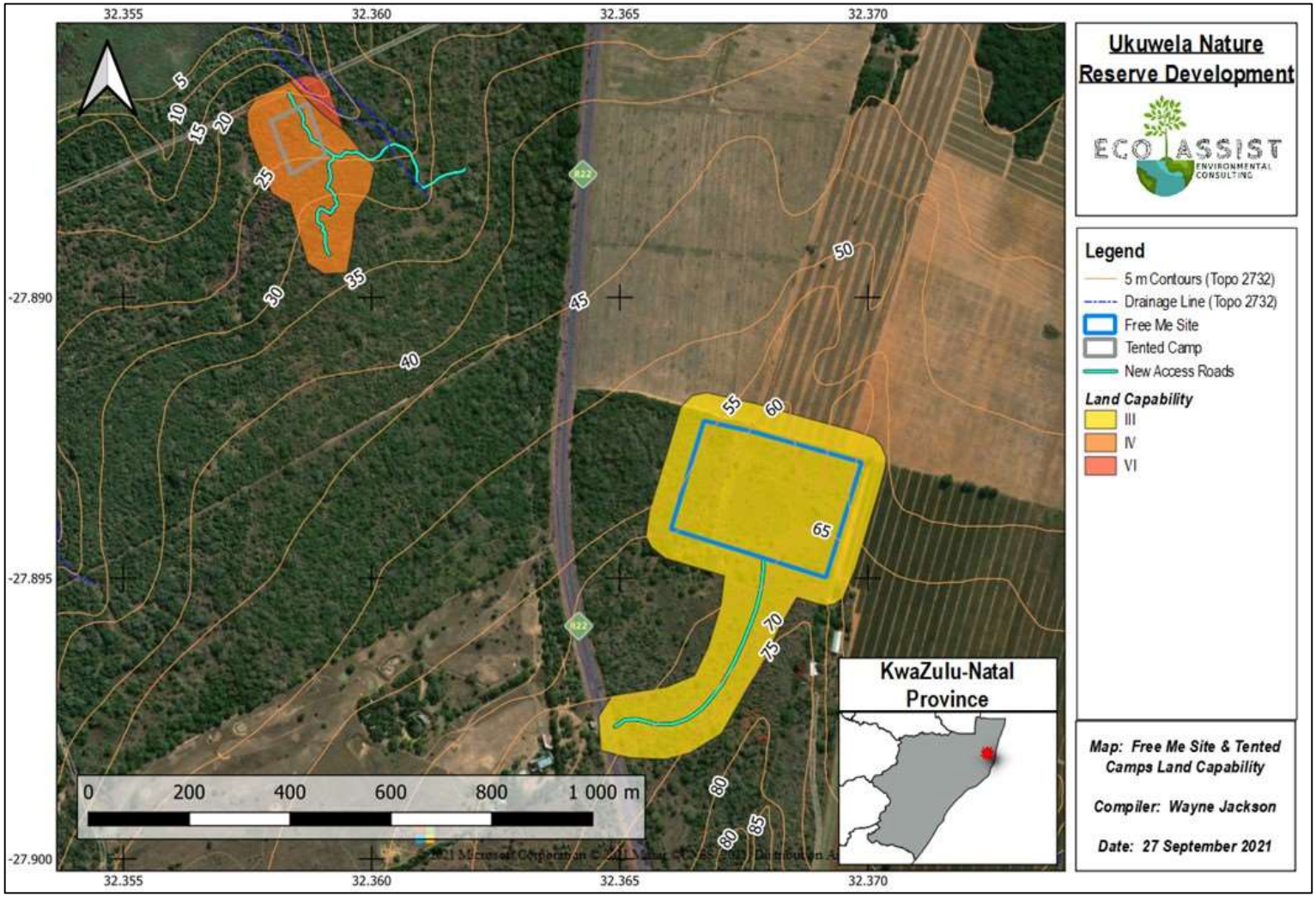


*Figure 9-7: The land capability for the Tented camp and the Free Me sites.*

## 9.3 Land Potential Classification

**The climate capability** for the project area is determined to be C3 – with a light to moderate limitation rating (Smith, 2006). The climate class has a slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for moderate range of adapted crops.

**The Land potential / Agricultural potential** of the project sites are shown in Figure 9-8 and Figure 9-9 with the breakdown of the classification is shown in Table 9-2. The class III and class IV land capability areas were determined to have a **L3 (Good potential)** land potential. The class VI land capability was determined to have a **L5 (Restricted potential)** land potential.

**L3 - Good potential:** Infrequent and/or moderate limitations due to soil, slope, temperatures, or rainfall. Appropriate contour protection must be implemented and inspected.

