

Heritage Study



Appendix G4



NATIONAL CULTURAL HISTORY MUSEUM
NASIONALE KULTUURHISTORIESE MUSEUM

Building/Gebou: AFRICAN WINDOW
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Pretoria
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Our Ref/Ons Verw	Your Ref/U Verw	Contact/Kontak	Date/Datum
2005KH57			20 April 2005

Ms Deshika Kathawaroo
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Dear Ms Kathawaroo

HERITAGE IMPACT ASSESSMENT: PORTION 5, TYGERVALLEI 334JR

As requested, we have investigated the above portion of the farm Tygervallei 334JR, located in the Pretoria district of Gauteng (Figure 1).

The scope of work consisted of conducting a Phase I archaeological survey of the site in accordance with the requirements of Section 38(3) of the National Heritage Resources Act (Act 25 of 1999). This included:

- Conducting a desk-top investigation of the area
- A visit to the proposed development site

The objectives were to

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.

The geology is made up of quartzite and the original vegetation of the area is classified as Rocky Highveld Grassland. A small hill occurs on the north eastern side of the property. The south western section of the survey area, below the hill, has been impacted on by construction activities (houses built within the last 30 years). The rest of the area has been subject to agricultural activities and has been ploughed over annually in the past.

One site has been identified. This consists of a number of smaller stone circles. It is possible that these relate to the very extensive Late Iron Age habitation found east of the site, on the farm Mooiplaats 267JR, and probably served as a cattle outpost. The site centre around the following coordinates: S -25.79229; E 28.37379.

NORTHERN FLAGSHIP INSTITUTION/NOORDELIKE VLAGSKIPINSTELLING
INCORPORATING/GEINKORPOREER
National Cultural History Museum/Nasionale Kultuurhistoriese Museum
Transvaal Museum
National Museum of Military History/Nasionale Museum vir Militêre Geskiedenis
Pioneer/Florwer Museum - Kruger Museum - Tswaing Crater/Krater Museum - Samny Marks Museum -
Wiem Prinsloo Agricultural/Landbou Museum

Of course, this was also the area over which the British troops advanced during the Anglo-Boer War, before engaging in battle, on 11 and 12 June 1900, that was later to become known as the "Battle of Diamond Hill" or, the "Slag van Donkerhoek". It was one of the largest battles that took place during the war and the remains of gun placements, trenches and fortifications can still be found, however, mostly to the east of the study area.

We have found one feature of cultural significance that would be impacted on by the proposed development. It is recommended that a buffer zone with a radius of 25 metres from the centre of the site be created around it, and that it is fenced off. However, if this is not feasible, mitigation measures can be implemented, i.e. the mapping and excavation of the site after obtaining a valid permit from SAHRA. As to the rest of the site, we recommend, from a heritage point of view, that the proposed development can continue and requests that if archaeological sites or graves are exposed during construction work, it should immediately be reported to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made.

Yours sincerely

J van Schaikwyk

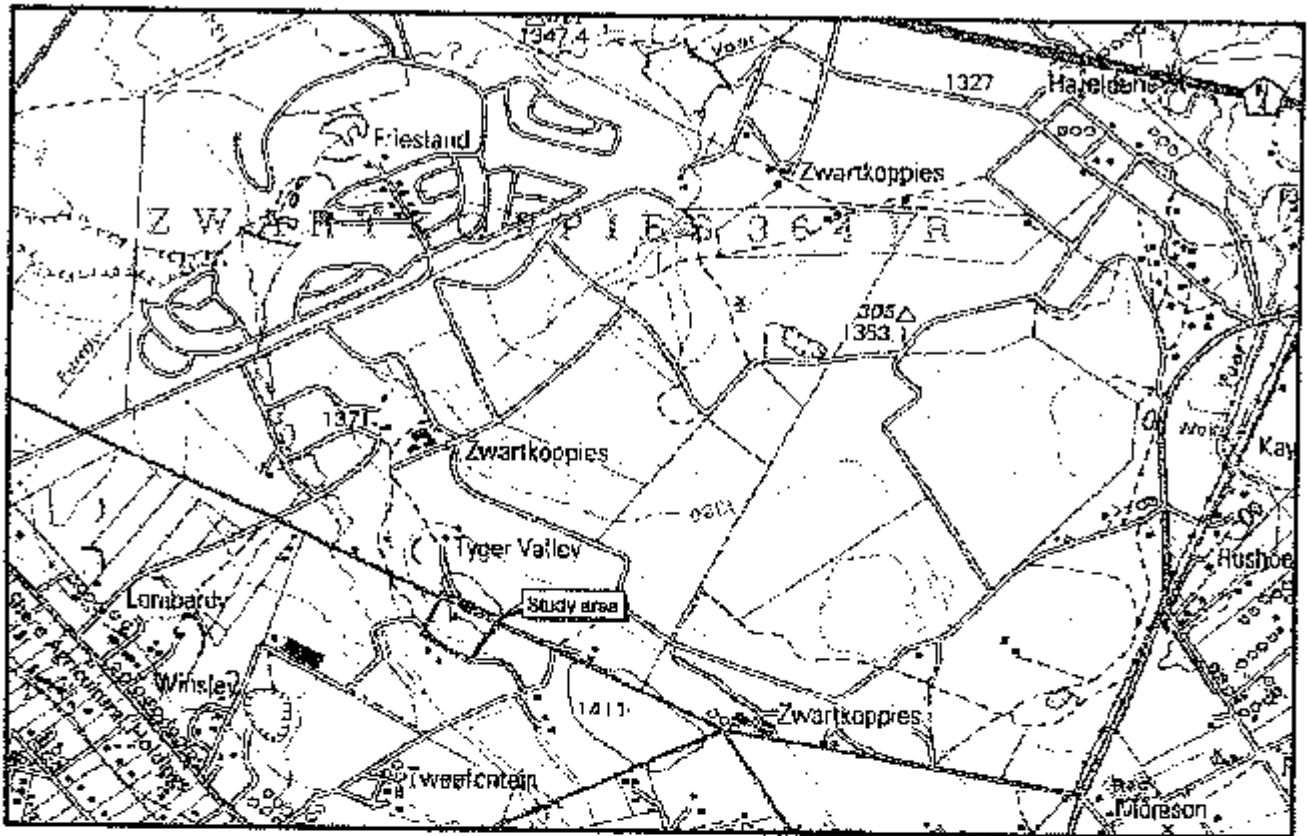


Figure 1. Location of the study area and the identified site (red dot).

Golden Mole Habitat Suitability



Appendix G5

Assessment of golden mole habitat suitability:

Portion 5 of the farm Tygervalley 344 JR

Compiled by Craig Jackson
Mammal Research Institute, University of Pretoria

Introduction

The present survey was undertaken by Craig Jackson following a request by Mrs Deshika Kathawaroo of Synergistics Environmental Services and included a site visit on Monday 7 March 2005. The assessment investigated the habitat suitability of the above-mentioned property for the Juliana's golden mole (*Neamblysomus julianae*), a red data species.

The Juliana's golden mole is endemic to South Africa. It is a range-restricted species that has only been recorded from three localities: Pretoria (Bronberg), Nylsvley area (120km away) and the Pretoriuskop region of the south-western Kruger National Park (400km). We currently cannot categorically say that these three populations are Juliana's golden moles, as they may possibly be three distinct species. Preliminary genetic evidence indicates that each of the three subpopulations may in fact represent separate species, making the conservation of each population even more important.

The golden mole is specialized for a life underground and lacks external ears and the eyes, which are not used, are covered with a layer of skin. It possesses strong forelimbs that are equipped with powerful pick like claws and a leathery hardened nose pad used to push through the sandy soil while burrowing. These animals live completely underground, they are weak diggers and confined to sandy soils through which they 'swim' in search of prey.

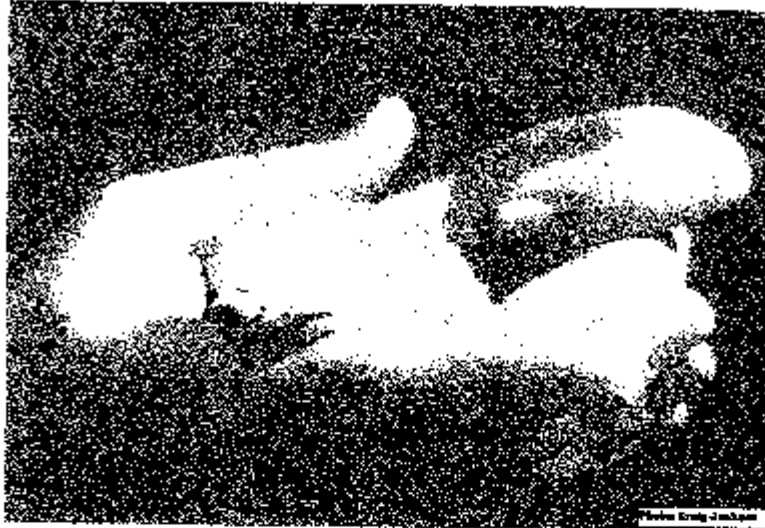


Figure 1. An adult Juliana's golden mole (*Neamblysomus julianae*)

The burrow systems comprise deep, permanent tunnels that link up to a nest, and a number of superficial foraging tunnels that are characterised by distinctive ridges of soil along the surface. These visible trails are only evident during summer rainfall months when the soil is moist enough for burrowing activity. This should be taken into consideration when conducting surveys, and any surveys done in the dry winter months may be very misleading.



Figure 2. A typical foraging tunnel produced by Juliana's golden moles. The green arrows indicate the trails that are usually inconspicuous to the untrained eye.

Present survey

The Pretoria population of the Juliana's golden mole occurs along the north and north eastern slopes and foot slopes of the Bronberg Ridge. These animals are restricted to this zone due to their dependence on the suitably sandy soil associated with underlying geology. The property in question is situated approximately 2km north east of the Bronberg Ridge but, with regards to soil properties, shares few similarities with the Ridge.

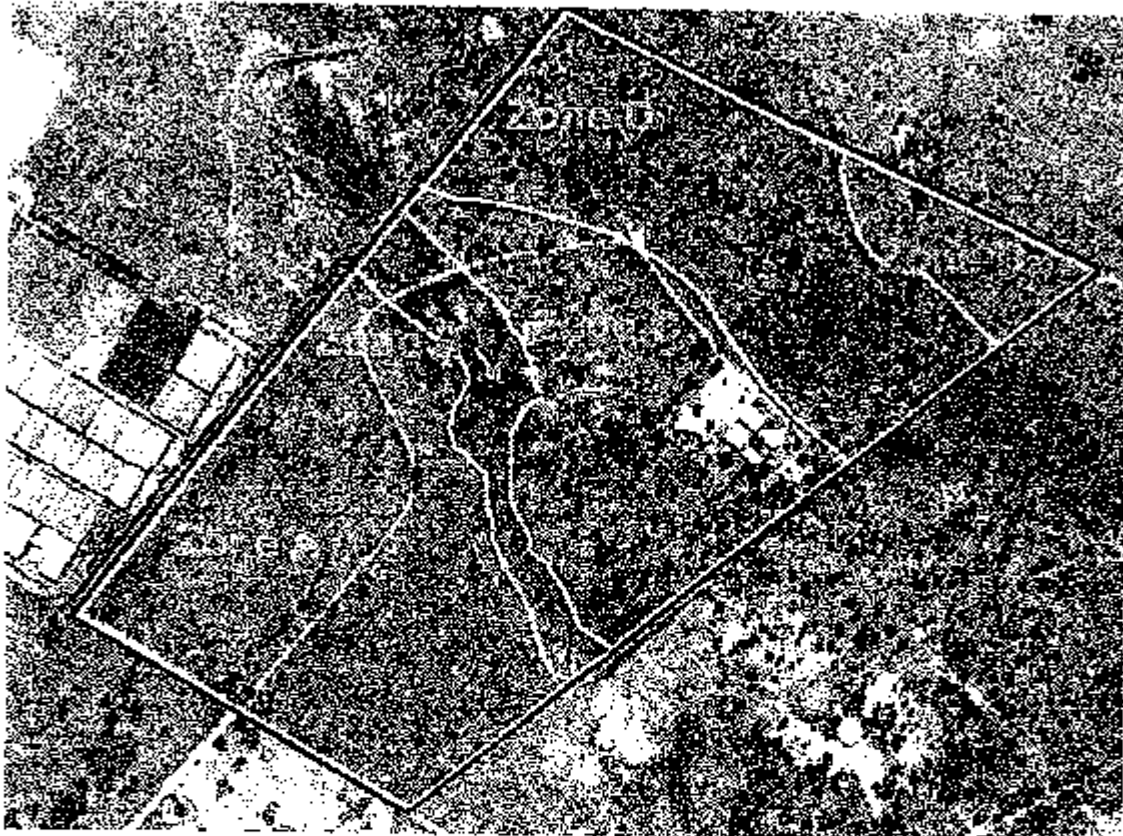


Figure 3. Portion 5 of the farm Tygervalley 344 JR with four different ecological zones indicated.

For the purposes of this study, the property can essentially be divided into four ecological zones, as shown in Figure 3. Zone A is a grassland area with relatively high clay content in the soil, resulting in a hard crust with very little loose, sandy soil. The seepage line that runs through the property is designated by Zone B and not suitable for the Juliana's golden mole. Zone C comprises a mixture of *Acacia* trees and grassland on a stonier substrate. A ridge runs through the northeastern portion of the property and forms Zone D. On top of the ridge, in the eastern corner of the property, a plateau is evident (Zone D₂) and differs slightly from the steep slopes of the remainder of the ridge (Zone D₁). The ridge area is extremely stony with relatively little exposed soil on the surface (See Figures 4 and 5). The plateau region has fewer stones and more soil than the greater part of the ridge.



Figure 4. A soil profile in Zone D indicating the prominent stony layer.

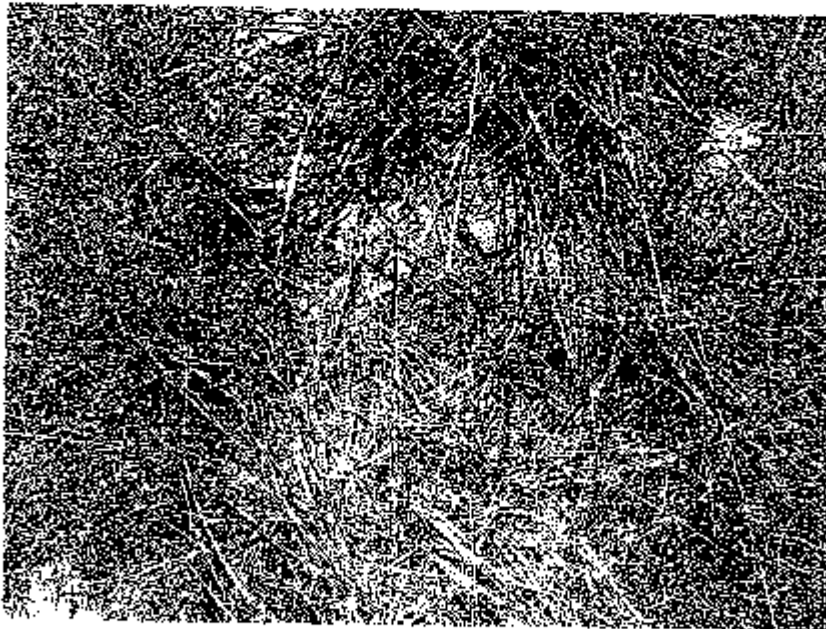


Figure 5. The stony surface as seen from above the soil.

All four Zones lack the characteristic ecological features associated with the Juliana's golden mole and the site can in no way be viewed as suitable habitat for this species. The species requires sandy soils in which the animals can move through easily in search of prey. No such areas were located on the property.

This study was done without prejudice and with no vested interest in any proposed development.

Wetland Delineation



Appendix G6

FINAL DRAFT

PRELIMINARY ASSESSMENT OF THE WETLAND ON PORTION 5 OF THE FARM TYGERVALLEY 334 JR

13 June 2005



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Executive Summary

Project and site description

A residential development north of Lynnwood Road is planned for Portion 5 of the farm Tygervalley 334 JR. A ridge occurs on the northern portion of the site, and a tributary of the Pienaars River transects the site from east to west. A dam has been constructed instream.

Methodology

Site visits were conducted on the 26th of February, and 1st and 30th of March 2005. The wetland was delineated, wetland zones identified and wetland functions determined. GPS points were taken of the drainage lines and wetlands, which were plotted on a map (Addendum B). Possible habitat for Red Data species was investigated, and species with a probability of occurring in the wetland areas are included in the document.

As part of the wetland assessment, a desktop study was conducted focussing on the groundwater and Red Data species. The groundwater information was obtained from the 1:500 000 Hydrogeological Map supplied by Department of Water Affairs and Forestry (Barnard, 2000). Red Data species information was obtained from the Gauteng Department of Agriculture, Conservation and Environment. Specialist publications and assessment during the site visits, (see reference list) were used to verify ecological and habitat requirements of Red Data species.

Statutory requirement related to wetlands

The following statutory requirements are applicable to the development:

- Conservation of Agricultural Resources Act, Regulations 7 and 8;*
- National Environmental Management Act, Section 4(a);*
- Constitution of South Africa, Section 24; and*
- Convention on Biological Diversity, Article 8;*

Wetland

The wetland is located along the drainage line, with temporary, seasonal and permanent zones occurring as a mosaic throughout the wetland. This mosaic effect was probably caused due to past disturbances in the area, resulting in a patchwork of wetter and drier zones within the wetland. Although the wetland has been impacted on extensively, the wetland is currently in a functional condition.

The damming of the wetland limits water flow on the property and therefore changes the water regime of the wetland. Rubble and soil have been dumped in various portions of the wetland, especially downstream of the dam wall on the property. Some erosion occurs in the drainage channel as well as along the main channel.

The functions of the wetland include flood attenuation, streamflow augmentation, sediment trapping and biodiversity maintenance (ecological integrity).

Wetland delineation

The wetland was delineated using the different criteria as discussed in the DWAF wetland delineation guide (DWAF 2003). Wetlands usually occur in depressions in valley bottoms, however they can occur on steep slopes and hills where they are fed by seeps. This wetland occurs in a valley bottom with a ridge to the north.

The soil wetness and duration of wetness, thereby indicating the different zones of the wetland, are indicated by the colour of the soil. The permanent zone has grey soil, while the seasonal and temporary zones have mottles and concretions. Soil zone D in the geotechnical report (Johan van der Merwe (Pty) Ltd), is the soil zone indicating the wetland and drainage areas on the property.

A variety of wetland and terrestrial plant species occur on the site. The site has been disturbed and many weeds or invasive species occur.

Red Data species

Seven Red Data species has potential of occurring on the site. The Red Data species include four bird species, one reptile species, one insect species and one plant species.

Recommendations

Various recommendations are suggested to limit the impact of the development on the wetland. The recommendations include that the development should remain 10m outside the delineated wetland area and mitigation measures regarding the bulk services, erosion, invasive species and rubble in the wetland. If these mitigation measures are adhered to during the construction and operational phases, it is anticipated that the function of the wetland and its inhabitants will remain.

June 2005

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Addendums

Addendum A – Site locality plan (1:50 000 topographic map)

Addendum B – Wetland map as delineated using vegetation indicators

Addendum C – Red Data Species potentially occurring on the site

Addendum D – Approximate location of wetland on layout map as delineated using the soil properties (Johan van der Merwe (Pty) Ltd 2005)

Addendum E – Geotechnical soil zones (Johan van der Merwe (Pty) Ltd 2005)

Addendum F – Wetland Rehabilitation Guidelines

1. INTRODUCTION

The Environmental Business Unit of Exigent Engineering Consultants CC was appointed by Synergistics Environmental Consultants to conduct a preliminary wetland assessment of Portion 5 of the farm Tygervally 334 JR.

The following was addressed during the wetland assessment:

- Wetland survey, focussing on the probable occurrences of Red Data species and potential habitat;
- The wetland was delineated according to scientifically recognisable delineation techniques; and
- A sensitivity map was compiled of the wetland, drainage and seepage lines on the property.
- Wetland rehabilitation guidelines have been included.

Due to the limited extent of wetlands and the valuable functions performed by them, wetlands are regarded as sensitive habitats. Wetlands are protected by various parts of legislation and international conventions. The functions performed by a wetland include direct and indirect functions. The direct functions of a wetland are apparent immediately, such as the provisioning of harvestable resources. The indirect functions are not as apparent, such as the cleaning of water resources. The impact of one wetland in a catchment may therefore be small within the overall picture, but the cumulative impact will be vast.

2. PROJECT DESCRIPTION

A residential development is planned for Portion 5 of the farm Tygervally 334 JR. The development will cover an area of 21.41ha. This includes the housing, private open space, access control, internal access, public roads and the clubhouse.

3. SITE DESCRIPTION

The site is located to the north of Lynwood Road just outside the municipal boundaries of Tshwane and to the south-east of Silverlakes. A ridge occurs on the northern portion of the site, and a stream (flowing into the Pienaars River further downstream) transects site from east to west. A small gravel road provides access to the site on the southern portion of the site and crosses the stream over a dam wall that has been constructed in the stream on the property. The development will be located outside the 1:50 year flood line.

4. METHODOLOGY

Site visits were conducted on the 28th of February, and 14th and 30th of March 2005. The wetland was delineated, and wetland zones identified. The functions of the wetland were also determined. GPS points were taken of the drainage lines and wetlands, which were plotted on a map (Addendum B). Possible habitat for Red Data species was investigated, and species with a probability of occurring in the wetland areas are included in the document.

The wetland was delineated according to the Department of Water Affairs and Forestry (DWAF) field guide (2003), "A practical field procedure for identification and delineation of wetlands and riparian areas".

The DWAF field guide makes use of indirect indicators of prolonged saturation by water, namely wetland plants (hydrophytes) and (hydromorphic) soils. The presence of these two indicators is indicative of an area that has sufficient saturation to classify the area as a wetland. The terrain unit is also an effective indicator to determine where wetlands are most likely to occur. Not all parts of a wetland will be saturated for the same duration. Therefore a wetland may be divided into three zones, depending on the changing frequency of the wetland. These zones are; the permanent zone, which is nearly always saturated, the seasonal zone surrounds this zone, these areas are saturated for a significant duration during the rainy season. The temporary zone in turn surrounds the seasonal zone, this zone is only saturated for long enough to encourage the formation of hydromorphic soils and the growth of wetland vegetation. The object of delineation is to determine the outer edge of the temporary zone, which indicates the boundary between the wetland and adjacent terrestrial areas (DWAF 2003).

Four specific indicators must be taken into consideration to determine the outer edge of the temporary zone (DWAF 2003):

- a. The terrain unit indicator;
- b. Soil form indicator;
- c. Soil wetness indicator; and
- d. Vegetation indicator.

Wetland Assess (Kotze *et al*, 2004) is a valuable tool used to assess the various functions of a wetland in a qualitative way. Individual wetlands differ according to their functions and characteristics, and Wetland Assess can be used to give an estimation of the wetland functions for individual wetlands. Wetland Assess is only a baseline study, and should not replace more in depth studies. The system has been developed to assess individual wetlands for comparative purposes, and do not give the cumulative value of a group of wetlands. Wetland Assess can however be used to prioritise wetlands for management and rehabilitation, and can be used to indicate important wetland benefits when managing individual wetlands. It can also be used in catchment planning to determine the importance of a wetland in the catchment context. It is therefore a useful preliminary tool in determining wetland function and prioritisation.

Wetland Assess has two levels of assessment. The level 1 assessment is a desktop study. Based on previous studies certain ecosystem services can be associated with hydro-geomorphic wetland types. The level 2 assessment is a rapid field assessment. Seven benefits can each be assessed according to the specific characteristics that are associated with each particular benefit (Kotze *et al*, 2004).

A desktop study was conducted focussing on the groundwater and the Red Data species. The groundwater information was obtained from the 1:500 000 Hydrogeological Map supplied by DWAF (Barnard, 2000). Red Data species information was obtained from the Gauteng Department of Agriculture, Conservation and Environment (GDACE). Specialist publications (see reference list) were also used to verify ecological information for the Red Data species.

In addition to the Red Data species desktop study the potential habitat for Red Data species on site was investigated during the field visit.

5. STATUTORY REQUIREMENTS RELATED TO WETLANDS

Various pieces of legislation provide statutory requirements when dealing with wetland areas. They have been summarised below.

5.1 CONSERVATION OF AGRICULTURAL RESOURCES ACT

Various regulations promulgated in terms of the **Conservation of Agricultural Resources Act** are relevant in terms of wetlands:

Regulations from Conservation of Agricultural Resources Act (No 43 of 1983)

Regulation 7:

- (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and subregulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside such flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.
- (3) Except on authority of a written permission by the executive officer, no land user shall – (a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on the farm unit

Regulation 8:

- (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), no land user shall in any manner whatsoever divert any run-off water from a watercourse on his farm unit to any other watercourse, except on authority of a written permission by the executive officer.
- (4) No land user shall effect an obstruction that will disrupt the natural flow pattern of run-off water on his farm unit or permit the creation of such obstruction unless the provision for the collection, passing through and flowing away of run-off water through, around or along that obstruction is sufficient to ensure that it will not be a cause for excessive soil loss due to erosion through the action of water or the deterioration of the natural agricultural resources.

5.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The principles underpinning environmental management contained in the National Environmental Management Act, must be taken into account by any organ of state in the exercise of any power that may impact on the environment. Section 4(a) states that sustainable development requires the consideration of all relevant factors including the following:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That the development, use and exploitation of renewable resources and the ecosystems of which they are a part do not exceed the level beyond which their integrity is jeopardised;
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

5.3 CONSTITUTION OF SOUTH AFRICA

The Constitution of South Africa also creates a duty on the State to conserve and rehabilitate wetlands.

Section 24 provides that:

**Everyone has the right –*

(b) *to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that-*

- i) *prevent pollution and ecological degradation;*
- ii) *promote conservation; and*
- iii) *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*.*

5.4 CONVENTION ON BIOLOGICAL DIVERSITY

In terms of the Convention on Biological Diversity, to which South Africa is also a party:

- the State has a duty to conserve wetlands and a duty to rehabilitate them.

Article 8 provides that:

**Each Contracting Party shall, as far as possible and as appropriate:*

(c) *Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;*

(f) *Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.*

(g) *Develop or maintain necessary legislation and/or regulatory provisions for the protection of threatened species or populations*.*

6. BIOPHYSICAL DESCRIPTION OF THE SITE

The site is located in the Rocky Highveld Grassland (Veld type 34) according to Low & Rebelo (1996) and the Bankenveld (Veld type 61) according to Acocks (1988). The lithology of the site is of the Transvaal supergroup, Pretoria group, Silverton formation. This formation consists of layers of shale (Keyser, 1997).

6.1 Wetland

According to the National Water Act (Act no 54 of 1956) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.*"

6.1.1 Origin and characteristics

A wetland occurs along the drainage line transecting the site from east to west. The drainage line has temporary, seasonal and permanent zones occurring as a mosaic throughout the wetland area. This mosaic effect was probably caused due to past disturbance in the area, which resulted in a patchwork of wetter and drier zones within the wetland. The dumping of rubble in the wetland and the damming of the drainage line results in a change in the water regime of the site, as well as a change in the flow patterns, which resulted in a change in the micro topography of the wetland. Due to the mentioned disturbances, the slope of wetland is steep and the valley part undulating.

Wetlands are usually divided into three zones, with various different vegetation structures and species. These factors all contribute to the ability of the wetland to retain its ecological integrity and maintain biodiversity. The wetlands most important function is therefore probably biodiversity maintenance. The wetland should therefore be protected to maintain the current biodiversity or to improve it by removing alien and invasive species.

The large amount of dams in the catchment could have played a role in the formation of the wetland. It is likely that this is a historical wetland.

Although of the wetland has been impacted on extensively, the wetland is in functional condition. The three different zones contribute to the species and habitat diversity the site has to offer. The wetland is therefore an important site to conserve biodiversity in the area. The wetland may have a flood attenuation function, but this is limited by the damming of the water course, both upstream and downstream of the wetland. The zones of this wetland are not clearly defined due to mentioned impacts, thereby creating the mosaic of wetland zones (wetter and drier zones throughout the wetland).

6.1.2 Impacts

The drainage line has been dammed directly east of the site, almost on the border between the site and the adjacent property. The drainage line has also been dammed on the property, close to the western border, and a road was constructed across the drainage line on the dam wall. The damming of the wetland limits water flow on the property and therefore changes the water regime of the wetland.

Rubble and soil have been dumped in various portions of the wetland, especially downstream of the dam wall on the property. The dumped material affects the water flow dynamics and the distribution of the different wetland zones in the wetland. The dumped material will have to be removed if the wetland is rehabilitated, which will result in the enhancement of wetland functions.

Some erosion occurs in the drainage channel as well as next to the channel. This contributes to siltation in the wetland as well as to the canalisation of the drainage line.

According to the layout map of the proposed development some units will be located within the boundaries of the wetland. The construction activities and the structures will have a negative impact on the wetland on the property as this will alter the water regime on the site. Water flow from the rest of the property should not be cut off from the wetland and should not be concentrated into the wetland. Should the water be cut off from the wetland the wetland will dry out. Alternatively, should the water flow into the wetland be concentrated, as through a pipe or concrete channel, erosion will take place in the wetland.

6.1.3 Functions

The functions of the wetland include flood attenuation, streamflow augmentation, sediment trapping and biodiversity maintenance (ecological integrity). The wetland has been dammed on the property and on the property upstream by the dam wall, which impact on the functions that can be performed by the wetland. The functions of flood attenuation and streamflow augmentation of the wetland are probably limited due to the damming at both sides of the property. The dam walls will hold back most of the water during a flood, but the wetland will still perform these functions once the dam's holding capacity has been reached. The dams probably increase the wetland's ability to trap sediment, but the sediment will have to come from the sides of the wetland and not down the stream channel. Erosion is taking place in the areas next to the wetland and this sediment will be trapped by the wetland or the dams occurring in the stream.

6.2 Wetland delineation

The wetland as indicated by the soil properties (Geotechnical report by Johan van der Merwe (Pty) Ltd 2005) is included in Addendum D. The species characteristic of wetlands do not however occur over this entire area, but are limited to the areas as shown on the map attached in Addendum B. Both of these indicate the presence of the wetland, but the soil retains wetland properties longer and at times when the vegetation will not necessarily indicate wetland conditions, such as in a dry year. The soil may therefore indicate the historical presence of the wetland or it may simply be an indication of the extreme limits of the wetland during wet years.

6.2.1 Terrain Unit

The terrain unit can be used as an indicator to determine where a wetland is likely to occur. Wetlands usually occur in depressions in valley bottoms, however they can occur on steep slopes and hills where they are fed by seeps. This wetland occurs in a valley bottom with a ridge to the north. It is clear from the relief of the site that the wetland is located in a low-lying area. The drainage lines can also be distinguished from the small-scale contour lines.

6.2.2 Soil

The soil wetness and duration of wetness are indicated by the colour of the soil. Grey soil is an indication of wetness for prolonged periods of time and mottles indicate fluctuating wetness. The permanent zone of a wetland is therefore characterised by grey soil, the seasonal zone has a high frequency of mottles and the temporary zone has less mottles. Soil in the terrestrial zone surrounding the wetland does not have soil mottles (DWAF 2003).

Due to the physical attributes indicative of wetness in the soil, some soil forms can be classified as wetland soils. Soil forms indicative of the permanent zone of the wetland include Champagne, Katepruit, Willowbrooke and Rensburg, while the following soil forms indicate the seasonal and temporary zones of a wetland: Inhoek, Tsitsikamma, Houwhoek, Molopo, Kimberley, Jonkersberg, Groenkop, Etosha, Addo, Brandvlei, Glenrosa and Dundee (DWAF 2003). It has been stated by ARC (2005) that "*around the dam, dark fine structured clayey top soils may occur giving the topsoil a melanic character. In those cases the Willowbrook soil form occurs*".

The site has been divided into four soil zones (A to D) according to the geotechnical report (Johan van der Merwe (Pty) Ltd, 2005). Soil zone D is the zone that "covers the central, lower-lying portion of the site where the major drainage feature is located as well as a number of subtle, subdued drainage features that occur elsewhere across the site" (Johan van der Merwe (Pty) Ltd, 2005). The geotechnical map indicating the locations of the different soil zones is included in Addendum E. The soil colour and wetness, as well as the vegetation have been regarded as sufficient proof that a wetland occurs on the site.

The permanent zone is located in standing water or in soil with the water just below the surface, the soil has a very high clay content and is dark grey-black in colour. The soil in the seasonal zone has a higher density of mottles, has a very high clay content and is dark brown in colour, with red and yellow mottles and concretions. The soil in the temporary zone of the wetland had some mottles and was yellowish brown in colour, with some metal concretions, and a very high clay content. In another part of the wetland, in one of the drainage areas, the temporary zone had dark red clay soil with mottles. It is therefore assumed that there is more than one soil form representing the temporary zone of the wetland. The soil is infrequently inundated for short periods of time.

It has been suggested by Johan van der Merwe (Pty) Ltd 2005, that "flood lines should be determined accurately and areas that may be affected by seasonal flooding and standing water conditions, should be excluded from the development". The wetland as determined by the soil profile and overlain over the layout plan is attached in Addendum D.

6.2.3 Species composition

6.2.3.1 *Flora*

A variety of wetland and terrestrial species occur on the site. The site has been disturbed and many weeds or invasive species occur. The disturbance contributed to the mosaic affect of the zones in the wetland.

The wetland has been delineated according to the wetland vegetation occurring on site and the map is included in Addendum B.

Permanent zone

The permanent zone of the wetland is distributed in a mosaic pattern along the drainage channel, interspersed with the seasonal and temporary zones. The portion of the wetland occurring downstream of the dam on the property has greater disturbance from rubble dumping than the portion upstream of the dam on the property and has more alien species.

Table 1. List of species occurring in the Permanent Zone

Permanent zone	Habitat
Grasses & Sedges	
* <i>Arundo donax</i>	Favours moist, not wet, conditions, but can grow in standing water
<i>Leersia hexandra</i>	In or near permanent water sources. Dense stands in shallow water or wet soil.
<i>Paspalum dilatatum</i>	Moist places such as vlei areas and near rivers. Mostly loam and clay soil. Often weeds in gardens, cultivated lands, roadsides and lawns
Forbs	
* <i>Persicaria lapathifolia</i>	Swamps, widespread
<i>Typha capensis</i>	Swampy areas and next to streams

* Indicates exotic species

Seasonal zone

The seasonal zone occurs in a mosaic pattern throughout the wetland in areas that are wetter than the temporary zone, but drier than the permanent zone. The seasonal zone consists of various patches with different dominant species. There are therefore different plant communities within the seasonal zone.

Table 2. List of species occurring in the Seasonal zone

	Habitat
Trees & shrubs	
* <i>Eucalyptus</i> species	Watercourses, roadsides
Grasses & Sedges	
<i>Andropogon eucomus</i>	Wet areas such as vleis, riverbanks, road reserves & seepage areas. Disturbed soil.
<i>Cyperus rotundus</i>	In moist disturbed places
<i>Cyperus textilis</i>	On stream and river banks and in marshy areas
<i>Eragrostis plana</i>	Grows in disturbed places in all types of soil. Mostly damp patches. (sub-climax)
<i>Leersia hexandra</i>	In or near permanent water sources. Dense stands in shallow water or wet soil.
<i>Mariscus</i> species	
<i>Panicum</i> species	
<i>Schoenoplectus corymbosus</i>	Swampy grassland
Forbs	
* <i>Bidens pilosa</i>	Cosmopolitan weed, common in disturbed areas
<i>Chamaecrista mimosoides</i>	Grassland
* <i>Coryza albidia</i>	Common weed of disturbed areas and crops
<i>Coryza podoccephala</i>	In disturbed grassland and road reserves
<i>Denekia capensis</i>	Widespread in moist areas and shallow water
<i>Gomphostigma virgatum</i>	Next to streams, usually in running water between rocks
<i>Lotononis listii</i>	Widespread in grassland, especially moist areas
* <i>Oenothera rosea</i>	Mostly moist disturbed areas. Sometimes in shade
<i>Phyllanthus parvulus</i>	Widespread in grassland
<i>Senecio</i> species	
<i>Sida dregel</i>	Normally in shade under trees

<i>*Tagetes minuta</i>	Common weed of disturbed areas and cultivated fields. Widespread
<i>Teucrium trifidum</i>	Bushy areas, often in colonies under trees
<i>Typha capensis</i>	Swampy areas and next to streams
<i>*Verbena brasiliensis</i>	A general weed in disturbed and moist areas

* Indicates exotic species

Temporary zone

The temporary zone includes the seepage areas entering the wetland as well as the temporary zone on the outside of the wetland. The temporary zone has patches of highly disturbed vegetation dominated almost completely by exotic species, as well as areas retaining most of its ecological integrity. This mosaic quality of disturbance and ecological functions results in the large number of species found in the temporary zone.

Table 3: List of plant species in the temporary zone

Temporary Zones	Habitat
Trees & shrubs	
<i>Acacia karoo</i>	Bushveld, grassland and coastal dune forest
<i>*Acacia mearnsii</i>	Invader of grassland, forest gaps, roadsides and watercourses
<i>Geltis africana</i>	Forest, bushveld and grassland. It often occurs on dolomite
<i>Diospyros lycioides</i>	Occurs in a wide variety of habitats
<i>*Eucalyptus species</i>	
<i>Rhus lancea</i>	Occurs in a wide variety of habitats, often on calcareous substrates
<i>Rhus pyroides</i>	Wide variety of habitats
<i>Rhus zeyheri</i>	Bushveld, often in rocky places or on dolomite
Grasses & Sedges	
<i>Aristida transvaalensis</i>	Bushveld, between rocks (Pioneer)
<i>Digitaria eriantha</i>	Grows along side vleis
<i>Eragrostis chloromelas</i>	Stony slopes in sandy and loam soil. More often in open grassland than bushveld. (sub-climax / climax)
<i>Eragrostis gummiflua</i>	Open grassland and bushveld. Often road reserves and other disturbed places. Also damp areas such as seepage zones. Mostly sandy and gravelly soil. (Sub-climax)
<i>Eragrostis plana</i>	Grows in disturbed places in all types of soil. Mostly damp patches. (sub-climax)
<i>Eragrostis species</i>	
<i>Eragrostis superba</i>	In disturbed places, mostly in sand, loam and gravelly soil. Sometimes in clay soil and on termite mounds. (sub-climax)
<i>Hyparrhenia tamba</i>	In road reserves, especially where water collects and in damp soil next to rivers and vleis. (climax)
<i>Imperata cylindrica</i>	Poorly drained, damp soil such as vleis and riverbanks where it forms dense stands. Also other habitat types in areas with a high rainfall.
<i>Melinis repens</i>	Disturbed places
<i>Panicum species</i>	
<i>Paspalum dilatatum</i>	Vlei areas and near rivers, also in disturbed places
<i>Setaria sphacelata</i>	
<i>Themeda triandra</i>	Abundant in undisturbed open veld. On any type of soil, but mostly clay soil.
<i>Trachypogon spicatus</i>	Mostly open undisturbed grassland. Often near vleis. Mostly in sandy and gravelly soil

Forbs	
<i>Aloe greatheadii</i> var. <i>davyana</i>	Grass and bushveld, often in overgrazed areas
* <i>Amaranthus hybridus</i>	Weed of disturbed places
<i>Asparagus species</i>	
<i>Asparagus suaveolens</i>	Rocky grassland in Bushveld
<i>Berkheya radula</i>	Moist grassland and wetlands
* <i>Bidens pilosa</i>	Cosmopolitan weed, common in disturbed areas
<i>Chamaecrista mimosoides</i>	Grassland
* <i>Coryza albida</i>	Common weed of disturbed areas and crops
<i>Crabbea species</i>	
<i>Gomphocarpus physocarpus</i>	In disturbed areas in grassland
<i>Helichrysum rugulosum</i>	Grassland
* <i>Hibiscus trionum</i>	Grassveld and disturbed places, often a weed of cultivated land
* <i>Ipomoea purpurea</i>	Weed of disturbed places
<i>Lantana rugosa</i>	Common in bushclumps in rocky hills, in shade
<i>Monsonia angustifolia</i>	Grassveld and bushveld, often in disturbed places.
* <i>Oenothera rosea</i>	Mostly moist disturbed areas. Sometimes in shade
<i>Schkuhnia pinnata</i>	Common weed
<i>Senecio affinis</i>	Widespread in grassland
<i>Sida dregei</i>	Normally in shade under trees
* <i>Solanum mauritianum</i>	Weed, mostly in bushclumps, and next to rivers and streams
<i>Solanum panduriforme</i>	Widespread in grassland
<i>Stoebe vulgaris</i>	Widespread in grassland. Increase in overgrazed veld
* <i>Tagetes minuta</i>	Common weed of disturbed areas and cultivated fields. Widespread
* <i>Verbena brasiliensis</i>	A general weed in disturbed and moist areas
<i>Vernonia oligocephala</i>	Common in grassland, widespread
* <i>Zinnia peruviana</i>	Naturalised weed. Often in disturbed places and in the shade of bushclumps

* Indicates exotic species

6.2.3.2 Invasive species

Category 1 plants are plants that will no longer be allowed to occur on any property in South Africa, because their harmful properties outweigh their useful qualities. The plants may not be planted or propagated in any way and existing individuals should be removed. These species may not be transported or allowed to disperse (Landcare South Africa). Category 1 invasive species found on the site is *Arundo donax* and *Solanum mauritianum*.

Category 2 plants are plants proven to have a potential for becoming invasive, but with commercial value. Provision is made in CARA in Regulation 15 and 16 for the species to occur in certain demarcated areas, but the species has to be removed from all areas outside the demarcated areas. An area for the growing of category 2 plants can only be demarcated by the Executive Officer. Since the growing of category 2 plants qualifies as a water use, a water use licence has to be obtained from Department of Water Affairs and Forestry (DWAF) for an area of 1ha and larger. It is also important to ensure that all reasonable steps have been taken to stop the spread of the species to other areas, through seed or vegetative growth. Category 2 plants may never occur within 30m of the 1:50 year floodline of any wetlands or watercourses (Landcare South Africa Date). Category 2 plants occurring on the site are *Acacia mearnsii* and *Eucalyptus* species.

Category 3 plant invaders are plants that are proven to have the potential of becoming invasive. These plants are however popular garden plants (ornamentals or shade trees) and it will take a long time to replace these species. Category 3 plants are not allowed to occur anywhere, unless the plants were already in existence when the regulations came into effect. The conditions for the plants to remain is that all reasonable measures are taken to prevent the spread of the species and that none of the plants occur within 30m of the 1:50 year flood zone of any wetlands or water courses. No propagative material of these plants may be planted, imported or transported in any way. It is however legal to trade the wood of these plants as well as other products that do not have the potential to grow (Landcare South Africa). *Ipomoea purpurea* is a category 3 plant occurring on the site.

6.3 Red Data species

Potential habitat for Red Data plants, mammals, birds, reptiles, amphibians and invertebrates were assessed. Although possible habitat for some Red Data species occurs on site, it should be taken into account that the habitat is disturbed and this may influence the occurrence of the species. The site is however surrounded by agricultural developments and low density developments. According to the GDACE Red Data database no potential Red Data mammal species occurs on site.

Most of the Red Data invertebrate species potentially occurring on the site occur on the ridge areas (M Forsyth, GDACE, *pers com* 12/04/2005). The only invertebrate species potentially occurring on site in the wetland area is the Marsh sylph (*Matisella meninx*). The host plant of this species, *Leersia hexandra* (http://www.lepsoc.org.za/red_data_book.htm, May 2005), has been observed on site. This butterfly species occurs widespread throughout the country. However, the species requires a number of habitat requirements to occur on the site.

Only one Red Data reptile and one Red Data plant species can possibly occur on site. The reptile species is the African Rock Python (*Python natalensis*), found in savanna, especially riverine areas and the plant species is *Galamagrostis epigeios* var. *capensis*, a species occurring in wetland areas and has been recorded in the quarter degree grid. Four Red Data bird species can possibly occur on the site and are listed in Addendum C.

Listed in Addendum C are all the Red Data species, which could potentially utilise the site.

7. BUFFER ZONES

Buffer zones are collars of land around sensitive areas that filters out the negative influences from adjacent activities. These include the effects of invasive plant and animal species, abiotic habitat alterations and pollution. Buffer zones can also provide more space for the functioning of ecological processes (Pfab, 2000).

There is a lot of debate on the width of a buffer zone that is required. These are a few guidelines:

- According to the Gauteng Red Data Plant Policy (Pfab, 2000) if Red Data plant species have been found on the site a buffer zone between 300m and 600m around the population is needed, depending on the species and the area. If suitable habitat occurs for a Red Data species to be present the habitat should be mapped and no structures may occur within the habitat for priority A1 and A2 species (critically endangered and endangered species), and disturbance of the natural environment should be kept to a minimum. In the case of priority B species (vulnerable species), impacts on the suitable habitat should be mitigated.
- According to the GDACE Ridge Policy (Pfab, 2001) a 200m buffer zone should be allowed around a Class 2 ridge.
- According to the Carolinian Canada Draft Guide for the Determination of Setbacks and Buffers (<http://www.carolinian.org>, 23 May 2003) the minimum buffer sizes are:
 - For wildlife habitat – 100 m
 - Woodlands – 10 m beyond drip line of trees
 - Wetlands – 30 m
 - Watercourses – 30 m from high water mark
 - Corridors – 100 m (urban) and 200 m (rural)

A development has different impacts on the surrounding environment and on a wetland. The development changes the infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. A hard impervious surface adjacent to the wetland will block normal water flow to the wetland, while increasing stormwater flow during a rainfall event. The combination of these factors will lead to the degradation of the wetland and erosion within the wetland and drainage line. Legislation requires a 10m area around wetlands, where no development or cultivation may take place. It is therefore suggested that a 10m buffer zone be placed around the wetland to limit the impact of the development on the wetland.

8. RECOMMENDATIONS

The following recommendations are made based on the wetland system and its functions:

- **Development buffer zones:** Development should remain outside all the wetland zones. A buffer zone of 10m is recommended around the wetland to limit the impacts of the development on the wetland. A channel can be constructed as indicated on the layout map of the regional townplanners, Vlietsra Town and Regional Planners Layout in Addendum D, to replace the existing drainage line running northwards to the wetland, but the channel has to be planted with suitable indigenous vegetation. The channel should not be lined with concrete. Suitable erosion control measures have to be implemented to prevent erosion in the channel as well as in the wetland.
- **Bulk services supply:** As the natural slope is towards the wetland, it is required that adequate protection be given to the services supply, especially sewerage.
- **Wetland rehabilitation:** Guidelines have been included for wetland rehabilitation (Addendum F).
- **Erosion:** In order to prevent erosion towards the wetland zones during the construction phase, physical protection measures will be required. Revegetation of the disturbed areas should occur as soon as possible after construction.
- **Protection of natural habitat:** Minimal areas should be disturbed for construction purposes.
- **Invasive species:** All invasive species should be removed and the wetland rehabilitated.
- **Rubble in wetland:** The rubble and soil that has been dumped in the wetland should be removed to rehabilitate the wetland. No dumping of rubble into the wetland should be allowed during construction and operation.

9. CONCLUSION

This document provides a status quo of the wetland on the proposed development site on Portion 5 of the farm Tygervalley 334 JR. Visible signs of disturbances occur on the site.

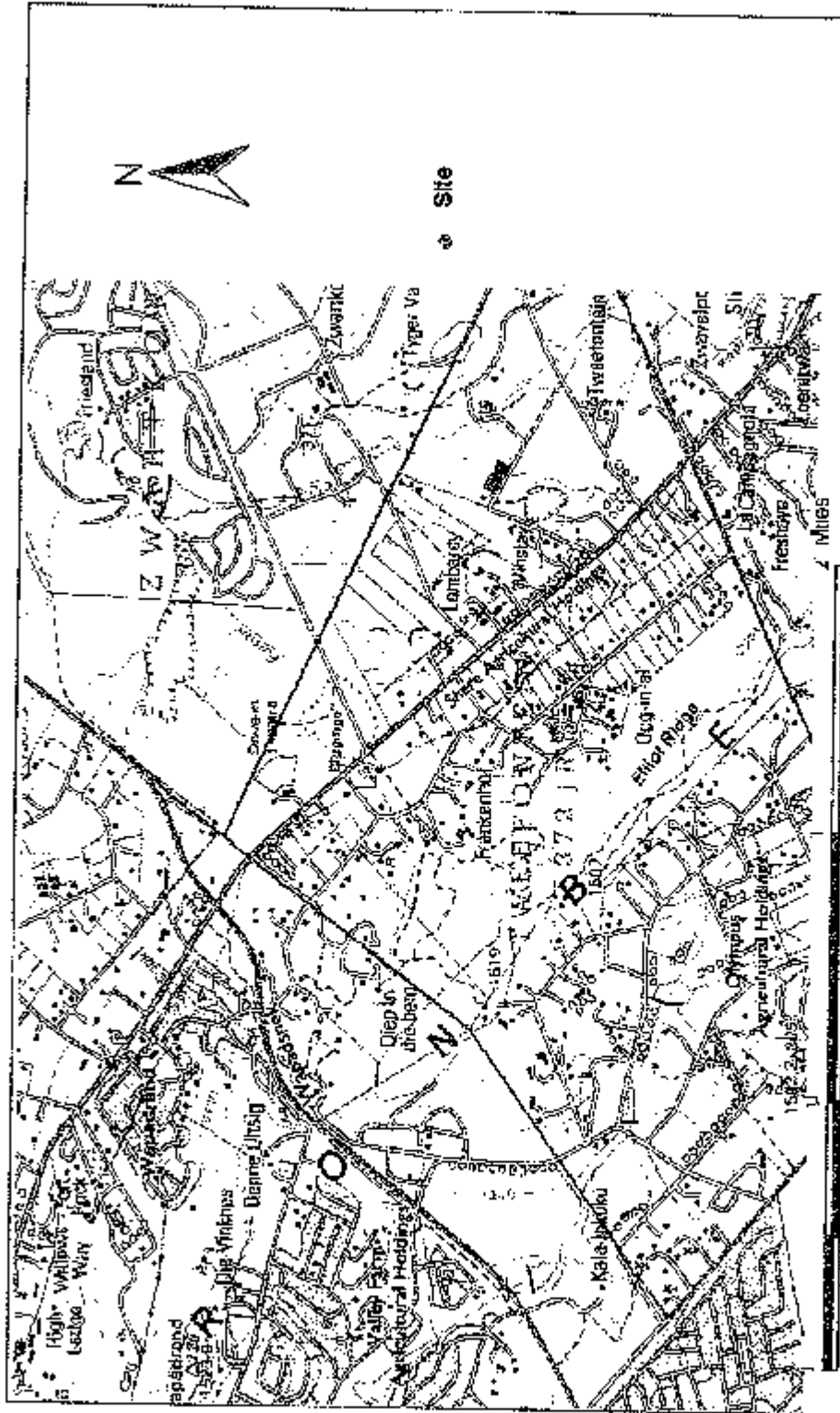
The wetland zones have been identified and the species occurring in each zone identified. The functions performed by the wetland have been identified. The most important of these functions is probably biodiversity maintenance and as habitat for Red Data species. The wetland provides potential habitat for Red Data species, mainly bird species and one invertebrate species. If the wetland habitat is not disturbed, the habitat for these species should remain undisturbed.

The wetland is not in a pristine state, however it does contribute to habitat diversity and flood attenuation. Several recommendations as well as a guideline for rehabilitation of the wetland, have been made with regards to the proposed development. If these mitigation measures are adhered to during the construction and operational phases, it is anticipated that the function of the wetland and its inhabitants will remain.

10. REFERENCES

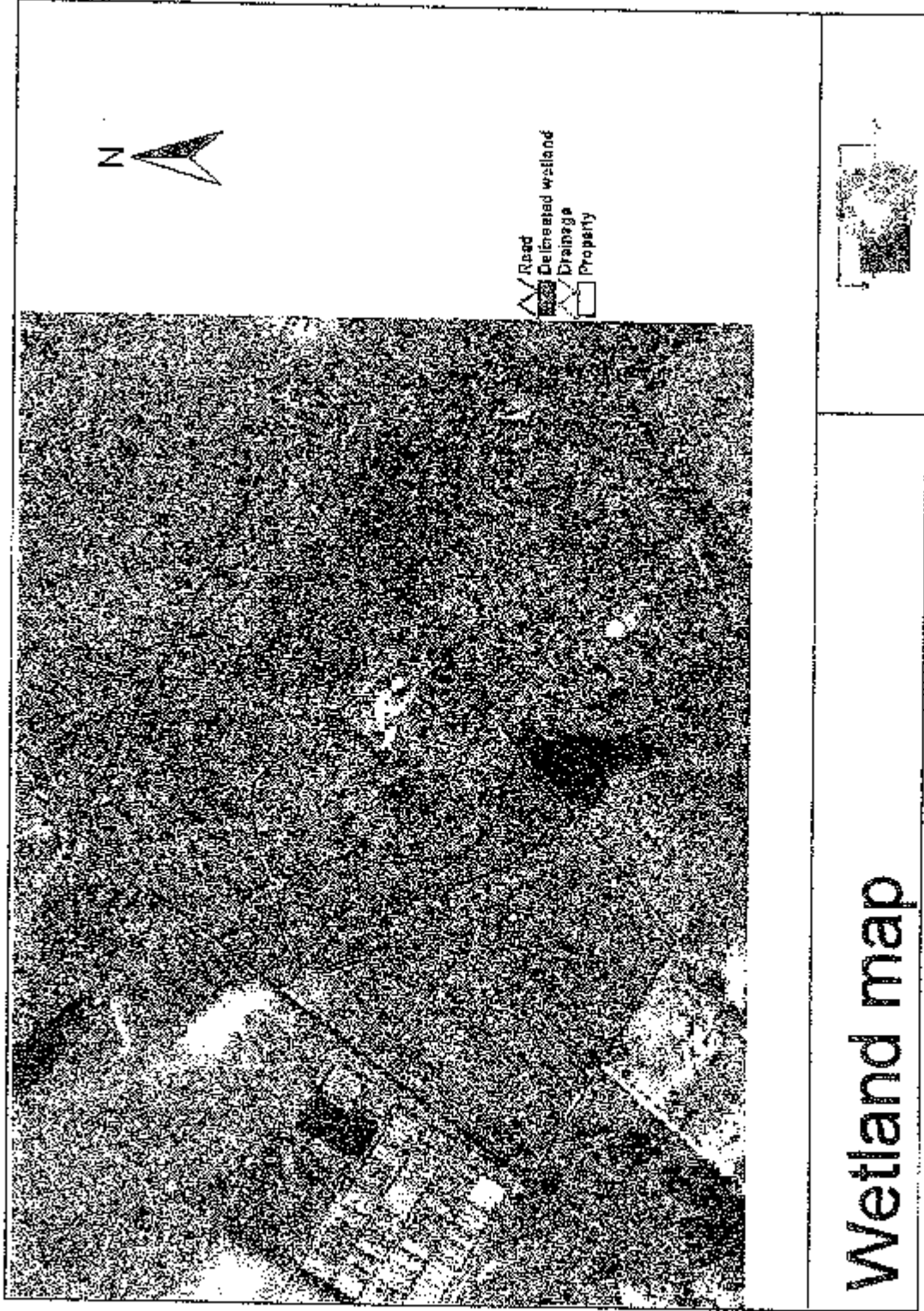
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Addendum A – Site locality plan



Portion of 1:50 000 map 2528CD

Addendum B – Wetland map as delineated using vegetation indicators



Wetland map

Addendum C – Red Data Species potentially occurring on the site

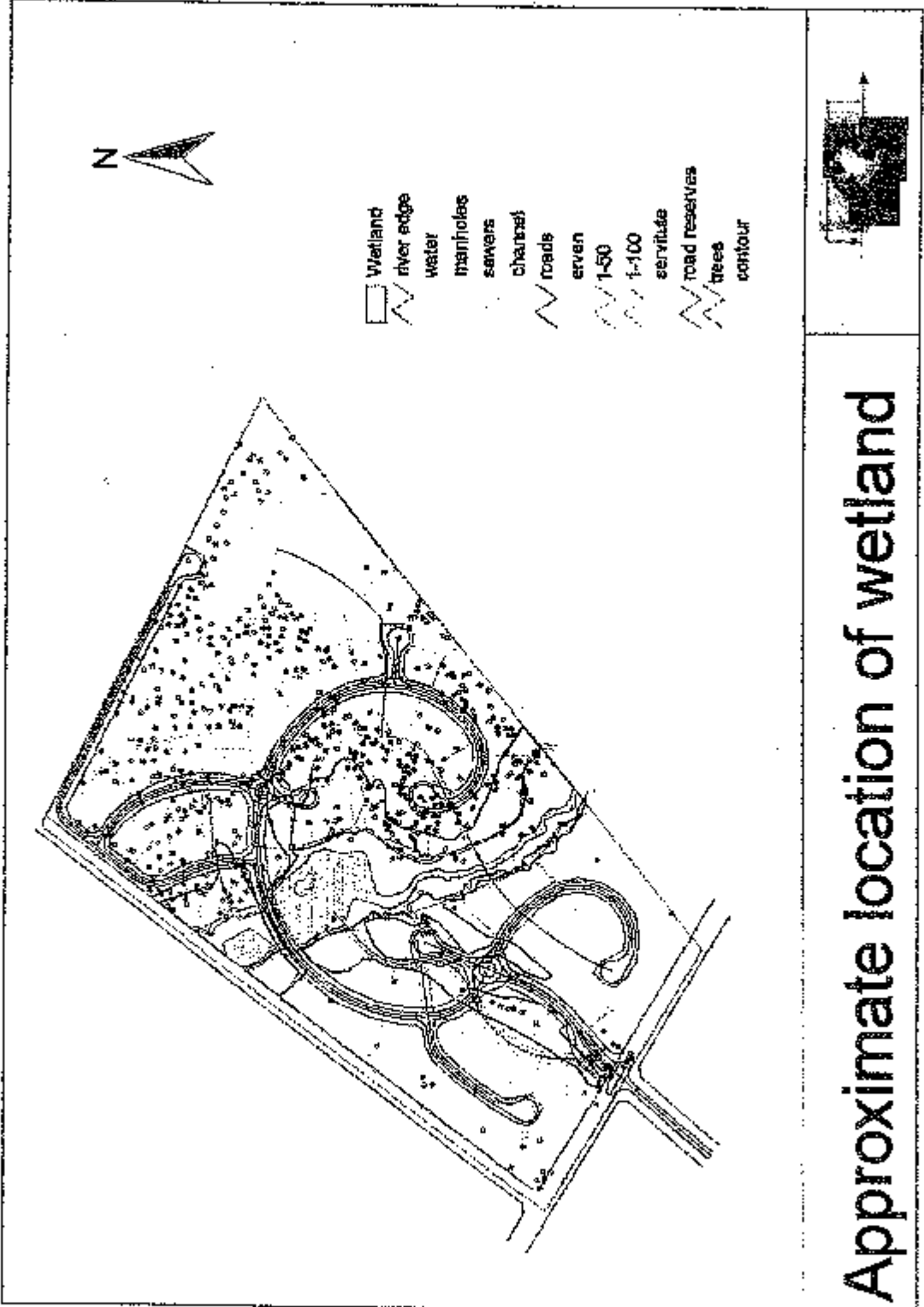
SCIENTIFIC NAMES	COMMON NAMES	STATUS	HABITAT
BIRDS			
<i>Anthropoides paradoxus</i>	Blue Crane	V	Midland and highland grassveld, edge of karoo, cultivated land and edges of vleis (Maclean 1993). Nests in both moist situations in vleis which have short grass cover and in dry sites far from water, usually exposed places such as on hillsides; forages in grassland and cultivated and fallow lands; roosts communally in the shallow water of pans and dams (Tarboton et al. 1987).
<i>Falco naumanni</i>	Lesser Kestrel	V	Forage preferentially in pristine grassland. They roost communally in tall trees, mainly <i>Eucalyptus</i> , in urban areas (in Barnes 2000). Open grassland and intensively cultivated agricultural areas under maize, sorghum, peanuts, wheat, beans and other crops (Tarboton & Ailan 1984). Typical of semi-arid grasslands, avoiding wooded areas.
<i>Tyto capensis</i>	Grass Owl	V	Almost exclusively in rank grass, typically fairly high altitudes. Breeds in permanent and seasonal vleis, which it vacates while hunting or post-breeding. Will breed in any area of long grass and is not necessarily associated with wetlands. Foraging confined to tall grassland (in Barnes 2000). May occur in sparse <i>Acacia</i> woodland where patches of dense grass cover are present (Harrison et al. 1997a).
<i>Myiarcha ibis</i>	Yellowbilled Stork	NT	Utilises diverse habitats, including dams, large marshes, swamps, estuaries, margins of lakes or rivers, seasonal wetlands where there are areas of vegetation free shallow water, and even small pools (Harrison et al. 1997a).
REPTILES			
<i>Python natalensis</i>	Southern African Python		Found in open savanna regions, specifically rocky and riverine shrub areas.
INSECTS			
<i>Metisella meninx</i>	Marsh flyph	V	Wetlands Host plant: <i>Leersia hexandra</i>
PLANTS			
<i>Calamagrostis epigeios</i> var. <i>capensis</i>		NT	Vleis.

V = Vulnerable

NT= Near threatened

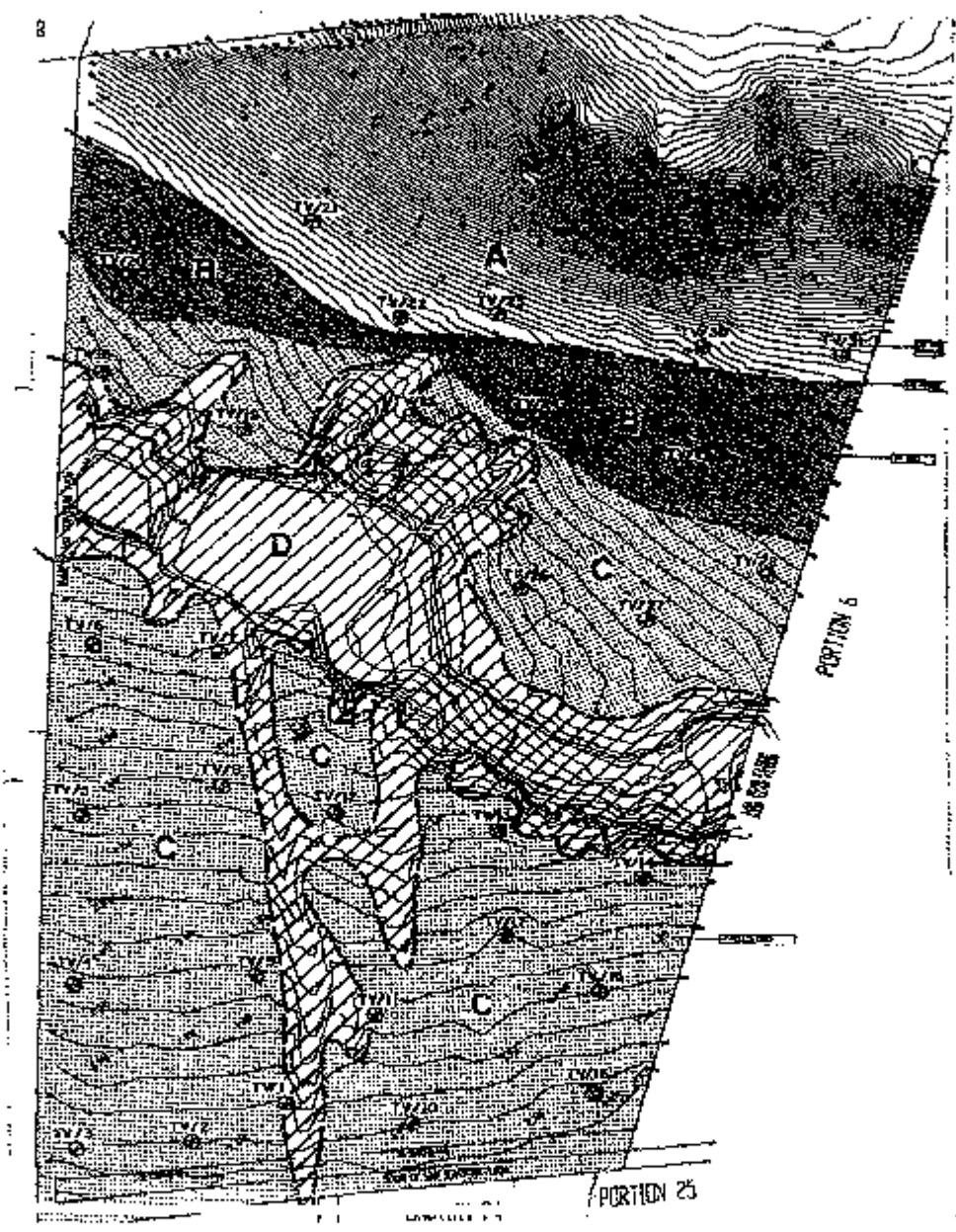
The categories of threat assigned to the species and the habitat description of the species is as provided by GDACE.

Addendum D – Approximate location of wetland on layout map as delineated using the soil properties (Johan van der Merwe 2005)



Approximate location of wetland

Addendum E – Geotechnical soil zones (Johan van der Merwe (Pty) Ltd, 2005)



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Addendum F – Wetland rehabilitation guidelines

WETLAND REHABILITATION GUIDELINES

1 Planning phase

1. Prepare an action plan for eradication of alien invasive species.
2. Prepare an action plan for the removal of dumped material.
3. Species to be used during the rehabilitation should be obtained from commercial sources/ replanted from other areas on site.

2 General rehabilitation

1. Rehabilitation of the disturbed wetland areas has to take place as soon as possible to prevent further deterioration of the wetland functions.
2. Vegetation should be planted in cleared areas in order to limit erosion.
3. All exotics should be removed and controlled, as these species establish in disturbed areas, thereby reducing the potential resources for indigenous vegetation.
4. All rubble and invasive species should be removed from the wetland in such a way as to prevent erosion taking place in the wetland.

3 Eradication of invasive species

Declared weeds/invasive species have to be removed according to Regulations of the Conservation of Agricultural Resources Act. Invasive species observed on the site are included under 6.2.3.2 of the main document. In the table below are the proposed removal methods.

Species	Category	Eradication
<i>Arundo donax</i>	1	Control of reeds are difficult. <i>A. donax</i> can be controlled by physically removing the whole plant, including the rhizomes, as regrowth can occur from pieces left in the soil. <i>A. donax</i> can also be controlled chemically but this is not recommended in a water course, especially one with as many dams downstream. Follow-up treatment is necessary.
<i>Solarium mauritanum</i>	1	The plants can be controlled by cutting and painting the stumps with an herbicide such as chopper. The clouds of fine hairs that are released when the plants are cleared mechanically contain toxins that cause respiratory disease and workers should be protected. A leaf-eating bio-control agent is available for this species. Follow-up control is necessary.
<i>Acacia mearnsii</i>	2	The long-term control of wattle is difficult as they produce seeds that may retain dormancy for up to 50 years, and the plants coppice easily. The plants should be cut down and a herbicide (such as Chopper) painted on the stumps. Coppice should also be controlled and regular follow-up is necessary for several years. A group such as Working for Water can be consulted on the control of wattle, and on the use of wattle products.
Eucalyptus species	2	The trees should be cut down and the stumps painted with herbicide. Working for Water can be consulted on the control of this species and on the uses of the wood.
<i>Iponoxea purpurea</i>	3	This species is best removed by hand. Regular follow-up care is necessary as the seeds from <i>I. purpurea</i> can germinate over an extended period of time and from great depths.

4 Wetland species to use in rehabilitation

Wetland species that may be used include *Typha capensis*, *Leersia hexandra*, *Imperata cylindrica*, *Eragrostis plana*, *Digitaria eriantha* and *Schoenoplectus corymbosus*. The species should be planted along the contour lines to intercept the flow of water. The habitat of these species is listed in the table below.

Species	Zone	Habitat
<i>Typha capensis</i>	Permanent / Seasonal	Swampy areas and next to streams
<i>Leersia hexandra</i>	Permanent / Seasonal	In or near permanent water sources. Dense stands in shallow water or wet soil.
<i>Imperata cylindrica</i>	Temporary	Poorly drained, damp soil such as wetlands and riverbanks where it forms dense stands. Also other habitat types in areas with a high rainfall.
<i>Eragrostis plana</i>	Temporary	Grows in disturbed places in all types of soil. Mostly damp patches.
<i>Digitaria eriantha</i>	Temporary	Grows at edges of wetlands
<i>Schoenoplectus corymbosus</i>	Seasonal	Swampy grassland

5 Monitoring

In order to evaluate the rehabilitation programme, the following monitoring measures can be applied:

- o The rehabilitation program is adhered to
- o Revegetation is successfully taking place
- o No dumping of waste
- o Revegetation is reinforced by planting appropriate plants if necessary
- o Limited erosion, and if it occurs repaired within reasonable timeframe
- o Compliance with all relevant legislation, permits and authorisations regarding soil conservation and rehabilitation of disturbed areas
- o Problems with the rehabilitation programme are addressed
- o Weeds and Invader species are controlled
- o Prevention of degradation of waterways by excessive amounts of soil particles in the water
- o Wetland species diversity remain or improve
- o Wetland habitat improve, especially for bird species

**Addendum 14: Report on Geotechnical investigation carried out for the proposed:
Tygervalley Housing Development to be established on: Portion 5 of the
farm Tygervallei 334-JR, Pretoria District, Tshwane Metropolitan
Municipality, Gauteng Province**

Fauna & Flora



Appendix G7

GALAGO ENVIRONMENTAL



***Flora and Fauna
Habitat Assessment***

of

**PORTION 5 OF THE FARM
TYGER VALLEY 334-JR**

November 2006

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1. INTRODUCTION

A mammal, bird, reptile, amphibian and plant survey was requested for the ridge area of Portion 5 of the Farm Tyger Valley 334-JR, scheduled for development. This specialist fauna and flora survey focuses on the current status of vertebrate and plant species occurring or likely to occur on the site of the proposed development. The study also provides an assessment of threatened and potentially threatened species likely to occur on the study area as this pertains to *in situ* habitats including throughout their inclusive distributional range.

2. OBJECTIVES OF THE HABITAT STUDY

- To assess the current status of the habitat component and current general conservation status of the property;
- To list the perceptible flora of the site and to recommend steps to be taken should endangered, vulnerable or rare species be found;
- To provide lists of mammals, birds, reptiles, and amphibians which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the development on the fauna and flora of the proposed site; and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. SCOPE OF STUDY

This report:

- Lists the more noticeable trees, shrubs, suffrutices, herbs, geophytes and grasses observed during the study and offers recommendations regarding the preservation of the pristine plant communities of the area;
- Provides a mammal, bird, reptile and amphibian survey based on sightings and literature, with comments on their preferred habitats;
- Comments on connectivity with natural vegetation on adjacent sites;
- Comments on ecological sensitive areas;
- Evaluates the conservation importance and significance of the site with special emphasis on the current status of resident threatened species; and
- Offers recommendations to reduce or minimise impacts, should the proposed exploration be approved

4. STUDY AREA

The study site lies in the quarter degree grid square 2528CD (Rietvleidam). According to the latest vegetation map of SANBI, the site falls within Marikana Thornveld (Mucina, Rutherford & Powrie, 2005).

Low and Rebelo (1996) classified the area as Rocky Highveld grassland with shallow rocky soil, which is a transitional type between the high inland plateau grassland and the lower inland plateau bushveld. Of the area covered by this type of grassland, 65% is transformed and 1,38% conserved. The vegetation is in addition highly threatened by urbanization, agriculture and frequent burning. The 21,5458 hectare site comprises two distinct biotopes, namely the grassy flatland towards the south, and the 10.1652 randjie/ridge along the north of the property, which is the focus of this evaluation.

The site is situated north-east of Lynnwood Road and south of Silver lakes and the Farm Inn Hotel. The soil on most of the site consists of light shale soil. A drainage line, that forms the wetland system of Silver Lakes Golf Estate to the north of the site, runs from south-east to north-west through the centre of the site. The north-eastern quadrant of the site comprised a rocky ridge with a plateau in the eastern corner.

The flat land appears to have been tilled in the past, and has since been overgrown with a dense stand of pioneer grass including tall thatch grass, parts of which has not been burnt in recent years. This section is also devoid of any trees of significance, with the exception of a few isolated *Eucalyptus* trees. The soil here is a deep brown sandy soil.

The ridge carries typical indigenous bushveld woodland and dense grass. The slope and ridge is exceptionally rocky. Derelict buildings are located at the foot of the ridge in the south-eastern corner of the main study area.

GPS coordinates;

The main gate to the site	25° 47' 39.8"S; 28° 22' 09.9"E
Dam wall	25° 47' 29.3"S; 28° 22' 14.8"E
Buildings at the foot of the ridge	25° 47' 32.7"S; 28° 22' 23.2"E

5. METHODS

5.1 Vegetation survey

Information about the Red Data species that occur in the area was obtained from GDACE. The Guidelines issued by GDACE to plant specialists were consulted to ascertain the habitat of the Red Data species concerned.

The PRECIS list of plants recorded in the 2528CD quarter degree grid square was obtained from SANBI. This list was consulted to verify the record of occurrence of the plant species seen on the site.

The site was visited on 4 December 2006 and reviewed to determine the various plant communities (see Figure 1). From each plant community one or more plots (depending on the size and composition of the plant community) were selected at random for detailed study. Each plot, which measured about 10m x 10m, was surveyed in a random crisscross fashion and the plants recorded. The vegetation along the ridge was surveyed in a random zigzag manner, searching meticulously for Red-listed species.

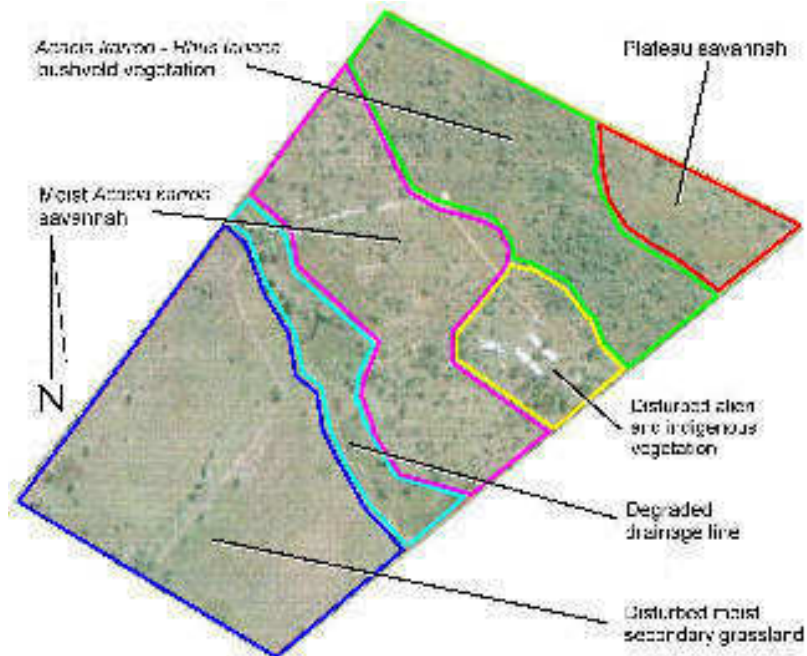


Figure 1. Vegetation communities

5.2 Fauna survey

Site visits were conducted on 18, 19 and 27 November 2006. During these visits the observed and derived presence of species associated with the recognized vegetation units of the study site, were recorded.

4.3.1 Field Survey

During the site visits mammals, birds, reptiles and amphibians were identified by visual sightings through random transect walks. In addition, mammals were also identified by means of spoor, droppings or roosting sites. Possible burrows or reptile habitats (termitaria, stumps or rocks) were inspected for any inhabitants. Amphibians were also identified by their vocalisations.

Birds were identified visually using a 10X42 Bushnell Legend binocular and a 20X-60X Pentax spotting scope and by call and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al.*, 2005) and *Southern African Bird Sounds* (Gibbon, 1991). Calls are in particular important to identify species of the genus *Cistocola*. All sighting of

bird species on site were plotted on a PDA using Cyber Tracker as database, which is connected to an external GPS mouse via blue tooth.

No trapping or mist netting was conducted, as the terms of reference did not require such intensive work.

Three criteria were used to assess the probability of occurrence of birds species as well as Red Data bird species listed for the study that will most probably make use of the site and surrounding area for breeding or feeding purposes: Known distribution range, habitat preference and the presence of suitable habitat on site as well as the presence of food to assess individual species probability of occurrence.

4.3.2 Desktop Survey

As the majority of mammals, reptiles and amphibians are secretive, nocturnal and/or seasonal; distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and data bases.

The probability of occurrences of **mammal** species was based on their respective geographical distributional ranges and the suitability of on-site habitat. In other words, *high* probability would be applicable to a species with a distribution range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorized as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.

A *low* probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorized as *low* are generally deemed to be rare.

The occurrence of some key **bird** species was verified according to the distribution record obtained during the Southern African Bird Atlas period from 1981 tot 1993 (Harrison *et al* 1997) as well as records from 1974 to 1987 according to Tarboton *et al* (1987).

The occurrence and historic distribution of these birds, including all Red Data bird species for the 2528CD quarter-degree grid cell were all verified according to Harrison *et al* (1997) and Tarboton *et al* (1987). The reporting rate was scored between 0 – 100% and is calculated as follows: Total number of cards on which a species was reported during the Southern African Bird Atlas period X 100 ÷ total number of cards for a particular quarter degree grid cell. The colour codes for each species are represented as follow: YELLOW = VERY LOW, LIGHT ORANGE = LOW, DARK ORANGE = MEDIUM AND RED = HIGH.

It is important to note that a quarter-degree grid square covers a large area. The 2528CD quarter-degree square covers an area of $\pm 27 \times 25$ kilometres ($\pm 693 \text{ km}^2$) and it is possible that suitable habitat may exist for a certain red data bird species within this general and surrounding area but that the specific habitat found on site will not suit the particular red data species although it was recorded for the quarter-degree square. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD which are both in the same quarter-degree square. Red data bird species were categorised according to Barnes (2000).

4.3.3 Specific Requirements

Particular reference was made to certain species (as required by the GDACE minimum requirements):

During the site visits, the study site was visually surveyed and assessed for the potential occurrence of:

- Juliana's golden mole (*Neamblosomus juliana*)
- Rough haired golden mole (*Chrysospalax villosus*)
- Giant Bullfrogs (*Pyxicephalus adspersus*);
- Red Data avifauna, with particular reference to the African Grass Owl (*Tyto capensis*), the Secretarybird (*Sagittarius serpentarius*) and the African Marsh Harrier (*Circus ranivorus*); and

6. RESULTS

6.1 Vegetation survey:

6.1.1 Plant communities

Six plant communities were identified:

- *Acacia karroo* – *Rhus lancea* bushveld;
- Plateau savannah;
- Moist *Acacia karroo* savannah;
- Disturbed moist secondary grassland;
- Degraded drainage line; and
- Disturbed alien and indigenous vegetation.

Tables 1 to 4 list the trees, shrubs, suffrutices, geophytes, herbs and grasses actually found on each of the surveyed areas of the site.

6.1.2 Medicinal plants

The names of known medicinal plants are marked with numbers to footnotes in Tables 1 to 4 and the footnotes themselves appear at the end of the last table. On the whole site 33 plant species with medicinal properties were recorded, 66% of which were found on the slope of the ridge.

6.1.3 Alien plants

Alien plants are not listed separately, but are included in the lists as they form part of each particular vegetation group. Their names are marked with an asterisk in Tables 1 to 4. Seven alien plant species, of which four species were Category 1 Declared weeds, and one was a Category 2 Declared invader, were recorded on the site. In general, the alien species were found around the old residence and outbuildings. The Eucalyptus trees, a Category 2 Declared invader, were found along the drainage line.

The alien plant names printed in **bold** in the plant tables are those of Category 1 Declared Weeds and the removal of these plants is **compulsory** in terms of the regulations formulated under “The Conservation of Agricultural Resources Act” (Act No. 43 of 1983), as amended. Category 2 Declared invaders should likewise be controlled.

6.1.4 Orange listed species

The habitat was suitable for three Orange-listed plant species known to occur in the quarter degree grid. (See Appendix A for a list of the Red-listed and Orange-listed plants that occur in the quarter degree grid.)

The orange-listed *Hypoxis hemerocallidea* occurred, especially in the Moist *Acacia karoo* savannah.

6.1.5 Red listed species

The habitat was not suitable for any of the red-listed plant species known to occur in the quarter degree grid.

6.1.6 *Acacia karoo* – *Rhus lancea* bushveld vegetation

The species diversity in this vegetation community was high with 88 species recorded, of which 17 were woody species, 12 were grasses and 45 were herbaceous species. Only one alien plant, an inoffensive species, was found. Sixty six percent of the medicinal species were found in this group.

Connectivity with natural vegetation areas existed on all sides. This vegetation community was considered sensitive and should be excluded from development.



Acacia karroo – *Rhus lancea* bushveld vegetation on slope of the ridge

Table 1: Plants recorded in the *Acacia karroo* – *Rhus lancea* bushveld vegetation

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Acacia caffra</i>	Common hook thorn	Gewone haakdoring
<i>Acacia karroo</i> ^{1,2}	Sweet thorn	Soetdoring
<i>Acalypha villicaulis</i>		
<i>Albica setosa</i>		Slymbol
<i>Aloe greatheadii</i> var <i>davyana</i> ^{1,2}		Kleinaalwyn
<i>Aloe marlothii</i> subsp <i>marlothii</i> ^{1,2}	Mountain aloe	Bergaalwyn
<i>Alysicarpus rugosus</i> subsp <i>perennirufus</i>	Pioneer fodder plant	
<i>Anthospermum rigidum</i> subsp <i>rigidum</i>		
<i>Aristida congesta</i> subsp <i>barbicollis</i>	Spreading three-awn grass	Witsteekgras
<i>Asparagus flavicaulis</i> subsp <i>flavicaulis</i>		
<i>Asparagus setaceus</i>	Asparagus fern	
<i>Aster harveyanus</i>		Bloublommetjie
<i>Athrixia elata</i>	Wild tea	Bostee
<i>Becium obovatum</i> subsp <i>obovatum</i> var <i>obovatum</i> ^{2,3}	Cat's whiskers	Katsnor
<i>Bonatea speciosa</i> var <i>antennifera</i>	Terrestrial orchid	Grondorgidie
<i>Brachiaria serrata</i>	Velvet grass	Fluweelgras
<i>Canthium gilfillanii</i>	Velvet rock alder	Fluweelklipels
<i>Canthium mundianum</i>	Rock alder	Klipels
<i>Celtis africana</i>	White stinkwood	Witstinkhout
<i>Cephalaria zeyheriana</i>	Mock scabious	
<i>Cheilanthes viridis</i> var <i>viridis</i>	Cliff brake	Kransruigtevaring
<i>Chlorophytum fasciculatum</i>		
<i>Clematis brachiata</i> ²	Traveler's joy	Klimop
<i>Conyza podocephala</i>		
<i>Corchorus asplenifolius</i>		
<i>Crabbaea angustifolia</i> ²		
<i>Cussonia paniculata</i> subsp <i>sinuata</i> ²	Highveld cabbage tree	Hoëveld kiepersol
<i>Digitaria eriantha</i>	Finger grass	Vingergras
<i>Diospyros lycioides</i> subsp <i>guerkei</i>		Bloubos
<i>Elionurus muticus</i>	Wire grass	Draadgras
<i>Eragrostis capensis</i>	Heart-seed love grass	Hartjiesgras

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Eragrostis chloromelas</i>	Curly leaf	Krulblaar
<i>Eragrostis curvula</i>	Weeping love grass	Oulandsgras
<i>Euclea crispa</i> subsp <i>crispa</i> ⁴	Blue guarri	Blou ghwarrie
<i>Felicia muricata</i> subsp <i>muricata</i> ^{1,2,3}	White felicia	
<i>Gerbera viridifolia</i>		Griekwateebossie
<i>Gladiolus</i> cf <i>dalenii</i> subsp <i>dalenii</i> ³	Wild gladiolus	Wildeswaardlelie
<i>Gymnosporia buxifolia</i> ²	Spikethorn	Pendoring
<i>Helichrysum nudifolium</i> var <i>nudifolium</i> ^{1,2}	Hottentot's tea	Hottentotstee
<i>Helichrysum rugulosum</i> ^{2,3}		
<i>Hermannia depressa</i> ^{2,3}	Creeping red Hermannia	Rooiopslag
<i>Heteromorpha arborescens</i> var <i>abyssinica</i> ^{1,2}	Common parsley tree	Gewone pietersielieboom
<i>Heteropogon contortus</i>	Spear grass	Assegaaigras
<i>Hibiscus aethiopicus</i> var <i>ovatus</i> ^{2,3}	Common dwarf Hibiscus	
<i>Hyparrhenia hirta</i>	Common thatching grass	Dekgras
<i>Hypoxis hemerocallidea</i> ^{1,2,3}	Star flower	Gifbol
<i>Hypoxis rigidula</i> var <i>rigidula</i>	Silver-leaved star flower	Wilde tulp
<i>Indigofera hedyantha</i>		Aambeibossie
<i>Indigofera hiliaris</i> var <i>hiliaris</i>	Red indigo bush	
<i>Ipomoea bathycolpos</i>		Veldsambreeltjies
<i>Ipomoea oblongata</i> ²		
<i>Jamesbrittenia aurantiaca</i>	Cape saffron	Saffraanbossie
<i>Lactuca inermis</i>	Wild lettuce	
<i>Lantana rugosa</i> ^{2,3}	Bird's brandy	Voëlbrandewyn
<i>Ledebouria inquinata</i>		
<i>Ledebouria</i> sp		
<i>Lippia javanica</i> ^{1,2,3}	Fever tea	Koorsbossie
<i>Macleodium zeyheri</i> subsp <i>zeyheri</i> ^{2,3}	Doll's protea	
<i>Melinis nerviglumis</i>	Bristle leaf red top	Steekblaarblinkgras
<i>Nidorella hottentotica</i>		
<i>Ornithogalum tenuifolium</i> subsp <i>tenuifolium</i>		Bosui
<i>Pellaea calomelanos</i> var <i>calomelanos</i> ^{1,2}	Black cliff brake	Swart kransruigtevaring
<i>Pentarrhinum inspidum</i>		Donkieperske
<i>Phyllanthus parvulus</i> var <i>parvulus</i>	Dye bush	Kleurbossie
<i>Polygala rehmannii</i>		
<i>Rhoicissus tridentata</i> subsp <i>cuneifolia</i> ¹	Northern bushman's grape	Noordelike boesmansdruif
<i>Rhus lancea</i>	Karee	Karee
<i>Rhus leptodictya</i>	Mountain karee	Bergkaree
<i>Rhus pyroides</i> var <i>pyroides</i> ⁴	Common wild currant	Taaibos
<i>Rhus zeyheri</i> ²	Blue currant	Blou taaibos
<i>Rhynchosia totta</i> var <i>totta</i>	Yellow carpet bean	Tottabossie
<i>Ruellia</i> cf <i>cordata</i>		
<i>Scabiosa columbaria</i> ^{1,2,3}	Wild scabiosa	Bitterbos
<i>Scolopia zeyheri</i>	Thorn pear	Doringpeer
<i>Senecio inornatus</i>		
<i>Senecio venosus</i>		Besembossie
<i>Seriphium plumosum</i>	Bankrupt bush	Bankrotbos
<i>Sonchus dregeanus</i>		
<i>Sonchus oleraceus</i> *	Sow thistle	Sydissel
<i>Tephrosia capensis</i> var <i>capensis</i>		
<i>Teucrium trifidum</i>	Koorsbossie	

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Themeda triandra</i>	Red grass	Rooigras
<i>Thesium sp</i>		
<i>Tragia minor</i>		
<i>Tristachya leucothrix</i>	Hairy trident grass	Harige drieblomgras
<i>Vernonia galpinii</i>		Perskwasbossie
<i>Vernonia oligocephala</i> ^{1,2}	Cape vernonia	Blounaaldetee bossie
<i>Withania somnifera</i> ^{1,2}	Winter cherry	Geneesblaarbossie
<i>Zanthoxylum capense</i> ^{1,2}	Small knobwood	Klein perdepram

6.1.7 Plateau savannah

The species diversity of this vegetation community was high with 57 species recorded. Of these only seven were wooded species and ten were grass species. Thirty herbaceous species and six geophytic species were recorded. Of the 33 medicinal species, 18 were recorded here. No alien species were observed. Connectivity with natural vegetation areas existed to the north-east and the south-east. This vegetation community was considered sensitive and should be excluded from development.

Table 2: Plants recorded in the Plateau savannah

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Acacia caffra</i>	Common hook thorn	Gewone haakdoring
<i>Acacia karroo</i> ^{1,2}	Sweet thorn	Soetdoring
<i>Aloe greatheadii var davyana</i> ^{1,2}		Kleinaalwyn
<i>Aster harveyanus</i>		Bloublommetjie
<i>Brachiaria serrata</i>	Velvet grass	Fluweelgras
<i>Bulbostylis burchellii</i>		Biesie
<i>Cephalaria zeyheriana</i>	Mock scabious	
<i>Chaetacanthus setiger</i>		
<i>Cienfuegosia cf gerrardii</i>		
<i>Elephantorrhiza elephantina</i> ^{1,2,3}	Elephant's root	Olifantswortel
<i>Elionurus muticus</i>	Wire grass	Draadgras
<i>Eragrostis capensis</i>	Heart-seed love grass	Hartjiesgras
<i>Eragrostis racemosa</i>	Narrow heart love grass	Smalhartjiesgras
<i>Euclea crispa subsp crispa</i> ⁴	Blue guarri	Blou ghwarrie
<i>Gerbera viridifolia</i>		Griekwateebossie
<i>Hermannia depressa</i> ^{2,3}	Creeping red Hermannia	Rooiopslag
<i>Heteromorpha arborescens var abyssinica</i> ^{1,2}	Common parsley tree Gewone pietersielieboom	
<i>Heteropogon contortus</i>	Spear grass	Assegaaigras
<i>Hibiscus aethiopicus var ovatus</i> ^{2,3}	Common dwarf Hibiscus	
<i>Hyparrhenia hirta</i>	Common thatching grass	Dekgras
<i>Hypoxis hemerocallidea</i> ^{1,2,3}	Star flower	Gifbol
<i>Hypoxis rigidula var rigidula</i>	Silver-leaved star flower	Wilde tulp
<i>Indigofera hedyantha</i>		Aambeibossie
<i>Indigofera hilaris var hilaris</i>	Red indigo bush	
<i>Ipomoea bathycolpos</i>		Veldsambreeltjies
<i>Ipomoea crassipes</i> ^{2,3}	Leafy-flowered Ipomoea	Wildewinde
<i>Justicia anagalloides</i>		
<i>Ledebouria inquinata</i>		
<i>Ledebouria revoluta</i> ³	Common ledebouria	
<i>Ledebouria sp</i>		

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Lippia javanica</i> ^{1,2,3}	Fever tea	Koorsbossie
<i>Macleodium zeyheri subsp zeyheri</i> ^{2,3}	Doll's protea	
<i>Melinis nerviglumis</i>	Bristle leaf red top	Steekblaarblinkgras
<i>Menodora africana</i>		Balbossie
<i>Nidorella hottentotica</i>		
<i>Pentanisia angustifolia</i>	Wild verbena	Sooibrandbossie
<i>Phyllanthus parvulus var parvulus</i>	Dye bush	Kleurbossie
<i>Polygala rehmannii</i>		
<i>Polygala uncinata</i>		
<i>Raphionacme hirsuta</i> ²	Khadi root	Khadiwortel
<i>Rhus lancea</i>	Karee	Karee
<i>Rhus pyroides var pyroides</i> ⁴	Common wild currant	Taaibos
<i>Rhus zeyheri</i> ²	Blue currant	Blou taaibos
<i>Rhynchosia totta var totta</i>	Yellow carpet bean	Tottabossie
<i>Ruellia cf cordata</i>		
<i>Scabiosa columbaria</i> ^{1,2,3}	Wild scabiosa	Bitterbos
<i>Senecio inornatus</i>		
<i>Senecio venosus</i>		Besembossie
<i>Setaria sphacelata var sphacelata</i>	Small creeping foxtail	Kleinkruipmannagras
<i>Sonchus cf nanus</i>		
<i>Striga bilabiata</i>	Small witch weed	
<i>Tephrosia capensis var capensis</i>		
<i>Themeda triandra</i>	Red grass	Roogras
<i>Thesium sp</i>		
<i>Tristachya leucothrix</i>	Hairy trident grass	Harige drieblomgras
<i>Vernonia oligocephala</i> ^{1,2}	Cape vernonia	Blounaaldetee bossie
<i>Withania somnifera</i> ^{1,2}	Winter cherry	Geneesblaarbossie

6.1.8 Moist *Acacia karroo* savannah

Although the species diversity of this vegetation community was not high, no alien species were recorded. The grass cover in general was rather dense, but only seven grass species could be identified, as most grasses have not yet formed inflorescences. A few patches of sparse vegetation were observed. Connectivity with natural vegetation areas on the north-west and part of the north-eastern sides, as well as the south-eastern side, existed. This vegetation community was not regarded as pristine and therefore not considered sensitive.