**L5 - Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperatures, or rainfall.

*Table 9-2: Land capability and the associated land potentials within the Ukuwela project sites.*

| Land Capability | Land Potential |
|---|---|
| Class III | L3 |
| Class IV | L3 |
| Class VI | L5 |

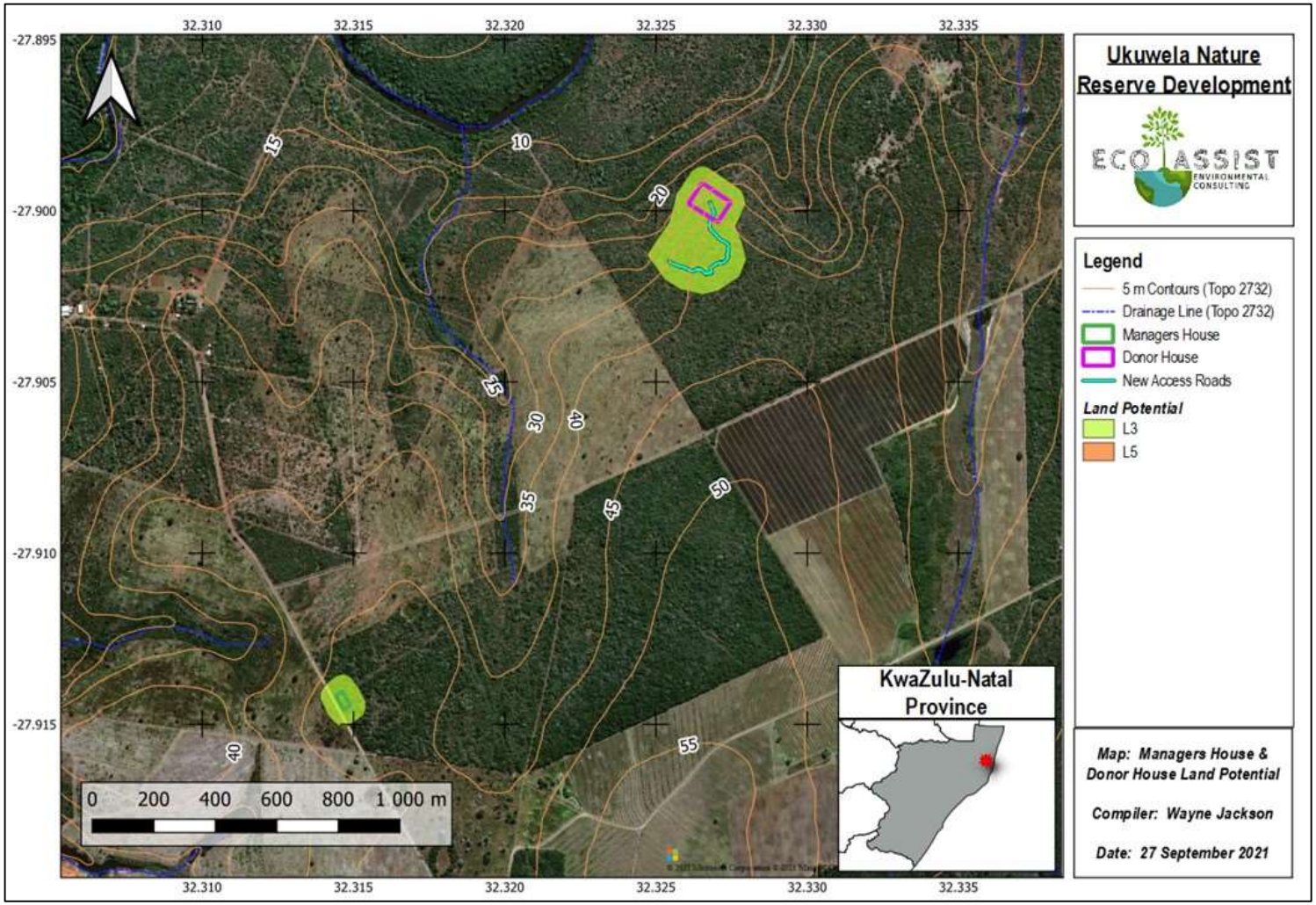


*Figure 9-8: The land potential for the Managers house and the Donor house sites.*

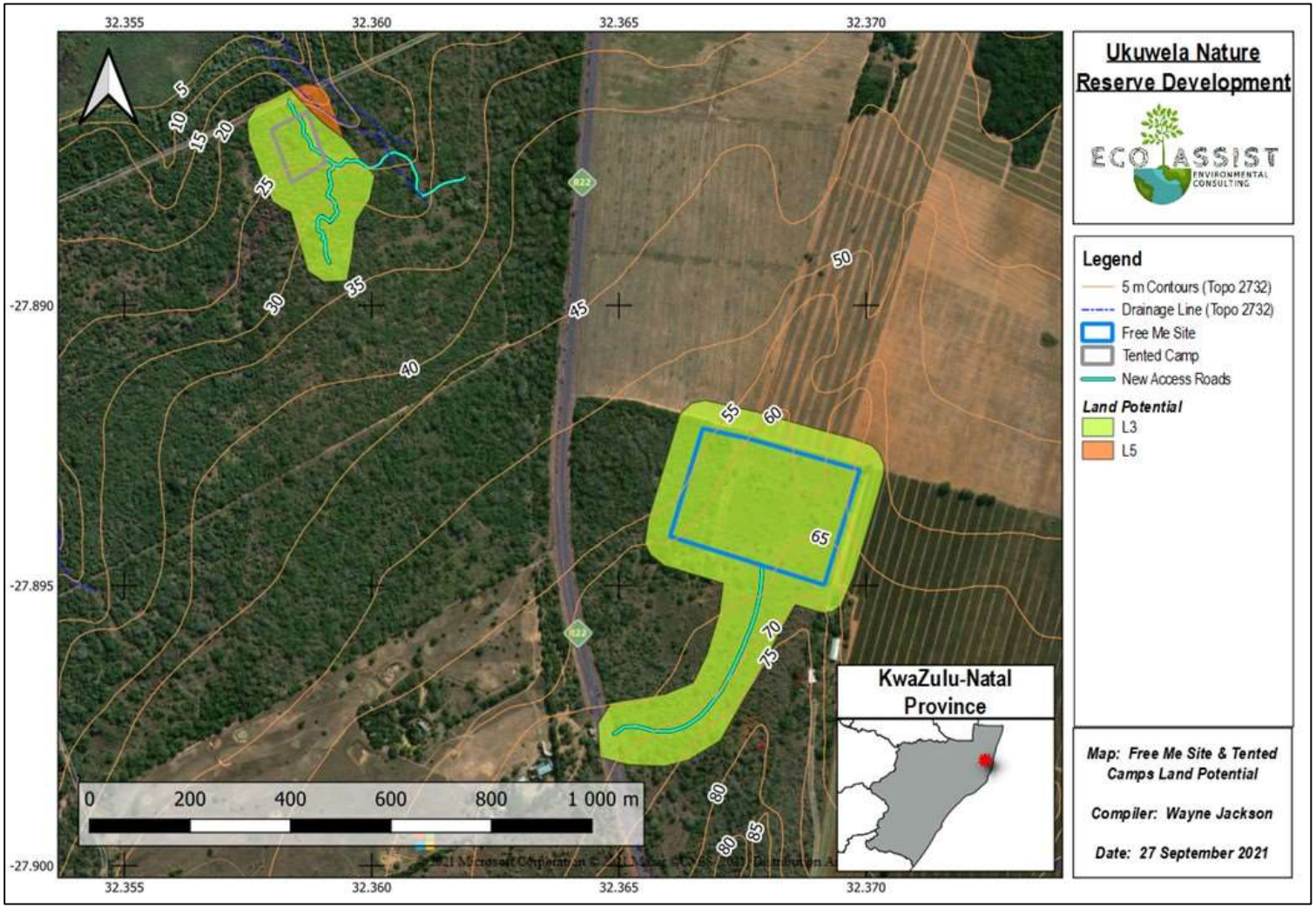


*Figure 9-9: The land potential for the Tented camp and the Free Me sites.*

## 9.4 Current Land Use

The project sites were dominated by veld/grasslands (Figure 9-12) and natural protected nature reserves (Figure 9-11). The surrounding land uses in some areas was commercial agriculture (Figure 9-10).

The land in the area is currently being utilised as game farms in natural veld conditions. No commercial crop production is currently taking place on the project area.

*Figure 9-10: Commercial agriculture on neighbouring areas.*

*Figure 9-11: Protected game reserve.*

*Figure 9-12: Veld in the project area.*

# 10 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

## 10.1 Methodology

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

### 10.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e., site, local, national, or global), whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 10-1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

### 10.1.2 Impact Rating System

The impact assessment must take account of the nature, scale, and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

***The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).***

#### 10.1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

*Table 10-1: Rating of impacts criteria*

| | | |
|---|---|---|
| **ENVIRONMENTAL PARAMETER** | | |
| A brief description of the environmental aspect likely to be affected by the proposed activity (e.g., Surface Water). | | |
| **ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE** | | |
| Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g., oil spill in surface water). | | |
| **EXTENT (E)** | | |
| This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined. | | |
| 1 | Site | The impact will only affect the site |
| 2 | Local/district | Will affect the local area or district |
| 3 | Province/region | Will affect the entire province or region |
| 4 | International and National | Will affect the entire country |
| **PROBABILITY (P)** | | |
| This describes the chance of occurrence of an impact | | |
| 1 | Unlikely | The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence). |
| 2 | Possible | The impact may occur (Between a 25% to 50% chance of occurrence). |
| 3 | Probable | The impact will likely occur (Between a 50% to 75% chance of occurrence). |
| 4 | Definite | Impact will certainly occur (Greater than a 75% chance of occurrence). |
| **REVERSIBILITY (R)** | | |

| | | |
|---|---|---|
| This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity. | | |
| 1 | Completely reversible | The impact is reversible with implementation of minor mitigation measures |
| 2 | Partly reversible | The impact is partly reversible but more intense mitigation measures are required. |
| 3 | Barely reversible | The impact is unlikely to be reversed even with intense mitigation measures. |
| 4 | Irreversible | The impact is irreversible, and no mitigation measures exist. |
| **IRREPLACEABLE LOSS OF RESOURCES (L)** | | |
| This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity. | | |
| 1 | No loss of resource. | The impact will not result in the loss of any resources. |
| 2 | Marginal loss of resource | The impact will result in marginal loss of resources. |
| 3 | Significant loss of resources | The impact will result in significant loss of resources. |
| 4 | Complete loss of resources | The impact is result in a complete loss of all resources. |
| **DURATION (D)** | | |
| This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity. | | |
| 1 | Short term | The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years). |
| 2 | Medium term | The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years). |