Table 3: Plants recorded in the Moist *Acacia karroo* savannah

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Acacia caffra</i>	Common hook thorn	Gewone haakdoring
<i>Acacia karroo</i> ^{1,2}	Sweet thorn	Soetdoring
<i>Acacia tortilis subsp heteracantha</i>	Umbrella thorn	Haak-en-steek
<i>Acalypha caperonioides</i>		
<i>Aloe greatheadii var davyana</i> ^{1,2}		Kleinaalwyn
<i>Anthospermum rigidum subsp rigidum</i>		
<i>Berkheya radula</i>		Boesmanrietjie
<i>Chlorophytum fasciculatum</i>		
<i>Conyza podocephala</i>		
<i>Crabbaea angustifolia</i> ²		
<i>Dipcadi viride</i>		Gifbolletjie, slymuintjie
<i>Eragrostis capensis</i>	Heart-seed love grass	Hartjiesgras

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Eragrostis chloromelas</i>	Curly leaf	Krulblaar
<i>Eragrostis curvula</i>	Weeping love grass	Oulandsgras
<i>Eragrostis rigidior</i>	Broad-leaved curly leaf	Breëkrulgras
<i>Helichrysum nudifolium var nudifolium</i> ^{1,2}	Hottentot's tea	Hottentotstee
<i>Helichrysum rugulosum</i> ^{2,3}		
<i>Hermannia depressa</i> ^{2,3}	Creeping red Hermannia	Rooiopslag
<i>Hyparrhenia hirta</i>	Common thatching grass	Dekgras
<i>Hypoxis hemerocallidea</i> ^{1,2,3}	Star flower	Gifbol
<i>Melinis nerviglumis</i>	Bristle leaf red top	Steekblaarblinkgras
<i>Nidorella anomala</i>		
<i>Raphionacme hirsuta</i> ²	Khadi root	Khadiwortel
<i>Rhus lancea</i>	Karee	Karee
<i>Rhus zeyheri</i> ²	Blue currant	Blou taaibos
<i>Rhynchosia totta var totta</i>	Yellow carpet bean	Tottabossie
<i>Scabiosa columbaria</i> ^{1,2,3}	Wild scabiosa	Bitterbos
<i>Senecio affinis</i>		
<i>Senecio inornatus</i>		
<i>Striga bilabiata</i>	Small witch weed	
<i>Themeda triandra</i>	Red grass	Rooigras
<i>Verbena aristigera</i>	Fine-leaved verbena	Fynblaar verbena
<i>Vernonia oligocephala</i> ^{1,2}	Cape vernonia	Blounaaldetee bossie
<i>Ziziphus zeyheriana</i> ²	Dwarf buffalothorn	Dwergblinkblaar wag-'n-bietjie

6.1.9 Disturbed moist secondary grassland

This vegetation community was very disturbed owing to overgrazing. Severe infestation of Bankrupt bush (*Seriphium plumosum*) occurred in places. This part of the site was very moist in places and comprised typical vlei vegetation such as *Nidorella anomala*, *Imperata cylindrica* and *Berkheya radula*. The soil of this part of the site was clay derived from brown shale and not suitable for the Red-listed species that occurs in wetland conditions in the quarter degree grid.

Large numbers of the orange-listed *Hypoxis hemerocallidea* occurred, which should be relocated to an area where they can be preserved.

A survey of the plants that occur in this area was not required. This vegetation community was not considered sensitive.

6.1.10 Degraded drainage line

The drainage line was very degraded with numerous Eucalyptus trees, Spanish reed (*Arundo donax*), Bugweed (*Solanum mauritianum*) and Kukuyu occurring. In places, Bulrush (*Typha capensis*) and various species of the Cyperaceae occurred. The drainage line was not considered sensitive.



The drainage line with Eucalyptus infestation.

6.1.11 Disturbed alien and indigenous vegetation

Along the south-western boundary of the site an old residence with various outbuildings occurred. The species diversity was not high and bare patches of soil occurred. Although only five alien species were found in this part, they grew abundantly and three of them were Category 1 Declared weeds. This vegetation community was not considered sensitive.

Table 4: Plants recorded in the Disturbed alien and indigenous vegetation

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Acacia caffra</i>	Common hook thorn	Gewone haakdoring
<i>Acalypha caperonioides</i>		
<i>Aloe greatheadii</i> var <i>davyana</i> ^{1,2}		Kleinaalwyn
<i>Aristida congesta</i> subsp <i>barbicollis</i>	Spreading three-awn grass	Witsteekgras
<i>Asparagus suaveolens</i>	Wild asparagus	Katdoring
<i>Campuloclinium macrocephalum</i>	Pom pom weed	Pompombossie
<i>Canthium gilfillanii</i>	Velvet rock alder	Fluweelklipels
<i>Celtis africana</i>	White stinkwood	Witstinkhout
<i>Clematis brachiata</i> ²	Traveler's joy	Klimop
<i>Conyza</i> cf <i>bonariensis</i>	Flax-leaf fleabane	Kleinskraalhans
<i>Conyza podocephala</i>		
<i>Eragrostis capensis</i>	Heart-seed love grass	Hartjiesgras
<i>Eragrostis curvula</i>	Weeping love grass	Oulandsgras
<i>Eragrostis rigidior</i>	Broad-leaved curly leaf	Breëkrulgras
<i>Euclea crispa</i> subsp <i>crispa</i> ⁴	Blue guarri	Blou ghwarrie
<i>Gymnosporia buxifolia</i> ²	Spikethorn	Pendoring
<i>Helichrysum rugulosum</i> ^{2,3}		

SCIENTIFIC NAME	ENGLISH NAME	AFRIKAANS NAME
<i>Heteromorpha arborescens</i> var <i>abyssinica</i> ^{1,2}	Common parsley tree Gewone pietersielieboom	
<i>Heteropogon contortus</i>	Spear grass	Assegaaigras
<i>Hyparrhenia hirta</i>	Common thatching grass	Dekgras
<i>Lantana camara</i>	Lantana	Lantana
<i>Lantana rugosa</i> ^{2,3}	Bird's brandy	Voëlbrandewyn
<i>Melinis nerviglumis</i>	Bristle leaf red top	Steekblaarblinkgras
<i>Rhoicissus tridentata</i> subsp <i>cuneifolia</i> ¹	Northern bushman's grape	Noordelike boesmansdruif
<i>Rhus lancea</i>	Karee	Karee
<i>Rhus pyroides</i> var <i>pyroides</i> ⁴	Common wild currant	Taaibos
<i>Rhus zeyheri</i> ²	Blue currant	Blou taaibos
<i>Scabiosa columbaria</i> ^{1,2,3}	Wild scabiosa	Bitterbos
<i>Setaria sphacelata</i> var <i>sphacelata</i>	Small creeping foxtail	Kleinkruipmannagras
<i>Solanum mauritianum</i>	Bugweed	Luisboom
<i>Solanum panduriforme</i>	Poison apple	Gifappel
<i>Tephrosia capensis</i> var <i>capensis</i>		
<i>Verbena aristigera</i>	Fine-leaved verbena	Fynblaar verbena
<i>Verbena brasiliensis</i>		
<i>Withania somnifera</i> ^{1,2}	Winter cherry	Geneesblaarbossie
<i>Zanthoxylum capense</i> ^{1,2}	Small knobwood	Klein perdepram

¹Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. 2002.

²Watt, J.M. & Breyer-Brandwijk, M.G. 1962.

³Pooley, E. 1998.

⁴Van Wyk, B. & Van Wyk P. 1997.

6.2 Vertebrate Faunal survey

6.2.1 Mammals:

Observed and Expected Species Richness

Of the 30 mammal species expected to be present on the two biotopes of the study site (Table 5), only three were confirmed during the site visits (Table 6).

Considering that the brief of this survey is to focus on the randjie/ridge those species expected to occur on this section are printed in Arial Black in Tables 5 and 6.

Table 5 lists the mammals which were observed or deduced to occupy the site, or to be occasional visitors. All feral mammals expected to occur on the study site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these species normally associate with human settlements.

Neamblosomus juliana (Juliana's golden mole) occurs on the nearby Bronberg, whereas the site falls within the known range of and has suboptimal habitat for the rough haired golden mole (*Chrysospalax villosus*). However, a thorough search of both the randjies and the drainage lines revealed no evidence that either species occur. The excellent grass cover on the lower plains section of the site is likely to harbour hedgehogs, as well as a plethora of more common small terrestrial mammals normally thriving in lush and humid ground cover.

The listed bats are widespread and common commensals, and are more than likely to hawk for insects over the drainage lines and water surfaces. The listed small carnivores have a high ability to tolerate human presence and activities, and are certain to reside on or visit the site.

Mammal Habitat Assessment

The observed low diversity is due to encroaching civilization and associated activities, low habitat diversity, the size of the site and of adjoining areas, the quality of conservation and past land uses. All the species of the resident assemblage (Table 5) are common and widespread (with the exception of hedgehogs). The regeneration of dense natural grassland (irrespective of its successional stage) provides excellent habitat for the terrestrial small rodents and insectivores listed, as well as their small predators. The scattered patches of semi-aquatic vegetation (viz. reed beds) provide habitat for vlei rats and cane rats (latterly observed in the near vicinity).

Rupicolous habitat generally displays lower mammal diversity, and Tyger Valley Farm is no exception. The randjie is very rocky with dense grass, which would benefit rock elephant shrews and Namaqua rock mice, and a dense stand of shrubby woodland which may support the South African Galago. However, the slope and summit display no pockets of deep sand, which is a prerequisite for the occurrence of Juliana's golden mole.

Table 5: Mammal assemblage of Farm Tyger Valley; species which definitely or with a *high* probability to occur are marked with a √, those with a *medium* probability to occur based on ecological and distributional parameters are marked with a *, and those with a *low* probability to occur are marked with a ?. The conservation status of Red Data species are given in the first column, i.e. **R** = Rare, **V** = Vulnerable, **I** = Indeterminate.

Entries printed in Arial Black are species expected to occur on the randjies.

	SCIENTIFIC NAME	ENGLISH NAME
√	<i>Elephantulus myurus</i>	Eastern rock elephant shrew
√	<i>Lepus saxatilis</i>	Scrub hare
√	<i>Pronolagus randensis</i>	Jameson's red rock rabbit
√	<i>Cryptomys hottentotus</i>	African mole rat
√	<i>Hystrix africaeaustralis</i>	Cape porcupine
*	<i>Thryonomys swinderianus</i>	Greater cane rat
*	<i>Rhabdomys pumilio</i>	Four-striped grass mouse
*	<i>Mus minutoides</i>	Pygmy mouse
*	<i>Mastomys natalensis</i>	Natal multimammate mouse
*	<i>Mastomys coucha</i>	Southern multimammate mouse
*	<i>Aethomys ineptus</i>	Tete veld rat
√	<i>Aethomys namaquensis</i>	Namaqua rock mouse
?	<i>Otomys angoniensis</i>	Angoni vlei rat
?	<i>Otomys irroratus</i>	Vlei rat
?	<i>Tatera leucogaster</i>	Bushveld gerbil
?	<i>Saccostomus campestris</i>	Pouched mouse
?	<i>Dendromus melanotis</i>	Grey pygmy climbing mouse
?	<i>Galago moholi</i>	South African galago
?	<i>Crocidura cyanea</i>	Reddish-grey musk shrew
*	<i>Crocidura hirta</i>	Lesser red musk shrew
R?	<i>Atelerix frontalis</i>	Southern African hedgehog
*	<i>Neoromicia capensis</i>	Cape serotine bat
*	<i>Scotophilus dinganii</i>	African yellow house bat
*	<i>Scotophilus viridis</i>	Greenish yellow house bat
*	<i>Genetta genetta</i>	Small-spotted genet
*	<i>Genetta tigrina</i>	SA large-spotted genet
*	<i>Cynictis penicillata</i>	Yellow mongoose
*	<i>Galerella sanguinea</i>	Slender mongoose
?	<i>Sylvicapra grimmia</i>	Common duiker
?	<i>Raphicerus campestris</i>	Steenbok

Table 6: Mammal species positively confirmed from the study site, observed indicators and the observed habitat. **Entries printed in Arial Black are species expected to occur on the randjies.**

Scientific Name	Vernacular Name	Observation Indicator	Habitat
<i>Lepus saxatilis</i>	Scrub hare	Droppings	Short grassland
<i>Pronolagus randensis</i>	Jameson's red rock rabbit	Droppings	Mountain slopes with grass
<i>Hystrix africaeaustralis</i>	Cape porcupine	Droppings	Catholic

All three species found to be present based on the signs indicated above, are common and widespread and have a high ability to co-exist in close proximity of human activities.

Threatened and Red Listed Mammal Species

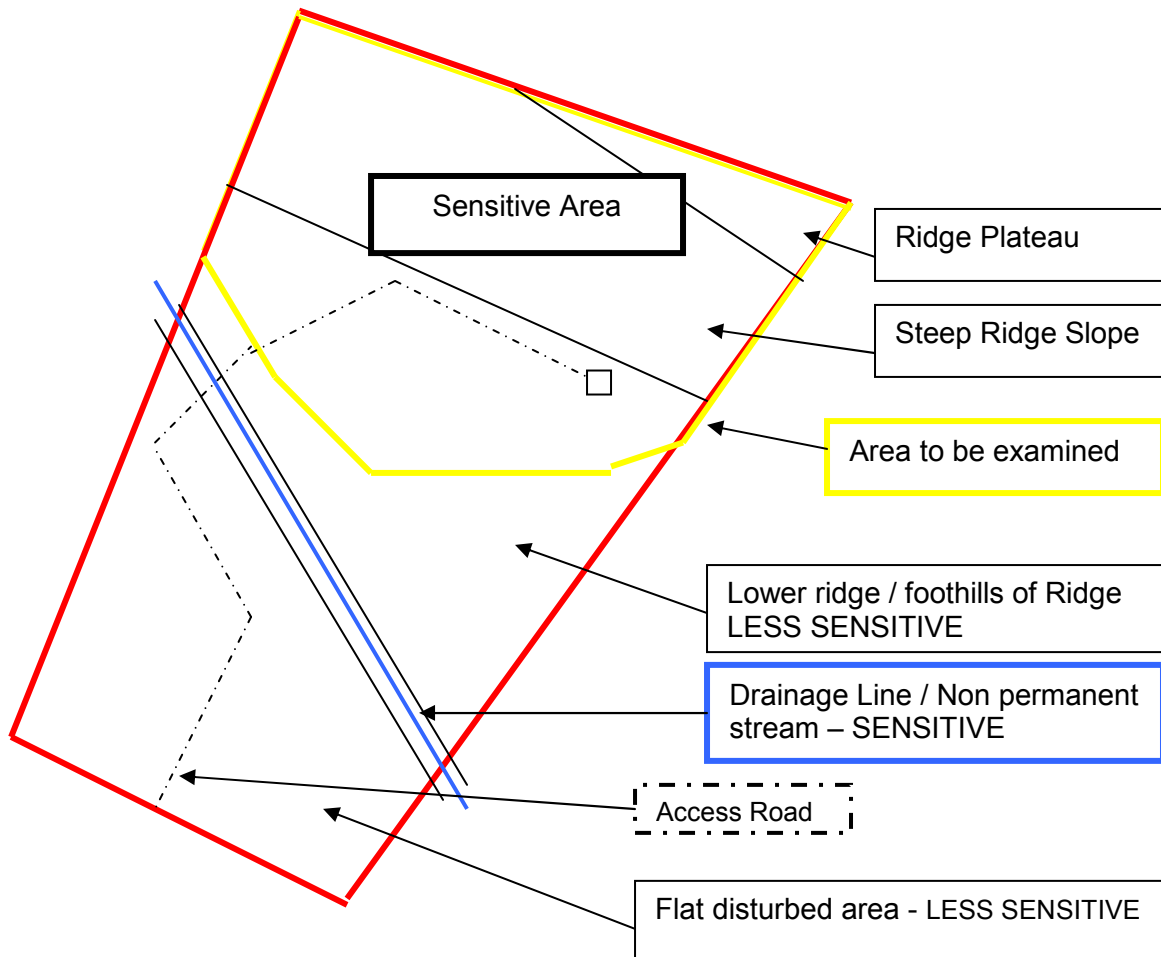
Only the hedgehog is rated as a Red Data mammal and is likely to be an inhabitant of the site. The active defensive mechanism of this insectivorous mammal is entirely ineffective to attack by medium-sized carnivores (including dogs) and raptors. They therefore rely on dense cover for protection during the day.

6.2.2 Birds:

Of the 167 species likely to occur on site, 23 species were recorded during the site visit. Almost all species were typical of woodland habitats.

Avifaunal Habitat Assessment:

Figure 2 illustrates the habitat types utilised by bird species expected to occur on the study site.



Three distinct bird habitat systems were identified. A short description of each habitat type is as follows ranked from most to least important (refer to figure 2):

Southern slope and summit of the ridge:

The area also known as the area to be examined forms the northern half of the study site and consists of vegetation that grows on the summit and southern cooler slope of the randjie/ridge that runs through the area. The plateau of the ridge consists of small open grassland areas surrounded by mainly small to medium sized *Acacia caffra* trees species (dominant). The tree cover becomes denser further to the south on the steep

ridge slope varying in density from place to place with few exotic plant species. Further south, inline with the main access road on the property the area is more disturbed through human activities in the past and various exotic trees such as Eucalyptus can also be found amongst the indigenous trees and vegetation. The grass cover between the exposed quartzite rocks is fairly dense and will produce seeds during late summer for seed eating bird species such as bishops, canaries and weavers and will also be an important food source during winter. Insect life is fairly abundant for insect eating bird species. Food availability for birds is greater than can be found on the northern slope of the ridge due to the denser tree cover and there is more cover available for birds for nest building and shelter.

This habitat will favour species typically associated with *Acacia* savanna habitat and more specifically mixed *Acacia* savanna woodland. The bird species within this habitat generally include a great variety of arboreal passerines such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. *Acacia* trees generally attract many insects and in turn attract a good diversity of typical *Acacia* savanna bird species. The rocky outcrops will favour birds associated with rocky habitats such as chats, wheateats, rock thrushes, buntings and cisticolas that will favour the rocky nature of the area for breeding and to perch from when hunting for insects and to scan surroundings for predators. The trees and shrubs growing between these rocks will also provide food in the form of seeds and fruits to various bird species and will also provide shelter and nest building sites for many birds especially passerines. This is the only area where possible Red Data bird species might be found but they will more than likely only move through the area than actually make use of the vegetation on site for breeding or foraging purposes.

Drainage line and surrounding vegetation

A non permanent stream or drainage line with generally steep banks runs through the middle of the property surrounded and overgrown by dense vegetation such as trees, weeds and grass. Little exposed water could be found and the impoundment on site does not retain water for a long time due to an eroded dam wall. This drainage line and associated vegetation is only likely to attract the more common bird species associated with semi aquatic habitat conditions. Large Eucalyptus surrounds the impoundment and grows at several places within the drainage line. Exotic Eucalyptus trees usually do not offer a large variation in plant communities and these trees are mostly unpalatable in their growing and live stage for insect and game species. As a result, a few insect eating bird species will occur within these plantations. A number of nectar feeding species such as white-eyes and sunbirds will feed on the nectar produced by the flowers of these trees. Some birds also make nest in these trees. None or little grass growth takes place on the ground where these trees grow and seed eating species are few. These trees are known to extract large volumes of water daily and the surrounding ground is normally hard and dry.

Open grassland:

The rest of the site consists mainly of open grassland dominated by *Hyperenia hirta* grass with scattered exotic and indigenous trees and shrubs on mainly disturbed soils and old lands. The presence and abundance of bird species in this habitat will vary from season to season being lush and green in summer after summer rains and dry and

brown or burnt during winter. The area will favour ground living bird species such as lapwings, francolins, pipits, long claws, larks and chats that either hunt for insects or breed on the ground, in burrows in the ground or between the grasses. Weavers and widow-birds will make use of this area for feeding (seeds) during late summer and early winter when the grass is not burnt and widow-birds and cisticolas will also breed in the tall grass during summer. Aerial feeding birds such as martins, swifts and swallows will hunt for insects over the grasslands.

Table 7: Bird species in species order according to *Robert - Birds of Southern Africa VII* th edition (Hockey *et al*, 2005) that were actually observed on site (**in bold**) or that are likely to occur within the specific habitat(s) found on site. This does not include over flying birds or rare vagrants. Reporting rate (%) according to Harrison *et al.* (1997). The habitat preference, SR = Southern Ridge slope, DL = Drainage Line and OG = Open Grassland are indicated next to the reporting rate with their possibility of occurrence in these specific habitats on site rated as H = High, M = Medium, L = Low, VL = very low, and X = Not likely to occur.

SCIENTIFIC NAME	ENGLISH NAME	R RATE (%) [*] 2528CD	HABITAT PREFERENCE		
			SR	DL	OG
<i>Peliperdix coqui</i>	Coqui Francolin	6	M	L	L
<i>Pternistis swainsonii</i>	Swainson's Spurfowl	19	M	L	H
<i>Numida meleagris</i>	Helmeted Guineafowl	52	H	H	H
<i>Dendrocygna viduata</i>	White-faced Duck	9	X	VL	X
<i>Alopochen aegyptiaca</i>	Egyptian Goose	33	X	M	X
<i>Anas undulata</i>	Yellow-billed Duck	16	X	L	X
<i>Indicator indicator</i>	Greater Honeyguide	4	H	H	M
<i>Indicator minor</i>	Lesser Honeyguide	8	H	M	H
<i>Prodotiscus regulus</i>	Brown-backed Honeybird	1	H	H	H
<i>Jynx ruficollis</i>	Red-throated Wryneck	32	H	H	H
<i>Campethera abingoni</i>	Golden-tailed Woodpecker	9	L	VL	VL
<i>Dendropicos fuscescens</i>	Cardinal Woodpecker	18	H	H	H
<i>Pogoniulus chrysoconus</i>	Yellow-fronted Tinkerbird	7	M	L	L
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet	20	M	M	M
<i>Lybius torquatus</i>	Black-collared Barbet	74	H	H	H
<i>Trachyphonus vaillantii</i>	Crested Barbet	91	H	H	H
<i>Tockus nasutus</i>	African Grey Hornbill	4	M	L	L
<i>Upupa africana</i>	African Hoopoe	80	L	M	H
<i>Phoeniculus purpureus</i>	Green Wood-Hoopoe	62	H	H	H
<i>Halcyon senegalensis</i>	Woodland Kingfisher	7	L	L	L
<i>Halcyon albiventris</i>	Brown-hooded Kingfisher	22	M	H	H
<i>Merops bullockoides</i>	White-fronted Bee-eater	12	L	M	M
<i>Merops pusillus</i>	Little Bee-eater	2	VL	L	L
<i>Merops apiaster</i>	European Bee-eater	18	H	H	H
<i>Colius striatus</i>	Speckled Mousebird	79	H	H	H
<i>Urocolius indicus</i>	Red-faced Mousebird	38	H	H	H
<i>Cuculus solitarius</i>	Red-chested Cuckoo	25	H	H	H
<i>Cuculus clamosus</i>	Black Cuckoo	9	L	L	L
<i>Chrysococcyx klaas</i>	Klaas's Cuckoo	6	L	L	L
<i>Chrysococcyx caprius</i>	Diderick Cuckoo	33	M	H	H

SCIENTIFIC NAME	ENGLISH NAME	R RATE (%)* 2528CD	HABITAT PREFERENCE		
			SR	DL	OG
<i>Centropus burchellii</i>	Burchell's Coucal	64	M	H	M
<i>Cypsiurus parvus</i>	African Palm-Swift	22	H	H	H
<i>Apus barbatus</i>	African Black Swift	3	M	M	M
<i>Apus affinis</i>	Little Swift	33	H	H	H
<i>Apus caffer</i>	White-rumped Swift	24	H	H	H
<i>Corythaixoides concolor</i>	Grey Go-away-bird	55	H	H	H
<i>Tyto alba</i>	Barn Owl	7	H	H	H
<i>Ptilopsis granti</i>	Southern White-faced Scops-Owl	<1	L	VL	VL
<i>Bubo africanus</i>	Spotted Eagle-Owl	12	H	H	H
<i>Glaucidium perlatum</i>	Pearl-spotted Owlet	1	VL	VL	VL
<i>Caprimulgus pectoralis</i>	Fiery-necked Nightjar	1	M	VL	X
Caprimulgus rufigena	Rufous-cheeked Nightjar	<1	M	VL	X
<i>Columba livia</i>	Rock Dove	31	M	L	H
<i>Columba guinea</i>	Speckled Pigeon	57	H	H	H
Streptopelia senegalensis	Laughing Dove	96	H	H	H
Streptopelia capicola	Cape Turtle-Dove	81	H	H	H
Streptopelia semitorquata	Red-eyed Dove	22	H	H	H
<i>Treron calvus</i>	African Green-Pigeon	1	L	L	L
<i>Burhinus capensis</i>	Spotted Thick-knee	40	L	L	H
<i>Charadrius tricollaris</i>	Three-banded Plover	15	X	VL	X
<i>Vanellus armatus</i>	Blacksmith Lapwing	39	X	M	L
<i>Vanellus senegallus</i>	African Wattled Lapwing	15	X	M	L
<i>Vanellus coronatus</i>	Crowned Lapwing	80	VL	L	H
<i>Aviceda cuculoides</i>	African Cuckoo Hawk	<1	VL	X	X
<i>Elanus caeruleus</i>	Black-shouldered Kite	48	L	H	H
<i>Milvus migrans</i>	Black Kite	14	L	L	L
<i>Accipiter minullus</i>	Little Sparrowhawk	1	L	M	L
<i>Accipiter ovampensis</i>	Ovambo Sparrowhawk	2	M	M	L
<i>Accipiter melanoleucus</i>	Black Sparrowhawk	1	VL	VL	X
<i>Buteo vulpinus</i>	Steppe Buzzard	4	M	M	VL
<i>Falco rupicolus</i>	Rock Kestrel	1	VL	X	X
<i>Falco rupicoloides</i>	Greater Kestrel	3	VL	X	X
<i>Ardea melanocephala</i>	Black-headed Heron	33	X	L	M
<i>Bubulcus ibis</i>	Cattle Egret	75	X	H	H
<i>Scopus umbretta</i>	Hamerkop	24	X	M	X
Bostrychia hagedash	Hadeda Ibis	91	M	H	H
<i>Oriolus larvatus</i>	Black-headed Oriole	20	H	H	M
<i>Dicrurus adsimilis</i>	Fork-tailed Drongo	35	H	H	H
<i>Terpsiphone viridis</i>	African Paradise-Flycatcher	18	H	H	H
<i>Nilaus afer</i>	Brubru	9	M	L	VL
<i>Dryoscopus cubla</i>	Black-backed Puffback	18	H	H	H
Tchagra senegalus	Black-crowned Tchagra	25	H	H	L

SCIENTIFIC NAME	ENGLISH NAME	R RATE (%)* 2528CD	HABITAT PREFERENCE		
			SR	DL	OG
<i>Tchagra australis</i>	Brown-crowned Tchagra	10	H	M	M
<i>Laniarius ferrugineus</i>	Southern Boubou	36	M	H	H
<i>Laniarius atrococcineus</i>	Crimson-breasted Shrike	8	M	L	L
<i>Telophorus zeylonus</i>	Bokmakierie	68	H	H	H
<i>Malaconotus blanchoti</i>	Grey-headed Bush-Shrike	1	M	M	M
<i>Batis molitor</i>	Chin-spot Batis	23	H	M	M
<i>Corvus albus</i>	Pied Crow	56	H	H	H
<i>Lanius collurio</i>	Red-backed Shrike	2	M	L	L
<i>Lanius collaris</i>	Common Fiscal	93	M	H	H
<i>Campephaga flava</i>	Black Cuckooshrike	6	M	X	X
<i>Parus niger</i>	Southern Black Tit	3	M	X	X
<i>Parus cinerascens</i>	Ashy Tit	6	VL	X	X
<i>Riparia paludicola</i>	Brown-throated Martin	7	X	L	X
<i>Riparia cincta</i>	Banded Martin	4	X	VL	VL
<i>Hirundo rustica</i>	Barn Swallow	23	H	H	H
<i>Hirundo albigularis</i>	White-throated Swallow	24	L	H	L
<i>Hirundo dimidiata</i>	Pearl-breasted Swallow	2	L	L	L
<i>Hirundo cucullata</i>	Greater Striped Swallow	41	H	H	H
<i>Hirundo abyssinica</i>	Lesser Striped Swallow	33	H	H	H
<i>Hirundo semirufa</i>	Red-breasted Swallow	9	VL	VL	VL
<i>Hirundo fuligula</i>	Rock Martin	13	M	VL	VL
<i>Delichon urbicum</i>	Common House-Martin	4	L	L	L
<i>Pycnonotus tricolor</i>	Dark-capped Bulbul	94	H	H	H
<i>Stenostira scita</i>	Fairy Flycatcher	5	M	L	L
<i>Sphenoeacus afer</i>	Cape Grassbird	15	X	H	VL
<i>Sylvietta rufescens</i>	Long-billed Crombec	13	M	VL	VL
<i>Acrocephalus baeticatus</i>	African Reed-Warbler	2	X	L	X
<i>Acrocephalus palustris</i>	Marsh Warbler	<1	H	M	H
<i>Acrocephalus arundinaceus</i>	Great Reed-Warbler	1	L	M	M
<i>Phylloscopus trochilus</i>	Willow Warbler	9	H	H	H
<i>Turdoides jardineii</i>	Arrow-marked Babbler	18	H	H	H
<i>Parisoma subcaeruleum</i>	Chestnut-vented Tit-Babbler	24	M	VL	VL
<i>Sylvia borin</i>	Garden Warbler	2	M	M	M
<i>Zosterops virens</i>	Cape White-eye	78	H	H	H
<i>Cisticola aberrans</i>	Lazy Cisticola	4	M	X	X
<i>Cisticola chiniana</i>	Rattling Cisticola	7	M	M	M
<i>Cisticola lais</i>	Wailing Cisticola	2	M	X	X
<i>Cisticola tinniens</i>	Levaillant's Cisticola	12	X	M	L
<i>Cisticola fulvicapilla</i>	Neddicky	28	H	H	H
<i>Cisticola juncidis</i>	Zitting Cisticola	12	L	M	H
<i>Cisticola aridulus</i>	Desert Cisticola	4	X	X	L
<i>Cisticola textrix</i>	Cloud Cisticola	2	X	X	VL
<i>Prinia subflava</i>	Tawny-flanked Prinia	32	L	H	M
<i>Prinia flavicans</i>	Black-chested Prinia	37	H	M	H

SCIENTIFIC NAME	ENGLISH NAME	R RATE (%)* 2528CD	HABITAT PREFERENCE		
			SR	DL	OG
<i>Apalis thoracica</i>	Bar-throated Apalis	17	H	H	L
<i>Mirafraga africana</i>	Rufous-naped Lark	16	X	X	L
<i>Psophocichla litsitsirupa</i>	Groundscraper Thrush	8	VL	L	L
<i>Turdus libonyanus</i>	Kurrichane Thrush	14	M	H	H
<i>Turdus smithi</i>	Karoo Thrush	84	M	H	H
<i>Sigelus silens</i>	Fiscal Flycatcher	46	H	H	H
<i>Muscicapa striata</i>	Spotted Flycatcher	7	H	H	H
<i>Cossypha caffra</i>	Cape Robin-Chat	78	H	H	H
<i>Cossypha humeralis</i>	White-throated Robin-Chat	9	H	L	L
<i>Cercotrichas leucophrys</i>	White-browed Scrub-Robin	8	L	VL	VL
<i>Saxicola torquatus</i>	African Stonechat	20	X	M	L
<i>Oenanthe monticola</i>	Mountain Wheatear	24	VL	X	X
<i>Cercomela familiaris</i>	Familiar Chat	5	M	L	VL
<i>Onychognathus morio</i>	Red-winged Starling	10	M	L	L
<i>Lamprotornis nitens</i>	Cape Glossy Starling	33	H	H	H
<i>Cinnyricinclus leucogaster</i>	Violet-backed Starling	5	M	M	M
<i>Acridotheres tristis</i>	Common Myna (INT)	7	M	H	H
<i>Chalcomitra amethystina</i>	Amethyst Sunbird	51	H	H	H
<i>Cinnyris talatala</i>	White-bellied Sunbird	59	H	H	H
<i>Ploceus capensis</i>	Cape Weaver	33	L	M	L
Ploceus velatus	Southern Masked-Weaver	84	H	H	H
<i>Ploceus cucullatus</i>	Village Weaver	6	L	L	L
<i>Quelea quelea</i>	Red-billed Quelea	4	H	H	H
<i>Euplectes afer</i>	Yellow-crowned Bishop	3	X	VL	X
<i>Euplectes orix</i>	Southern Red Bishop	44	M	H	H
<i>Euplectes albonotatus</i>	White-winged Widowbird	27	X	H	M
<i>Euplectes ardens</i>	Red-collared Widowbird	28	X	H	L
<i>Amblyospiza albifrons</i>	Thick-billed Weaver	<1	L	M	M
<i>Sporaeginthus subflavus</i>	Orange-breasted Waxbill	7	X	M	L
<i>Ortygospiza atricollis</i>	African Quailfinch	4	X	M	M
<i>Estrilda astrild</i>	Common Waxbill	20	L	H	H
<i>Lagonosticta rhodopareia</i>	Jameson's Firefinch	3	H	H	H
<i>Spermestes cucullatus</i>	Bronze Mannikin	30	M	H	H
<i>Vidua macroura</i>	Pin-tailed Whydah	24	M	H	H
<i>Vidua paradisaea</i>	Long-tailed Paradise-Whydah	6	VL	VL	VL
<i>Passer domesticus</i>	House Sparrow	71	L	X	X
<i>Passer melanurus</i>	Cape Sparrow	93	H	H	H
<i>Passer diffusus</i>	Southern Grey-headed Sparrow	28	H	H	H
<i>Motacilla capensis</i>	Cape Wagtail	70	X	M	L
<i>Macronyx capensis</i>	Cape Longclaw	20	X	VL	L
<i>Anthus lineiventris</i>	Striped Pipit	1	M	X	X
<i>Anthus cinnamomeus</i>	African Pipit	8	X	VL	H
<i>Crithagra mozambicus</i>	Yellow-fronted Canary	15	H	H	H
Crithagra atrogularis	Black-throated Canary	30	H	H	H

SCIENTIFIC NAME	ENGLISH NAME	R RATE (%)* 2528CD	HABITAT PREFERENCE		
			SR	DL	OG
<i>Crithagra gularis</i>	Streaky-headed Seedeater	23	H	H	H
<i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting	7	M	X	X

*The reporting rate is calculated as follow: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell.

INT = Introduced or alien birds species to Southern Africa.

Red Data Species Categories for the birds (Barnes, 2000)

RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened.

6.2.3. Reptiles and Amphibians:

No termitaria were noticed on the site and the area does not appear to be particularly suitable for reptiles nor amphibians, due to the hard substrate and lack of other shelter, such as burrows or retreats under rocks or other debris. Accumulated dry vegetable matter is available temporarily. Dead and fallen aloes provide ideal shelter for small reptiles.

The area south of the drainage line appears to consist of a rather hard clayey substrate without noticeable retreats, such as burrows or dead termitaria, apart from a relatively dense accumulation of dry grass, with added fresh growth. There are indications that this area was ploughed in the past. Consequently, the species diversity and population densities would be low.

The area of special interest against the southern slope of the ridge at the northern end of the site also lacks obvious, suitable retreats for amphibians and reptiles. The substrate consists of stony to rocky clayey soil, not suitable for burrowing or sand swimming reptiles. Less specialised terrestrial reptile species may utilise the limited available possibilities provided by accumulated dry vegetable matter. No amphibians are expected to occur here.

The wetland and the drainage line may be suitable for the reproduction of some toads and sandfrogs. The bottom of the valley does not appear to be suitable for the formation of breeding ponds for the 'Near Threatened' Giant Bullfrog (*Pixycephalus adspersus*) nor is the substrate of the adjacent terrain suitable for burrowing for the purposes of aestivation and hibernation. Occasionally individual specimens from adjacent areas may appear on this site.

The ruins of the former farm buildings are still utilised by the most common commensals, such as the Speckled Skink (*Trachylepis punctatissima*) and the Cape Dwarf Gecko (*Lygodactylus capensis*).

Based on the impressions gathered during the visit and records in the Transvaal Museum, as well as the documentation of the herpetofauna of the then Transvaal by Dr N. H. G. Jacobsen (Unpublished Ph.D. thesis, University of Pretoria, 1989), his internal report for the Gauteng Province (1995) and the 'Atlas and Red Data Book of the Frogs of

South Africa, Lesotho and Swaziland' (Minter, *et al*, 2004) the following list of species seen to occur and which may occur on this site was compiled.

Table 8: List the amphibians and reptiles which may still occur on this site:-

SCIENTIFIC NAME	ENGLISH NAME	PROBABILITY OF OCCURRENCE
CLASS: AMPHIBIA	AMPHIBIANS	
Order: ANURA	FROGS	
Family: Bufonidae	Toads	
<i>Bufo gutturalis</i>	Guttural Toad	Low
<i>Bufo rangeri</i>	Ranger's Toad	Low
<i>Schismaderma carens</i>	Red Toad	Medium
Family: Ranidae	Common Frogs	
<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	Low
CLASS: REPTILIA	REPTILES	
Order: SQUAMATA	SCALE-BEARING REPTILES	
Suborder: LACERTILIA	LIZARDS	
Family: Gekkonidae	Geckos	
<i>Lygodactylus capensis</i>	Cape Dwarf Gecko	Medium
<i>Pachydactylus affinis</i>	Transvaal Thick-toed Gecko	Low
<i>Pachydactylus capensis</i>	Cape Thick-toed Gecko	Low
Family: Chamaeleonidae	Chameleons	
<i>Chamaeleo dilepis</i>	Flap-necked Chameleon	Medium
Family: Scincidae	Skinks	
<i>Trachylepis capensis</i>	Cape Skink	Low
<i>Trachylepis punctatissima</i>	Speckled Skink	High
<i>Lygosoma sundevallii</i>	Sundevall's Writhing Skink	Low
<i>Panaspis wahlbergii</i>	Wahlberg's Snake-eyed Skink	Low
Family: Gerrhosauridae	Plated Lizards	
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Low
Family: Cordylidae	Girdled Lizards	
<i>Chamaesaura aenea</i>	Transvaal Grass Lizard	Low
Sub-order: SERPENTES	SNAKES	

SCIENTIFIC NAME	ENGLISH NAME	PROBABILITY OF OCCURRENCE
Family: Leptotyphlopidae	Thread Snake	
<i>Leptotyphlops incognitus</i>	Eastern Thread Snake	Low
Family: Atractaspidae	African Burrowing Snakes	
<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Low
<i>Aparallactus capensis</i>	Cape Centipede Eater	Low
Family: Colubridae	Typical Snakes	
<i>Lamprophis capensis</i>	Brown House Snake	Medium
<i>Lycophidion capense</i>	Cape Wolf Snake	Low
<i>Psammophis brevirostris</i>	Short-snouted Sand Snake	Low
<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	Low
<i>Crotaphopeltis hotamboeia</i>	Herald or Red-lipped Snake	Medium
<i>Telescopus s. semiannulatus</i>	Eastern Tiger Snake	Low
<i>Dispholidus typus</i>	Boomslang	Low
<i>Dasypeltis scabra</i>	Common or Rhombic Egg-eater	Low
Family: Elapidae	Cobras, Mambas and others	
<i>Hemachatus haemachatus</i>	Rinkhals	Low
<i>Naja annulifera</i>	Snouted Cobra	Low
<i>Naja mossambica</i>	Mozambique Spitting Cobra	Low
Family: Viperidae	Adders	
<i>Causus rhombeatus</i>	Rhombic Night Adder	Low

7. FINDINGS AND POTENTIAL IMPLICATIONS

7.1 Flora

A plant survey was not required for the lower third of the site, which included the drainage line. However, notes were made of the vegetation in these areas and opinions given in clauses 6.1.4, 6.1.9 and 6.1.10 above.

The upper two thirds of the site, except for the area with residences that comprised alien and indigenous vegetation, consisted of natural vegetation of which two plant communities were considered sensitive with good connectivity.

7.2 Fauna

7.2.1 Mammals

The following section is an impact assessment in terms of development on the site:

The site is scheduled for residential development, and as such much of the habitat elements on the plain will be destroyed, with a domino effect on most of the mammals bar the bats. It is not certain whether development is intended on the randjie slope and ridge, but even if not the woodland may be subjected to wilful destruction during the construction phase.

From a conservation perspective, reducing the few listed alien trees and plants will be advantageous, especially if new residents will eventually use garden plants proven to benefit garden birds.

- *Loss of ecological sensitive and important vegetation units*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Ridge vegetation	Site specific	Medium term	Requires mitigation	Requires intervention	High
Semi-aquatic vegetation	Site and adjoining areas	Medium term	Requires mitigation	Requires directed restoration	Medium

It would be inadvisable to develop the higher slopes and ridge of the randjie so as to retain the indigenous woodland and associated fauna. As such this portion should be protected against destructive practices such as fire and snaring during development, and once the development is completed active management would be advisable. It is suggested that the semi-aquatic vegetation be restored.

- Loss of ecosystem function (e.g. reduction in water quality, soil pollution)

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of wetland ecosystem function	Site specific	Long-term	Probable	Low	Low

At present the semi-aquatic vegetation along the drainage courses are disturbed and weakly developed. However, as such they still support habitat-specific vertebrates. Should these water courses be destroyed by lining with concrete, it will be at the cost of biodiversity. A better option would be restoration and conversion in an open-air recreational site.

- Loss of faunal habitat

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Wetland vegetation	Site and adjoining properties	Long-term “	Probable “	Low “	Low “

Apart from supporting a number of narrowly-adapted faunal species, semi-aquatic vegetation along drainage lines as well as woodlands along the randjies/ridge also act as dispersal corridors. However, since none of the species reliant on the wetlands or on the ridge of the site is deemed Red Data, the intensity and significance of loss is rated as low.

(See Appendix B for definitions)

7.2.2 Birds

The following Red Data Species were recorded for the 2528CD quarter degree grid cell (q.d.g.c) (Table 9).

Table 9: Red Data species recorded for the 2528CD q.d.g.c according to Harrison *et al.* (1997) and Tarboton *et al.* (1987).

SCIENTIFIC NAME	ENGLISH NAME	REPORTING RATE (%)* 2528CD RIETVLEI DAM
<i>Alcedo semitorquata</i>	Half-collared Kingfisher (NT)	<1(T)
<i>Tyto capensis</i>	African Grass-Owl (VU)	1(Tb)
<i>Neotis denhami</i>	Denham's Bustard (VU)	(T)
<i>Eupodotis caerulescens</i>	Blue Korhaan (NT)	<1(T)
<i>Eupodotis senegalensis</i>	Barrow's Korhaan (VU)	<1(T)
<i>Anthropoides paradiseus</i>	Blue Crane (VU)	3(Tb)
<i>Podica senegalensis</i>	African Finfoot (VU)	(T)
<i>Crex crex</i>	Corn Crake (VU)	<1
<i>Rostratula benghalensis</i>	Greater Painted-snipe (NT)	<1
<i>Glareola nordmanni</i>	Black-winged Pratincole (NT)	<1(T)
<i>Sterna caspia</i>	Caspian Tern (NT)	<1
<i>Gyps coprotheres</i>	Cape Vulture (VU)	(T)
<i>Aegypius tracheliotus</i>	Lappet-faced Vulture (VU)	(T)
<i>Terathopius ecaudatus</i>	Bateleur (VU)	(T)
<i>Circus ranivorus</i>	African Marsh-Harrier (VU)	(T)
<i>Aquila rapax</i>	Tawny Eagle (VU)	<1
<i>Aquila ayresii</i>	Ayres's Hawk-Eagle (NT)	<1
<i>Polemaetus bellicosus</i>	Martial Eagle (VU)	(Tb)
<i>Sagittarius serpentarius</i>	Secretarybird (NT)	2(T)
<i>Falco naumanni</i>	Lesser Kestrel (VU)	1(T)
<i>Falco biarmicus</i>	Lanner Falcon (NT)	1(Tb)
<i>Falco peregrinus</i>	Peregrine Falcon (NT)	<1

SCIENTIFIC NAME	ENGLISH NAME	REPORTING RATE (%)* 2528CD RIETVLEI DAM
<i>Phoenicopterus ruber</i>	Greater Flamingo (NT)	<1(T)
<i>Mycteria ibis</i>	Yellow-billed Stork (NT)	(T)
<i>Ciconia nigra</i>	Black Stork (NT)	<1
<i>Mirafra cheniana</i>	Melodious Lark (NT)	(Tb)
	Very Low :	15
	Low :	2
	Meduim :	0
	High :	0
	TOTAL :	17
	Tarboton :	14
	Tarboton breeding:	5
		19

*The reporting rate is calculated as follow: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell.

Red Data Species Categories for the birds (Barnes, 2000)

RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened.

Br? = Suspected breeding, Br = Confirmed breeding, V = Vagrant, RV = Rare Vagrant, VRV = Vary Rare Vagrant, OV = Occasional Visitor and (?) or (X) Unlikely to occur on site

Twenty-six Red Data bird species have been recorded within the 2528CD q.d.g.c (Table 9). Nine of these have disappeared from the area or have not been recorded for this quarter degree grid cell during the time of the southern African Bird Atlas project. It is unlikely that they will ever be seen in this region again except maybe on rare occasions in protected areas. Five of these species used to breed within the said q.d.g.c (Tarboton 1987) and none have been recorded breeding for the q.d.g.c. during the period of the Southern African bird atlas project. All of the red data species that have been recorded shows a low to very low reporting rate. This decline in breeding species is probably due to the large extent of development that has taken place in the area during a short space of time.

On site habitat assessment:

With regards to the specific habitat found on site none of the Red Data bird species listed in the Eskom Red Data Book of Birds of Southern Africa, Lesotho and Swaziland (Barnes, 2000) are likely to make use of the study site due to the lack of sufficient breeding and foraging habitat and the large scale of development surrounding the site and the disturbance caused by these developments. Species such as the Peregrine and Lanner Falcon might on occasion move through the area and use the ridge as a route to move through.

Table 9 provides a list of the Red Data birds recorded for the 2528CD q.d.g.c according to Harrison *et al.* (1997) and an indication of the likelihood of occurring on the study site based on habitat and food availability on site.

Table 10: Red Data bird species assessment for all red data species recorded for the 2527CD q.d.g.c according to Harrison *et al.* (1997) with particular reference to the availability of suitable habitat and food on the study site.