| | | |
|---|---|---|
| 3 | Long term | The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years). |
| 4 | Permanent | The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite). |
| **INTENSITY / MAGNITUDE (I / M)** | | |
| Describes the severity of an impact (i.e., whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily). | | |
| 1 | Low | Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible. |
| 2 | Medium | Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity). |
| 3 | High | Impact affects the continued viability of the system/component and the quality, use, integrity, and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation. |
| 4 | Very high | Impact affects the continued viability of the system/component and the quality, use, integrity, and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation. |
| **SIGNIFICANCE (S)** | | |
| Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:<br>**Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.** The summation of the different criteria will produce a non- | | |

weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

| Points | Impact Significance Rating | Description |
|---|---|---|
| 5 to 23 | Negative Low impact | The anticipated impact will have negligible negative effects and will require little to no mitigation. |
| 5 to 23 | Positive Low impact | The anticipated impact will have minor positive effects. |
| 24 to 42 | Negative Medium impact | The anticipated impact will have moderate negative effects and will require moderate mitigation measures. |
| 24 to 42 | Positive Medium impact | The anticipated impact will have moderate positive effects. |
| 43 to 61 | Negative High impact | The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact. |
| 43 to 61 | Positive High impact | The anticipated impact will have significant positive effects. |
| 62 to 80 | Negative Very high impact | The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws". |
| 62 to 80 | Positive Very high impact | The anticipated impact will have highly significant positive effects. |

## 10.2 Impacts Identified

The potential impacts on agricultural resources identified for the proposed construction of the development within the various sites and the associated mitigation measures are provided in Table 10-2.

*Table 10-2: Impacts description and mitigation measures to be taken.*

| Impact | Description |
|---|---|
| Loss of agricultural land and / or loss of agricultural potential as a result of the proposed activity | Potential disturbances include compaction, physical removal, and potential pollution; The exposed soil surfaces have the potential to erode easily if left uncovered which could lead to the loss of the soil resource.<br>• Soil that are excavated for the installation of foundations will have their physical and chemical states altered negatively;<br>• Potential loss of stockpiled topsoil and other materials through erosion if not protected properly;<br>• Insufficient stormwater control measures may result in localised high levels of soil erosion, possibly creating dongas or gullies, which may lead to decreased water quality in surrounding watercourses;<br>• Increased erosion could result in increased sedimentation which could impact on ecological processes;<br>• The additional hardened surfaces created during construction could increase the amount of stormwater runoff, which has the potential to cause erosion;<br>• Physical disturbance of the soil and plant removal may result in soil erosion/loss; and<br>• Erosion and potential soil loss from cut and fill activities and areas where naturally dispersive soils occur. |

## 10.3 Impact Assessment Findings

The Table 10-3 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 and the erosion of the soil resource. As well as the development on high potential land. It is important to note that the loss of topsoil as a valuable resources is also included in the assessment. the loss of topsoil can occur through erosion, compaction, and/or contamination.

The impact assessment has determined that the activities are rated as a Low impact on agricultural resources. This is largely due to the following aspects;

- The sites are not located on any existing or previously utilised agricultural land;
- The sites are not fragmenting agricultural resources;
- The development will be sparsely utilised as and secondary impacts are unlikely;

- The size of the development sites are small in nature and do not pose a significant impact on the overall agricultural importance of the region; and
- The sites are located within a protected nature reserve and it is not proposed to change the current land use to agriculture.

*Table 10-3: Impact assessment ratings for the Ukuwela development sites*

| Ukuwela Development | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENVIRONMENTAL PARAMETER | ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE | ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION | | | | | | | | | RECOMMENDED MITIGATION MEASURES | ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION | | | | | | | | |
| | | E | P | R | L | D | I / M | TOTAL | STATUS (+ OR -) | S | | E | P | R | L | D | I / M | TOTAL | STATUS (+ OR -) | S |
| **Planning Phase** | | | | | | | | | | | | | | | | | | | | |
| Loss of Agricultural Resources (Including Land Use) | The loss of current agricultural land use through poor planning of new development footprints. | 1 | 3 | 1 | 1 | 1 | 1 | 7 | - | Low | • Every effort must be made to avoid potential impacts from the outset of a project (e.g., through careful spatial or temporal placement of elements of infrastructure) to prevent or limit impacts to high potential soil resources. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | - | Low |
| Loss of High Potential Soil Resources | The loss of high value soil resources through poor planning of new development footprints. | 1 | 3 | 1 | 2 | 3 | 2 | 20 | - | Low | | 1 | 1 | 1 | 2 | 3 | 2 | 16 | - | Low |
| Loss of High Potential Land Capability | The loss of current agricultural land use through poor planning of new development footprints. | 1 | 3 | 1 | 2 | 3 | 2 | 20 | - | Low | | 1 | 1 | 1 | 2 | 3 | 2 | 16 | - | Low |
| **Construction Phase** | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loss of Agricultural Resources (Including Land Use) | The loss of current agricultural land use through altering the land use for alternative land uses. | 1 | 1 | 3 | 1 | 1 | 1 | 7 | - | Low | • No agricultural resources were identified within the project footprint. | 1 | 1 | 3 | 1 | 1 | 1 | 7 | - | Low |
| Loss of High Potential Soil Resources | The excavation, compaction, erosion, and contamination of high value soil resources. | 1 | 2 | 3 | 2 | 3 | 2 | 22 | - | Low | • Topsoil that is removed during excavation must NEVER be buried or rendered unusable in any way (such as mixing it with spoils or being compacted by machinery).<br>• During excavation soil must be excavated one layer at a time and stored in separate stockpiles so they can be returned in their natural order when the area is backfilled. This improves soil functions and improves the template for plant growth.<br>• The footprint area must be kept to a minimum.<br>• Where possible, plants should be cut down to ground level instead of being removed completely to stabilise the soil during land-clearing operations.<br>• Once surfaces have been exposed, they must immediately be protected from erosion, so limiting the source of the sediment.<br>• Temporary diversion must be used to direct runoff from impervious areas to the sediment traps.<br>• Sediment traps must be used in areas of concentrated runoff.<br>• If soil contamination occurs (such as due to a spill) the soil must be removed from the site and disposed of appropriately.<br>• Green Engineering structures should be considered to improve infiltration into soil profiles and minimise runoff volumes. | 1 | 2 | 3 | 2 | 3 | 2 | 22 | - | Low |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loss of High Potential Land Capability | The loss of high potential land capability through altering the land use for alternative land uses. As well as through excavation, compaction, erosion, and contamination of soil resources. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low | • The high potential land which will be impacted on is small and will have a low impact as the land is not used for agriculture. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low |
| **Operational Phase** | | | | | | | | | | | | | | | | | | | | |
| Loss of Agricultural Resources (Including Land Use) | The loss of current agricultural land use through altering the land use for alternative land uses. | 1 | 1 | 3 | 1 | 1 | 1 | 7 | - | Low | • The dominant land use will not change as the land use is currently a protected game lodge. | 1 | 1 | 3 | 1 | 1 | 1 | 7 | - | Low |
| Loss of High Potential Soil Resources | The compaction, erosion, and contamination of high value soil resources which were not initially part of the construction impacts. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low | • Green Engineering structures should be considered to improve infiltration into soil profiles and minimise runoff volumes.<br>• Water on the road should be diverted away as quickly as possible, to minimise the amount of water running directly from the road. The drainage must lead the water to vegetated filter strips, which remove particles and contaminants from the water.<br>• Having more frequent drains on the approach to a water body ensures that the least amount of water is discharged directly into the water body and reduced sediment loading. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | • A water bar diverts water flowing down a surface (e.g., road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs.<br>• Sediment basins and rock dams can be used to capture sediment from stormwater runoff before it leaves a site. | | | | | | | | | |
| Loss of High Potential Land Capability | The loss of high potential land capability through altering the land use for alternative land uses. As well as through excavation, compaction, erosion, and contamination of soil resources. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low | • The high potential land which will be impacted on is small and will have a low impact as the land is not used for agriculture. | 1 | 1 | 3 | 2 | 3 | 2 | 20 | - | Low |
| **Decommissioning Phase** | | | | | | | | | | | | | | | | | | | | |
| Loss of Agricultural Resources (Including Land Use) | The removal of infrastructure and rehabilitation to prior conditions | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low | • It is not envisioned that the project will have a decommissioning phase.<br>• The rehabilitation should not be an onerous task as the footprint area is small. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low |
| Loss of High Potential Soil Resources | The removal of infrastructure and rehabilitation to prior conditions | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low | • It is not envisioned that the project will have a decommissioning phase.<br>• Once surfaces have been exposed, they must immediately be protected from erosion, so limiting the source of the sediment. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low |

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| | | | | | | | | | | | • Temporary diversion must be used to direct runoff from impervious areas to the sediment traps.<br>• Sediment traps must be used in areas of concentrated runoff.<br>• If soil contamination occurs (such as due to a spill) the soil must be removed from the site and disposed of appropriately. | | | | | | | | | |
| Loss of High Potential Land Capability | The removal of infrastructure and rehabilitation to prior conditions | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low | • The high potential land which will be impacted on is small and will have a low impact as the land is not used for agriculture. | 1 | 1 | 1 | 1 | 1 | 1 | 5 | + | Low |
| **Cumulative** | | | | | | | | | | | | | | | | | | | | | |
| Loss of Agricultural Resources (Including Land Use) | The cumulative loss of agricultural resources over the region through small or large projects impacting on the agriculture. | 1 | 1 | 2 | 1 | 1 | 1 | 6 | - | Low | • No agricultural resources were identified within the project footprint. | 1 | 1 | 2 | 1 | 1 | 1 | 6 | - | Low |
| Loss of High Potential Soil Resources | The cumulative loss of high value soil resources over the region through small or large projects impacting on the soils. | 1 | 1 | 2 | 2 | 3 | 1 | 9 | - | Low | • The footprint areas are small and the initial impact ratings were low. This will have a low cumulative impact. | 1 | 1 | 2 | 2 | 3 | 1 | 9 | - | Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loss of High Potential Land Capability | The cumulative loss of high potential land capability over the region through small or large projects impacting on the total land capability. | 1 | 1 | 2 | 2 | 3 | 1 | 9 | - | Low | • The footprint areas are small and the initial impact ratings were low. This will have a low cumulative impact. | 1 | 1 | 2 | 2 | 3 | 1 | 9 | - | Low |

## 10.4 Mitigation Measures

The mitigation hierarchy is regarded internationally as the best practice framework for environmental planning and managing environmental impacts. It is a set of prioritized, sequential steps that are applied to anticipate, avoid, and reduce the potential negative impacts of project activities on the natural environment. It involves a sequence of four key components: avoidance, minimization, remediation, and offset as illustrated in (Edwards, et al., 2018).