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
<i>Alcedo semitorquata</i> (Half-collared Kingfisher) (NT)	None, prefers clear fast-flowing rivers fringed with riparian growth.	Highly unlikely
<i>Tyto capensis</i> (African Grass-Owl) (VU)	None. prefers rank moist grassland bordering vleis	Highly Unlikely
<i>Eupodotis caerulescens</i> (Blue Korhaan) (NT)	None: prefers natural open grassland, karoo scrub and cultivated lands.	Highly unlikely
<i>Eupodotis senegalensis</i> (Barrow's Korhaan) (VU)	None: preferred tall vegetation, typically fairly dense grassland in either open or lightly wooded regions and seems abundant in hilly areas (Barnes 2000).	Highly unlikely
<i>Anthropoides paradiseus</i> (Blue Crane) (VU)	None. Prefers more open grassland and Karriod grassland.	Highly unlikely
<i>Crex crex</i> (Corn Crake) (VU)	None. Tall grass bordering wetlands and marsh	Highly unlikely
<i>Rostratula benghalensis</i> (Greater Painted-snipe) (NT)	None. Prefers marshes within wetland habitat	Highly unlikely
<i>Glareola nordmanni</i> (Black-winged Pratincole) (NT)	None:	Highly unlikely
<i>Sterna caspia</i> (Caspian Tern) (NT)	None. Prefers coastline and estuaries and large inland impoundments.	Highly unlikely
<i>Aquila rapax</i> (Tawny Eagle) (VU)	None. Their presence is dependent on the availability of food and it is a rare visitor to the region.	Highly unlikely
<i>Aquila ayresii</i> (Ayres's Hawk-Eagle) (VU)	None. They are only likely to move over the area on rare occasions.	Highly unlikely. Only on rare occasions
<i>Circus ranivorus</i> (African Marsh-Harrier) (VU)	None. Dependent on permanent wetlands for breeding, roosting and foraging.	Highly unlikely
<i>Sagittarius serpentarius</i> (Secretarybird) (NT)	None. Restricted to large conservation areas in the region. Avoids densely wooded or rocky, hilly or mountainous areas.	Highly unlikely. Only on rare occasions.
<i>Falco naumanni</i>	Palaeartic migrant. Prefers open country	Unlikely:

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
(Lesser Kestrel) (VU)	such as pristine open grassland and pastures for foraging purposes	Occasional
<i>Falco biarmicus</i> (Lanner Falcon) (NT)	May hunt over and move through the area on rare occasions.	Unlikely: Might hunt over the area on occasion
<i>Falco peregrinus</i> (Peregrine Falcon) (NT)	May hunt over the area on rare occasions	Unlikely:
<i>Phoenicopterus ruber</i> (Greater Flamingo) (NT)	None. Prefers extensive systems of wetland, notably pans, marshes, lakes and floodplains	Highly unlikely
<i>Ciconia nigra</i> (Black Stork) (NT)	None. Prefers shallow waterbodies such as estuaries and rivers	Unlikely

To ensure future bird diversity and free movement of birds on site it is important that no development be allowed on the steep slope and summit of the ridge as well as within 50 meters on both side of the drainage line.

7.2.3 Reptiles and Amphibians

The area south of the drainage line appears to consist of a rather hard clayey substrate without noticeable retreats, such as burrows or dead termitaria, apart from a relatively dense accumulation of dry grass, with added fresh growth. There are indications that this area was ploughed in the past. Consequently, the species diversity and population densities would be low.

The area of special interest against the southern slope of the ridge at the northern end of the site also lacks obvious, suitable retreats for amphibians and reptiles. The substrate consists of stony to rocky clayey soil, not suitable for burrowing or sand swimming reptiles. Less specialised terrestrial reptile species may utilise the limited available possibilities provided by accumulated dry vegetable matter. No amphibians are expected to occur here.

The wetland and the drainage line may be suitable for the reproduction of some toads and sandfrogs. The bottom of the valley does not appear to be suitable for the formation of breeding ponds for the 'Near Threatened' Giant Bullfrog (*Pixycephalus adspersus*) nor is the substrate of the adjacent terrain suitable for burrowing for the purposes of aestivation and hibernation. Occasionally individual specimens from adjacent areas may appear on this site.

The ruins of the former farm buildings are still utilised by the most common commensals, such as the Speckled Skink (*Trachylepis punctatissima*) and the Cape Dwarf Gecko (*Lygodactylus capensis*).

8. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

To date, only the new SANBI vegetation map was published. No details of the composition of the various vegetation communities were published as yet and assumptions about the status of the natural vegetation on the site were made on the basis of past experience of natural pristine vegetation in the area.

Part of the site was burned in late winter, followed by months of drought until the first rains in September/October 2006. Most species had sprouted sufficiently to facilitate identification. Some grass species had not yet formed inflorescences and could therefore not be identified.

9. RECOMMENDED MITIGATION MEASURES

- No development should be allowed on the steep slope and summit of the ridge (vegetation communities: *Acacia karroo* – *Rhus lancea* bushveld and Plateau Savannah).
- No development should be allowed within the 1:100 year floodline of the drainage line.
- Development should be restricted to disturbed areas.
- Development on the randjies slope and ridge is deemed inadvisable.
- It is suggested that the drainage course be retained and ecologically developed as such.
- Hedgehogs (if any) that are found on site must be relocated to suitable protection areas as identified by GDACE.
- The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed from site.
- No plants not indigenous to the area, or exotic plant species, especially lawn grasses and other ground-covering plants, should be introduced in the landscaping of the proposed site, as they might spread into the natural vegetation areas;
- The cultivation of trees and shrubs indigenous to the area in gardens should be encouraged. With proper cultivation of specific indigenous plant species natural to the area, butterfly and bird numbers and species in the area would increase. Lists of plant species, which attract butterflies and birds to gardens, are available.
- Where possible work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- No vehicles must be allowed to move in or across the wet areas or drainage lines (except over the existing bridge and access road) and possibly get stuck. This leaves visible scars and destroys habitat. It is important to conserve areas where there are tall reeds or grass and areas where there are short grass and mud.
- It is suggested that where work is to be done close to the drainage lines, these areas be fenced off during construction to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system.

- It is important to note that birds inhabiting one of the named microhabitats on site will in most cases not move into a different habitat. In other words, birds found on the open woodland will not now, with the development, move into the grassland areas or the wetland area. If the objective is to keep these species on site, suitable open spaces must be kept for these species.
- During the construction phase noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.

10. CONCLUSIONS

Flora:

The vegetation in the *Acacia karroo* – *Rhus lancea* bushveld and in the Plateau savannah is deemed sensitive and should be excluded from the development and where possible, these areas must be connected to other natural vegetation areas on the neighbouring properties to facilitate connectivity. The drainage line should be cleared of all Category 1 Declared weeds and Category 2 Declared invaders and its flow into the neighbouring site be properly managed. All alien weeds and invader plants should likewise be removed from the rest of the site. Dumping of builders' rubble and other waste in the areas earmarked for exclusion must be prevented, through fencing or other management measures. These areas must be managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity.

Mammals:

Of the 30 mammal residents of the site; no Red Data mammals are identified.

Birds:

The proposed development should not have a negative affect on any Red Data bird species recorded for the 2528CD q.d.g.c. Within the area to be examined, no development should be allowed on the steep slope and summit of the ridge on site as this area consists of indigenous and undisturbed vegetation and will act as a corridor for birds and other fauna species to move through and will also ensure foraging and breeding habitat for many bird species. The area between the access road at the foothill of the steep slope of the ridge and the drainage line is less sensitive as well as the southern portion of the site south of the drainage line.

Reptiles and Amphibians:

Development on this site would require the removal of most of the vegetation cover, which at present is the most important shelter for the herpetofauna. If the steepest and rocky areas above the former farm buildings would be left untouched, this could provide a small retreat for a few individuals of the more common species.

The study site is not very suitable at present as habitat for amphibians or reptiles. A further reduction of species diversity and population densities is expected after development on this site.

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APPENDIX A

Red and Orange-listed plants of the 2528CD quarter degree grid

Species	Flowering season	Suitable habitat	Priority grouping	Conservation status	PRESENCE ON SITE
<i>Bowiea volubilis</i>	Sep-Apr	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	N/A	Declining ²	Habitat not suitable
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Nov-Apr	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.	A1	Vulnerable ¹	Habitat not suitable
<i>Delosperma gautengense</i>	Nov-Apr	Among rocks of Magaliesberg quartzite in grassland in transition to sour grassveld.	A1	Vulnerable ¹	Habitat not suitable
<i>Eucomis autumnalis</i> subsp. <i>clavata</i>	Nov-Apr	Open grassland, marshes.	N/A	Declining ²	Habitat suitable
<i>Eulophia coddii</i>	Early Dec	Steep hillsides on soil derived from sandstone, grassland or mixed bush.	A2	Vulnerable ¹	Habitat not suitable
<i>Habenaria bicolor</i>	Jan-Mar	Terrestrial in drained grassland, recorded from about 1800m.	B	Near Threatened ²	Habitat not suitable
<i>Habenaria kraenzliniana</i>	Feb-Apr	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	A3	Near Threatened ¹	Habitat not suitable
<i>Habenaria mossii</i>	Mar-Apr	Open grassland on dolomite or in black sandy soil.	A1	Endangered ¹	Habitat not suitable
<i>Holothrix randii</i>	Sep-Jan	Grassy slopes & rocky ledges.	B	Near Threatened ²	Habitat not suitable
<i>Hypoxis hemerocallidea</i>	Sep-Mar	Grassland and mixed woodland.	N/A	Declining ²	Habitat suitable
<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Mar-Apr	Brown shale on hilltops.	N/A	Declining ²	Habitat suitable
<i>Trachyandra erythrorrhiza</i>	Sep-Nov	Marshy areas, grassland, usually in black turf marshes.	A3	Near Threatened ¹	Habitat not suitable

¹) global status;

²) national status

* Orange listed plants have no priority grouping and are designated 'N/A'

APPENDIX B: DEFINITIONS OF IMPACT RATINGS.

Extent Rating	
High	Widespread Far beyond site boundary Regional / national / international scale
Medium	Beyond site boundary Local area
Low	Within site boundary

Intensity Rating / Nature of Impact	
High	Disturbance of pristine areas that have important conservation value Destruction of rare or endangered species
Medium	Disturbance or areas that have potential conservation value or are of use as resources Complete change in species occurrence or variety
Low	Disturbance of degraded areas, which have little conservation value Minor change in species occurrence or variety

Duration Rating	
High (Long term)	Permanent Beyond decommissioning Long term (more than 15 years)
Medium	Reversible over time Lifespan of the project Medium term (5-15 years)
Low	Quickly reversible Less than the project lifespan Short term (0-5 years)

Impact Magnitude and Significance Rating	
High	Of the highest order possible within the bounds of impacts that could occur. 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. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (<i>albeit</i> in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.
Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less consuming.
No impact	Zero impact

Visual Impact Assessment



Appendix G8

**PORTION 5 TYGERVALLEI 334 – JR
VISUAL IMPACT ASSESSMENT**

Summary

The visual impact for the above mentioned project will be summarized and described as follows:

After all the mitigation measure has been applied Loss of sense of place and visual quality will have a moderate effect and the significance of the impact will be low.

The visual impact due to incompatible land-use, low visual absorption capacity, and high visibility and critical views from Lynwood road and surrounding properties will have a slight impact but the significance of the impact will be low.

According to these conclusions the visual impact of the above mentioned project will not be negative to the surrounding areas and the site.

Insite landscape Architects cc
012 567 2780

**PORTION 5 TYGERVALLEI 334 – JR
VISUAL IMPACT ASSESSMENT**

INTRODUCTION

This Visual Impact Assessment is a specialist study to determine the visual effects of the proposed Residential Development of Portion 5 Tygervallei 334 - JR on the surrounding environment. This study forms part of the overall environmental impact assessment for the Residential Development of Portion 5 Tygervallei 334 – JR project.

The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. This goal will be reached through the realisation of the following objectives:

1. Determine the extent of the study area; this includes the site and the surrounding landscape, which is visually connected to the site.
2. Determine the visual character of the study area.
3. Identify the project components that may potentially impact on the visual environment.
4. Assess the significance of the identified impacts on the visual environment.
5. Identify elements of particular visual quality that could be affected by the proposed project, and
6. Recommend generic mitigation measures to reduce the potential visual impacts generated in the study area by the proposed project.

1. STUDY APPROACH

1.1 Method

The following methodology was followed:

The extent of the study area was identified as the area falling within a five-kilometre radius of the Site.

The proposed site was visited for orientation purposes and to capture the landscape character, views and proposed alignments in photographic images.

Topocadastral plans at 1:50 000 scale were used to determine the visual absorption capacity of the study area.

A report was prepared which describes: the visual environment, the project components, the potential risk sources and their assessed impact on the visual environment. This report examines the following visual aspects:

- Genius Loci (Sense of place)
- Visual Quality (Aesthetics)
- Landscape Character
- Surrounding Landscape Compatibility
- Scale
- Visual Absorption Capacity (VAC)
- Visibility (view shed and viewing distance)
- Critical Views

A summary of the identified visual impacts and their significance was compiled based on the visual aspects mentioned above.

2. STUDY AREA

The proposed site for the Residential Development project considered in this report is situated on the of Portion 5 Tygervallei 334 – JR. An area within a 5 km radius from the site was included in the study area, taking into consideration views toward the site.

Figure 1: Locality Plan Shows the Site position and the 5km radius from the site.

3. DESCRIPTION OF THE PROJECT COMPONENTS

3.1 Access road network.

A proposed new access road network will be constructed to accommodate traffic (See attached layout plan).

Road surface material: The major road surface material will be Asphalt blocks. At all intersections and major nodes red coloured concrete blocks will be laid in a pattern to accommodate traffic calming and create an aesthetic pleasing effect. Concrete kerbs will be placed on either side of the road surface.

Landscaping: Manicured lawns, veldgrass and indigenous trees will be installed next to all major roads. Indigenous trees, shrubs and groundcovers will be planted next to all intersections and major nodes to enhance the aesthetic effect.

3.2 Cut and fill operations – access road.

Cut and fill operations would be necessary to obtain the desired levels to accommodate the plots. After the removal of vegetation in the area of the road footprint, the existing soil and rock level would be cut on the slope, the slopes of the excavation stabilized and earth retaining measures put in place. Some blasting could be required (unknown). In the area requiring fill, soil from the cut operations and other imported soil would be placed on appropriate areas and stabilized, also taking care to stabilize the sides and finally covering with topsoil before being rehabilitated either through re-vegetation or according to the requirements of its identified use.

Two types of distinctive slope has been identified, moderate and steep.

Soft slopes: Cut and fill operations will be minimum, and the impact will be mitigated with general landscaping solutions.

Steep slopes: Cut and fill operations will be balanced out, landscaping and retaining structures will be implemented. All

retaining structures will be designed to blend into the surrounding area and architectural theme. Indigenous landscaping will be used as a visual support.

3.3 Erven

There will be a number of 132 erven all approximately 1 000m² in size with Highdensity housing situated at the entrance. Most of the erven of a rectangular shape, and some pan-handle erven to fill open spaces.

Open spaces: Many green 'Finger' open spaces have been provided for between designated areas. Areas will be landscape with indigenous trees, shrubs and ground covers to soften the visual impact. In areas where the slope is too steep to build on, the existing landscape will remain (most of the area of the hill/small ridge).

3.1 Architecture

The architectural theme for this English village was derived from a typical 'English Country' style. It is characterized by one and two story residential buildings using building material such as natural stone, timber, plaster and paint and clay roof tiles. Roof forms are simple, yet accentuated by dormers and double pitch gable end roofs. The architectural style is natural and truly English. The use of chimneys that protrude above the roof apex of the house, natural timber window frames and natural stone walls become distinctive and legible elements in this village.

Boundary walls and screening walls will only be allowed in the yard areas of the house. Yard walls shall not be higher than 1.8m. Low 'werf-type' walls are allowed on the sides of dwellings, not higher than 600mm. Boundary walls may not protrude beyond any housing unit.

All roofs must be double pitched with gable ends. The roofs will be finished with mazista clay tile.

Gutters and down pipes must be unobtrusive and must match the colour palette of the house

Only square-type small pane casement windows are allowed. Window timber frames to be of natural wood colour.

Only earthy colours will form part of the total colour scheme.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

This study was prepared at a sub-regional level therefore the study area was divided into six broad landscape types. These landscape types were derived from 1:50 000 topocadastral maps. The six landscape types are:

- * Rocky Hillside.
- * Open or mostly undeveloped grassland.
- * Smallholdings/ small farm lots.
- * Residential.
- * Commercial.
- * Quarry areas.

Figure 2: Landscape Types Plan shows the general position of these areas within the study area.

4.1 Rocky Hillside

This landscape is characterised by rocky outcrops and general rocky terrain sloping up to the crest of the hill. The vegetation occurring in this landscape is typical of the southern slope of the mountain range. The rocky features are considered noteworthy and would difficult to build and excavate these areas for development. 30% of the upper portion of the site does have these rocky outcrops.

4.2 Open undeveloped grassland

Open land is land where very little building development has taken place. This includes areas that are currently or have previously been cultivated or used for grazing. Large parcels of vacant land that may be zoned for some other use other than agricultural or public open space have been included in this landscape type.

This landscape can be described as having few or no structures and low vegetation profile less than 1 m in height, dominated by grasslands with limited areas of trees. Since this study is conducted at a sub-regional level large but scattered groups of trees are disregarded in this category.

4.3 Smallholdings/ Small farm lots

Smallholdings typically have a low density of buildings and structures with relatively large areas of undeveloped land spread evenly around and between them. Buildings are generally single or double storey structures. The vegetation has a low profile less than 1 m in height.

4.4 Residential

The buildings in the residential area are generally single or double story structures. The vegetation in this area has a very high profile with trees and palms up to 10 m in height. The viewing distance within the residential areas are mostly limited due to the high profile trees.

4.5 Commercial

The commercial zones are along the main traffic route, approximately 3 km + from the proposed building site. The commercial zone lies in an Eastern and western direction along Lynwood road.

4.6 Quarry areas

The quarry areas are approximately 2 and 4 km + to the east and western direction respectively of the proposed building site. The quarry areas typically have a lower density of buildings and structures. Buildings are generally single or double storey structures. The vegetation has a low profile, dominated by grasslands with limited areas of trees.

5. METHOD

This section describes the method of assessing the visual aspects, which have been considered in order to determine the intensity of the visual impact on the area.

5.1 Genius Loci (Sense of place)

The spirit, or sense, of place is that quality imparted by the aspects of scale, colour, texture, landform, enclosure, and in particular, the land use. According to Lynch (1996), "it is the extent to which a person can recognise or recall a place as being distinct from other places as having a vivid, or unique, or at least a particular, character of its own."

Table 1: Genius Loci Rating

A particularly definite place with an almost tangible dominant ambience or theme.	High
A place, which projects a loosely defined theme or ambience.	Moderate
A place having little or no ambience with which it can be associated.	Low

5.2 Visual Quality (Aesthetics)

The visual quality is the viewer's impression of a landscape, influenced by their own cultural values and past associations and the landscape's intrinsic physical properties. While cultural and past associations are individual to each viewer, the aesthetic properties, which invoke a reaction to the landscape character, can be identified and evaluated.

These aesthetic properties include the degree of visual diversity or complexity, any discernible textures or patterns, and the presence of unique or striking visual features in the landscape. The viewer's impression of the landscape is also significantly influenced by the degree of human intrusion into the landscape. The degree and compatibility of the human intrusion determines the intactness of the visual character. Together, these properties can be assessed in terms of the overall vividness, intactness and unity of the landscape.

Table 2: Visual Quality Rating

A very attractive setting with great variation and interest but no clutter.	High
A setting, which has some aesthetic and visual merit.	Moderate
A setting, which has little aesthetic value.	Low

5.3 Landscape Character

The topography, vegetation cover and settlement patterns are the chief aesthetic properties, which define the landscape character of the study area. The study area can be divided into a number of landscape types.

5.4 Surrounding Landscape Compatibility

Two methods are used to assess the compatibility of a proposed project with the surrounding landscape. Firstly by comparing the proposed land use to that of the existing use and secondly by comparing the level of complexity between the proposed and existing use in terms of the technology, cultural style, and design philosophy evident.

The design philosophy is considered to be the degree of a formal, academic or western science response, as apposed to an evolved response where development is informed by, and is the result of the overlaying of natural and social patterns. Table 3 defines the landscape compatibility factors and rating.

Table 3: Landscape Compatibility factors and rating

LANDSCAPE FACTOR	CATEGORIES	COMMENT
Land-use	Range	
	High	Complements and enhances the existing visual character of the land-use.
	Moderate	Complements the visual character of the existing land-use.
	Indifferent	Neither complements nor detracts from the visual character of the existing land-use.
	Low	Detracts from the visual character of the existing land-use.
	None	The visual character of the proposed and existing land-uses is not at all compatible.
Complexity	Range	
	High	The existing technology, cultural style, and design philosophy is complimented and enhanced through refinement.
	Moderate	The existing technology, cultural style, and design philosophy is complimented.
	Indifferent	The proposed technology, cultural style, and design philosophy neither complements nor is it in conflict with the existing.
	Low	The proposed technology, cultural style, and design philosophy is it in conflict with the existing.
	None	The proposed technology, cultural style, and design philosophy is not only in conflict with but also overwhelms the existing.

A final value is determined by combining the value given for Land-use and Complexity compatibility. The final value must be None, Low, Moderate or High.

5.5 Scale

The scale of an area relates to the vertical and horizontal dimensions of the landscape. The vertical and horizontal dimensions of the topography and natural features including vegetation, rock outcrops, water bodies and rivers influence on one's spatial interpretation of the landscape.

A repetition or layering of either horizontal or vertical elements emphasises these dimensions and adds perspective to the landscape, thereby increasing its visual quality.

Upright features in the landscape typically define the vertical scale while the horizontal scale and depth of field are defined by natural and man-made features that block or interrupt the field of vision along the horizontal plane or the line of sight to the horizon respectively.

5.6 Visual Absorption Capacity (VAC)

The visual absorption capacity (VAC) is a measure of the landscape's ability to visually accept / accommodate or embrace a development. Areas that have a high visual absorption capacity are able to easily accept features or structures so that their visual impact is less noticeable. Conversely areas with low visual absorption capacity will suffer a higher visual impact from structures imposed on them.

In this case, the VAC has been defined as a function of three factors:

- Slope
- Vegetation height
- Visual pattern (diversity) with regard to vegetation and structures

Three ranked categories are defined within each factor and each category has been assigned a numerical value to enable an arithmetic calculation of the VAC of different zones. The VAC factors, categories and their values are shown in Table 4.

As this study was undertaken at a local to sub-regional level, the areas of varying visual pattern (diversity) and vegetation height were based on the landscape types as discussed under section above. A 5 km buffer was drawn around the proposed site (where possible). Figure 2: Landscape Types Plan shows how this buffer area was divided into zones according to the six landscape types.

For the purpose of this study in terms of vegetation height the following was assumed:

Rocky Hillside, with shrubbery, medium size trees and grass	> 5m
Undeveloped land, which is characterised by grassland	1 < > 5m
Smallholdings are characterised by grassed areas with spread out structures	< 1m
Residential, with gardens: lawn, shrubs, medium to large trees	>5m

For the purpose of this study in terms of visual pattern/diversity the following was assumed:

Hillside with Rocky features, Shrubbery and Medium size trees has High VAC
 Undeveloped land, where grassland is typically uniform has Low VAC value.

Smallholdings with grassed areas with spread out structures have a Moderate VAC value.

Table 4: Visual Absorption Capacity (VAC) factors and their numerical values

VAC Factor	Categories			
Slope	Range	0-3 *	3-7 *	> 7 *
	Numerical	3	2	1
	Value	Low	Moderate	High
	VAC			
Vegetation Height	Range	< 1 m	1-5 m	5 m
	Numerical	3	2	1
	Value	Low	Moderate	High
	VAC			
Visual Pattern	Description	Uniform	Moderate	Diverse
	Numerical	3	2	1
	Value	Low	Moderate	High
	VAC			

5.7 Visibility (View Shed and Viewing Distance)

A Visibility survey was done for various selected viewpoints within the study area. These points were selected by assessing the areas and transport corridors most often frequented by potential viewers. Lynwood road was considered to be the most frequented transport corridor, and strategic viewpoints were selected along the road within the 5 km study area. Additional points were selected such as points within the residential area, which had a clear view on the proposed building site.

Figure 3: Viewpoints shows the various viewpoint positions within the study area.

Figures 4: Visuals from Viewpoints features photographs from each viewpoint towards the site.

Table 5: Descriptions of Viewpoints

Viewpoint No.	Description
1.	View from cnr. Hans strydom and Lynwood.
2.	View from filling station at the Hans strydom intersection.
3.	View from cnr. Lynwood and Silver lakes road.
4.	View from Silver lakes road.
5.	View from Silver lakes road.
6.	View from Lynwood road as indicated on the map.
7.	View from Lynwood road close to Lombardy estate.
8.	View from Lynwood road close to Lombardy estate.
9.	View from Lynwood at the entrance of the estate
10.	View in front of the estate
11.	View from La Campagnola
12.	View from Lynwood road as indicated on the map.
13.	View from Lynwood road as indicated on the map.
14.	View from Lynwood road as indicated on the map.
15.	View from the bridge at Swawe/ poort and Lynwood street
16.	View from Lynwood road as indicated on the map.

Visibility ratings were derived by determining the degree of visibility from the viewpoint.

Table 6: Visibility ratings

Where a significant area allows uninterrupted view distances to the site from the source	High
Where a significant area allows limited visibility of the site from the source.	Moderate
Where a significant area none or very limited visibility of the site from the source.	Low

5.8 Critical Views

Table 7: Critical view ratings

Views of the project are to be seen by many people passing on main roads and from prominent areas i.e. communities and settlements.	High
Some views of the project from surrounding main roads and communities.	Moderate
Limited views to the project from main roads and communities.	Low

6. VISUAL INTERPRETATION

This section describes the visual aspects, which have been considered in order to determine the potential visual impact on the area resulting from the proposed House Weltz. Certain visual aspects are assumed to be consistent throughout large sections of the study area. The interpretation of these aspects is therefore undertaken at a sub-regional level.

6.1 Visual Aspects

- Landscape Character

This area is characterised by a natural ridge with vegetation is that typical of the southern aspect of hillsides, including hardy shrubbery, succulents, several grass species and medium size trees including *Acacia species*, *Rhus species* and *Combretum species*, to name a few. The character of the study area could further be described as having a lower more even area, filled with veld-grass and exotic blue gum trees and a area recessed to form a pond. The upper portion has less grass with some areas consisting only of rock.

Figures 5: Panoramas & Figure 6: Landscape Character shows images of the site.

- Scale

The Ridge defines the vertical and horizontal planes. The ridge is typically elevated 32 m to the general landscape. The significance of the ridge as vertical feature diminishes as one move further away. Some views toward the ridge from Lynwood road are obscured with large exotic and indigenous tree clumps

6.2 Visual Aspects Sensitive to Visual Impacts

Ratings for the following visual aspects are given in Table 8.

- Sense of Place

The site generally and partly lies between the Bronberg ridge and part of a small ridge minimizes the visual impact from areas other than between the two ridges see figure 1. The Bronberg Ridge (2km south of the site) has a distinct sense of place although it has already been developed in some areas. The rest of the study area, consisting of a mixture of residential, commercial, smallholdings open grassland and small quarry areas also have a distinct sense of place that contrasts greatly from that of the City and Suburbs of Pretoria.

- Visual Quality

Due to the natural environment and varying topography of the study area, the visual quality is considered to be moderate. The seasonal dam and trees add to the unique visual quality to the site itself.

- Visibility

Figure 1: Locality Plan shows the view shed from the site that defines the study area. This includes a 5 km zone from the site to the east and west and 1,5 km zone south. The reason for this is because the Bronberg ridge and to a lesser degree the small ridge block the view from areas else where. It is anticipated that visibility within this view shed would be highest close to the site, diminishing as one continues towards the 5 km boundary or beyond the ridges. Factors such as the 10m high tree clumps growing next to the roads and adjacent properties, clusters of buildings and residential estates and adjacent ridges reduce the visibility at critical points within the view shed. A moderate visibility would be considered for this area.

- Critical Views

Lynwood carries a moderate volume of traffic that might increase in the future, and all views toward the site would thus be considered moderate. Clear views of the site are found along certain parts of the road within the view shed, mostly to the east of the site.

6.4 Project Components

- Construction such as the gate house, clubhouse, tennis court and dam restorations, walking trails, bird hide and construction of new dwellings as proposed (mainly on the relatively flat areas of the site).
- Access road to the site and within the site to the new Erven.
- Cut and fill operations for the road construction and driveways to the houses

6.5 Visual Impact Potential (Checklist)

The potential visual impact of each project component on each visual aspect is assessed using Table 9. Potential impacts are given a Low, Moderate or High rating. The significance of the impact is not considered at this stage, i.e. it is not relevant whether an impact is positive or negative or whether it would be considered significant in the overall context of either the proposed project or the receiving environment.

Table 10: Assessment of potential visual impacts

Visual Aspect		Project Components			
		Construction	Cut & Fill	Access Road	Pond
Sense of place		high	moderate	low	low
Visual quality		high	moderate	low	moderate
Landscape character		high	high	moderate	low
Surrounding landscape compatibility		Moderate	moderate	moderate	moderate
Scale		high	low	low	low
Visual Absorption Capacity (VAC)	Slope	low	n/a	n/a	n/a
	Vegetation height	moderate	moderate	moderate	moderate
	Diversity	moderate	moderate	moderate	moderate
Visibility		high	moderate	moderate	moderate
Critical views		moderate	moderate	low	low

7. RECOMMENDED MITIGATION MEASURES

7.1 Introduction

Typical modifications to the topography and therefore the visual environment can be linked to the project components:

- Buildings
- Planting adjacent roads
- Pond
- 'Green-finger' – extensive open spaces
- Limited development at the small ridge

7.2 Mitigation of Project Components

Mitigation measures to address visual impacts for each construction method are as follows:

7.2.1 Building

Mitigation measures to minimise the visual impact of the house:

The building

- The use of natural stone cladding will be highly recommended to the buyers of each home, and cement based coatings such as 'Cemcrete' and 'earthcoat' will also be recommended
- All roofs to be tiled with 'earth coloured' tiles
- Only low 'verf-type' boundary walls (600mm high) will be allowed round the dwellings, only at the yard/ service may boundary walls (1800mm high) be built.
- No building to be higher than 2 stories.
- The placement of the buildings on site in such a manner that it has the least obtrusive effect on neighbouring communities. (Only 3 buildings paced on the small ridge)

- The building texture of the façade surface could be made less visually intrusive through the placement of medium to large planting in front of the façade.
- Almost all building work will be constructed in the valet below the small-ridge

7.2.2 Planting adjacent roads

Requires mitigation of visual impacts, primarily resulting from scarring of the landscape during construction of the roads and sidewalks. Mitigation during construction and at completion of construction period would include:

- Cut slopes should be stabilized and retained; using planting and materials colour and texture finishes which match that of the visual environment.
- Immediate rehabilitation and re-vegetation of areas cleared. Treatment of exposed surfaces should match that of the surrounding visual landscape character (planting).
- The soil profile of Fill should be shaped to blend in with the gradients of the surrounding landscape.
- Planting adjacent roads will include indigenous tree planting to soften the visual impact of the buildings
- Landscape the areas affected by construction using natural materials and indigenous plants to blend in with the surrounding landscape.

7.2.3 Pond

This will be a mitigation measure; the construction and upgrade of the existing pond will add value to the visual quality of the site and surrounding environment. The upgraded pond will also act as a wild life magnet, attracting all sort of animal, bird and insect life to the site.

Mitigation during operational phase should include:

- Using material, colour and texture finishes that match that of the visual environment.
- Planting of large indigenous tree species and shrubbery along the edge and immediate surroundings.
- Immediate rehabilitation and re-vegetation of cut slopes.

- Shaping of remaining and exposed soil profile to blend in with the gradients of the surrounding landscape.
- Creating of an island, this will act as a habitat creation feature.
- Using of natural stone cladding when upgrading the existing bridge, this will blend into the exiting landscape.
- Planting of wetlands so that the quality of the water will improve

7.2.4 'Green-fingers' – extensive open spaces

This will be a mitigation measure; the introduction of extensive 'green-fingers' into the residential development will act as a softening element. The network of open spaces will create important green links between the pond and small ridge and into the development it self. The planting of indigenous trees, shrubs and groundcovers will add to the mitigation effect of softening the residential façade. This 'green-fingers' will also act as lungs for the development and act as a wildlife-magnet.

7.2.5 Conservation of the 'small-ridge'

This will be a mitigation measure; the conservation of the 'small-ridge' will be achieved by limiting the construction activities on the ridge to the minimum. The ridge will also be upgraded by introducing limited indigenous planting. This will give the development a unique natural character. The existing planting theme of the 'small-ridge' will also be introduced into the residential landscape and planted next to the road. The home owners will be encouraged to plant these floras into their gardens.

8. REFERENCES

LYNCH, K. (1996). *Good City Form*. 10th Printing. Massachusetts Institute of Technology (MIT) Press, Cambridge, Massachusetts, USA.

APPENDIX 1

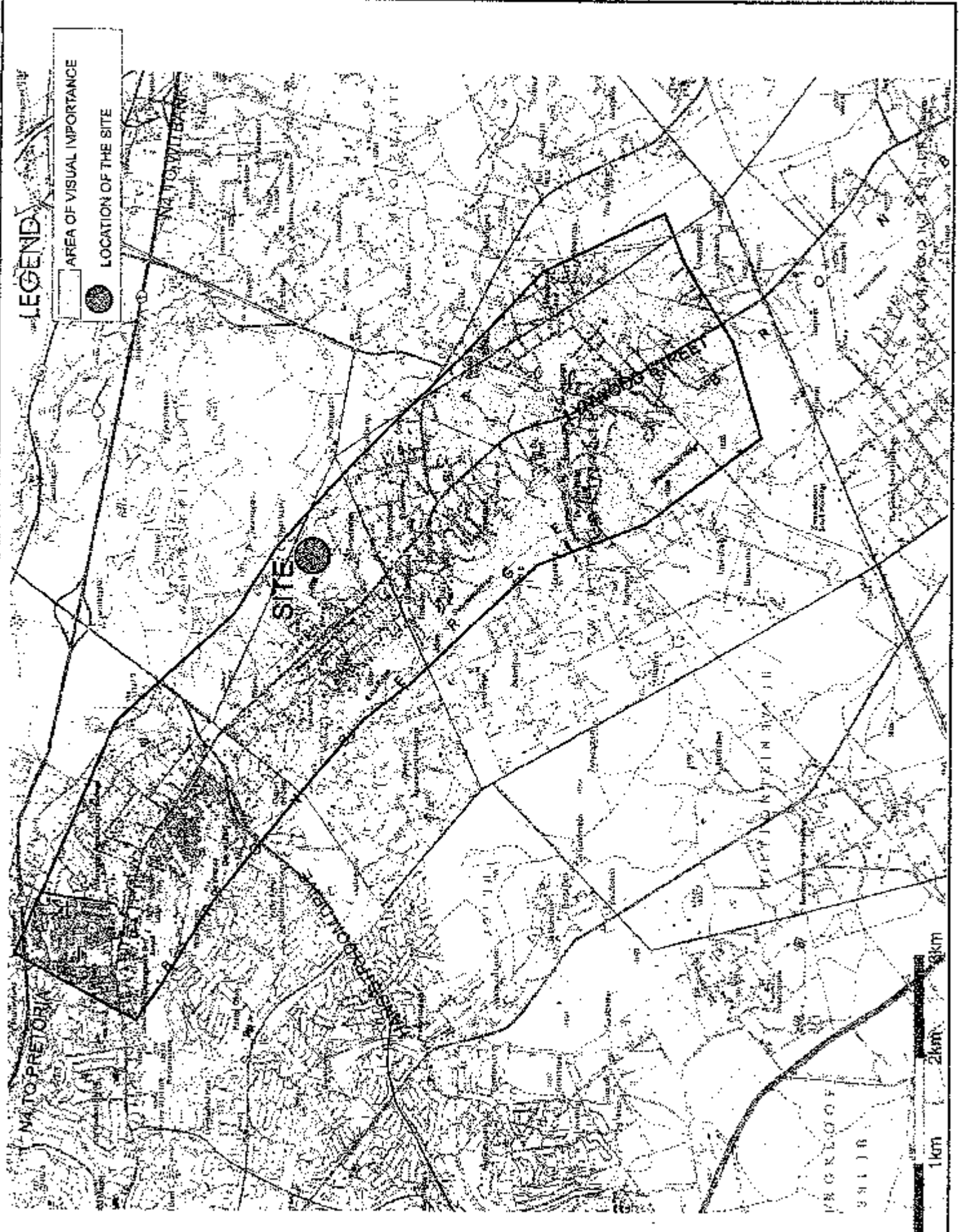
SUMMARY OF POTENTIAL VISUAL IMPACTS PORTION 5 TYGERVALLEI 334 - JR

Issue/Impact	Without mitigation						With mitigation	
	Risk	Temporal	Spatial	Probability	Severity	Significance	Severity	Significance
Loss of sense of place and visual quality	Moderate	Permanent	Localised	Probable	Moderate	Moderate	Moderate	Low
Visual impact due to incompatible land-use, low visual absorption capacity, and high visibility and critical views from Lynwood road and surrounding properties.	Definite	Permanent	Localised	Probable	Moderately severe	Moderate	Slight	Low








LEGEND

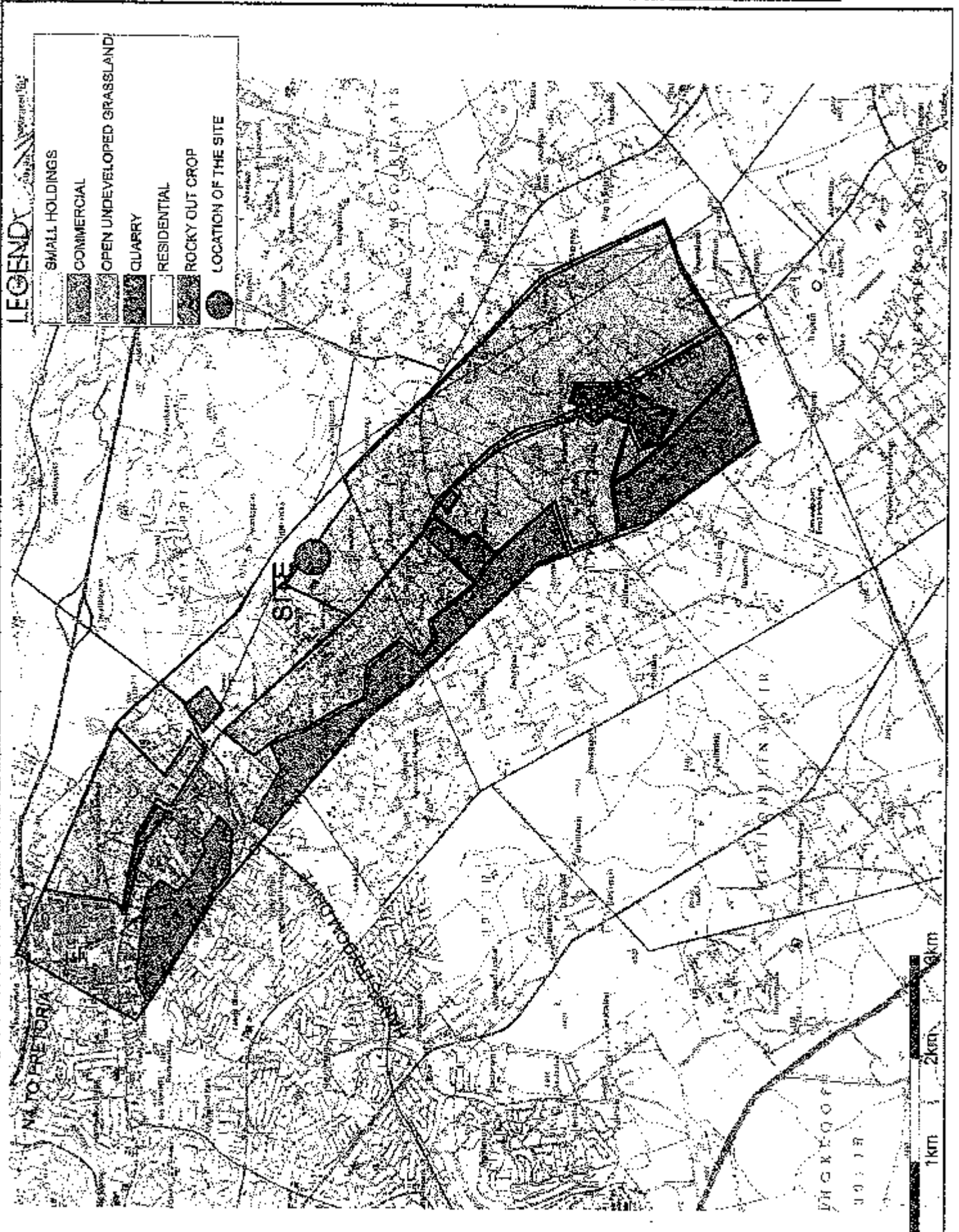
AREA OF VISUAL IMPORTANCE

LOCATION OF THE SITE



LEGEND

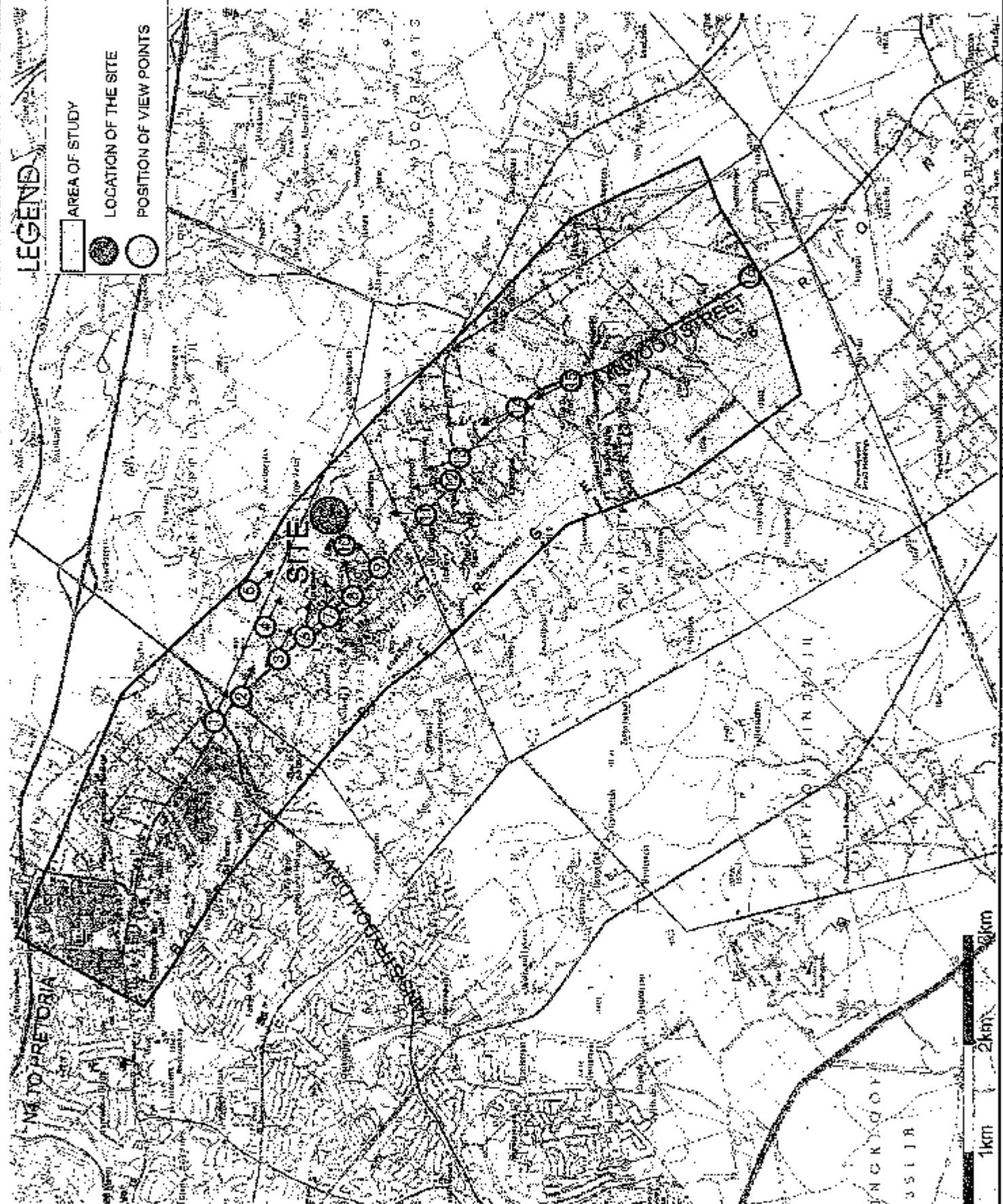
-  SMALL HOLDINGS
-  COMMERCIAL
-  OPEN UNDEVELOPED GRASSLAND
-  QUARRY
-  RESIDENTIAL
-  ROCKY OUTCROP
-  LOCATION OF THE SITE



PORTION 5

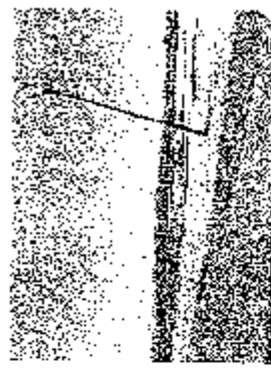
LEGEND

- ▭ AREA OF STUDY
- LOCATION OF THE SITE
- POSITION OF VIEW POINTS



VIEWS FROM VIEWPOINTS

PORTION 5
TYGEBALLEI 334 - JR
VISUAL IMPACT



④ VIEW # 4



⑥ VIEW # 6



⑫ VIEW # 12



⑯ VIEW # 16



③ VIEW # 3



⑦ VIEW # 7



⑪ VIEW # 11



⑮ VIEW # 15



② VIEW # 2



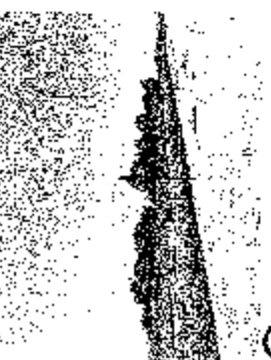
⑥ VIEW # 6



⑩ VIEW # 10



⑭ VIEW # 14



① VIEW # 1



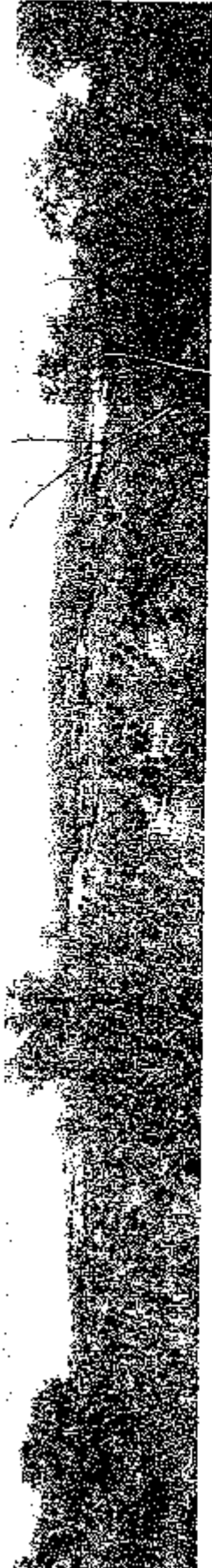
⑤ VIEW # 5



⑨ VIEW # 9



⑬ VIEW # 13



① VIEW FROM THE SITE FROM THE TOP OF THE HILL



② VIEW OF THE SITE NEAR THE ENTRANCE



VIEW OF INDIGENOUS PLANTING ON SITE



VIEW OF DRY POND



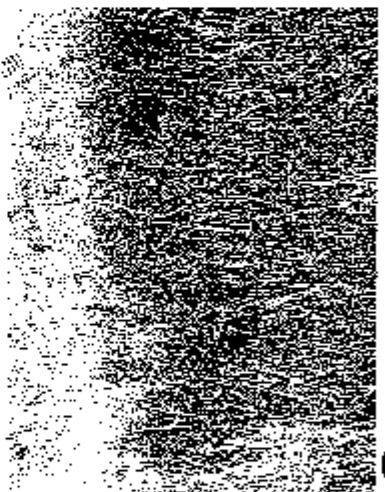
VIEW OF LARGE EXOTIC TREES



VIEW OF EXISTING DWELLINGS ON SITE



VIEW OF DRY RIVER BED WITH VELDGRASS



VIEW OF WATER TOLERANT PLANTING



VIEW OF ROCKY OUTCROPS



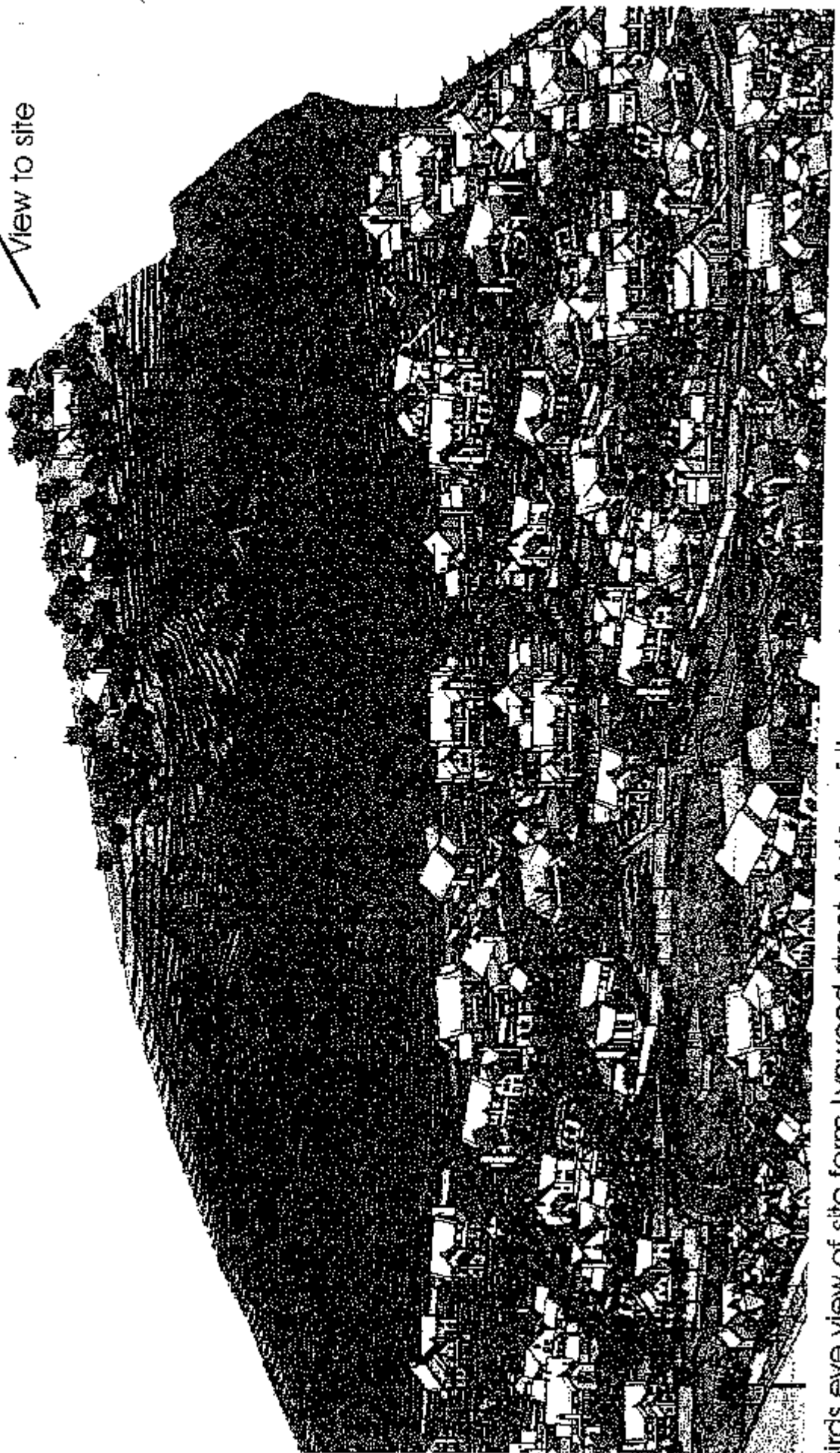
VIEW OF ALOE SPECIES ON SITE



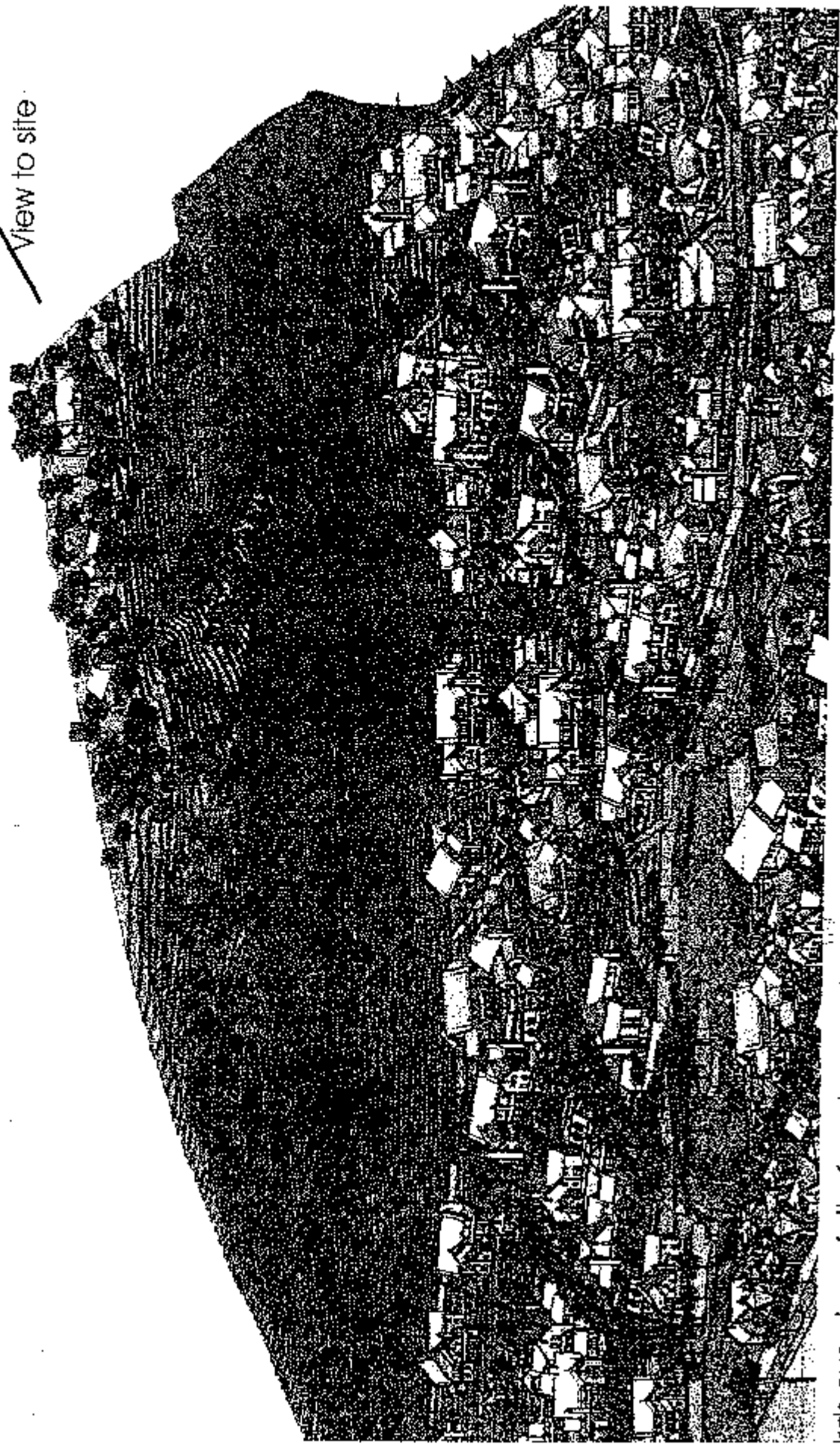
VIEW OF ROCKY OUTCROPS

Copyright by

View to site



birds eye view of site form Lynwood street. A view of the pond and the -small-ridge'



View to site



birds eye view of site form Lynwood street. A view of the pond and the small-ridge

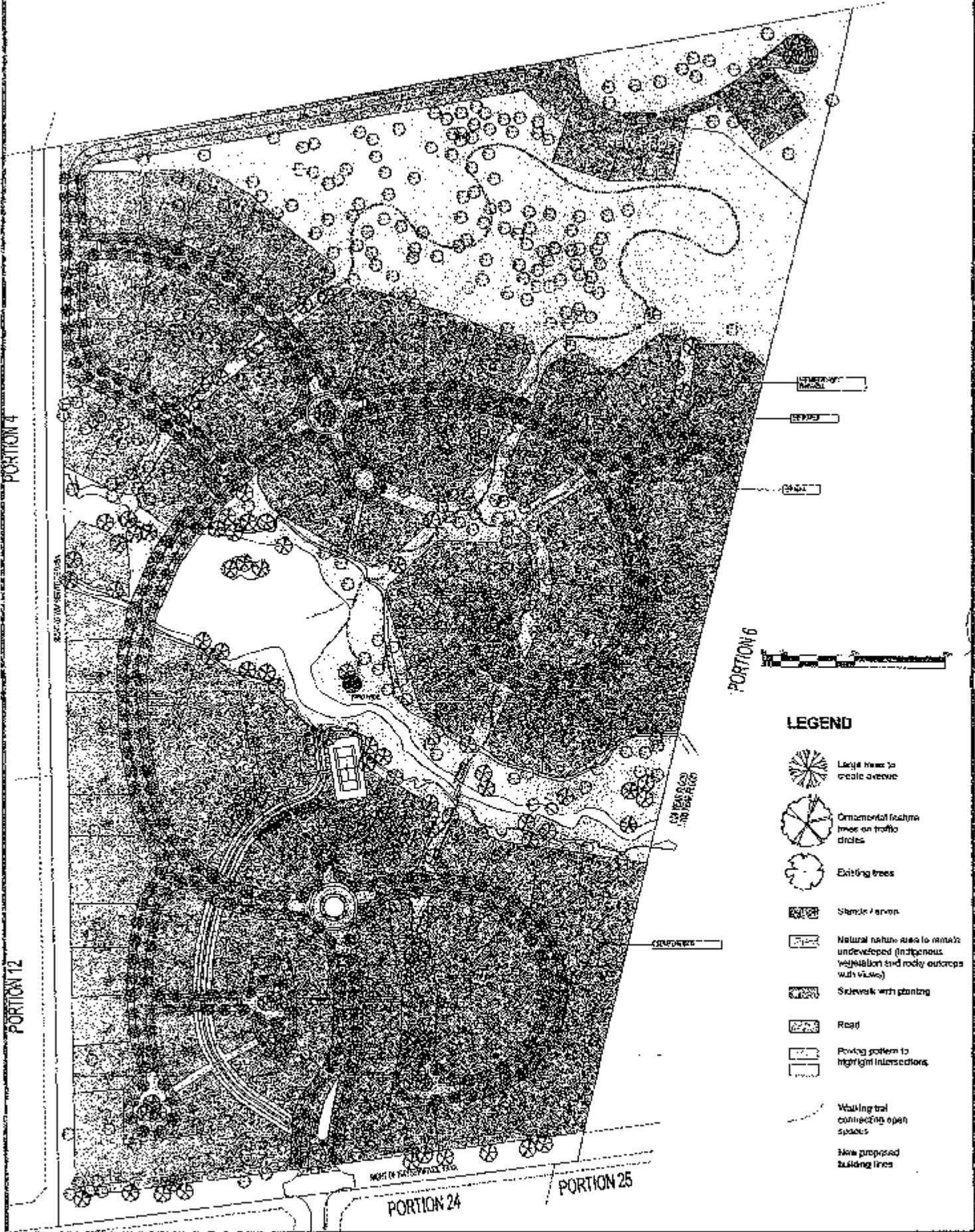
PORTION 4

PORTION 12

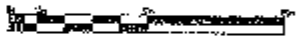
PORTION 6

PORTION 24

PORTION 25



- Landscape Material
- EPPPS
- Pond



LEGEND

- Large tree to create avenue
- Ornamental feature trees on traffic drives
- Existing trees
- Standish / arvon
- Natural native area to remain undeveloped (indigenous vegetation and rocky outcrops with views)
- Sidewalk with planting
- Road
- Paving pattern to highlight intersections
- Walking trail connecting open spaces
- New proposed building lines

GRAYSTONE LANDSCAPE CONCEPT MASTER PLAN



Scale 1:1000 (A1)

in site

LANDSCAPE ARCHITECTURE
 1010010000
 1010010000
 1010010000
 1010010000

DATE	9 JUNE 2006
SCALE	(A1)
SCALE	1:1000
PROJECT	WR

Environmental Management Plan (EMP)



Appendix H

FINAL ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED TIJGER VALLEY EXTENTION 14 & 34

On a Part of Portion 5 of the Farm Tyger Valley 334
JR, Pretoria.

GAUT: 002/14-15/0091

JUNE 2015



BOKAMOSO

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0161



1 Project Outline

1.1 Background

Bokamoso Landscape Architects & Environmental Consultants was appointed by **Andre Wright** to compile a Basic Assessment Report for the proposed development of **Tijger Valley Extension 14 & 34** and its associated activities.

1.2 Project description

The proposed development is situated on a Part of Portion 5 of the Farm Tyger Valley 334 JR, Pretoria. The proposed study area is located approximately 1km North-East of Graham Road (Lynnwood Rd) and approximately 1km East of Lombardy Estate.

Refer to Figure 1 for the Locality Map and Figure 2 for the Aerial Map.

The study area is approximately 15,8 hectares in extent and falls within the area of jurisdiction of the City of Tshwane Local Municipality

Timeframe for construction:

It is expected that construction of the proposed development will commence as soon as authorisation from the involved Authorities has been granted.

The EMP will be a binding document for purposes of compliance.

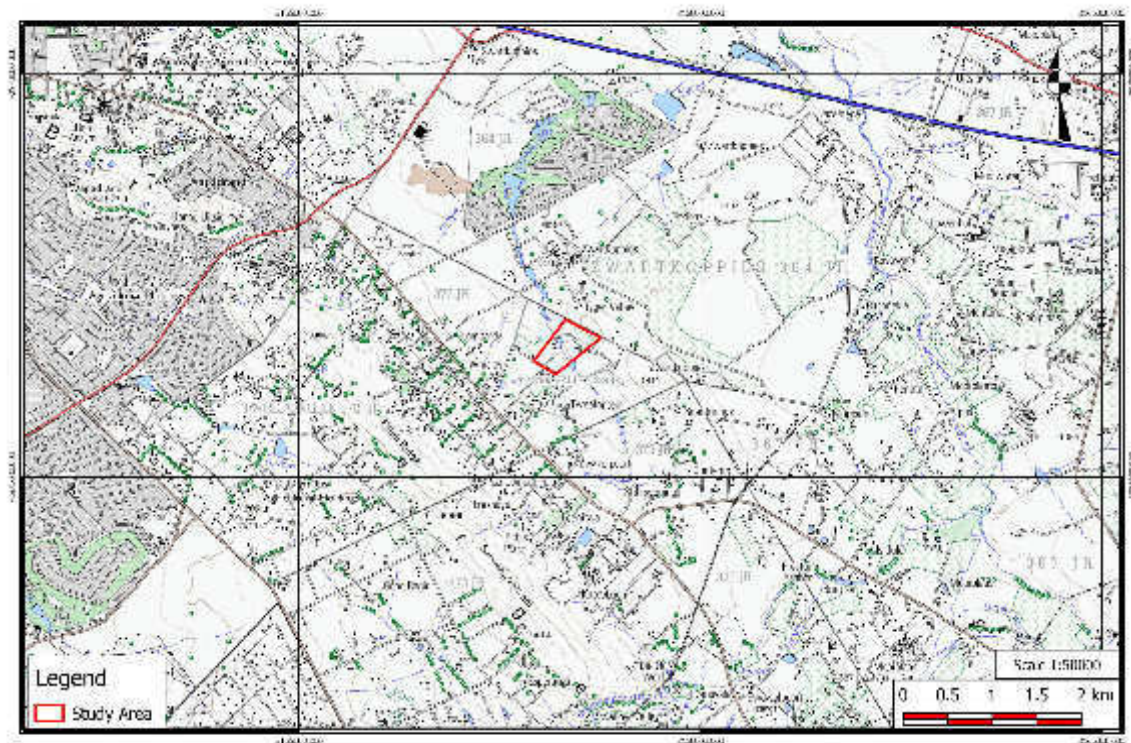


Figure 1 – Locality Map



Figure 2 – Aerial Map

Hydrology:

There is a wetland / drainage line that traverses the site. No construction will take place in the drainage line as it will be zoned private open space except for a road crossing.

Fauna and flora:

The proposed study area falls within the Marikana Thornveld which forms part of the Savannah biome. The Orange-Listed plant species, *Hypoxis hemerocallidea*, which was identified on site, was found within the Disturbed moist secondary grassland. It is recommended by the specialist that this plant species be relocated to an area where it can be preserved. No Red-Listed plant species were found on site.

Cultural /Historical:

A heritage impact assessment was conducted for the proposed development on the larger study area. One site of heritage importance was found on this larger study area. This site consisted of a number of smaller stone circles. There is a possibility that these relate to the Late Iron Age habitation that was found east of the site. This important site centres around the coordinates S-25.79229; E28.37379. The specialist recommended that a 25m buffer zone be established around the site.

Visual:

The study area is partly visible to the surrounding land uses (such as a rose farm and game lodge) to the west and north of the proposed development.

Geology:

The site is underlain by alluvial and colluvial clayey soils overlying residual soils and shale bedrock. These belong to the Silverton Shale Formation, Pretoria Group, Transvaal Supergroup. The area proposed for development consists of the Sepane soil form. Around the drainage line area there is dark fine structured clayey top soils. The soils on the site suggest low to moderate agricultural potential.

2 EMP Objectives and context

Objectives

The objectives of this plan are to:

- Identify the possible environmental impacts of the proposed activity;
- Develop measures to minimise, mitigate and manage these impacts;
- Meet the requirements of the Environmental Authorisation (EA) of GDARD and requirements of other Authorities; and
- Monitor the project.

EMP context

This EMP fits into the overall planning process of the project by carrying out the conditions of consent set out by the Gauteng Department of Agriculture and Rural Development. In addition, mitigation measures recommended in the Basic Assessment Report are included in the EMP.

This EMP addresses the following three phases of the development:

- Pre-construction planning phase;
- Construction phase; and
- Operational phase.

3 Monitoring

In order for the EMP to be successfully implemented all the role players involved must have a clear understanding of their roles and responsibilities in the project.

These role players may include the Authorities (A), other Authorities (OA), Developer/proponent (D), Environmental Control Officer (ECO), Project Manager (PM), Contractors (C), Environmental Assessment Practitioner (EAP) and Environmental Site Officer (ESO). Landowners, interested and affected parties and the relevant environmental and project specialists are also important role players.

3.1 Roles and responsibilities

Developer (D)

The developer is ultimately accountable for ensuring compliance with the EMP and conditions contained in the EA. The developer must appoint an independent Environmental Control Officer (ECO), for the duration of the pre-construction and construction phases, to ensure compliance with the requirements of this EMP. The developer must ensure that the ECO is integrated as part

of the project team. The responsibility of compliance will be carried across to the home owner as soon as transfer of the erven has taken place. It will be ensured that a copy of this document accompanies the purchase agreements for the erven.

Project Manager (PM)

The Project Manager is responsible for the coordination of various activities and ensures compliance with this EMP through delegation of the EMP to the contractors and monitoring of performance as per the Environmental Control Officer's monthly reports.

Environmental Control Officer (ECO)

An independent Environmental Control Officer (ECO) shall be appointed, for the duration of the pre-construction and construction phase of the services and bulk infrastructure, by the developer to ensure compliance with the requirements of this EMP. Thereafter the Home Owners Association will be responsible for the further appointment of the ECO.

- The Environmental Control Officer shall ensure that the contractor is aware of all the specifications pertaining to the project.
- Any damage to the environment must be repaired as soon as possible after consultation between the Environmental Control Officer, Consulting Engineer and Contractor.
- The Environmental Control Officer shall ensure that the developer staff and/or contractor are adhering to all stipulations of the EMP.
- The Environmental Control Officer shall be responsible for monitoring the EMP throughout the project by means of site visits and meetings. This should be documented as part of the site meeting minutes.
- The Environmental Control Officer shall be responsible for the environmental training program.
- The Environmental Control Officer shall ensure that all clean up and rehabilitation or any remedial action required, are completed prior to transfer of properties.
- A post construction environmental audit is to be conducted to ensure that all conditions in the EMP have been adhered to.

Contractor (C):

The contractors shall be responsible for ensuring that all activities on site are undertaken in accordance with the environmental provisions detailed in this document and that sub-contractor and labourers are duly informed of their roles and responsibilities in this regard.

The contractor will be required, where specified to provide Method Statements setting out in detail how the management actions contained in the EMP will be implemented.

The contractors will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the environmental regulations.

Environmental Site Officer (ESO):

The ESO is appointed by the developer and then finally the home owner as his/her environmental representative to monitor, review and verify compliance with the EMP by the contractor. The ESO is not an independent appointment but must be a member of the contractor's management team. The ESO must ensure that he/she is involved at all phases of the construction (from site clearance to rehabilitation).

Authority (A):

The authorities are the relevant environmental department that has issued the Environmental Authorisation. The authorities are responsible for ensuring that the monitoring of the EMP and other authorization documentation is carried out by means of reviewing audit reports submitted by the ECO and conducting regular site visits.

Other Authorities (OA):

Other authorities are those that may be involved in the approval process of the EMP.

Environmental Assessment Practitioner (EAP):

According to section 1 of NEMA the definition of an environmental assessment practitioner is “the individual responsible for the planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management plans or any other appropriate environmental instruments through regulations”.

3.1 Lines of Communication

The Environmental Control Officer in writing should immediately report any breach of the EMP to the Project Manager. The Project Manager should then be responsible for rectifying the problem on-site after discussion with the contractor. Should this require additional cost, then the developer should be notified immediately before any additional steps are taken.

3.2 Reporting Procedures to the Developer

Any pollution incidents must be reported to the Environmental Control Officer immediately (within 12 hours). The Environmental Control Officer shall report to the Developer on a regular basis (site meetings).

3.3 Site Instruction Entries

The site instruction book entries will be used for the recording of general site instructions as they relate to the works on site. There should be issuing of stop work order for the purposes of immediately halting any activities of the contractor that may pose environmental risk.

3.4 ESA/ESO (Environmental Site Officer) Diary Entries

Each of these books must be available in duplicate, with copies for the Engineer and Environmental Site Officer. These books should be available to the authorities for inspection or on request. All spills are to be recorded in the ESA/Environmental Site Officer's diary.

3.5 Methods Statements

Methods statements from the contractor will be required for specific sensitive actions on request of the authorities or ESA/ESO (Environmental Site Officer). All method statements will form part of the EMP documentation and are subject to all terms and conditions contained within the EMP document. For each instance wherein it is requested that the contractor submit a method statement to the satisfaction of ESA/ESO, the format should clearly indicate the following:

- What – a brief description of the work to be undertaken
- How – a detailed description of the process of work, methods and materials
- Where – a description / sketch map of the locality of work; and

- When – the sequencing of actions with due commencement dates and completion date estimate.

The contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ESA/ESO.

3.6 Record Keeping

All records related to the implementation of this management plan (e.g. site instruction book, ESA/ESO dairy, methods statements etc.) must be kept together in an office where it is safe and can be retrieved easily. These records should be kept for two years and at any time be available for scrutiny by any relevant authorities.

4 Acts

4.1 The National Water Act, 1998 (Act No: 36 of 1998)

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Reducing and preventing pollution and degradation of water resources;
- Facilitating social and economic development; and
- Providing for the growing demand for water use.

Impact on proposed Development:

Significant – The proposed residential development is subject to flood lines (non-perennial river) as the proposed residential township is planned to border the 1:100 year flood line, thus it will be less than 500 meters away from the river. The drainage line area will be private opens space and apart for a road crossing there will be no construction in this area.

4.2 National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)

The NEMA: AQA serves to repeal the Atmospheric Pollution Prevention Act (45 of 1965) and various other laws dealing with air pollution and it provides a more comprehensive framework within which the critical question of air quality can be addressed.

The purpose of the Act is to set norms and standards that relate to:

- Institutional frameworks, roles and responsibilities
- Air quality management planning
- Air quality monitoring and information management
- Air quality management measures
- General compliance and enforcement.

Amongst other things, it is intended that the setting of norms and standards will achieve the following:

- The protection, restoration and enhancement of air quality in South Africa
- Increased public participation in the protection of air quality and improved public access to relevant and meaningful information about air quality
- The reduction of risks to human health and the prevention of the degradation of air quality.

The Act describes various regulatory tools that should be developed to ensure the implementation and enforcement of air quality management plans. These include:

- Priority Areas, which are air pollution 'hot spots'
- Listed Activities, which are 'problem' processes that require an Atmospheric Emission Licence
- Controlled Emitters, which includes the setting of emission standards for 'classes' of emitters, such as motor vehicles, incinerators, etc.
- Control of Noise
- Control of Odours.

Impact on proposed Development:

During the construction phase, dust and the generation of noise can become a significant factor, especially to the surrounding landowners. However if the development is well planned and the mitigating measures are successfully implemented the proposed township's contribution to air pollution and the generation of air pollution can become less significant. None of the listed activities, according to this Act, have been triggered.

4.3 National Environmental Management Act (Act 107 of 1998)

The NEMA is primarily an enabling Act in that it provides for the development of environmental implementation plans and environmental management plans. The principles listed in the act serve as a general framework within which environmental management and implementation plans must be formulated.

The principles in essence state that environmental management must place people and their needs at the forefront of its concern and that development must be socially, environmentally and economically sustainable.

Please note that the NEMA EIA Regulations were amended on 4 December 2014 and came into effect on 8 December 2014.

Impact on proposed Development:

Significant – Section 28 (1) of NEMA stated that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

The EMP is compiled in terms of Section 28 of NEMA.

4.4 National Environmental Management: Waste Act (Act 59 of 2008)

This Act came into effect on 11 June 2009. It aims to consolidate waste management in South Africa, and contains a number of commendable provisions, including:

- The establishment of a national waste management strategy, and national and provincial norms and standards for, amongst others, the classification of waste, waste service delivery, and tariffs for such waste services;
- Addressing reduction, reuse, recycling and recovery of waste;
- The requirement for industry and local government to prepare integrated waste management plans;
- The establishment of control over contaminated land;
- Identifying waste management activities that requires a licence, which currently include facilities for the storage, transfer, recycling, recovery, treatment and disposal of waste on land;
- Co-operative governance in issuing licenses for waste management facilities, by means of which a licensing authority can issue an integrated or consolidated license jointly with other organs of state that has legislative control over the activity; and
- The establishment of a national waste information system.

On 3 July 2009 the Minister of Environmental Affairs and Tourism promulgated a list of waste management activities that might have a detrimental effect on the environment. These listed activities provide the activities that require a Waste Management License. Two Categories is specified: Category A and Category B. As part of Category a Waste Management License application a Basic Assessment in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be submitted to the relevant Authority. As part of a Category B Waste Management License a Scoping and EIA process in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be followed and submitted to the relevant Authority.

Please note that on 29 November 2013 the listed activities for waste licenses have been amended.

Impact on proposed Development:

Not Significant – No waste management license will be required during the construction or operational phases of the proposed residential township. Due to the fact that a small amount of solid construction waste will be stored and handled on the site, before it is hauled away and dumped at the nearest registered landfill site.

4.5 National Veld and Forest Fire Act, 1998 (Act No. 101, 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

Impact on proposed Development:

Significant – Fires of construction workers may only be lit in the designated site camp as indicated in assistance with the ECO. It is important that a site development camp be located on a part of the application site that is already disturbed.

4.6 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act legislates the necessity and heritage impact assessment in areas earmarked for development, which exceed 0.5ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

Impact on proposed Development:

Not significant- Due to the highly disturbed and totally transformed state of the study area, it was not deemed necessary to conduct a Heritage Impact Assessment in terms of the requirements as provided for in Section 38 of the NHRA, 1999. If any remains/cultural resources are exposed or uncovered during the construction phase, it should immediately be reported to the South African Heritage Resources Agency (SAHRA). Burial remains should not be disturbed or removed until inspected by an archaeologist.

4.7 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

Impact on proposed Development:

Not Significant – According to the Gauteng Agricultural Potential Atlas (GAPA 3), Tijinger Valley Extension 14 and 34 is located on land with very low agricultural potential. The study area does not fall within any of the Seven Agriculture Hubs identified for the Gauteng province.

4.8 Water Services Act, 1997 (Act No. 108 of 1997)

This Act provides for the minimum standards and measures of which the following Water Services should adhere to:

- Basic sanitation
- Basic water supply
- Interruption in provision of water services
- Quality of potable water
- Control of objectionable substances
- Disposal of grey water
- Use of effluent
- Quantity and quality of industrial effluent discharged into a sewerage system
- Water services audit as a component in the Water Services Development Plan
- Water and effluent balance analysis and determination of water losses
- Repair of leaks
- Consumer installations other than meters

- Pressure in reticulation system

Impact on proposed Development:

Significant – The application will need to adhere to the water services act.

4.9 National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management of South Africa's biodiversity within the Framework of the NEMA and the protection of species and ecosystems that warrant National protection. As part of the implementation strategy, the National Spatial Biodiversity Assessment was developed.

Impact on proposed Development:

The proposed development is situated within the Marikana Thornveld vegetation type according to Mucina and Rutherford (2006). The area south-west of the Degraded Drainage Line was identified as a Disturbed Moist Secondary Grassland and not considered sensitive. The drainage line was not considered sensitive during the specialist assessment. The orange-listed plant species, *Hypoxis hemerocallidea*, occur on the site and the specialist recommended that they be relocated to an area where they can be preserved.

4.10 National Spatial Biodiversity Assessment

The National Spatial Biodiversity Assessment (NSBA) classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels.

Impact on proposed Development:

Not Significant – Situated within an urban area.

4.11 Protected Species – Provincial Policies

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the Provincial Departments of Environmental Affairs.

Impact on proposed Development:

The Degraded drainage line however could be suitable for some of these species, this area will however be zoned as private open space in the proposed development. No Red Listed Plant species have been encountered during the specialist's assessments and none are expected to occur due to the high level of disturbance. The Orange-Listed plant species, *Hypoxis hemerocallidea*, was found on the proposed development area and it was recommended that the species be relocated to an area where it can be preserved.

4.12 National Environmental Management: Protected Areas Act, 2003 (Act No.57 of 2003)

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes.

Impact on proposed Development:

Not Significant – The study area is not situated in a Protected Area identified in terms of the Protected Areas Act.

4.13 National Road Traffic Act, 1996 (Act No. 93 of 1996)

This Act provides for all road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith.

Impact on proposed Development:

Not significant – Not Applicable.

10.14 Environmental Conservation Act: Noise Regulations, 1989 (Act no.73 of 1989)

The purpose of this Act is to provide measures and management relating Noise levels. This Act enables Noise levels to be acceptable to standards within a specific area and community.

Impact on proposed Development:

Significant – The proposed development may include activities which can produce noise during the construction phase.

4 Project activities

4.1 Pre-Construction Phase

<i>TYPE</i>	<i>Environmental risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Performance indicator</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
General	Project contract	To make the EMP enforceable under the general conditions of the contract.	The EMP document must be included as part of the tender documentation	The EMP is included as part of the tender documentation	Developer	-
Design and planning	Stability of structures	To ensure stability of structures	1) The foundation recommendations by the involved geotechnical engineers must be implemented	The foundation recommendations are implemented.	Individual Developer Engineer	-
	Storm water design		The applicant must comply with the DWA's Best Practise Guidelines for Stormwater Management The proposed stormwater design must be submitted to DWA for approval.	Complied	Developer Engineer	
		To prevent erosion and saturation of the soil profile and to prevent problems with dampness in surface structures and installation of services	Good site drainage must be ensured.			
		To prevent and restrict erosion, siltation and groundwater pollution	1) The storm water design for the proposed development must be designed to reduce and/ or prevent siltation, erosion and water pollution. 2) Storm water runoff should not be concentrated as far as possible and sheet flow should be implemented. 3) Attenuation ponds and energy	Compilation and approval of storm water management plan	Engineer Individual Developer	-

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>dissipaters must be installed on the study area to break the speed of the water and to act as siltation ponds where required.</p> <p>4) Surface storm water generated as a result of the development must not be channeled directly into any natural drainage system or wetland.</p> <p>5) The storm water management plan should be designed in a way that aims to ensure that post development runoff does not exceed predevelopment values in:</p> <ul style="list-style-type: none"> - Peak discharge for any given storm; - Total volume of runoff for any given storm; - Frequency of runoff; and - Pollutant and debris concentrations reaching water courses. 			
	Services	To ensure adequate capacity is available for services	A written agreement between the relevant municipality and the applicant regarding the supply and availability of water should be made available to the DWA.	Agreement in place	Engineer	
	Light pollution	To minimise light pollution	The generation of light by night events, security lighting and other lighting shall be effectively designed so as not to spill unnecessary outward into the oncoming traffic, or into the yards of the neighbouring properties or open spaces.	Lightning effectively designed.	Architect	-
	Visual impact	To minimize the visual impact of the proposed development.	Architectural guidelines to minimise the visual impact: The chosen roof and wall colours should blend in with the surrounding environment. Suitable plant materials should be used at strategic points to screen off impacts caused by roofs and cars in large parking areas. Existing trees	Architectural guidelines minimizes visual impact	Architect	-

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			should be retained as far as possible as it will soften the impact of the proposed development.			
Climate	Extreme change in micro climate temperatures	To prevent the extreme change in micro climate temperatures	Where open parking bays are involved, one tree for every two parking bays shall be indicated on Landscape Development Plan which shall be approved by the Design Review Committee / Local Authority.	Landscape Development Plan complies	Landscape Architect	-
Fauna and flora	Floral biodiversity and ecological health	To ensure that the species introduced to the area, are compatible with the current and future quality of the ecological processes.	1) The Landscape Development Plan for the proposed development shall be submitted to the local authority for approval. 2) It is important that all the plant positions, quantities and coverage per m ² be indicated on the Landscape Development Plan. 3) The proposed planting materials for the areas to be landscaped shall be non-invasive, and preferably indigenous and /or endemic. 4) Where possible, trees naturally growing on the site should be retained as part of the landscaping.	The landscape development plan submitted to the local authority for approval.	Landscape Architect	-
	Loss of orange listed species	To ensure the relocation of orange listed species.	Should any <i>Hypoxis hemerocallidae</i> species be encountered on site, it should be relocated to another nearby site of similar habitat.		Developer Flora specialist	
Preparing Site Access	Environmental integrity	To avoid erosion and disturbance to indigenous vegetation	Designated routes shall be determined for the construction vehicles and designated areas for storage of equipment. Clearly mark the site access point and routes on site to be used by construction vehicles and pedestrians. Provide an access map to all contractors whom in turn must provide copies to the	Access to site is erosion free. Minimum disturbance to surrounding vegetation.	Contractor	Continuous

<i>TYPE</i>	<i>Environmental risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Performance indicator</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
			construction workers. Instruct all drivers to use access point and determined route.	Vehicles make use of established access routes.		
		Entrance of Vehicles	Entrance by vehicles, especially off-road cars and bakkies, off-road bicycles and quad bikes should be prohibited prior to commencement of construction. During construction only vehicles required for construction purposes may be allowed on site.			
	Waste storage	To control the temporary storage of waste.	Temporary waste storage points on site shall be determined. These storage points shall be accessible by waste removal trucks and these points should not be located in sensitive areas/areas highly visible from the properties of the surrounding land-owners/tenants/in areas where the wind direction will carry bad odours across the properties of adjacent tenants or landowners.		Contractor ESO	-
		Ensure waste storage area does not generate pollution	Build a bund around waste storage area to stop overflow into storm water.		Contractor	-

4.2 Construction Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
Contractors Camp	Vegetation and topsoil	To minimise damage to and loss of vegetation and retain quality of topsoil	1) Site to be established under supervision of ECO. 2) Clearing and relocation of plants to be undertaken in accordance with site specific requirements.	Minimal vegetation removed/ damaged during site activities.	Contractor	As and when required
	Surface and ground water pollution	To minimise pollution of surface and groundwater resources.	1) Sufficient and temporary facilities including ablution facilities must be provided for construction workers operating on the site. 2) A minimum of one chemical toilet shall be provided per 10 persons. The contractor shall keep the toilets in a clean, neat and hygienic condition. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilised. The contractor (who must use reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor (using reputable toilet-servicing company) shall ensure that all toilets are cleaned and emptied before the builders' or other public holidays. 3) No person is allowed to use any other area than chemical toilets. 4) No French drain systems may be installed. 5) No chemical or waste water must be allowed to contaminate the run-off on site. 6) Avoid the clearing of the site camp (of specific phase) or paved surfaces with	Effluents managed effectively. No pollution of water resources from site. Workforce use toilets provided.	Contractor ESO	As and when required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			soap.			
		To minimise pollution of surface and groundwater resources due to spilling of materials.	<p>1) Drip trays and/ or lined earth bunds must be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil and cement.</p> <p>2) Repair and storage of vehicles only within the demarcated site area.</p> <p>3) Spill kits must be available on site.</p> <p>4) Oils and chemicals must be confined to specific secured areas within the site camp. These areas must be bunded with adequate containment (at least 1.5 times the volume of the fuel) for potential spills or leaks.</p> <p>5) All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site.</p> <p>6) No leaking vehicle shall be allowed on site. The mechanic/ the mechanic of the appointed contractor must supply the environmental officer with a letter of confirmation that the vehicles and equipment are leak proof.</p> <p>7) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p>	No pollution of the environment	Contractor ESO	Daily
		To minimise pollution of surface and groundwater resources by cement	The mixing of concrete shall only be done at specifically selected sites, as close as possible to the entrance, on mortar boards or similar structures to prevent run-off into drainage lines, streams and natural vegetation.	No evidence of contaminated soil on the construction site.	Contractor ESO	Daily
		To minimise pollution of surface and	No effluent (including effluent from any storage areas) may be discharged into any water surface or ground water resource.	No evidence of contaminated water resources.	Contractor ESO	Daily

<i>TYPE</i>	<i>Environmental risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Performance indicator</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
		Groundwater resources due to effluent.				
			The DWA must be notified in the event of any pollution of the water resource. Proper management measures must be employed towards the appropriate clean-up of the leaking or spilled substance and its proper disposal in an acceptable manner as required by Section 19 of the National Water Act, 1998 (Act 36 of 1998). If any pollution incident is experienced, the DWA must be notified immediately (within 24 hours) as required in terms of Section 20 of the National Water Act, 1998 (Act 36 of 1998).		Contractor ESO	
	Pollution of the environment	To prevent unhygienic usage on the site and pollution of the natural assets.	<p>1) Weather proof waste bins must be provided and emptied regularly.</p> <p>2) The contractor shall provide labourers to clean up the contractor's camp and construction site on a daily basis.</p> <p>3) Temporary waste storage points on the site should be determined. THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT IS ALREADY DISTURBED. These storage points should be accessible by waste removal trucks and these points should be located in already disturbed areas /areas not highly visible from the properties of the surrounding landowners/ in areas where the wind direction will not carry bad odours across the properties of adjacent landowners. This site should comply with the following:</p> <ul style="list-style-type: none"> • Skips for the containment and disposal of waste that could cause 	<p>No waste bins overflowing</p> <p>No litter or building waste lying in or around the site</p>	Contractor ESO	Daily Weekly

<i>TYPE</i>	<i>Environmental risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Performance indicator</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
			<p>soil and water pollution, i.e. paint, lubricants, etc.;</p> <ul style="list-style-type: none"> • Small lightweight waste items should be contained in skips with lids to prevent wind littering; • Bunded areas for containment and holding of dry building waste. <p>4) No solid waste may be disposed of on the site.</p> <p>5) No waste materials shall at any stage be disposed of in the open veld or on adjacent properties.</p> <p>6) The storage of solid waste on the site, until such time as it may be disposed of, must be in a manner acceptable to the local authority and DWA.</p> <p>7) Cover any wastes that are likely to wash away or contaminate storm water.</p>			
		Recycle material where possible and correctly dispose of unusable wastes	<p>1) Waste shall be separated into recyclable and non-recyclable waste, and shall be separated as follows:</p> <ul style="list-style-type: none"> • General waste: including (but not limited to) construction rubble, • Reusable construction material. <p>2) Recyclable waste shall preferably be deposited in separate bins.</p> <p>3) All solid waste including excess spoil (soil, rock, rubble etc) must be removed to a permitted waste disposal site on a weekly basis.</p> <p>4) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p> <p>5) Keep records of waste reuse, recycling</p>	<p>Sufficient containers available on site</p> <p>No visible signs of pollution</p>	Contractor ESO	Daily Weekly

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			and disposal for future reference. Provide information to ECO.			
	Increased fire risk to site and surrounding areas	To decrease fire risk.	<p>1) Fires shall only be permitted in specifically designated areas and under controlled circumstances.</p> <p>2) Food vendors shall be allowed within specified areas.</p> <p>3) Fire extinguishers to be provided in all vehicles and fire beaters must be available on site.</p> <p>4) Emergency numbers/ contact details must be available on site, where applicable.</p>	No open fires on site that have been left unattended	Contractor	Monitor daily
Construction site	Geology and soils	To prevent the damaging of the existing soils and geology.	<p>1) The top layer of all areas to be excavated for the purposes of construction shall be stripped and stockpiled in areas where this material will not be damaged, removed or compacted.</p> <p>2) All surfaces that are susceptible to erosion, shall be protected either by cladding with biodegradable material or with the top layer of soil being seeded with grass seed/planted with a suitable groundcover.</p>	<p>Excavated materials correctly stockpiled</p> <p>No signs of erosion</p>	Contractor	Monitor daily
		<p>To prevent the loss of topsoil</p> <p>To prevent siltation & water pollution.</p>	<p>1) Stockpiling will only be done in designated places where it will not interfere with the natural drainage paths of the environment.</p> <p>2) In order to minimise erosion and siltation and disturbance to existing vegetation, it is recommended that stockpiling be done/ equipment is stored in already disturbed/exposed areas.</p> <p>3) Cover stockpiles and surround downhill sides with a sediment fence to stop materials washing away.</p> <p>4) Remove vegetation only in areas designated during the planning stage.</p>	<p>Excavated materials correctly stockpiled</p> <p>No visible signs of erosion and sedimentation</p> <p>Minimal invasive weed growth</p> <p>Vegetation only removed in</p>	Contractor of the Individual Developer	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>5) Rehabilitation/ landscaping are to be done immediately after the involved works are completed.</p> <p>6) All compacted areas should be ripped prior to them being rehabilitated/landscaped by the contractor as appointed by the individual erf owner.</p> <p>7) The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes.</p> <p>8) Strip topsoil at start of works and store in stockpiles no more than 1,5 m high in designated materials storage area.</p> <p>9) During the laying of any cables, pipelines or infrastructure (on or adjacent to the site) topsoil shall be kept aside to cover the disturbed areas immediately after such activities are completed.</p>	designated areas		
	Erosion and siltation	To prevent erosion and siltation	<p>1) It is recommended that the construction of the development be done in phases.</p> <p>2) Each phase should be rehabilitated immediately after the construction for that phase has been completed. The rehabilitated areas should be maintained by the appointed rehabilitation contractor until a vegetative coverage of at least 80% has been achieved as appointed by the individual erf owner.</p> <p>3) Mark out the areas to be excavated.</p> <p>4) Large exposed areas during the construction phases should be limited. Where possible areas earmarked for</p>	<p>No erosion scars</p> <p>No loss of topsoil</p> <p>All damaged areas successfully rehabilitated</p>	Contractor ESO	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.</p> <p>5) Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.</p> <p>6) All embankments must be adequately compacted and planted with grass to stop any excessive soil erosion and scouring of the landscape if required.</p> <p>7) The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas by the individual erf owner.</p> <p>8) Storm water outlets shall be correctly designed to prevent any possible soil erosion.</p> <p>9) All surface run-offs shall be managed in such a way so as to ensure erosion of soil does not occur.</p> <p>10) Implementation of temporary storm water management measures that will help to reduce the speed of surface water by the individual erf owner / developer.</p> <p>11) All surfaces that are susceptible to erosion shall be covered with a suitable vegetative cover as soon as construction is completed by the individual erf owner / developer.</p>			
	Hydrology	To minimise pollution of soil, surface and groundwater	1) Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced.	<p>No visible signs of erosion.</p> <p>No visible signs</p>	Contractor	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			2) The contractor shall ensure that excessive quantities of sand, silt and silted water does not enter the storm water system.	of pollution		
	Fauna and flora	To protect the existing fauna and flora.	<p>1) All exotic invaders and weeds must be eradicated on a continuous basis.</p> <p>2) Exotic invaders must be included in an alien management programme for the site. Eradication must occur every 3 months.</p> <p>3) No plants not indigenous to the area, or exotic plant species, especially lawn grasses and other ground-covering plants, should be introduced in the communal landscaping of the proposed site, as they will drastically interfere with the nature of the area</p> <p>4) Where possible, trees naturally growing on the site should be retained as part of the landscaping.</p> <p>5) As much vegetation growth as possible should be promoted within the proposed development area.</p>	No exotic plants used for landscaping	Contractor ESO / Home Owners Association / Design Review Committee	As and when required Every 6 months
		To protect the existing fauna and flora.	<p>1) Trees that are intended to be retained shall be clearly marked on site.</p> <p>2) Snaring and hunting of fauna by construction workers on or adjacent to the study area are strictly prohibited and the Council shall prosecute offenders.</p> <p>3) All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.</p> <p>4) Wood harvesting of any trees or shrubs</p>	No measurable signs of habitat destruction	Contractor ESO	As and when required

<i>TYPE</i>	<i>Environmental risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Performance indicator</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
			<p>on the study area or adjacent areas shall be prohibited.</p> <p>5) Where possible, work should be restricted to one area at a time.</p> <p>6) Noise should be kept to a minimum and the development should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.</p> <p>7) The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed. Caught animals should be relocated to the conservation areas in the vicinity.</p>			
			<p>1) Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.</p> <p>2) All areas affected by the construction should be rehabilitated once construction activities are complete. Areas should be reseeded with indigenous grasses as required. All rehabilitated areas should be rehabilitated to a point where natural processes will allow the pre-development ecological functioning and biodiversity of the area to be re-instated.</p> <p>3) Prior to construction and operation it is advised to perform a "flush out" in order to help warn faunal species to move and relocate naturally</p> <p>4) Educate construction and project personnel about the importance of the natural faunal species and biodiversity of the natural surroundings.</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
Social	Noise impact	To maintain noise levels below “disturbing” as defined in the national Noise Regulations.	1) Site workers must comply with the Provincial noise requirements as outlined in Provincial Notice No. 5479 of 1999: Gauteng Noise Control Regulations. 2) Noise activities shall only take place during working hours	No complaints from surrounding residents and I & AP	Contractor	Monitored daily
	Dust impact	Minimise dust from the site	1) Dust pollution could occur during the construction works, especially during the dry months. Regular and effective damping down of working areas (especially during the dry and windy periods) must be carried out to avoid dust pollution that will have a negative impact on the surrounding environment. 2) When necessary, these working areas should be damped down in the mornings and afternoons.	No visible signs of dust pollution No complaints from surrounding residents and I & AP	Contractor	Monitored daily
	Safety and security	To ensure the safety and security of the public.	1) Although regarded as a normal practice, it is important to erect proper signs indicating the operations of heavy vehicles in the vicinity of dangerous crossings and access roads or even in the development site if necessary. 2) With the exception of the appointed security personnel, no other workers, friend or relatives will be allowed to sleep on the construction site (weekends included) 3) Construction vehicles and activities to avoid peak hour traffic times 4) Presence of law enforcement officials at strategic places must be ensured 5) Following actions would assist in management of safety along the road <ul style="list-style-type: none"> ▪ Adequate road marking ▪ Adequate roadside recovery areas ▪ Allowance for pedestrians and 	No incidences reported	Contractor ESO	Monitored daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>cyclists where necessary</p> <ul style="list-style-type: none"> ▪ Although regarded as a normal practice, it is important to erect proper signs indicating the danger of the excavation in and around the development site. Putting temporary fencing around excavations where possible. 			
	Infrastructure and services	Installation of services	Determine areas where services will be upgraded and relocated well in advance. Discuss possible disruptions with affected parties to determine most convenient times for service disruptions and warn affected parties well in advance of dates that service disruptions will take place	No complaints from I & AP	Contractor ESO	When required
	Cultural Resources		If any graves or archaeological sites are exposed during construction work it should immediately be reported to a museum. The report from the archaeologist must be provided to GDARD if any graves are recovered.	No destruction of or damage to graves or known archaeological sites	Contractor ESO	Monitor daily
	Visual impact	In order to minimise the visual impact.	<p>1) The disturbed areas shall be rehabilitated immediately after the involved construction works are completed.</p> <p>2) Shade cloth must be used to conceal and minimise the visual impact of the site camps and storage areas</p>	Visual impacts minimised	Contractor ESO	Monitor daily
	Vegetation	Landscaping	<p>1) When planting trees, care should be taken to avoid the incorrect positioning of trees and other plants, to prevent the roots of trees planted in close proximity to the line of water-bearing services from causing leaking in, or malfunctioning of the services.</p> <p>2) The proposed planting materials for the areas to be landscaped should preferably be endemic and indigenous.</p>	Landscaping done according to landscape development plan	Landscape architect Contractor / Individual Developer	When required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>3) All new trees and shrubs to be planted on the study area shall be inspected for pests and diseases prior to them being planted.</p> <p>4) The inspection shall be carried out by the maintenance contractor at the property of the supplier and not on the study area.</p> <p>5) All trees to be planted shall be in at least 20L containers with a height of approximately 1,8 metres and a main stem diameter of approximately 300 mm.</p>			
		Loss of plants	<p>1) Aerate compacted soil and check and correct pH for soils affected by construction activities.</p> <p>2) Make sure plant material will be matured enough and hardened off ready for planting. Water in plants immediately as planting proceeds.</p> <p>3) Apply mulch to conserve moisture Plant according to the layout and planting techniques specified by the Landscape Architect in the Landscape Development plans for the site.</p>	Landscaping done according to landscape development plan	Landscape architect Contractor / Individual Developer	When required
		Spread of weeds	<p>Ensure that materials used for mulching and topsoil/ fertilisers are certified weed free. Collect certifications where available.</p> <p>Control weeds growth that appears during construction.</p>	Weed growth controlled	Landscape architect Contractor	When required
		To ensure rehabilitation of the site	<p>1) Compacted soils shall be ripped at least 200mm.</p> <p>2) All clumps and rocks larger than 30mm diameter shall be removed from the soil to be rehabilitated</p> <p>3) The soil shall be leveled before seeding</p> <p>4) Hydroseed the soil with appropriate mixture</p> <p>5) Watering shall take place at least once</p>	Grass have hardened off	Landscape architect Contractor	Once a day Then every 4 days

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			per day for the first 14 days until germination of seeds have taken place 6) Thereafter watering should take place at least for 20 minutes every 4 days until grass have hardened off.			