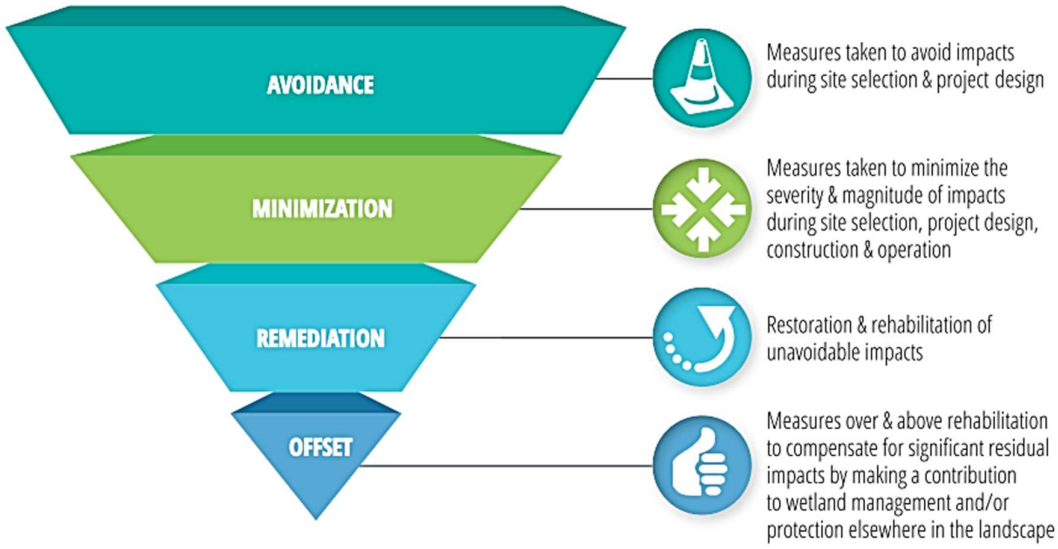


*Figure 10-1: The mitigation hierarchy (Edwards, et al., 2018)*

The focus of mitigation measures is to follow the mitigation hierarchy where possible. The prescribed mitigation measures for the proposed activity are provided in the respective sections below.

### 10.4.1 Site Planning

Every effort must be made to avoid potential impacts from the outset of a project (e.g., through careful spatial or temporal placement of elements of infrastructure) to prevent or limit impacts to high potential soil resources.

Various aspects will contribute to the risks described above, and as a result the mitigation measures for these aspects are listed below.

### 10.4.2 Site Clearing

During site clearing the vegetation and topsoil is removed, increasing the runoff and erosion potential of flowing water. To mitigate these impacts the following measures must be followed:

- Minimise the area of soil disturbance to reduce the footprint of impact zones.
- Clearing and grading must occur only where necessary to build and provide access to structures and infrastructure. Clearing must be done immediately before construction, rather than leaving soils exposed for months or years.

- Where possible, plants should be cut down to ground level instead of being removed completely to stabilise the soil during land-clearing operations.
- The proposed limits of land disturbance must be physically marked off to ensure that only the land area required for the development is cleared.
- When excavated areas are backfilled the surface must be level with the surrounding land surface, to minimise soil erosion from the areas when the excavation is complete.
- The most efficient approach to control erosion is to minimise the area of land disturbed as well as the duration for which it is exposed.
- Once surfaces have been exposed, they must immediately be protected from erosion, so limiting the source of the sediment.
- During the excavation of pits, roads, construction sites etc. the removed topsoil must be stored and appropriately protected so that it does not wash into waterbodies, causing sedimentation and nutrient loading. This is then used to backfill the area so that it can be effectively rehabilitated.
- Topsoil that is removed during excavation must NEVER be buried or rendered unusable in any way (such as mixing it with spoils or being compacted by machinery).
- During excavation soil must be excavated one layer at a time and stored in separate stockpiles so they can be returned in their natural order when the area is backfilled. This improves soil functions and improves the template for plant growth.

### 10.4.3 Erosion & Sedimentation Control

- Temporary diversion must be used to direct runoff from impervious areas to the sediment traps.
    - Sediment traps detain sediments in stormwater runoff to protect receiving water bodies, and the surrounding area.
- Sediment traps must be used in areas of concentrated runoff.
    - Sediment traps are small impoundments that allow sediment to settle out of runoff. They are usually installed in a drainageway or other point of discharge from a disturbed area.
    - Sediment traps detain sediments in stormwater runoff to protect receiving water bodies, and the surrounding area.
    - The traps are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. An outlet or spillway is often constructed using large stones or aggregate to slow the release of runoff.