4.3 Operational Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
SITE CLEAN UP AND PREPARED FOR USE	Storm water pollution	Do not allow any materials to wash into the storm water system.	Remove erosion and sediment controls only if all bare soil is sealed, covered or re-vegetate. Sweep roadways clean and remove all debris from kerb and gutter areas. Do not wash into drains.	Contractor	-
		Minimise waste	Decontaminate and collect waste in storage area ready for off-site recycling or disposal Arrange for final collection and removal of excess and waste materials.	Contractor	-
ESTABLISHING PLANTS	Slow or no Revegetation to stabilise soil; loss or degradation of habitat	To ensure Revegetation to stabilize soil	Agreed schedule for regular follow-up watering, weed control, mulch supplements and amenity pruning, if needed. Replace all plant failures within three month period after planting.	Contractor	To be agreed
MATERIALS FAILURE	Structural damage. Loss of site materials.		Inspect all structures monthly to detect any cracking or structural problems. Confirm with designer if there are design problems. Rectify with materials to match, or other agreed solution.	Contractor	-
DRAINAGE	On-site and	Storm water	Inspect all site drainage works and repair any	Contractor	-

<i>TYPE</i>	<i>Environment al risk or issue</i>	<i>Objective or requirement</i>	<i>Mitigation measure</i>	<i>Responsibility</i>	<i>Frequency of Action</i>
<i>FAILURE</i>	<i>downstream drainage pollution or flooding</i>	management plan	failures. Confer with design engineer to correct site problems.		
<i>SITE AUDIT</i>	<i>Eventual project failure</i>	Successful project establishment	Routinely audit the works and adjust maintenance schedule accordingly.	Contractor	-
<i>GENERAL</i>			Open fires and smoking during maintenance works are strictly prohibited.	Contractor	-

5 Procedures for environmental incidents

5.1 Leakages & spills

- Identify source of problem.
- Stop goods leaking, if safe to do so.
- Contain spilt material, using spills kit or sand.
- Notify Environmental Control Officer
- Remove spilt material and place in sealed container for disposal (if possible).
- Environmental Control Officer to follow Incident Management Plan.

5.2 Failure of erosion/sediment control devices

- Prevent further escape of sediment.
- Contain escaped material using silt fence, hay bales, pipes, etc.
- Notify ECO.
- Repair or replace failed device as appropriate.
- Dig/scrape up escaped material; take care not to damage vegetation.
- Remove escaped material from site.
- ECO to follow Incident Management plan.
- Monitor for effectiveness until re-establishment.

5.3 Bank/slope failure

- Stabilize toe of slope to prevent sediment escape using aggregate bags, silt fence, logs, hay bales, pipes, etc.
- Notify ECO.
- ECO to follow Incident Management plan.
- Divert water upslope from failed fence.

- Protect area from further collapse as appropriate.
- Restore as advised by ECO.
- Monitor for effectiveness until stabilized.

5.4 Discovery of rare or endangered species

- Stop work.
- Notify ECO.
- If a plant is found, mark location of plants.
- If an animal, mark location where sighted.
- ECO to identify or arrange for identification of species and or the relocation of the species if possible.
- If confirmed significant, ECO to liaise with Endangered Wildlife Trust.
- Recommence work when cleared by ECO.

5.5 Discovery of archeological or heritage items

- Stop work.
- Do not further disturb the area.
- Notify ECO.
- ECO to arrange appraisal of specimen.
- If confirmed significant, ECO to liaise with National, Cultural and History Museum.
P.O. Box 28088
SUNNYSIDE
0132
Contact Mr. J. van Schalkwyk
or
Mr. Naude
- Recommence work when cleared by ECO.

6 EMP review

1. The Site supervisor is responsible for ensuring the work crew is complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes that may have been implemented by GDARD before starting any works.
2. If the contractor cannot comply with any of the activities as described above, they should inform the ECO with reasons within 7 working days.

Enlarged Figures

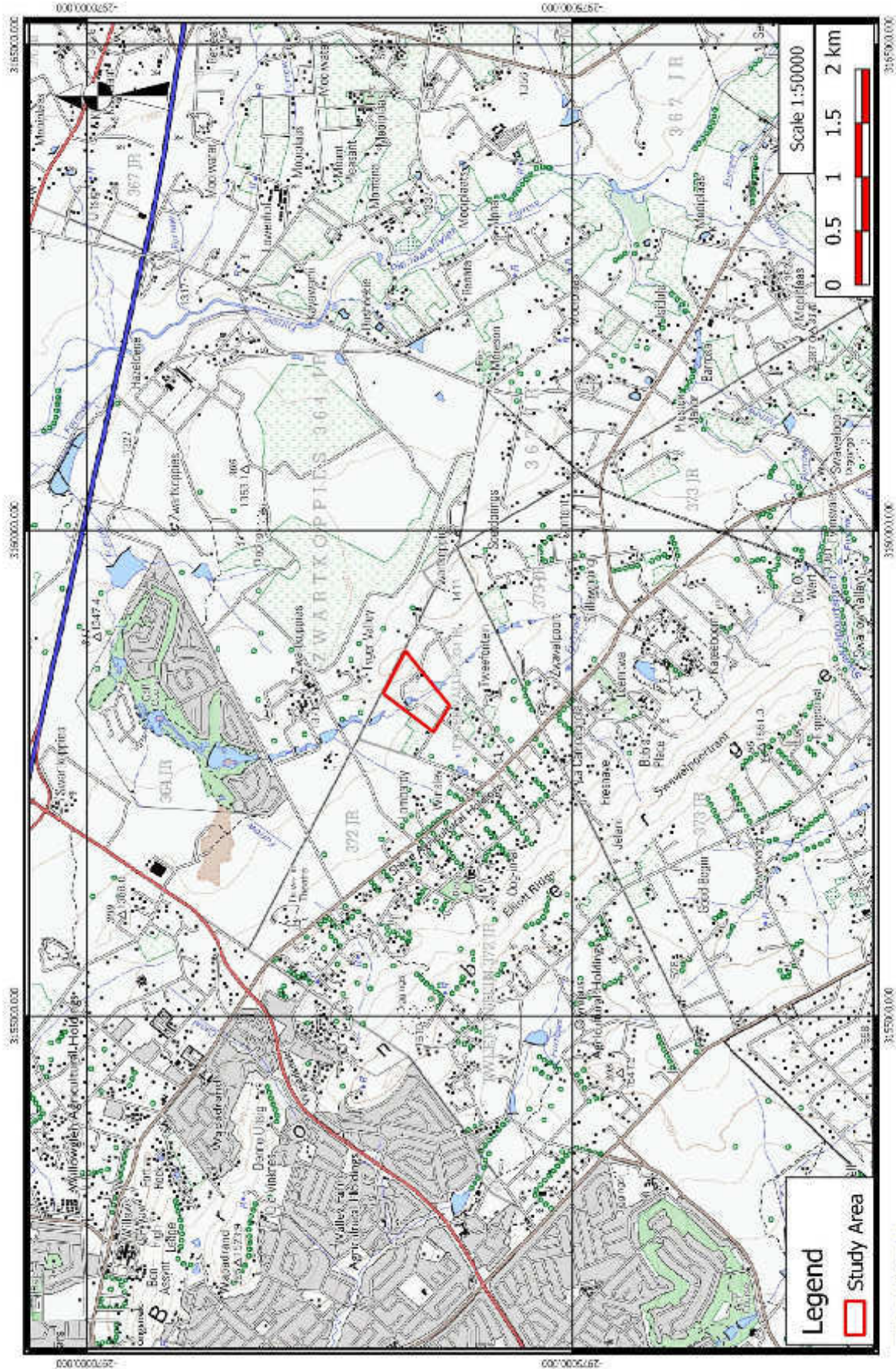


Appendix I

Locality Map



Appendix I1



Datum WGS 84

Aerial Map

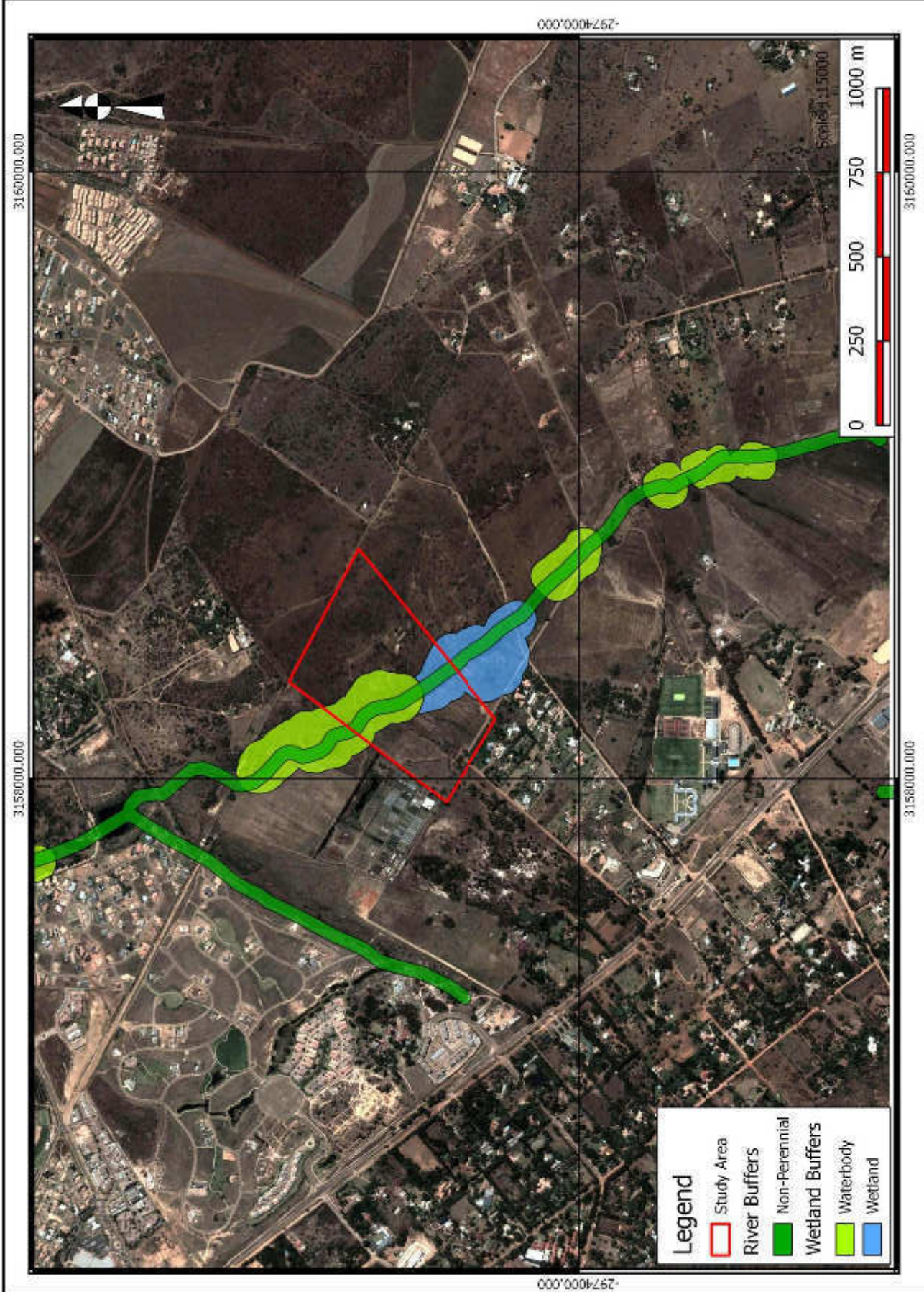


Appendix 12

Hydrology Map



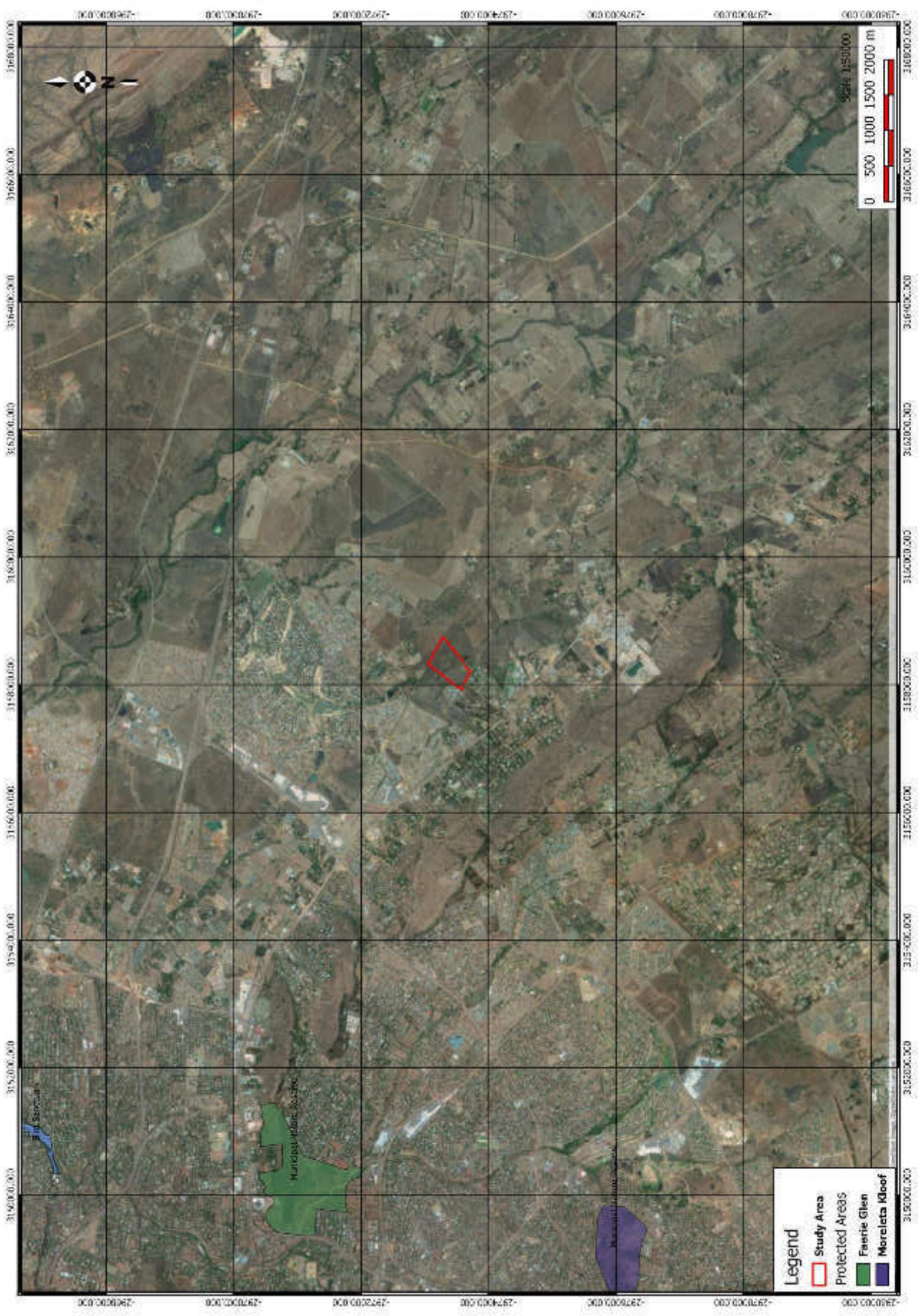
Appendix 13



Protected Areas



Appendix 14



Legend

-  Study Area
-  Protected Areas
-  Faerie Glen
-  Mariceta Kloof

Municipal Water Supply

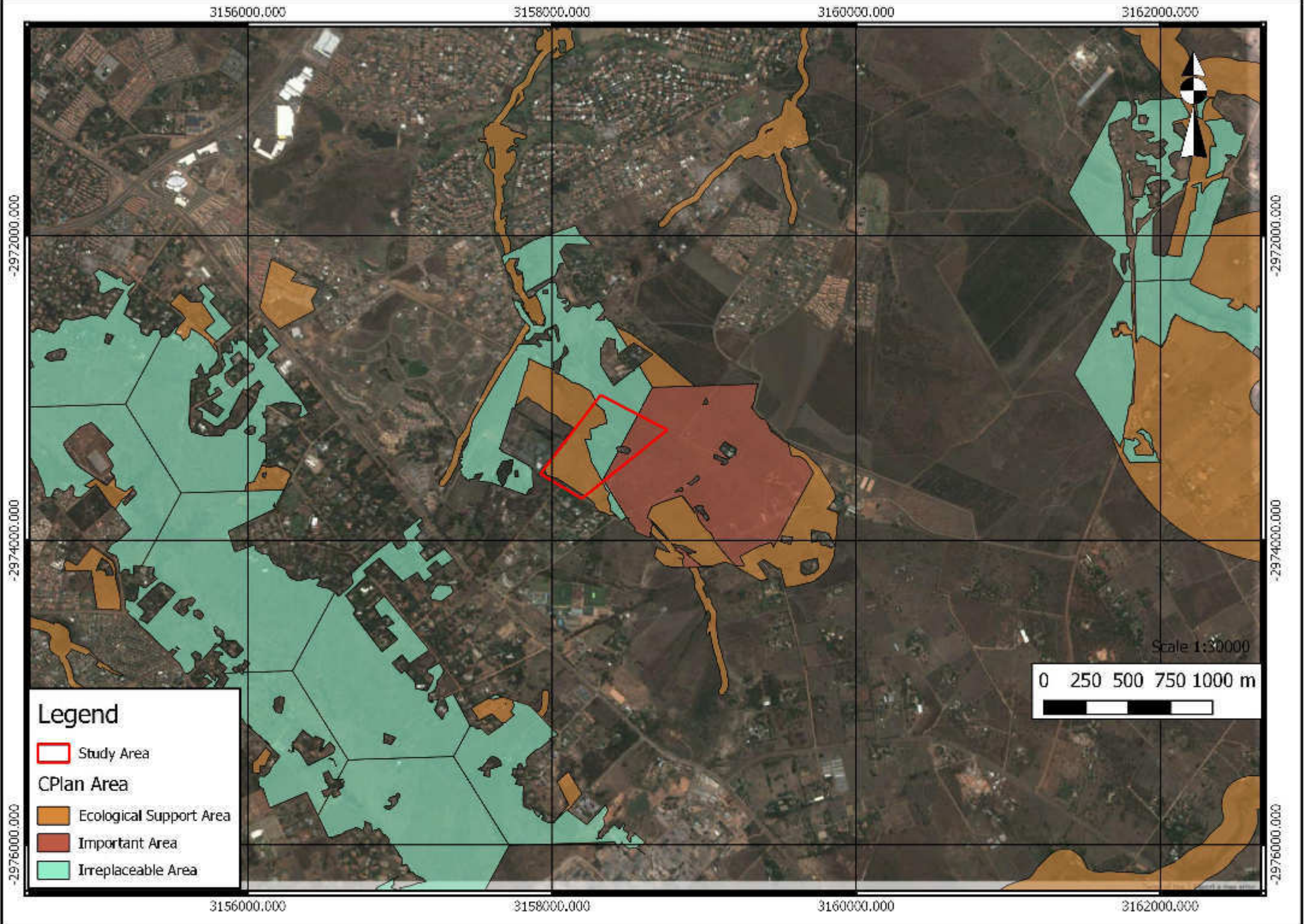
Municipal Water Supply

Municipal Water Supply

GDARD C-Plan



Appendix 15



3156000.000

3158000.000

3160000.000

3162000.000

-2972000.000

-2972000.000

-2974000.000

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-2976000.000

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3158000.000

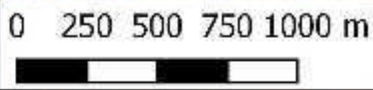
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3162000.000

Legend

- Study Area
- CPlan Area**
 - Ecological Support Area
 - Important Area
 - Irreplaceable Area

Scale 1:30000



Irreplaceable Areas



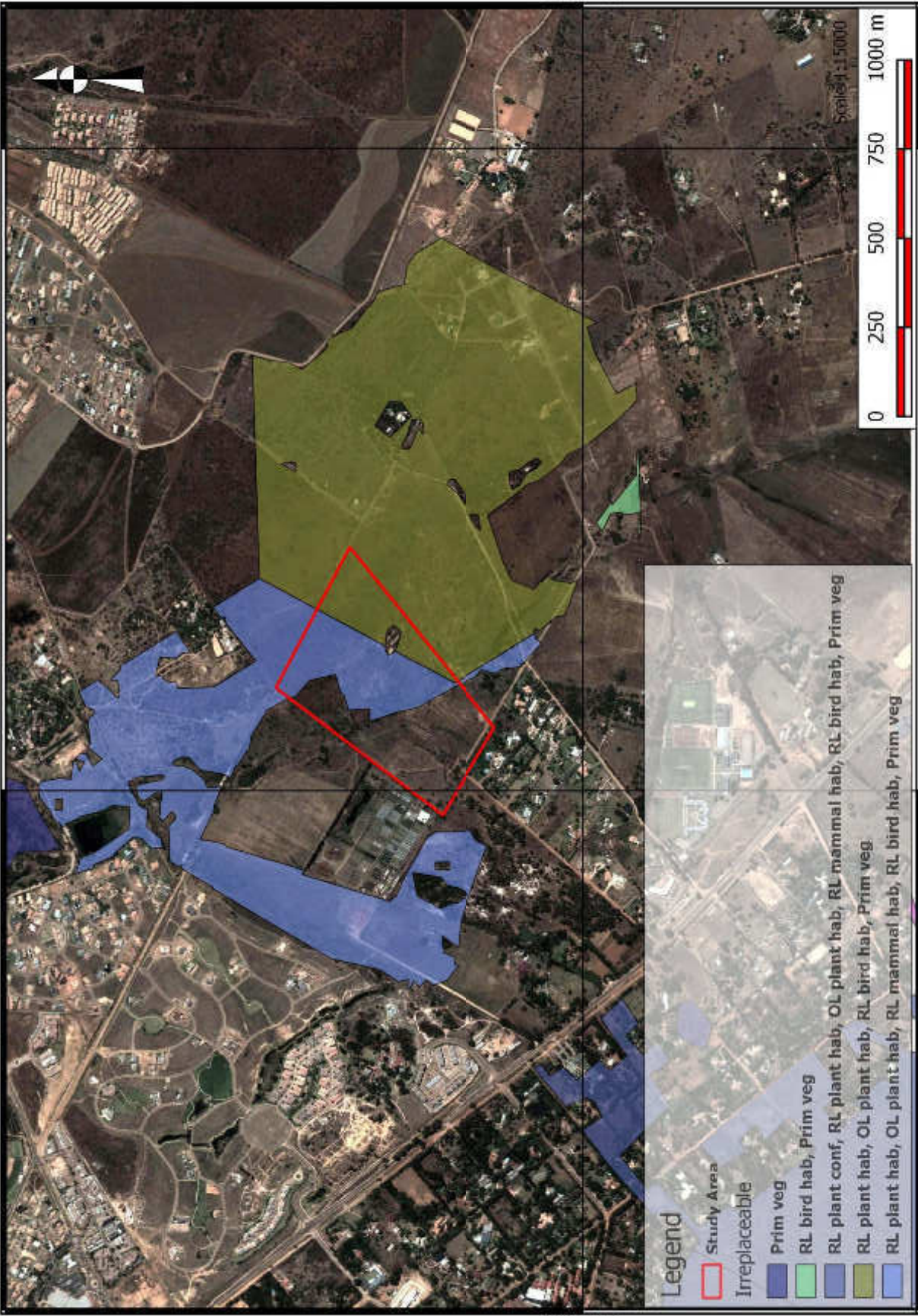
Appendix 16

3160000.000

3158000.000

-2974000.000

-2974000.000



Legend

- ▭ Study Area
- ▭ Irreplaceable
- ▭ Prim veg
- ▭ RL bird hab, Prim veg
- ▭ RL plant conf, RL plant hab, OL plant hab, RL mammal hab, RL bird hab, Prim veg
- ▭ RL plant hab, OL plant hab, RL bird hab, Prim veg
- ▭ RL plant hab, OL plant hab, RL mammal hab, RL bird hab, Prim veg

Scale: 1:5000



3160000.000

3158000.000

Ridges



Appendix 17

3156000.000

3158000.000

3160000.000

3162000.000

-2972000.000

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-2974000.000

-2974000.000

-2976000.000

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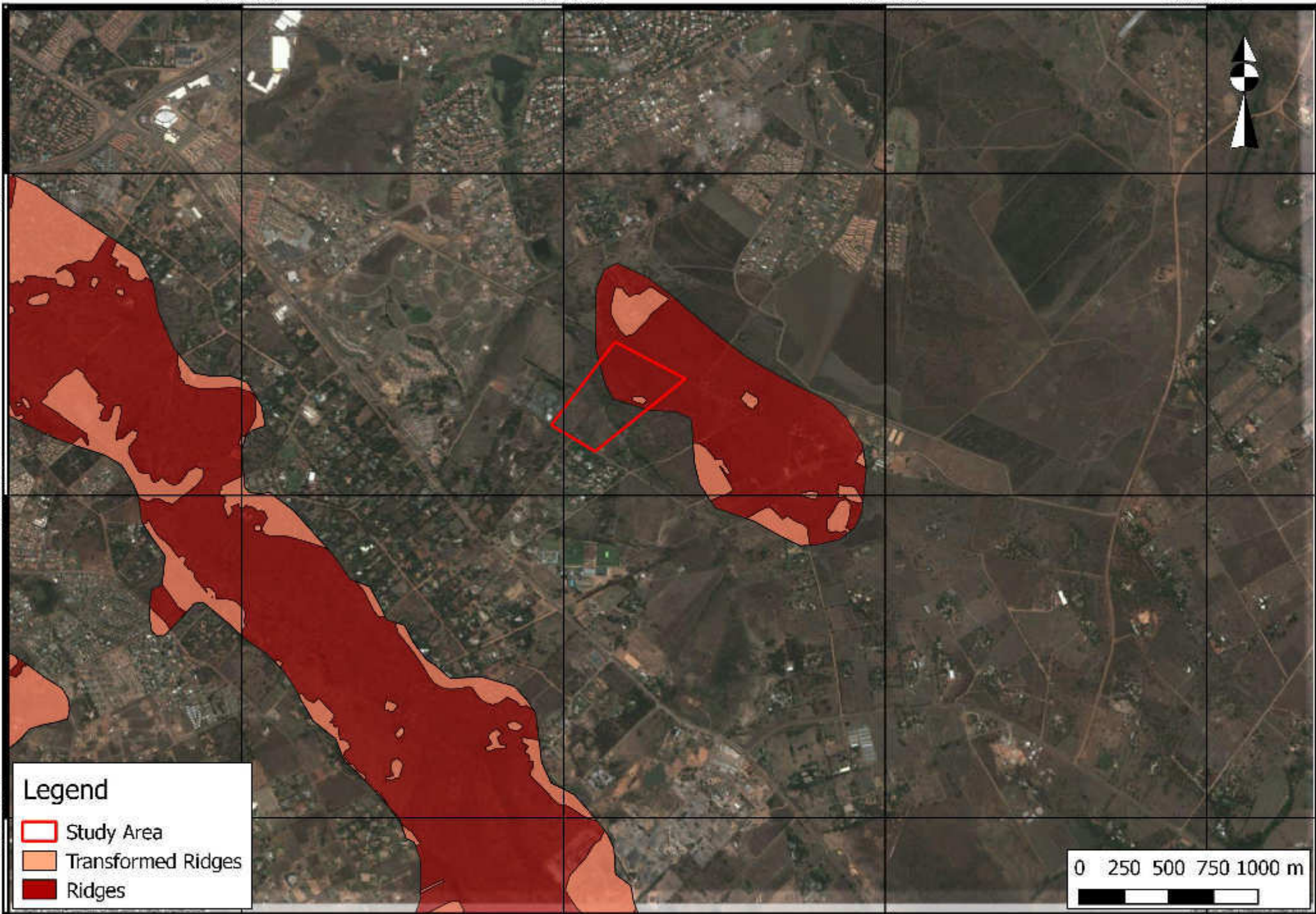
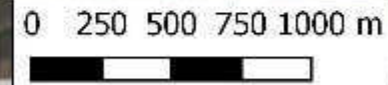
3160000.000

3162000.000



Legend

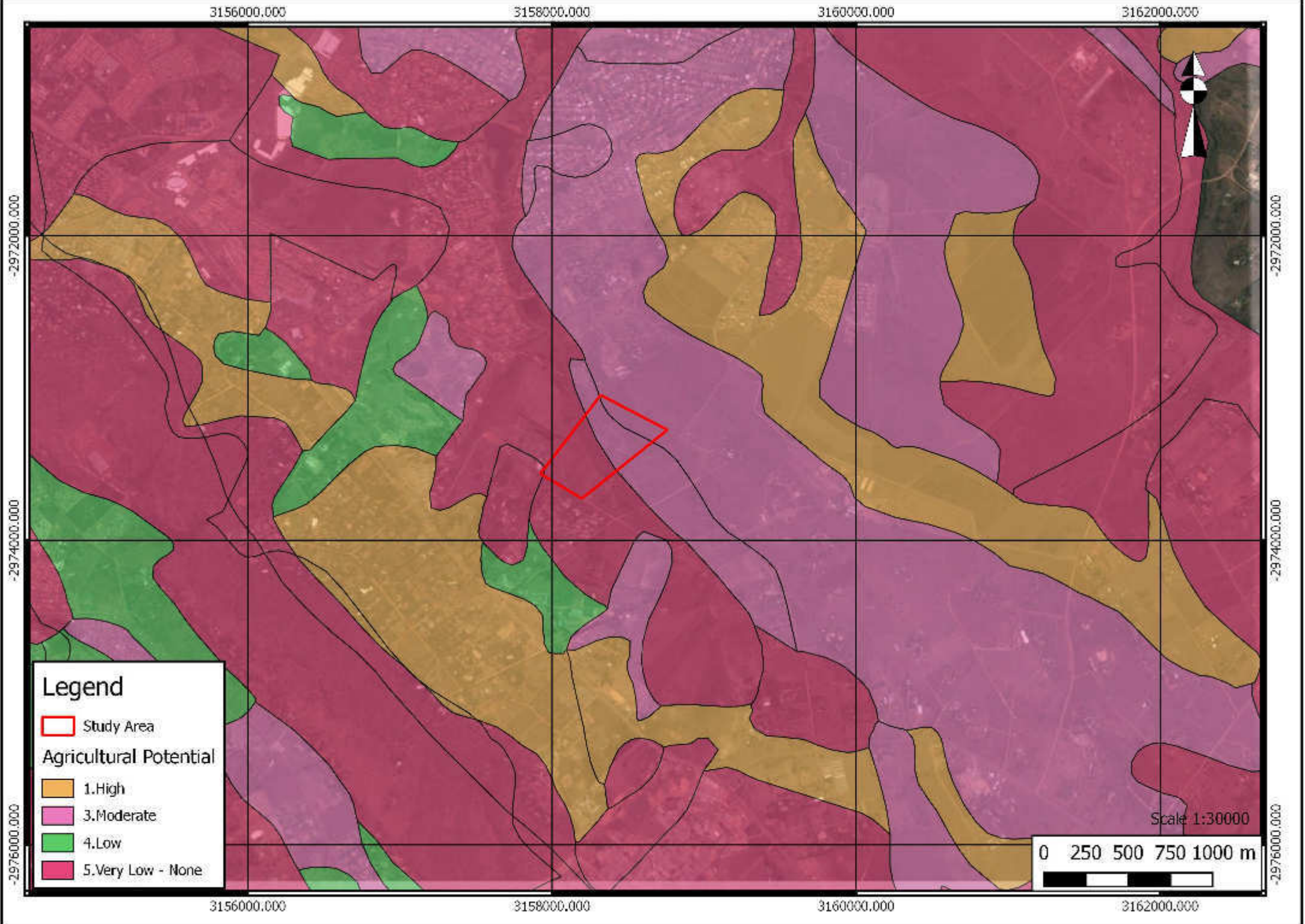
-  Study Area
-  Transformed Ridges
-  Ridges



Agricultural Potential



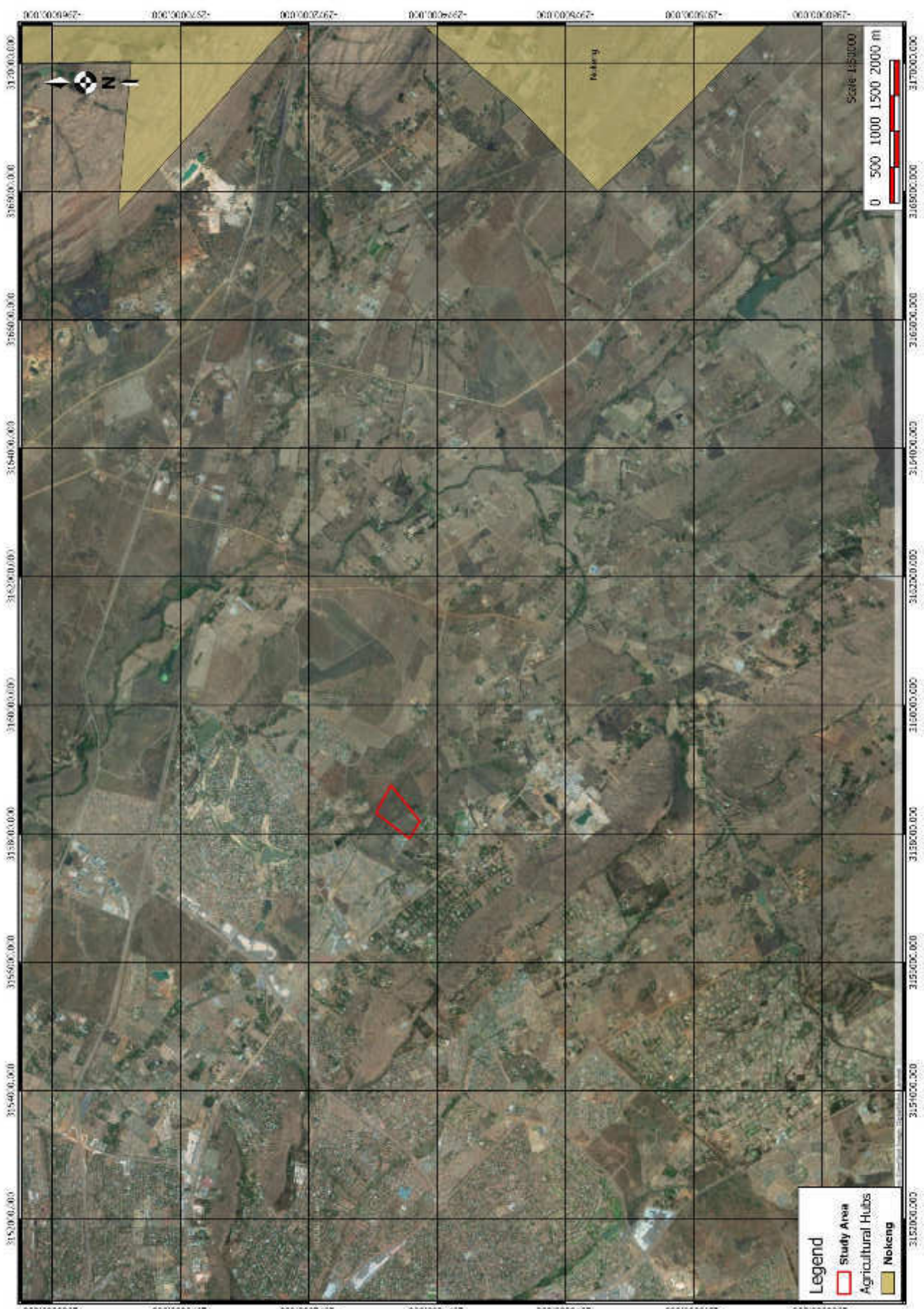
Appendix 18



Agricultural Hubs



Appendix 19



Legend

- Study Area
- Agricultural Hubs
- Nkeng

Scale 1:50,000

0 500 1000 1500 2000 m



Nkeng

Urban Edge



Appendix I10

3156000.000

3158000.000

3160000.000

3162000.000

-2972000.000

-2972000.000

-2974000.000

-2974000.000

-2976000.000

-2976000.000

3156000.000

3158000.000

3160000.000

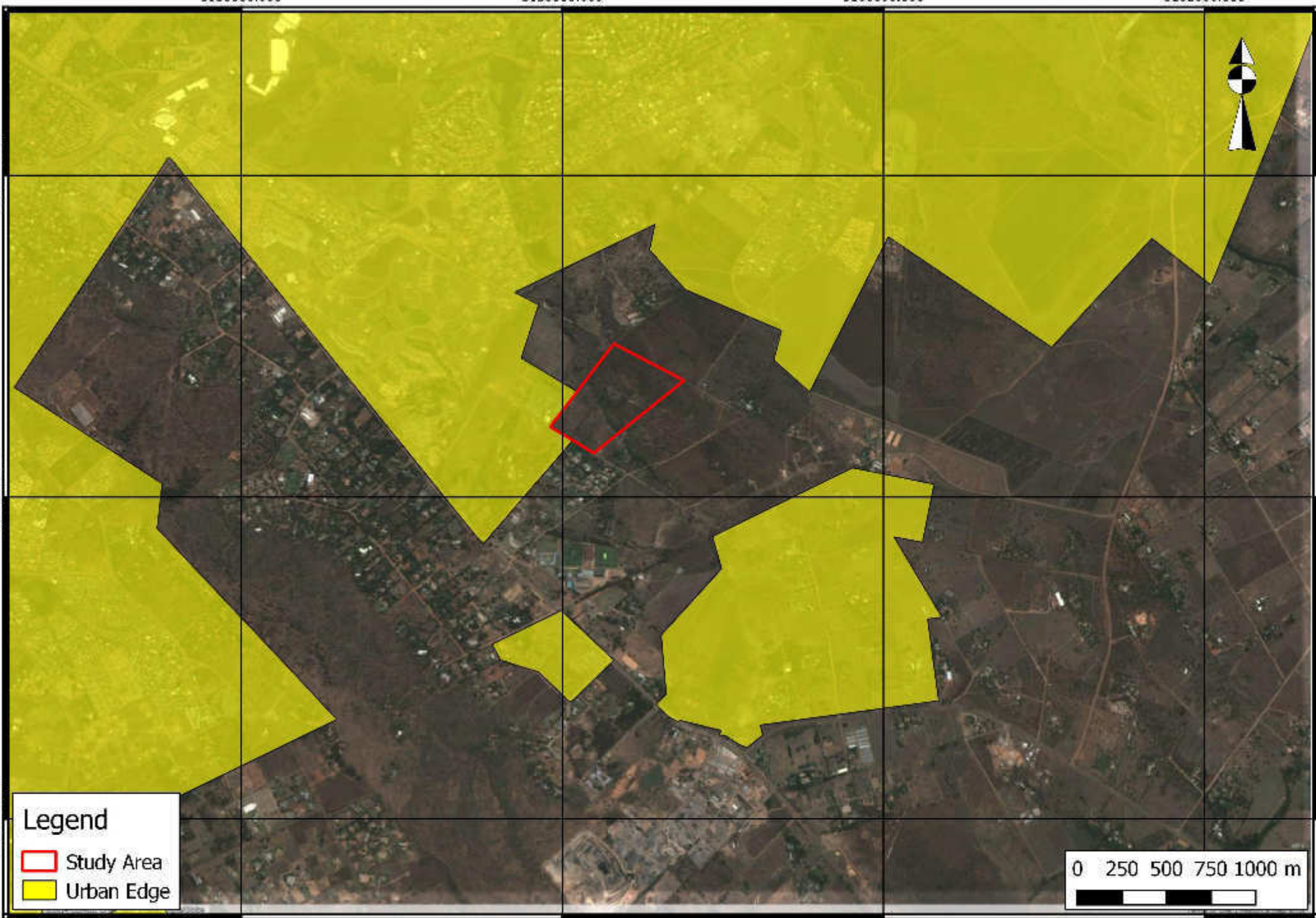
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Legend

-  Study Area
-  Urban Edge

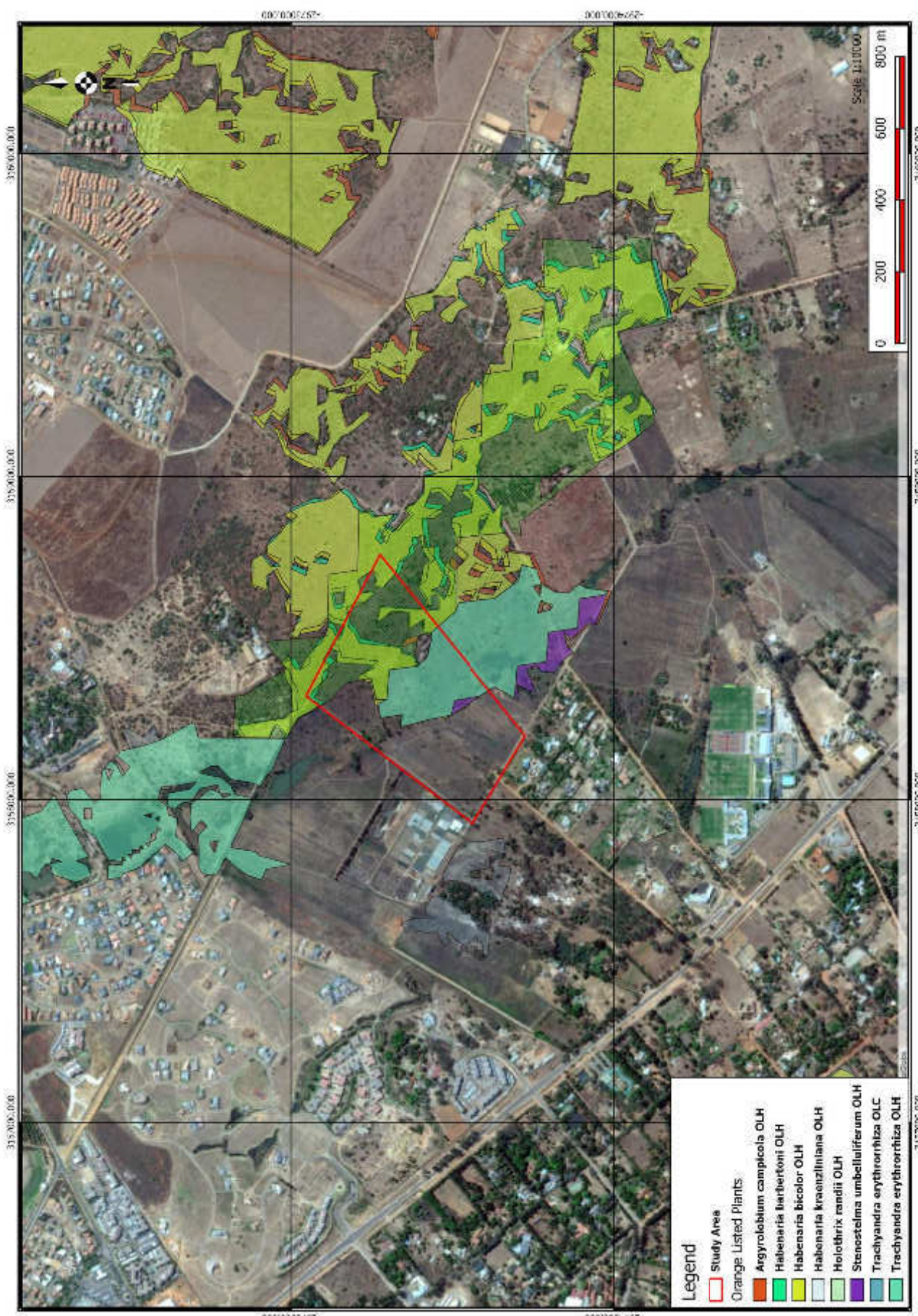
0 250 500 750 1000 m



Orange Listed Plants



Appendix I11



- Legend**
- ▭ Study Area
 - Orange Listed Plants
 - ▭ *Argyrobolium campicola* OLI
 - ▭ *Habenaria berthoultii* OLI
 - ▭ *Habenaria bicolor* OLI
 - ▭ *Habenaria kraetzliniana* OLI
 - ▭ *Holothrix randii* OLI
 - ▭ *Stenostelma umbelliferum* OLI
 - ▭ *Trachyantha erythrorhiza* OLC
 - ▭ *Trachyantha erythrorhiza* OLI

Scale 1:10000



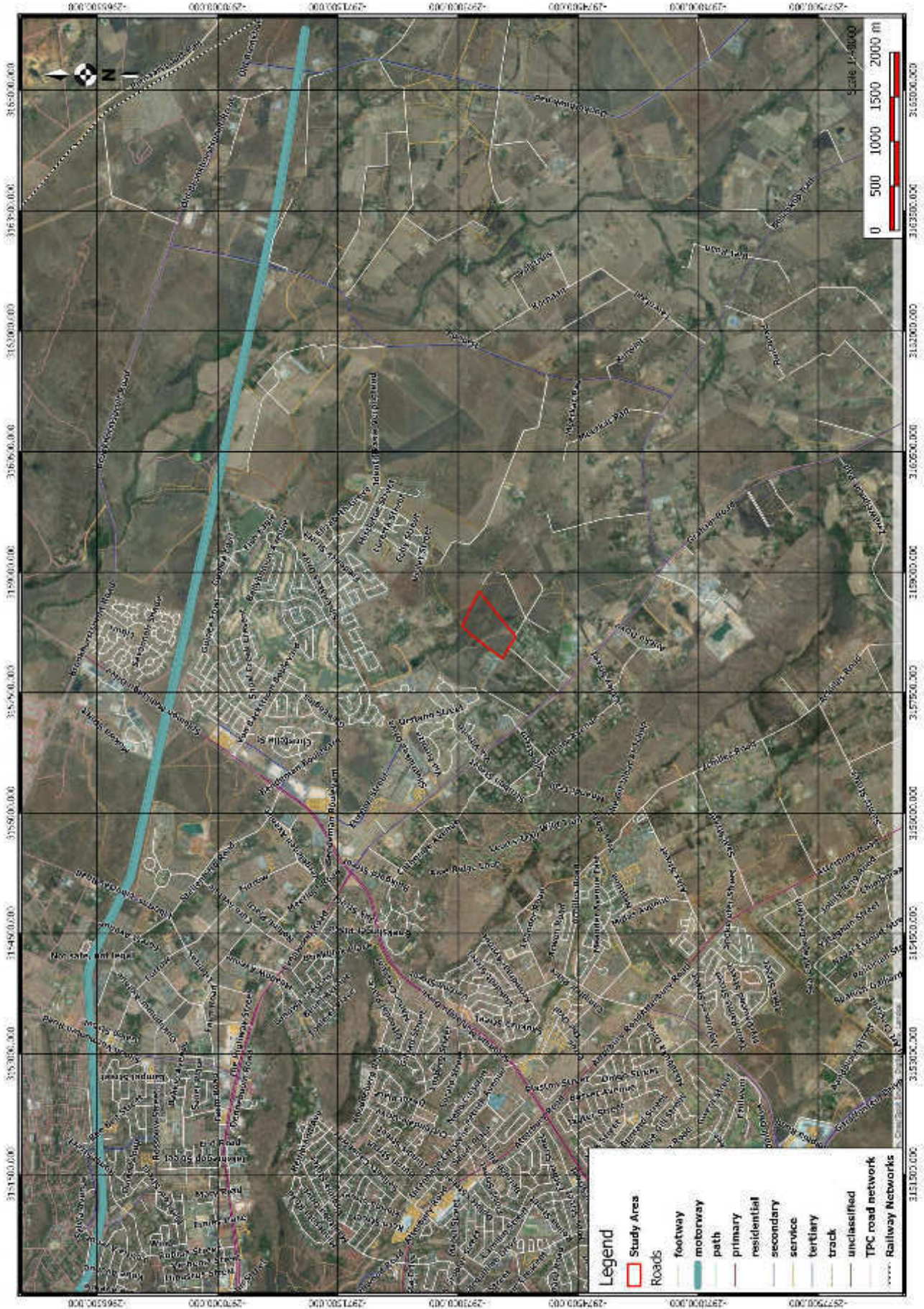
3152000.000 3155000.000 3158000.000 3161000.000

-2973000.000 -2970000.000 -2967000.000 -2964000.000

Roads and Railways



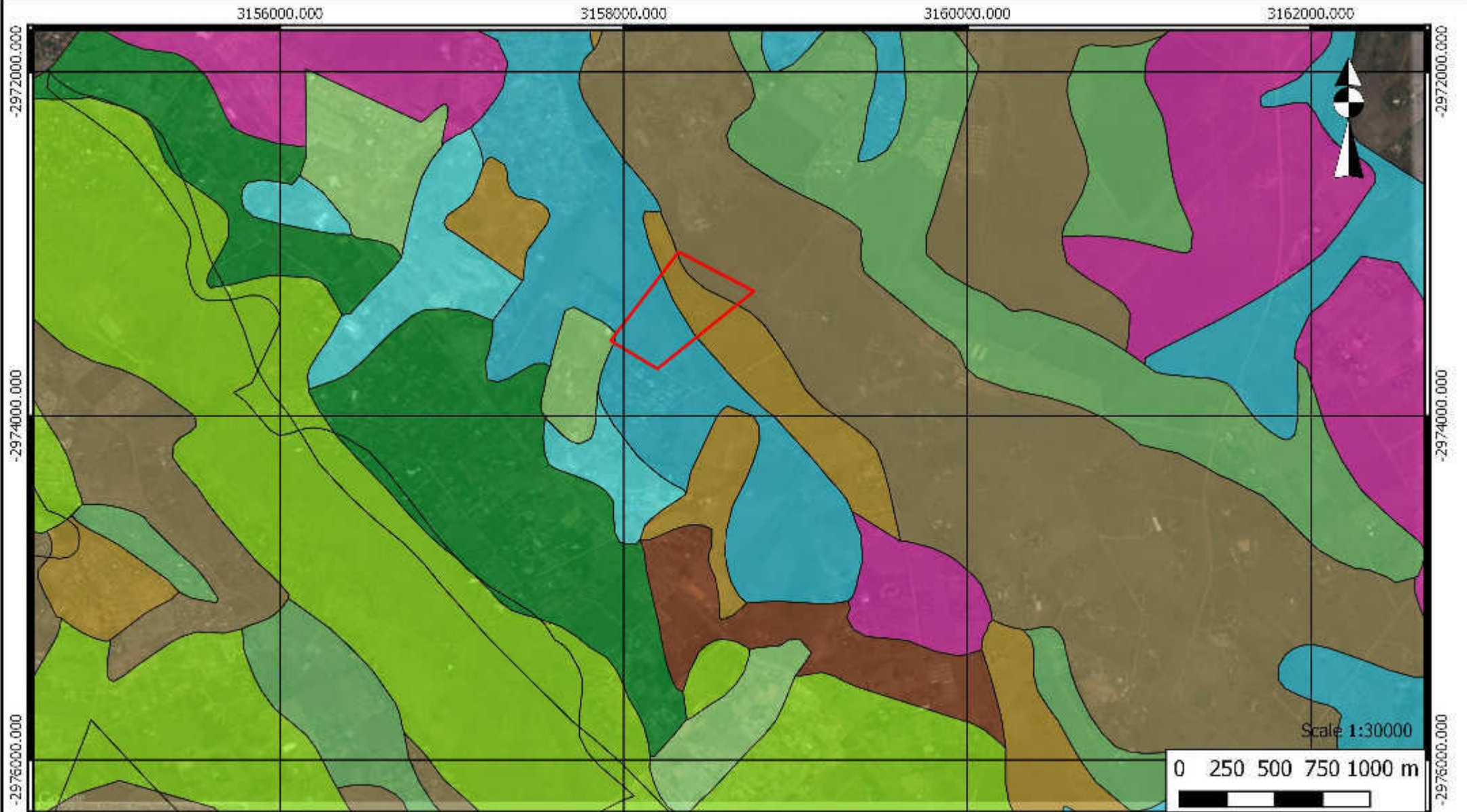
Appendix I12




Soils



Appendix I13





Legend

 Study Area


Soils


 Disturbed sites

 Impeded internal drainage, flood hazard


 Impeded internal drainage, limiting soil depth


 Limiting soil depth


 Limiting soil depth, impeded internal drainage in subsoil


 Limiting soil depth, moderate to strong structure, high clay content


 Limiting soil depth, rainfall efficiency, rock outcrops

 Limiting soil depth, rock outcrops, steepness

 Low clay content

 Moderate to strong structure, high clay content

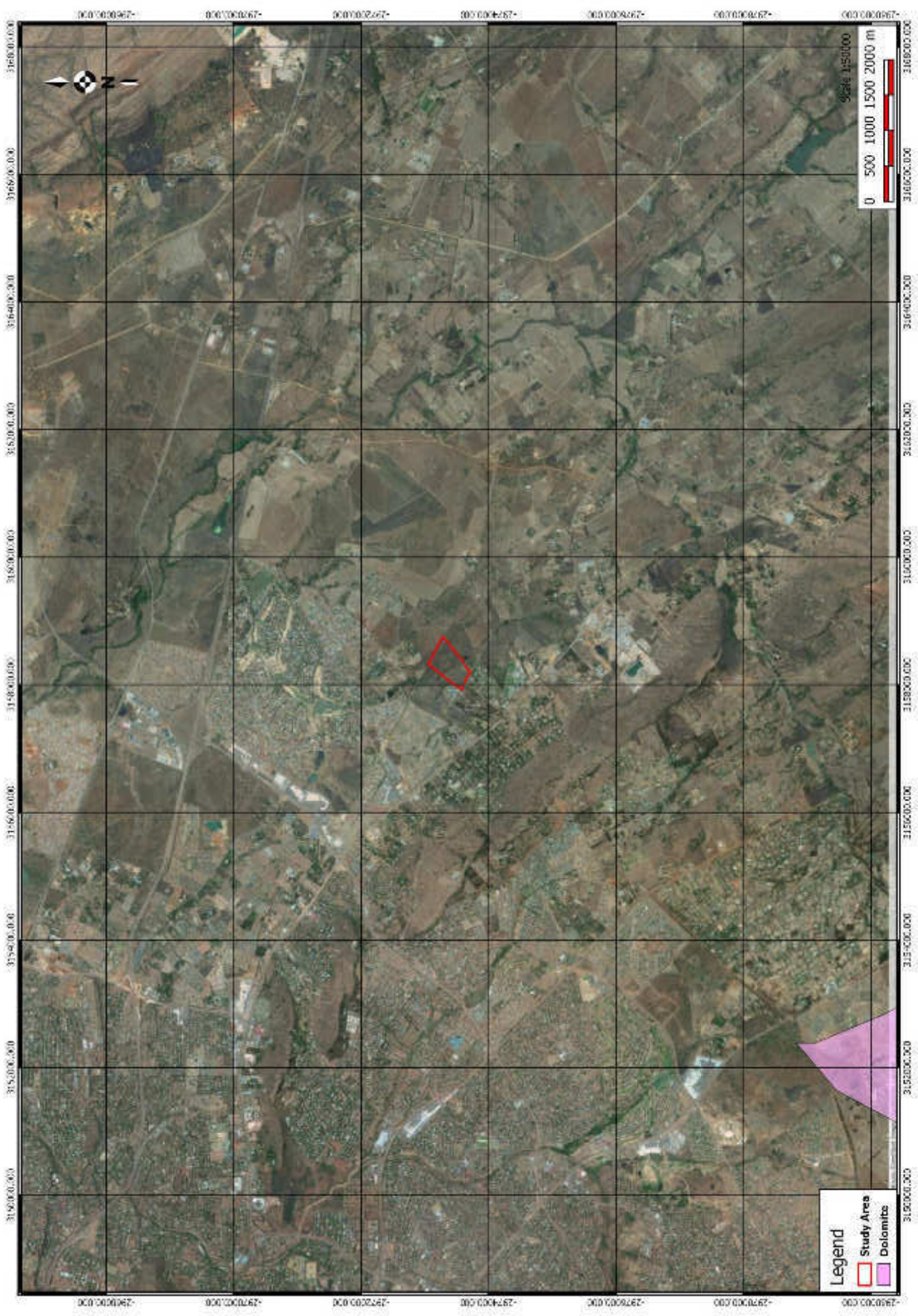
 Moderate to strong structure, high clay content, rainfall efficiency

 Moderate to strong structure, high clay content, water erosion hazard

Dolomite



Appendix I14

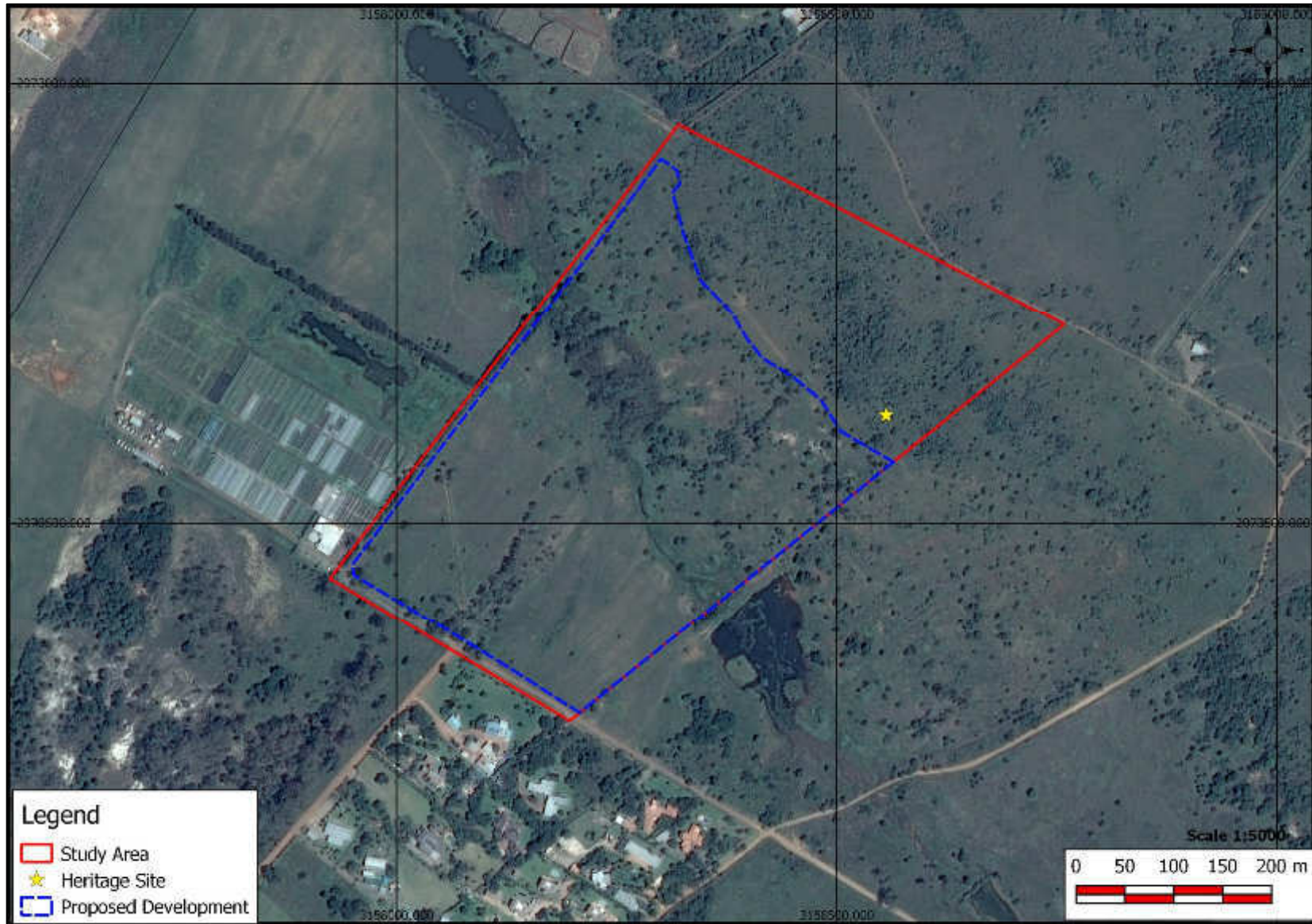


Heritage Site



Appendix I15

Tijger Valley X34 Heritage



Legend

- Study Area
- Heritage Site
- Proposed Development

Projection - Transverse Mercator
Datum - Hartbeeshoek 1994
Reference Ellipsoid - WGS 1984
Central Meridian -29

Company Profile & CV of Lizelle Gregory (Environmental Assessment Practitioner)



Appendix J



Bokamoso

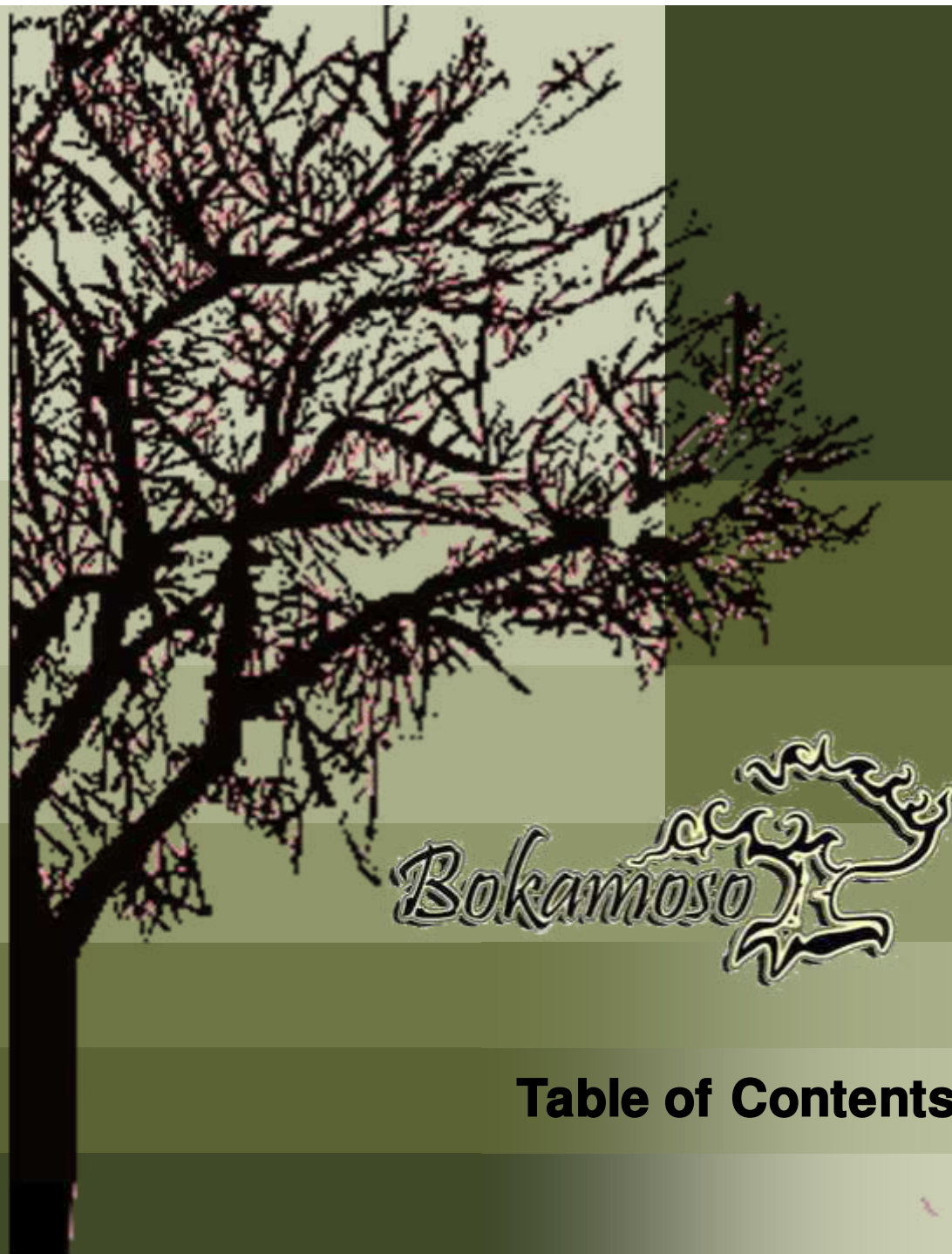
**Landscape Architects &
Environmental consultants**

**P.O.BOX 11375
Maroelana
0161**

**Tel: (012) 346 3810
Fax: (086) 570 5559**

**E-mail: lizelleg@mweb.co.za
Website: www.bokamoso.biz**

- 01** Executive Summary
- 02** Vision, Mission & Values
- 03** Human Resources
- 04** Services
- 05** Landscape Projects
- 06** Corporate Highlights
- 07** Environmental Projects
- 08** Indicative Clients
- 09** Tools



Bokamoso 

Table of Contents

Bokamoso specialises in the fields of Landscape Architecture and all aspects of Environmental Management and Planning. Bokamoso was founded in 1992 and has shown growth by continually meeting the needs of our clients. Our area of expertise stretches throughout the whole of South Africa. Our projects reflect the competence of our well compiled team. The diversity of our members enables us to tend to a variety of needs. Our integrated approach establishes a basis for outstanding quality. We are well known to clients in the private, commercial as well as governmental sector.

At Bokamoso we stand on a firm basis of environmental investigation in order to find unique solutions to the requirements of our clients and add value to their operations.



01 Executive Summary

011 Company Overview



Vision:

At Bokamoso we strive to find the best planning solutions by taking into account the functions of a healthy ecosystem. Man and nature should be in balance with each other.

Mission:

We design according to our ethical responsibility, take responsibility for successful completion of projects and constitute a landscape that contributes to a sustainable environment. We add value to the operations of our clients and build long term relationships that are mutually beneficial.

Values:

Integrity

Respect



Bokamoso stands on the basis of fairness. This include respect within our multicultural team and equal opportunities in terms of gender, nationality and race.

We have a wide variety of projects to tend to, from complicated reports to landscape installation. This wide range of projects enables us to combine a variety of professionals and skilled employees in our team.

Bokamoso further aids in the development of proficiency within the working environment. Each project, whether in need of skilled or unskilled tasks has its own variety of facets to bring to the table.

We are currently in the process of receiving our BEE scorecard. We support transformation in all areas of our company dynamics.



03 Human Resources

031 Employment Equity

Lizelle Gregory (100% interest)

Lizelle Gregory obtained a degree in Landscape Architecture from the University of Pretoria in 1992 and passed her board exam in 1995.

Her professional practice number is PrLArch 97078.

Ms. Gregory has been a member of both the Institute for Landscape Architecture in South Africa (ILASA) and South African Council for the Landscape Architecture Profession (SACLAP), since 1995.

Although the existing Environmental Legislation doesn't yet stipulate the academic requirements of an Environmental Assessment Practitioner (EAP), it is recommended that the Environmental Consultant be registered at the International Association of Impact Assessments (IAIA). Ms. Gregory has been registered as a member of IAIA in 2007.

Ms. Gregory attended and passed an International Environmental Auditing course in 2008. She is a registered member of the International Environmental Management and Assessment Council (IEMA).

She has lectured at the Tshwane University of Technology (TUT) and the University of Pretoria (UP). The lecturing included fields of Landscape Architecture and Environmental Management.

Ms. Gregory has more than 20 years experience in the compilation of Environmental Evaluation Reports:

Environmental Management Plans (EMP);

Strategic Environmental Assessments;

All stages of Environmental input ;

EIA under ECA and the new and amended NEMA regulations and various other Environmental reports and documents.

Ms. Gregory has compiled and submitted more than 600 Impact Assessments within the last 5-6 years. Furthermore, Ms. L. Gregory is also familiar with all the GDARD/Provincial Environmental policies and guidelines. She assisted and supplied GAUTRANS/former PWV Consortium with Environmental input and reports regarding road network plans, road determinations, preliminary and detailed designs for the past 12 years.



03 Human Resources

032 Members

Consulting

Anè Agenbacht

Introduction to Sustainable Environmental Management—An overview of Principles, Tools, & Issues (Potch 2006)
Leadership Training School (Lewende Woord 2010)
BA Environmental Management (UNISA 2011)
PGCE Education (Unisa 2013) - CUM LAUDE
Project Manager
More than 10 years experience in the compilation of various environmental reports

Mary-Lee Van Zyl

Msc. Plant Science (UP)
BSc (Hons) Plant Science (UP)
BSc Ecology (UP)
More than 3 years working experience in the Environmental field
Specialises in ECO works, Basic Assessments, EIA's, and Flora Reports
Compilation of various Environmental Reports

Dashentha Naidoo

BA Honours Degree in Environmental Management (UNISA) - CUM LAUDE
Bachelor Social Science in Geography & Environmental Management (UKZN)
More than 4 years experience in WUL Application & Integrated Environmental Management within water resource management.
Senior Environmental Practitioner & Water Use Licences Consultant
Specialises in Water Use License & Compilation of various Env. Reports

Ben Bhukwana

BSc Landscape Architecture (UP)
More than 5 years experience in the field of Landscape Architecture (Design, Construction, and Implementation).
Specialises in Landscape Design, ECO, Rehabilitation Plans and Compilation Basic Assessment Reports
Compilation of Tender documents



03 Human Resources

033 Personnel

Anton Nel

B-Tech Landscape Technology (TUT)
N Dip Landscape Technology (TUT)
Hazardous Waste Management Short Course
2 years experience in ECO.
Specialises in Basic Assessment Reports.

Juanita de Beer

Diploma Events Management and Marketing (Damelin)
Specializes in Public relations and Public Participation Processes (3 years experience)

Alfred Thomas

CIW Foundation& Internet Marketing (IT Academy)
12 years experience in GIS and IT in general.
GIS Operator and Multimedia Specialist.

Bianca Reyneke

Applying SHE Principles and Procedures (NOSA)
Intro to SAMTRAC Course (NOSA)
SHEQ Coordinator and compilation of environmental reports
Specialises in compiling various environmental reports

A.E. van Wyk

BSc. Environmental Sciences (Zoology and Geography)
Specialises in compiling various environmental reports



03 Human Resources

034 Personnel

Elsa Viviers

Interior Decorating (Centurion College)

(Accounting/ Receptionist) and Secretary to Lizelle Gregory

Loura du Toit

N. Dip. Professional Teacher (Heidelberg Teachers Training College)

Librarian and PA to Project Manager

Merriam Mogalaki

Administration Assistant with in-house training in bookkeeping

Landscape Contracting

Elias Maloka

Site manager overseeing landscape installations.

Irrigation design and implementation.

Landscape maintenance

18 years experience in landscape contracting works.

The contracting section comprises of six permanently employed black male workers. In many cases the team consists of up to 12 workers, depending on the quantity of work.



03 Human Resources

035 Personnel

01 Environmental Management Services

- Basic Assessment Reports
- EIA & Scoping Reports
- Environmental Management Plans
- Environmental Scans
- Strategic Environmental Assessments
- EMP for Mines
- Environmental Input and Evaluation of Spatial Development Frameworks
- State of Environmental Reports
- Compilation of Environmental Legislation and Policy Documents
- Environmental Auditing and Monitoring
- Environmental Control Officer (ECO)
- Visual Impact assessments
- Specialist Assistance with Environmental Legislation Issues and Appeals
- Development Process Management
- Water Use License applications to DWA
- Waste License Application



04 Services

041 Consulting Services

02 Landscape Architecture

- Master Planning
- Sketch Plans
- Planting Plans
- Working Drawings
- Furniture Design
- Detail Design
- Landscape Development Frameworks
- Landscape Development Plans (LDP)
- Contract and Tender Documentation
- Landscape Rehabilitation Works

03 Landscape Contracting

Implementation of Plans for:

- Office Parks
- Commercial/ Retail / Recreational Development
- Residential Complexes
- Private Residential Gardens
- Implementation of irrigation systems



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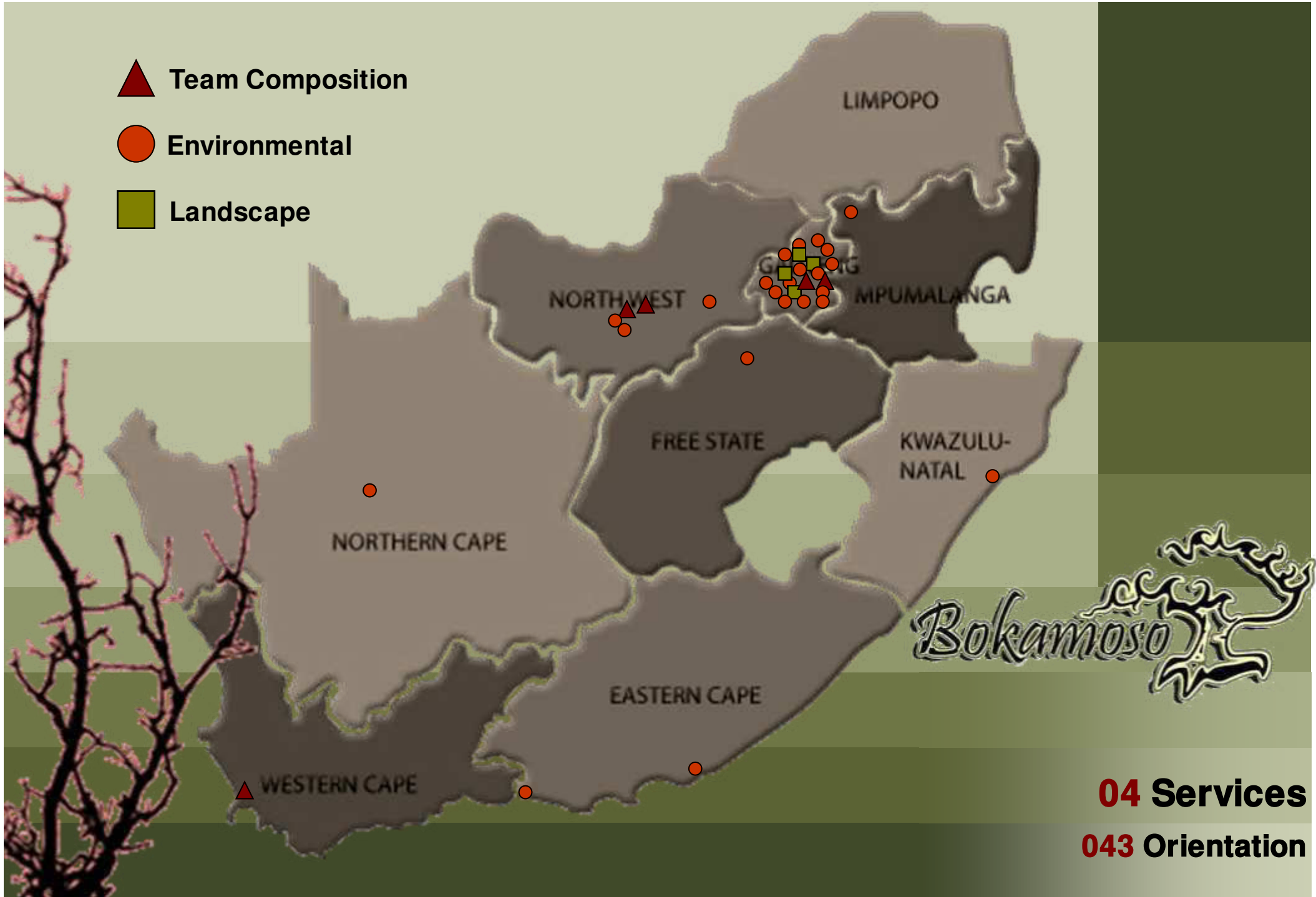
04 Services

042 Contracting Services

▲ Team Composition

● Environmental

■ Landscape



Bokamoso

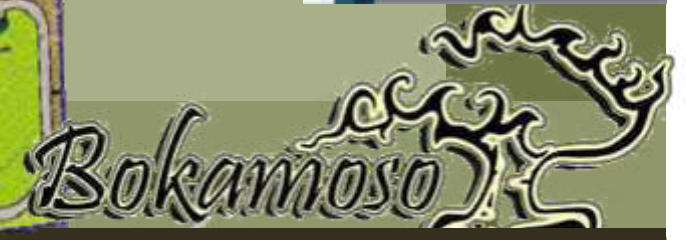
04 Services

043 Orientation

01 Valpre Bottling Plant, Heidelberg



project
shelter- site plan

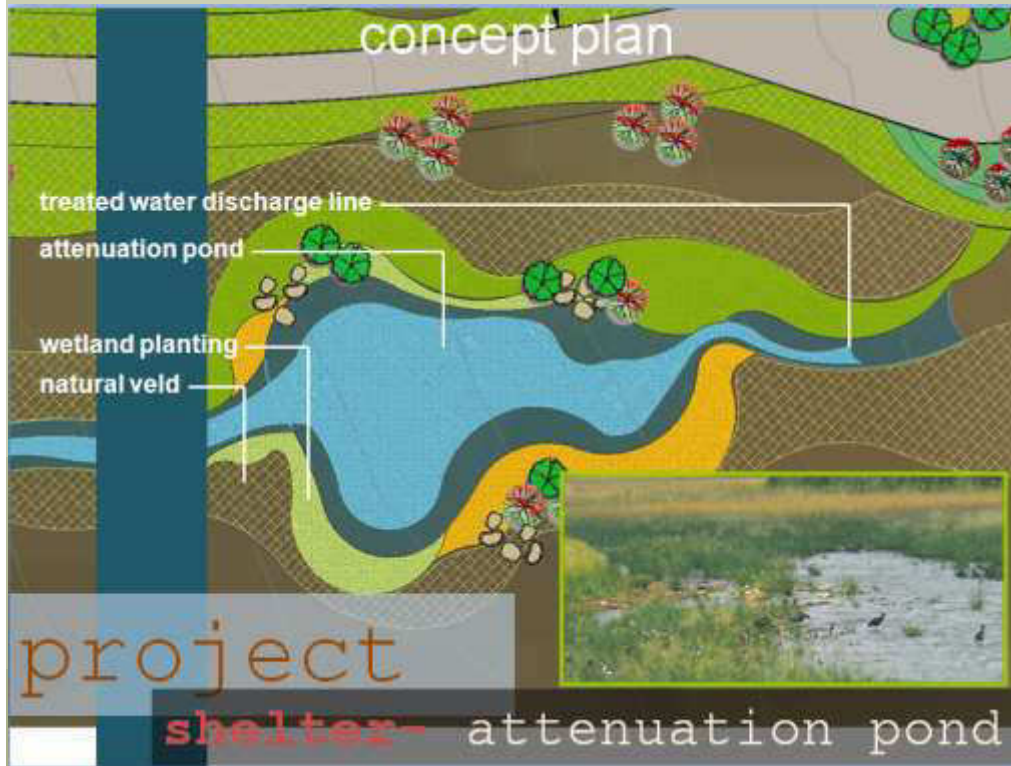


05 Landscape Projects- Current

051 Commercial



01 Valpre Bottling Plant, Heidelberg

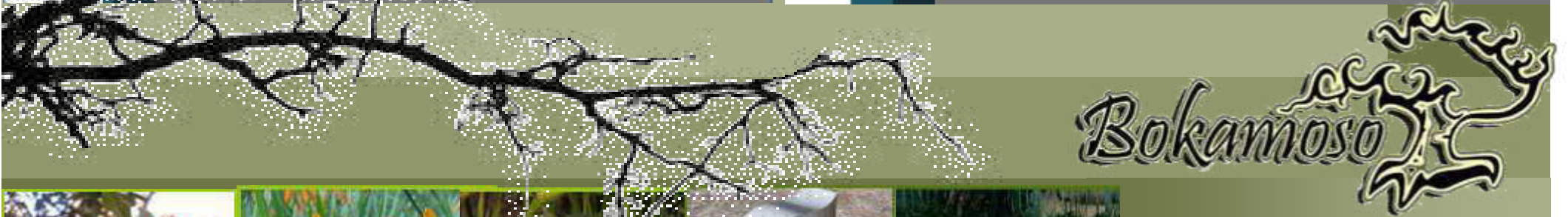
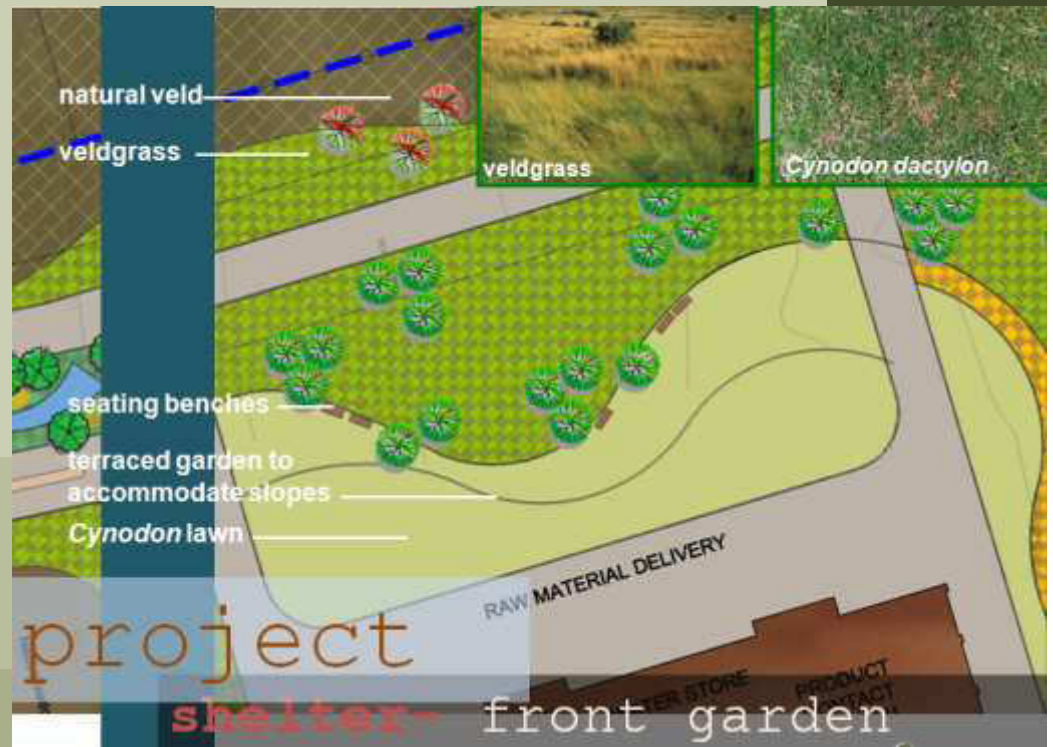


05 Landscape Projects- Current

051 Commercial



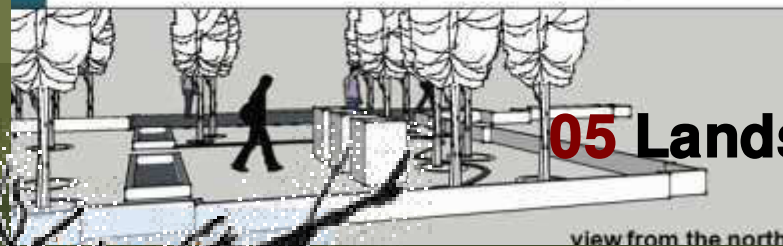
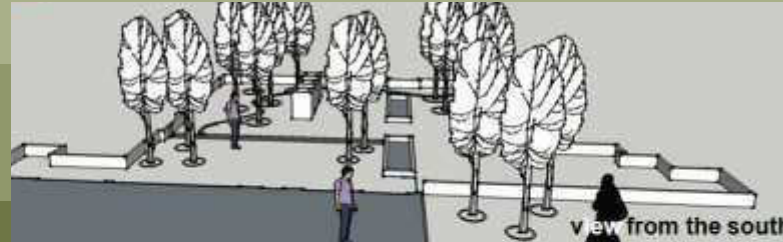
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

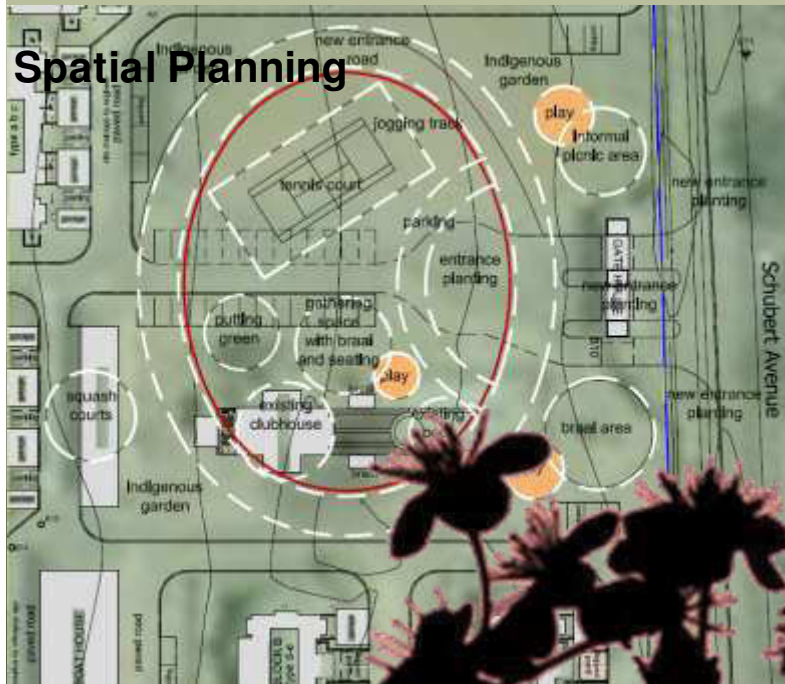
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