### 10.4.4 Soil Stabilisation

- Stabilization practices (e.g., revegetation) must occur as soon as possible after grading. In colder climates, a mulch cover is needed to stabilize the soil during the winter months when grass does not grow or grows poorly.
- The following measures must be used to stabilize soils for site preparation and construction: hydro mulch, straw (placed evenly on slope), crimping (rolling the placed straw with a sheep-foot roller), seeding, fertiliser, transplanting and net (jute netting pinned onto the slope).

### 10.4.5 Stockpile management

- Unprotected stockpiles are very prone to erosion and therefore must be protected. Small stockpiles can be covered with a tarp to prevent erosion. Large stockpiles must be stabilized by erosion blankets, seeding, and/or mulching.

### 10.4.6 Pollution Control

- If soil contamination occurs (such as due to a spill) the soil must be removed from the site and disposed of appropriately.
- Prevention of spills eliminates or minimizes the discharge of pollutants to valuable natural resources.
- Handle hazardous and non-hazardous materials, such as concrete, solvents, asphalt, sealants, and fuels, as infrequently as possible and observe all national and local regulations when using, handling, or disposing of these materials.
- An effective response plan must be in place and personnel must be ready to mobilise in the event of a spillage to reduce the environmental effects of an oil or chemical spill.
- Spill control devices such as absorbent snakes and mats must be placed around chemical storage areas, and they can be used in an emergency to contain a spill.
- Implement preventative maintenance system to ensure that work vehicles are maintained in an acceptable condition. This would involve routinely checking vehicles for leaks before construction begins; and not allowing vehicles with significant leaks to operate or be repaired within the construction site. Ideally, vehicle maintenance and washing occurs in garages and wash facilities, not on active construction sites.
- Before an operation occurs, vehicles must be checked for leaks, to reduce soil and water contamination from vehicle fluids.
- Old engine oil must NOT be thrown on the ground or down a stormwater drain but rather collected in containers and recycled.
- Ensure that appropriate solid waste disposal facilities are provided, and adequate signage is provided for all solid, liquid, and hazardous waste types. These must contain waste products in a weatherproof manner and to prevent any airborne litter, access to scavengers or loss of food residues that may be washed into surface or ground waters. Collected waste needs to be disposed of at a registered landfill site/hazardous waste facility.
- Re-fuelling areas for vehicles must be bunded and located away from water resources and sensitive environments to prevent any accidental spillage contaminating soil or seeping into groundwater aquifers. All servicing area run-off must be directed towards a fully contained collection sump for recovery and appropriate disposal.
- There must be no standing water at a stockpile site, to reduce erosion as well as the contamination of the water by nutrients/ toxics.

### 10.4.7 Road Construction & Maintenance

- Green Engineering structures should be considered to improve infiltration into soil profiles and minimise runoff volumes.
- Water on the road should be diverted away as quickly as possible, to minimise the amount of water running directly from the road. The drainage must lead the water to vegetated filter strips, which remove particles and contaminants from the water.

- Having more frequent drains on the approach to a water body ensures that the least amount of water is discharged directly into the water body and reduced sediment loading.
- A water bar diverts water flowing down a surface (e.g., road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs.

### 10.4.8 Runoff Control

- Green Engineering structures should be considered to improve infiltration into soil profiles and minimise runoff volumes.
- Runoff from disturbed areas (such as landing/depot areas, extraction routes, gravel pits, temporary and unpaved roads) must be directed to silt traps (silt fences, sandbags, etc) to remove sediment and reduce the sedimentation of the water bodies.
- ***Check dams*** are small, temporary dams constructed across a swale or channel. They can be constructed using gravel, rock, gabions, or straw bales. They are used to reduce the velocity of concentrated flow and, therefore, to reduce erosion in a swale or channel.

### 10.4.9 Sediment Controls

- Sediment basins and rock dams can be used to capture sediment from stormwater runoff before it leaves a site. Both structures allow a pool to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment or through the gravel of the rock dam. The water is released more slowly than it would be without the control structure.

### 10.4.10 Sanitation

- Portable toilets must be provided where work is being done and must be located a considerable distance away from water resources and riparian areas.

### 10.4.11 Site Management

- Alien and invasive vegetation have several detrimental effects on water quality, from nutrient enrichment to increased erosion and excessive water use, which is especially relevant in dry areas or in important catchments. Invasive species are highly likely to colonise disturbed areas, even after rehabilitation and follow-up clearing must be done until healthy vegetation returns to the site.
- Within a construction site, vehicle access must be strictly controlled (i.e., there must be set parking, turning areas, set routes and no access to undisturbed areas.) This minimises soil disturbance and compaction and pollution from fluids leaking onto the ground.

# 11 AGRO-ECOSYSTEM ASSESSMENT

The sensitivity analysis identified the project area to have a Medium to High sensitivity and as such an Agro-Ecosystem Assessment was required.

The results show that none of the development sites are within any crop boundaries, which are designated by hashed polygons (see Figure 4-1 to Figure 4-3). These crop boundaries have High to Very High sensitivities. The remaining area ranges from Medium to High sensitivity. The Managers house and the Free Me site are within a High sensitivity area. The Donor house and the Tented camp site are within a Medium sensitivity area.

The Medium sensitivity areas (Tented camp and Donor house) have been verified as medium, based on the slope of these sites. The sandy nature of the soil at the tented camp is also a limiting factor.

The High sensitivity ratings of the managers house and the Free Me sites were verified as High.

The DFFE screening tool is a guideline, and it is up to the specialists to verify these results in the field. The screening tool is based on coarse datasets and the areas may not be accurate.

The following is the findings as per the GN 320 requirements;

1. The assessment was conducted by a SACNASP registered Soil Scientist.
2. The assessment as conducted on all the proposed sites and the soils delineated within these potential impact areas.
3. The assessment determined that the proposed sites have not been used for agriculture in the past 5 years and as such;
    a. There is no requirement for current production figures to be reported on;
    b. The extent of the impact on the agricultural resource is determined to be not applicable as there was no agriculture taking place; and
    c. There is no impact on the agricultural resources as the proposed activities are small.
4. Status quo of the site;
    a. The soil forms and soil depths have been discussed in section 9.1 of this report.
    b. The slopes and landscape units are described in section 8.2 and section 8.3.2.
    c. The climatic conditions are described in section 8.1.
    d. The vegetation composition (land use is described in sections 8.6 and 9.4.
    e. The water resources are of no relevance as the proposed sites are not under agricultural use now or within the past 5 years.
    f. No employment figures are recorded as the proposed sites are not under agricultural use now or within the past 5 years.
5. The impacts of these proposed developments are small and will not fragment any potential agricultural uses.

The following is a summarised findings of the Agro-Ecosystems Assessment conducted by Wayne Jackson;

- Managers House;
- DFFE screening assessment determined the agricultural sensitivity to be High;
- The site is not within a crop field boundary;
- The desktop land capability rated the project area as Moderate-High;
- The climate capability was determined to be Moderate-High;
- The desktop soil capability rated the project area as Moderate;
- The desktop grazing capability rated the project area as having a 6 ha/LSU;
- The site assessment land capability was determined as Arable;
- The site assessment land potential was determined to be L3 (good potential);

- The site assessment land use showed no agricultural activity;
- The impact on current agricultural land use was determined to be Low;
- The impact on soil resources was determined to be Low; and
- The impact on the land capability was determined to be Low.
- Donor House;
- DFFE screening assessment determined the agricultural sensitivity to be Medium;
- The site is not within a crop field boundary;
- The desktop land capability rated the project area as Low-Moderate;
- The climate capability was determined to be Moderate-High;
- The desktop soil capability rated the project area as Moderate;
- The desktop grazing capability rated the project area as having a 6 ha/LSU;
- The site assessment land capability was determined as Arable;
- The site assessment land potential was determined to be L3 (good potential);
- The site assessment land use showed no agricultural activity;
- The impact on current agricultural land use was determined to be Low;
- The impact on soil resources was determined to be Low; and
- The impact on the land capability was determined to be Low.
- Free Me Site;
- DFFE screening assessment determined the agricultural sensitivity to be Medium with small portion in High;
- The site is not within a crop field boundary;
- The desktop land capability rated the project area as Moderate;
- The climate capability was determined to be Moderate-High;
- The desktop soil capability rated the project area as Low-Moderate;
- The desktop grazing capability rated the project area as having a 6 ha/LSU;
- The site assessment land capability was determined as Arable;
- The site assessment land potential was determined to be L3 (good potential);
- The site assessment land use showed no agricultural activity;
- The impact on current agricultural land use was determined to be Low;
- The impact on soil resources was determined to be Low; and
- The impact on the land capability was determined to be Low.
- Tented Camps;
- DFFE screening assessment determined the agricultural sensitivity to be Medium;
- The site is not within a crop field boundary;
- The desktop land capability rated the project area as Low-Moderate;

- The climate capability was determined to be Moderate-High;
- The desktop soil capability rated the project area as Low-Moderate;
- The desktop grazing capability rated the project area as having a 6 ha/LSU;
- The site assessment land capability was determined as Non-Arable;
- The site assessment land potential was determined to be L5 (restricted potential);
- The site assessment land use showed no agricultural activity;
- The impact on current agricultural land use was determined to be Low;
- The impact on soil resources was determined to be Low; and
- The impact on the land capability was determined to be Low.

The impact assessment has determined that the activities are rated as a Low impact on agricultural resources. This is largely due to the following aspects;

- The sites are not located on any existing or previously utilised agricultural land;
- The sites are not fragmenting agricultural resources;
- The development will be sparsely utilised as and secondary impacts are unlikely;
- The size of the development sites are small in nature and do not pose a significant impact on the overall agricultural importance of the region; and
- The sites are located within a protected nature reserve and it is not proposed to change the current land use to agriculture.

# 12 RECOMMENDATIONS

The following recommendations are made;

- Green engineering methods be implemented to retain some soil structure in the development area; and
- The mitigation measures are to be followed to prevent unnecessary loss to soil resources.

# 13 ACCEPTABILITY STATEMENT

It is the opinion of the Agricultural Specialist that the proposed development may proceed, this is based on the above recommendations.

# 14 REFERENCES

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