02 Melodie Waters, Hartebeespoortedam



Streetscape

Indigenous Planting



05 Landscape Projects – Current

052 Commercial/Recreational



02 Melodie waters, Hartebeestpoortdam



Rehabilitation



Area Layout

Development Framework



05 Landscape Projects– Current

052 Commercial/Recreational

03 Grain Building, Pretoria



Bokamoso

05 Landscape Projects– Completed

053 Offices

04 Ismail Dawson offices, Pretoria



Bokamoso

05 Landscape Projects – Conceptual

053 Offices

05 Celtic Manor, Pretoria

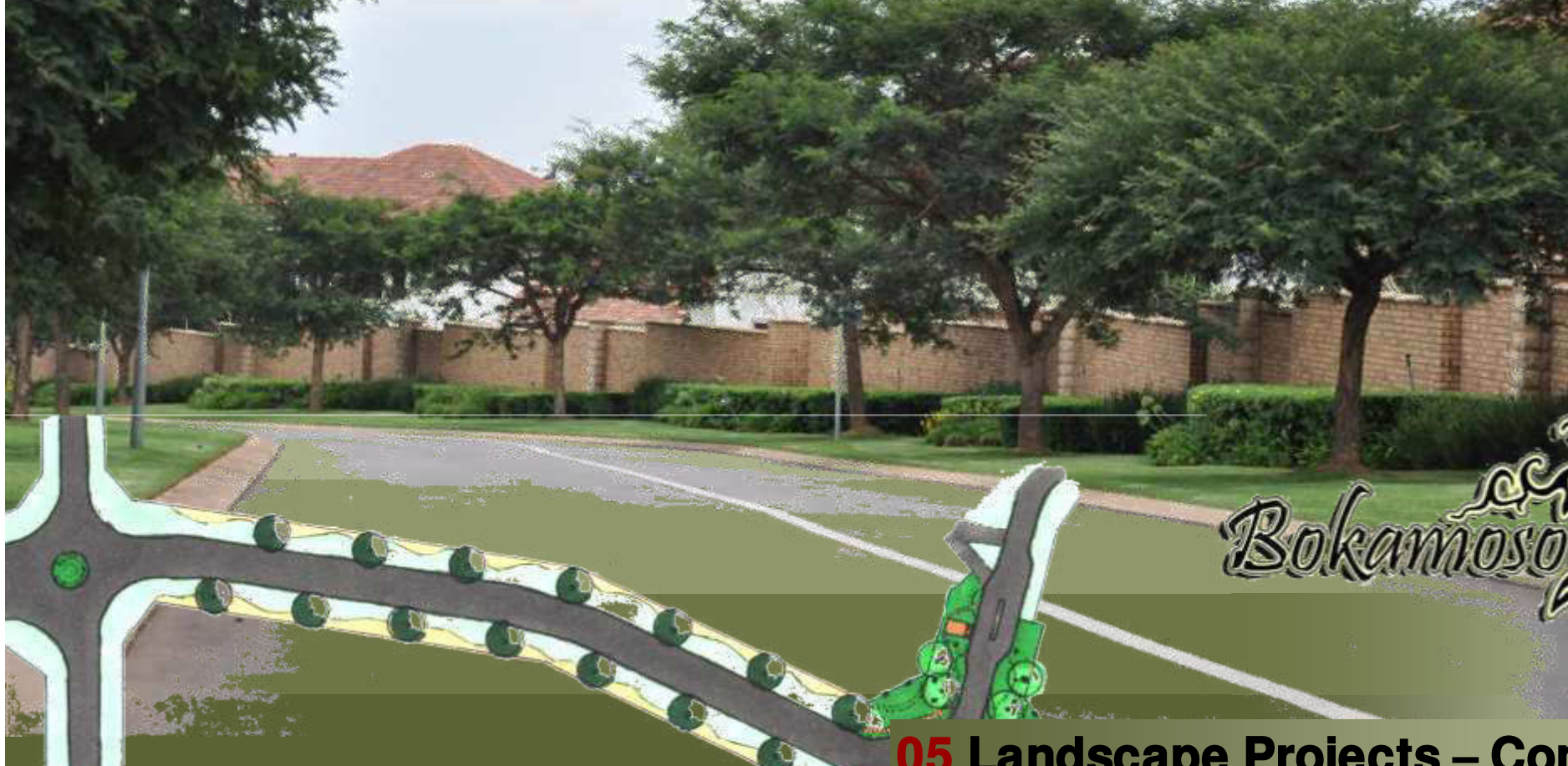


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05 Landscape Projects - Completed

054 Complex Development

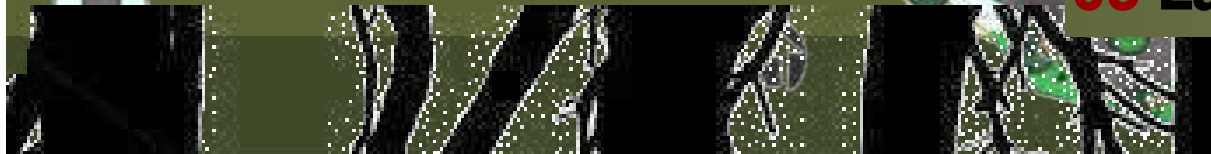
06 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

054 Complex Development



07 The Wilds, Pretoria

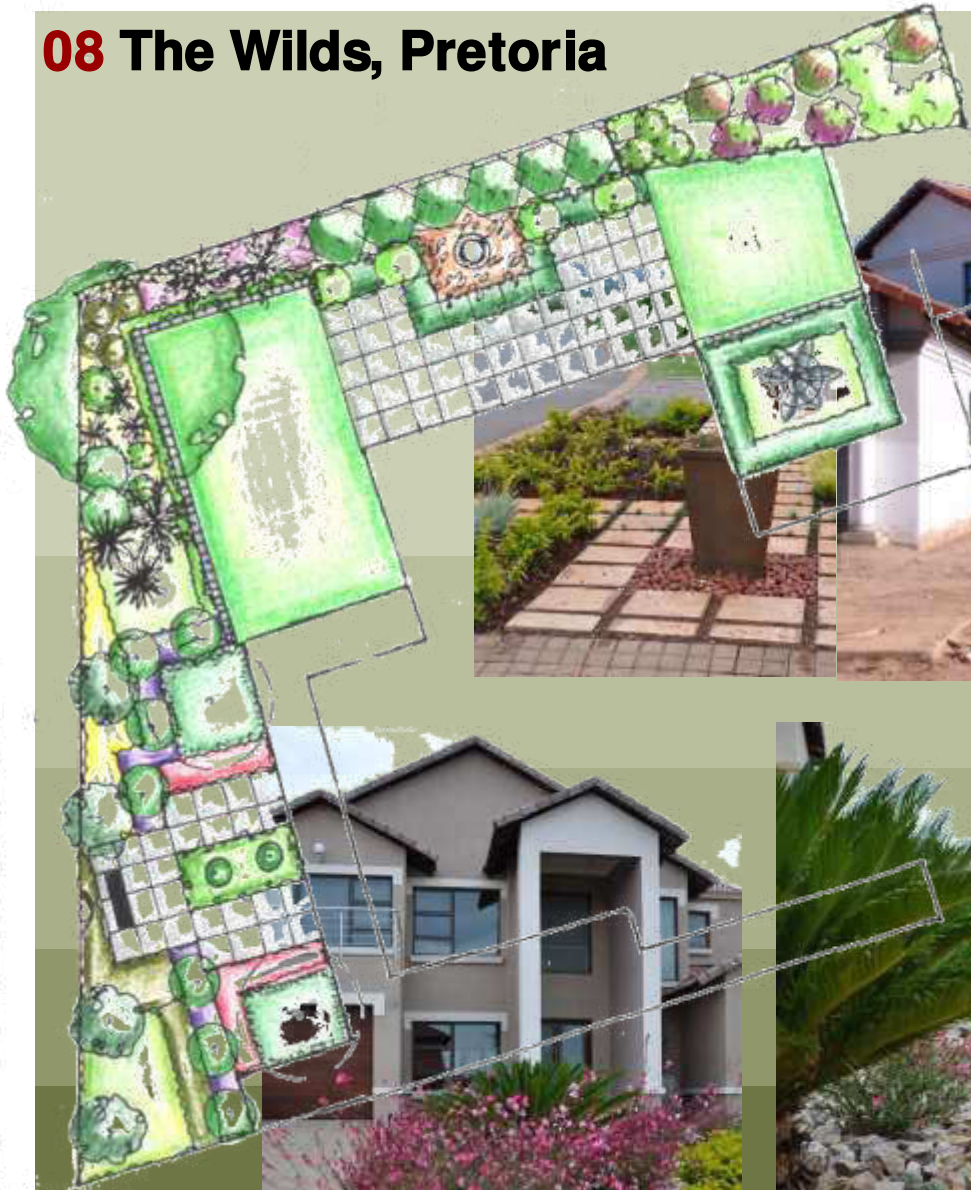


بوكاموسو
Bokamoso

05 Landscape Projects – Completed

055 Residential

08 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

09 The Wilds, Pretoria

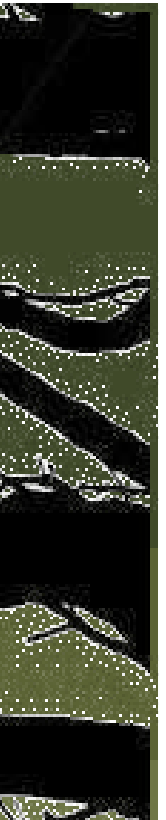


Bokamoso

05 Landscape Projects – Completed

055 Residential

010 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential



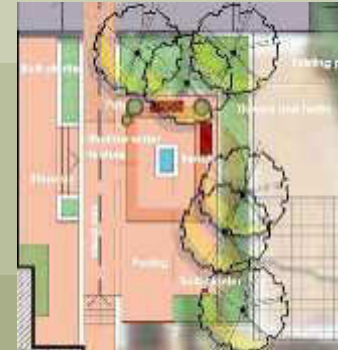
011 Governor of Reserve Bank's Residence, Pretoria



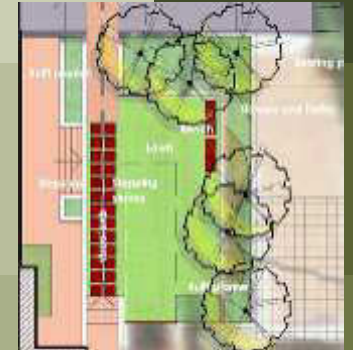
Plant Palette



Option 1



Option 2



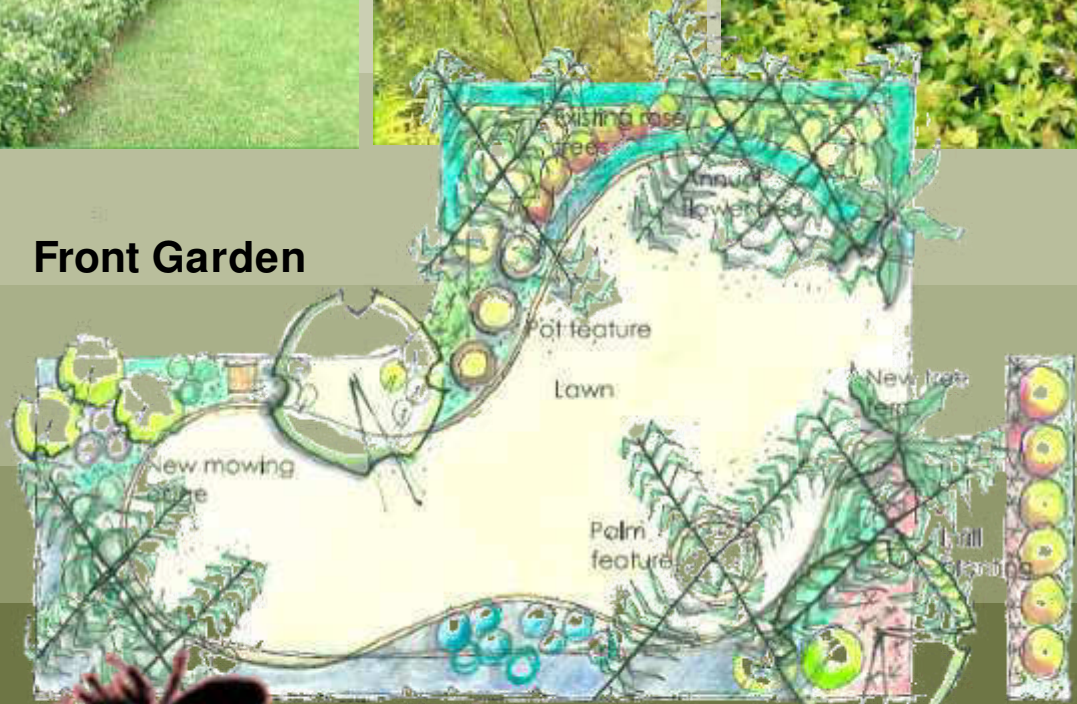
05 Landscape Projects – Conceptual

055 Residential

012 House Ismail, Pretoria



Front Garden



Back Garden



05 Landscape Projects - Conceptual

055 Residential



013 Forest Garden, Pretoria

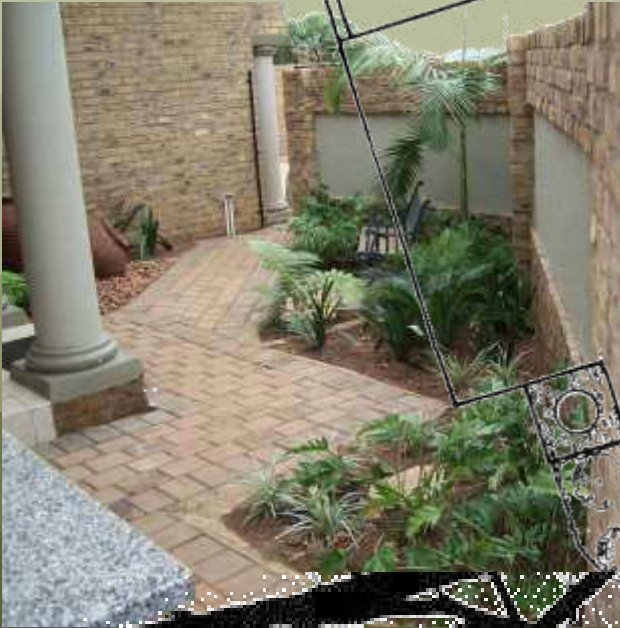


Bokamoso

05 Landscape Projects - Completed

055 Residential

015 Forest Garden, Pretoria



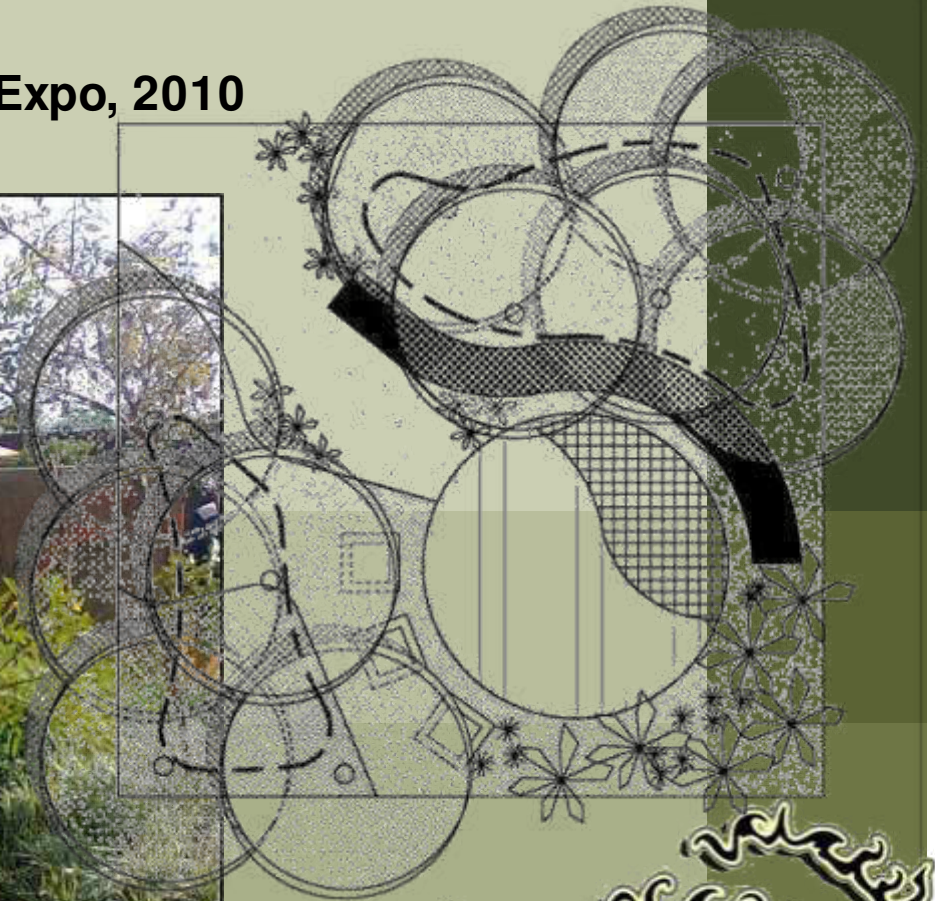
Bokamoso

05 Landscape Projects - Completed

055 Residential

01 Safari Garden Expo

Received a Silver Certificate at the Safari Garden Expo, 2010



Bokamoso 

06 Corporate Highlights

061 Awards

02 UNISA Sunnyside Campus, Pretoria

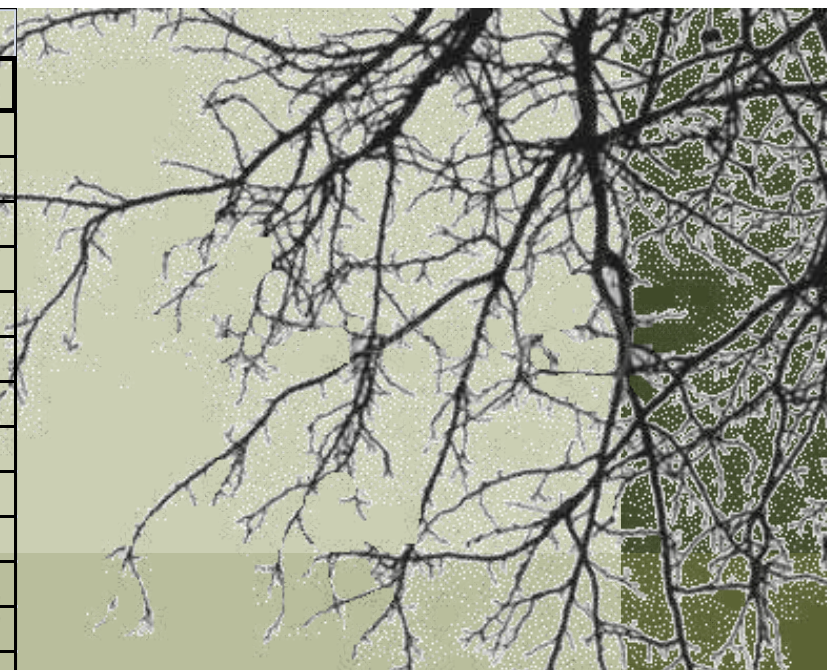
Best Commercial Paving Plan in Gauteng, 1997



06 Corporate Highlights

061 Awards

Project Name	Status	Project
Environmental Impact Assessment(EIA) and Scoping Report		
Junction 21	ROD	EIA
5 O'clock site access	In Progress	EIA
Bokamoso X 1	In Progress	Scoping & EIA
Doornvallei Phase 6 & 7	In Progress	EIA
Engen Interchange	In Progress	Scoping & EIA
Erasmia X15	In Progress	EIA
Franschkloof	In Progress	EIA
K113	Amendment of ROD	EIA
K220 East	ROD	EIA
K220 West	ROD	EIA
K54 ROD conditions	In Progress	EIA
Knopjeslaagte 95/Peachtree	ROD	EIA
Knopjeslaagte portion 20 & 21	ROD	EIA
Lillieslief/Nooitgedacht	In Progress	EIA
Mooiplaats 70 (Sutherland)	In Progress	EIA
Naauwpoort 1 - 12/Valley View	In Progress	EIA
PeachTree X5	In Progress	EIA
Strydfontein 60	In Progress	EIA
Thabe Motswere	In Progress	Scoping & EIA
Vlakplaats	In Progress	EIA
Waterval Valley	In Progress	EIA
Environmental Opinion		
Doornkloof 68 (Ross)	In Progress	Opinion
Monavoni X 53	In Progress	BA & Opinion
Mooikloof (USN)	In Progress	Opinion
Norwood Mall/Sandspruit	In Progress	Opinion
Riversong X 9	In Progress	Opinion
Sud Chemie	In Progress	Opinion
USN Benjoh Fishing Resort	In Progress	Opinion



The adjacent list host the status of our current projects. Only a selected amount of projects are displayed.



07 Current Environmental Projects

071 EIA, Scoping & Opinion

Project Name	Status	Project
Basic Assessment(BA)		
Annlin X 138	In Progress	BA
Clubview X 29	ROD	BA
Darrenwood Dam	In Progress	BA
Durley Holding 90 & 91	In Progress	BA
Elim	In Progress	BA
Fochville X 3	In Progress	BA
Hartebeeshoek 251	In Progress	BA
Klerksdorp (Matlosana Mall)	In Progress	BA
Monavoni External Services	ROD	BA
Monavoni X 45	Amendment of ROD	BA
Montana X 146	In Progress	BA
Rooihuiskraal X29	In Progress	BA
Thorntree Mall	In Progress	BA

Environmental control officer (ECO)		
Grace Point Church	In Progress	ECO
R 81	In Progress	ECO
Highveld X 61	In Progress	ECO
Mall of the North	In Progress	ECO
Olievenhoutbosch Road	In Progress	ECO
Orchards 39	In Progress	ECO
Pierre van Ryneveld Reservoir	In Progress	ECO
Project Shelter	In Progress	ECO

S24 G		
Wonderboom	In Progress	S24 G
Mogwasi Guest houses	Completed	S24 G



07 Current Environmental Projects

072 BA, ECO & S24 G

Project Name	Status	Project
Objection		
Colesberg WWTW	In Progress	Objection
Nigel Steelmill	Completed	Objection
Chantilly Waters	Completed	Objection

Development facilitation Act- Input (DFA)		
Burgersfort	In Progress	DFA & BA
Doornpoort Filling Station	In Progress	DFA & EIA & Scoping
Eastwood Junction	In Progress	DFA
Ingersol Road (Erf 78, 81 - 83)	In Progress	DFA
Roos Senekal	In Progress	DFA & EIA & Scoping
Thaba Meetse 1	In Progress	DFA & EIA & Scoping

Water Use License Act (WULA)		
Britstown Bulk Water Supply	In Progress	WULA
Celery Road / Green Channel	In Progress	WULA
Clayville X 46	In Progress	WULA
Dindingwe Lodge	In Progress	WULA
Doornpoort Filling Station	In Progress	WULA+DFA+EIA+SC
Eco Park Dam	In Progress	WULA
Groote Drift Potch	In Progress	WULA
Jozini Shopping Centre	In Progress	WULA+BA
K60	Completed	WULA
Maloto Roads	In Progress	WULA
Kwazele Sewage Works	In Progress	WULA
Monavoni External Services	In Progress	WULA+BA
Nyathi Eco Estate	In Progress	WULA
Prairie Giants X 3	In Progress	WULA
Waveside Water Bottling Plant	Completed	WULA



07 Current Environmental Projects

073 Objection, DFA & WULA

Project Name	Status	Project
Environmental Management Plan(EMP)		
Heidelberg X 12	ROD	EMP
Monavoni Shopping Centre	Completed	EMP
Forest Hill Development	Completed	EMP
Weltevreden Farm 105KQ	Completed	EMP+EIA
Raslouw Holding 93	Completed	EMP+BA
Durley Development	Completed	EMP+BA
Rooihuiskraal North X 28	Completed	EMP

Rehabilitation Plan		
Norwood Mall/Sandspruit	In Progress	Rehabilitation
Project Shelter Heidelberg	In Progress	Rehabilitation
Sagewood Attenuation Pond	ROD	Rehabilitation
Velmore Hotel	Completed	Rehabilitation
Grace Point Church	Completed	Rehabilitation
Mmamelodi Pipeline	Completed	Rehabilitation

Visual Impact Assessment		
Swatzkop Industrial Developme	Completed	Assessment +DFA
Erasmia	Completed	Assessment

Signage Application		
Menlyn Advertising	Completed	Signage
The Villa Mall	Completed	Signage+EMP+BA



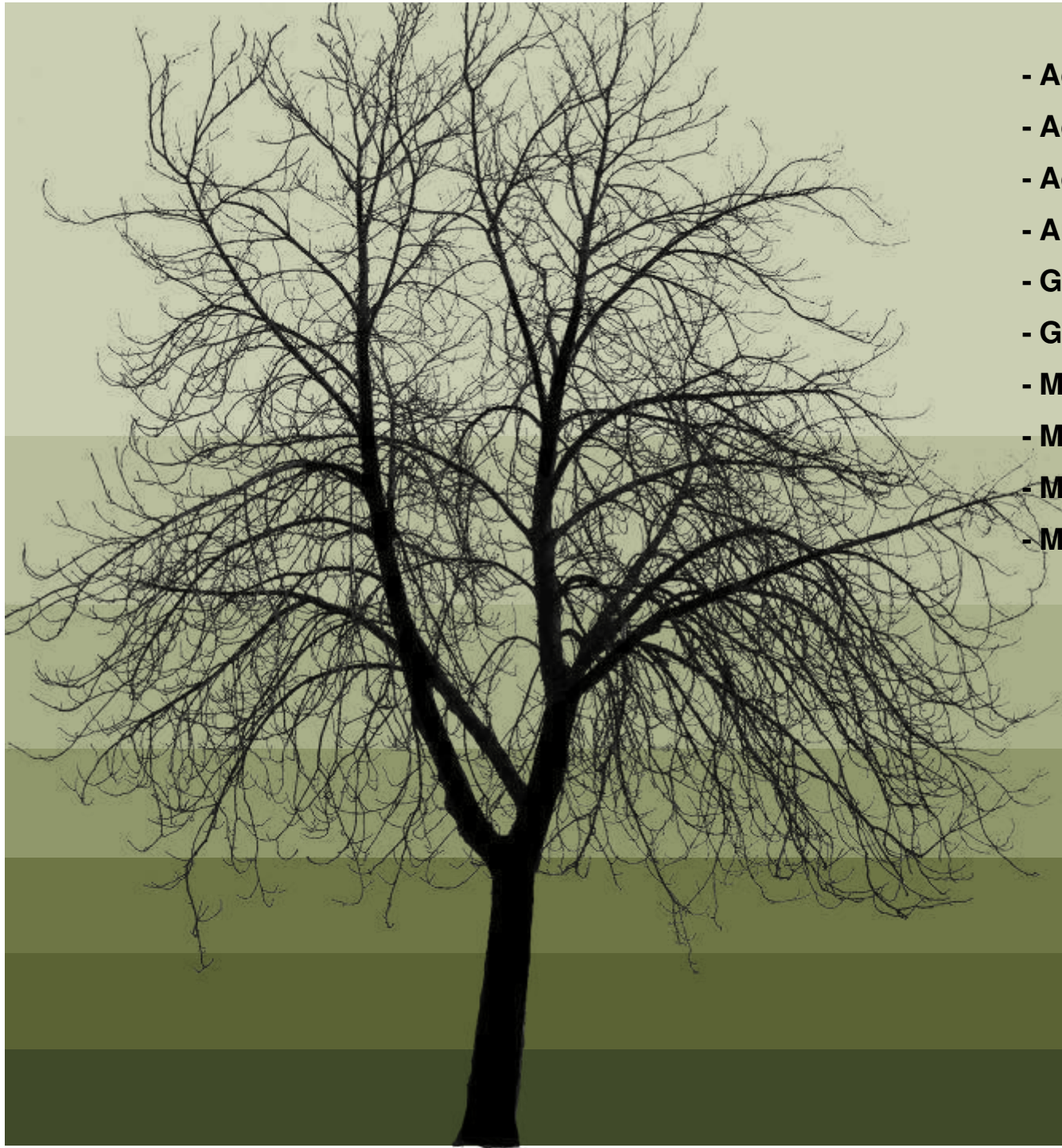
07 Current Environmental Projects

074 EMP, Rehabilitation , Waste Management & Signage Application

- Billion Property Group
- Cavaleros Developments
- Centro Developers
- Chaimberlains
- Chieftain
- Century Property Group
- Coca Cola
- Elmado Property Development
- Flanagan & Gerard
- Gautrans
- Hartland Property Group
- Moolman Group
- MTN
- M&T Development
- Old Mutual
- Property Investment Company
- Petroland Developments
- RSD Construction
- SAND
- Stephan Parsons
- Twin City Developments
- Urban Construction
- USN



08 Indicative Clients



- Adobe Illustrator CS3
- Adobe Photoshop CS3
- Adobe InDesign CS3
- AutoCAD
- Google SketchUP
- GIS
- Microsoft Office Word
- Microsoft Office Excel
- Microsoft Office Publisher
- Microsoft Office Power Point



Qualifications And Experience In The Field Of Environmental Planning And Management (Lizelle Gregory (Member Bokamoso)):

Qualifications:

- Qualified as **Landscape Architect** at UP 1991;
- Qualified as **Professional Landscape Architect in 1997**;
- A Registered Member at The **South African Council for the Landscape Architect Profession (SACLAP)** with Practise Number: **PrLArch97078**;
- A Registered Member at the **International Association for Impact Assessment Practitioners (IAIA)**;
- Qualified as an **Environmental Auditor in July 2008** and also became a Member of the International Environmental Management Association (IEMAS) in 2008.

Working Experience:

- Worked part time at Eco-Consult – 1988-1990;
- Worked part time at **Plan Associates as Landscape Architect in training** – 1990-1991;
- Worked as Landscape Architect at **Environmental Design Partnership (EDP)** from 1992 - 1994
- Practised under **Lizelle Gregory Landscape Architects** from 1994 until 1999;
- Lectured** at Part-Time at **UP** (1999) – Landscape Architecture and **TUT** (1998- 1999)- Environmental Planning and Plant Material Studies;
- Worked as **part time Landscape Architect and Environmental Consultant at Plan Associates** and **managed their environmental division for more than 10 years** – 1993 – 2008 (assisted the **PWV Consortium** with various road planning matters which amongst others included environmental Scans, EIA's, Scoping reports etc.)
- Renamed business as **Bokamoso in 2000** and is the only member of Bokamoso Landscape Architects and Environmental Consultants CC;
- More than 20 years experience in the compilation of Environmental Reports**, which amongst others included the compilation of various **DFA Regulation 31 Scoping Reports**, EIA's for EIA applications in terms of the applicable environmental legislation, Environmental Management Plans, Inputs for Spatial Development Frameworks, DP's, EMF's etc. Also included EIA Application on and adjacent to mining land and slimes dams (i.e. Brahm Fisherville, Doornkop)

Qualifications And Experience In The Field Of Landscape Architecture (Lizelle Gregory (Member Bokamoso)):

Landscape Architecture:

-Compiled landscape and rehabilitation plans for more than 22 years.

The most significant landscaping projects are as follows:

-Designed the Gardens of the Witbank Technicon (a branch of TUT). Also supervised the implementation of the campus gardens (2004);

-Lizelle Gregory was the Landscape Architect responsible for the paving and landscape design at the UNISA Sunnyside Campus and received a Corobrick Golden Award for the paving design at the campus (1998-2004);

-Bokamoso assisted with the design and implementation of a park for the City of Johannesburg in Tembisa (2010);

-The design and implementation of the landscape gardens (indigenous garden) at the new Coca-Cola Valpre Plant (2012-2013);

-Responsible for the rehabilitation and landscaping of Juksei River area at the Norwood Shopping Mall (Johannesburg) (2012-2013);

-Designed and implemented a garden of more than 3,5ha in Randburg (Mc Arthurpark). Bokamoso also seeded the lawn for the project (more than 2,5 ha of lawn successfully seeded) (1999);

-Bokamoso designed and implemented more than 800 townhouse complex gardens and submitted more than 500 Landscape Development Plans to CTMM for approval (1995 – 2013);

-Assisted with Landscape Designs and the Masterplan at Eco-Park (M&T Developments) (2005-2011);

-Bokamoso designed and implemented an indigenous garden at an office park adjacent to the Bronberg. In this garden it was also necessary to establish a special garden for the Juliana Golden Mole. During a recent site visit it was established that the moles are thriving in this garden. Special sandy soils had to be imported and special indigenous plants had to be established in the natural section of the garden.

-Lizelle Gregory also owns her own landscape contracting business. **For the past 20 years she trained more than 40 PDI jobless people (sourced from a church in Mamelodi)** to become landscape contracting workers. All the workers are (on a continuous basis) placed out to work at nurseries and other associated industries;

-Over the past 20 years the Bokamoso team compiled more than 800 landscape development plans and also implemented most of the gardens. Bokamoso also designed and implemented the irrigation for the gardens (in cases where irrigation was required). Lizelle regarded it as important to also obtain practical experience in the field of landscape implementation.

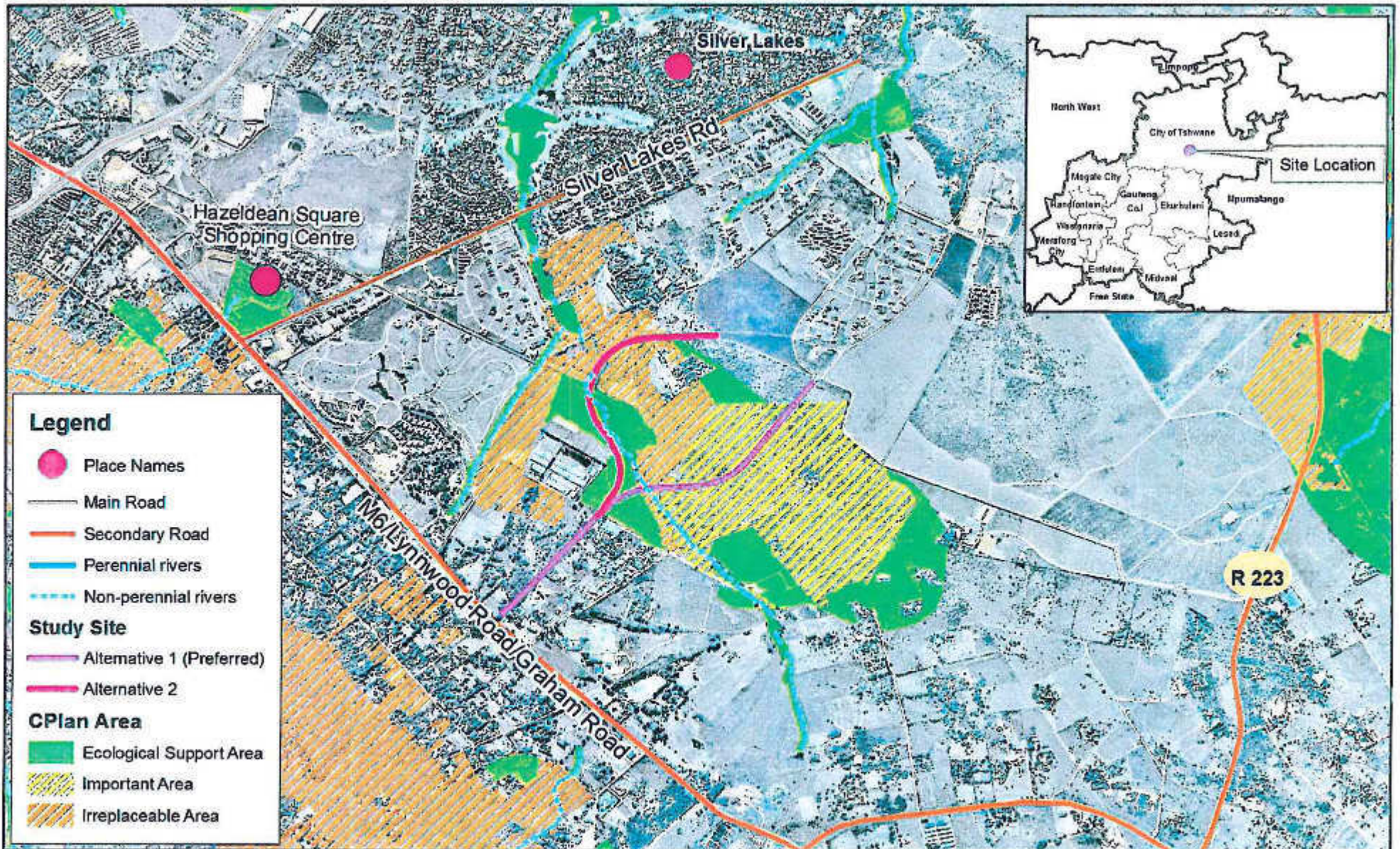
Other Information



Appendix K

**The original alignment for Hazeldean Road
across the Ridge (not the preferred
alternative)**





**505648 Class 3
Link from K34 to Hazeldean**

Source of Information
Gauteng Department of
Agriculture & Rural Development
BGAP
Conservation Plan Version 3
2011
Johannesburg

N
1:25 000
0 0.7 1.4 Km

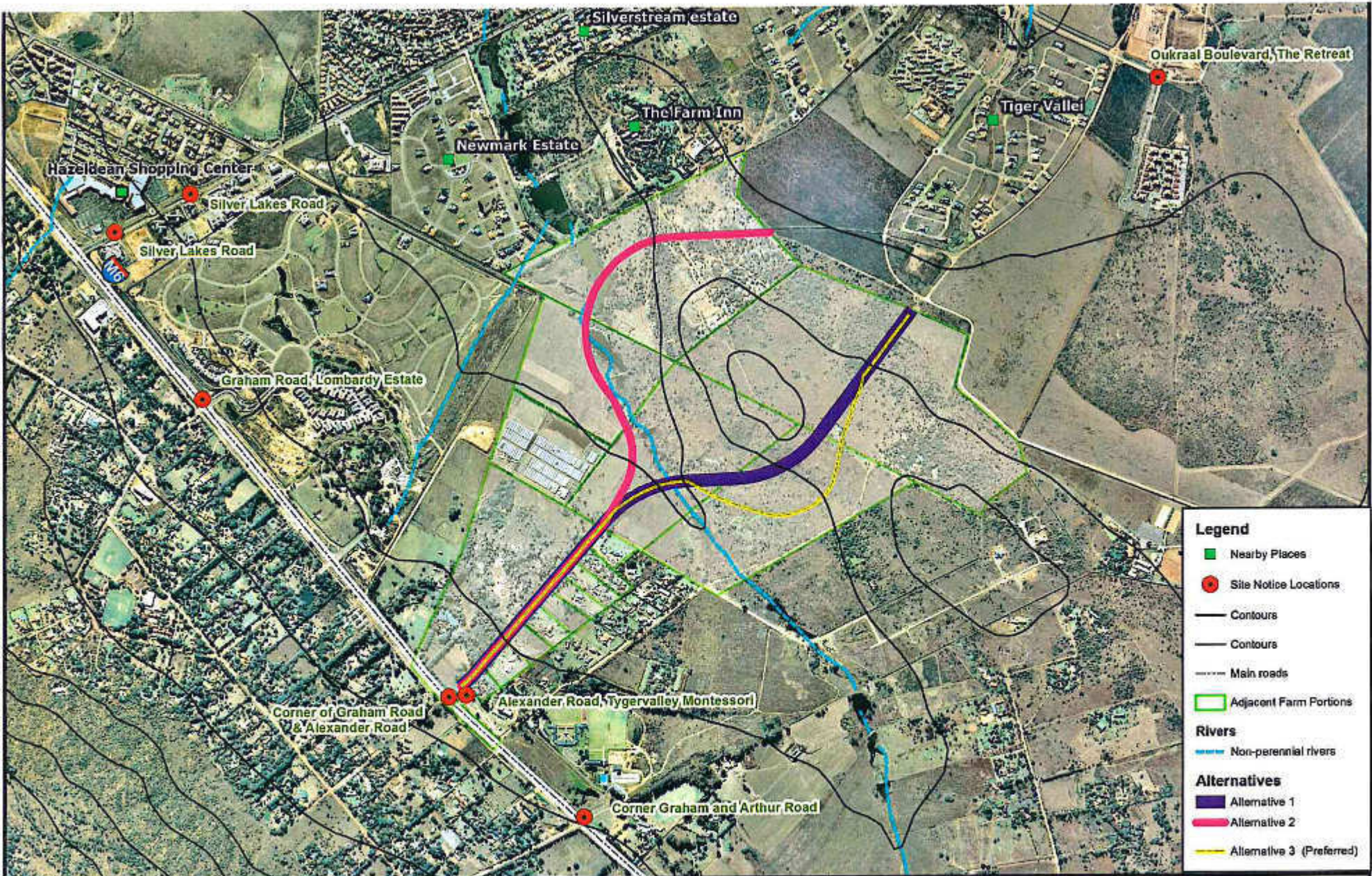
Map Produced
by:  **S · E · F**
STRATEGIC ENVIRONMENTAL FOCUS
Date: February 2014

Sensitivity Map

Alternative 3 – Preferred Alignment Alternative for Hazeldean Road



Appendix Kii



**505648 Class 3
Link from K34 to Hazeldean**

Locality Map

Source of Information:
Client data: Cad site layout
CDSM Aerial Imagery: 2010
Roads: CDSM 2009



Map Produced
by:

S · E · F
STRATEGIC ENVIRONMENTAL FOCUS

Date: January 2015

Original RoD Issued for the Development



Appendix Kiii



AGRICULTURE, CONSERVATION AND ENVIRONMENT

Office of the Head of Department

Diamond Corner Building, 58 Eloff & Market Street, Johannesburg
P O Box 6769, Johannesburg, 2000

Telephone: (011) 355-1900

Fax: (011) 333-0667

Email: steven.cornelius@gauteng.gov.za

Website: <http://www.gdacel.gpg.gov.za>

Reference: Gaut 002/03-04/185

Enquiries: Tinyiko Malungani

Telephone: 011 355 1675

E-mail: Tinyiko.malungani@gauteng.gov.za

Andre Wright
Runtogo (Pty) Ltd
P. O. Box 12516
HATFIELD
0028

Fax: (012) 346 8687

BY FACSIMILE / REGISTERED MAIL

Dear Sir/Madam

AMENDMENT OF THE RECORD OF DECISION ISSUED ON 15 MAY 2006 GRANTING AUTHORISATION FOR PROJECT REFERENCE GAUT002/03-04/185: PROPOSED RESIDENTIAL DEVELOPMENT ON PORTION 5 OF THE FARM TYGER VALLEY 334 JR: GRAYSTONE ESTATE

The above-mentioned project and the letter from Bokamoso Landscape Architects and Environmental Consultants, dated 16 December 2006 refer.

In terms of section 28 A (5) of the Environment Conservation Act, 1989 (Act 73 of 1989) ("the Act") the competent authority is entitled, as the case may be, may from time to time review any authorisation issued or condition determined and if it deems it necessary, withdraw such authorisation or delete or amend such condition.

In light of the above, condition 3.2 (2) of the Record of Decision (RoD) issued on 15 May 2006, which read "no further development will be allowed on the property due to its ecological and biodiversity characteristics" is hereby amended to read as follows:

- Only limited development on the less sensitive part of the site would be considered taking into account the applicable departmental policies and guidelines including the Ridges guidelines and the Red List Plant and Animal Species guidelines.

Relative to the layout plan submitted for the proposed Phase 2 development, please note that:

- Development will only be considered within the disturbed area and to the south of the road. No development will be allowed north of the road, i.e. stands 2 - 13 as indicated in your accompanying layout plan. A revised layout plan taking into account the restrictions on the development area must be submitted to the Department for approval.

Should you have queries pertaining to this letter, please contact the responsible official at the number mentioned above.

Yours faithfully



Dr S. T. Cornelius
Head of Department
Department of Agriculture, Conservation and Environment
Date: 03/04/2007

CC:	Bokamoso Landscape Architects & Environmental Consultants	Attn:	Lizelle Gregory
	Kungwini Local Municipality	Tel:	(012) 346 3810
		Fax:	(012) 460 7079
		Attn:	Lynn Schindler
		Tel:	(012) 809 0563
		Fax:	(012) 809 0871

Amended Authorisation issued by GDARD



Appendix Kiv



AGRICULTURE, CONSERVATION AND ENVIRONMENT

Office of the Head of Department

Diamond Corner Building, 69 Eloff & Market Street, Johannesburg
P O Box 8766, Johannesburg, 2000

Telephone: (011) 355-1900

Fax: (011) 333-0667

Email: trishh@gppg.gov.za

Website: <http://www.dace1.gppg.gov.za>

Reference: Gaut 002/03-04/185

Enquiries: Ulne van den Berg

Telephone: (011) 355 1286

E-mail: ulne.vanderberg@gauteng.gov.za

Andre Wright
Runtogo (Pty) Ltd
P. O. Box 12516
HATFIELD
0028

Fax: (012) 346 8687

BY FACSIMILE/ REGISTERED MAIL

Dear Sir/Madam

**GRANTING OF CONDITIONAL AUTHORISATION FOR PROJECT REFERENCE
GAUT 002/03-04/185; PROPOSED TOWNSHIP DEVELOPMENT ON PORTION 5
OF THE FARM TYGER VALLEY 334 JR; GRAYSTONE ESTATE**

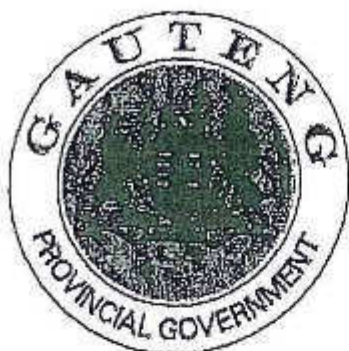
Please find attached the Record of Decision in respect of your application for authorisation in terms of Regulations R1182 and R1183 (as amended) promulgated under sections 21, 22, 26 and 28 of the Environment Conservation Act (Act 73 of 1989).

Yours faithfully

Dr. S. F. Cornelius
Head of Department
Department of Agriculture, Conservation and Environment

Date: 15/05/2006

CC: Bokamoso Landscaps Architects & Attn: Lizelle Gregory
Environmental Consultants Fax: (012) 460 7079
Kungwini Local Municipality Attn: Lynn Feneysey
Fax: (012) 809 0871



AGRICULTURE, CONSERVATION AND ENVIRONMENT

Diamond Corner Building, 68 Eloff & Market Street,
Johannesburg
P O Box 8769, Johannesburg, 2000

Telephone: (011) 355-1900

Fax: (011) 355-1000

Website: <http://www.gdace.gpg.gov.za>

RECORD OF DECISION FOR PROJECT REFERENCE GAUT 002/03-04/185

By virtue of the powers delegated by the Minister in terms of Section 22 of the Environment Conservation Act (Act 73 of 1989) ("the Act"), the Department of Agriculture, Conservation and Environment ("the Department") hereby authorises Runtogo (Pty) Ltd to undertake the activity specified/ detailed below subject to the indicated conditions.

1. DESCRIPTION, EXTENT AND LOCATION OF THE ACTIVITY:

The proposed activity is the change of land use to allow for township development which falls within the ambit of sub regulation 2(c) of Government Notice R1182 (as amended) promulgated under sections 21, 26 and 28 of the Act.

The township development is proposed to take place on Portion 5 of the farm Tyger Valley 334 JR to be known as Graystone Estate. The site falls within the jurisdiction of Kungwini Local Municipality of the Metsweding District Municipality.

2. KEY FACTORS INFORMING THE DECISION:

In reaching its decision in respect of the application, the Department has taken, *inter alia*, the following into consideration:

- a) The information contained in the:
 - Plan of Study for Scoping dated 7 July 2003.
 - Scoping Report dated June 2005.
 - The final layout plan drawn by Vlietsra Town and Regional Planning 15 February 2006.
 - Supporting document dated 20 March 2006.
- b) Information obtained from the Departmental information base including *inter alia*:
 - Geographical Information System (GIS).
 - Gauteng Open Space Programme (GOSP).
 - Kungwini Local Municipality's Integrated Development Plan.
 - Departmental Ridge Policy.
- c) Compliance with applicable departmental, provincial and national legislation, policies and guidelines including the principles set out in section 2 of the National Environmental Management Act 1998 (Act 107 of 1998).
- d) The findings of the site visit undertaken by Olivia Rakobela and Rosemary Maswakhomu on 18 October 2005.

In reviewing this information, the Department made the following findings:

- 1.1 The application entails the township development indicated as phase 1 on Portion 5 of the farm Tyger Valley 334 JR to be known as Graystone Estate.
- 1.2 The site is 21.41ha in extent and the proposed development will occupy 6.2706ha.

- 1.3 A river traverses the subject property.
- 1.4 The Gauteng Agricultural Potential Atlas – (GAPA 2002) indicates that part of the site has a moderate to low agricultural value.
- 1.5 The Gauteng Open Space Programme (GOSP) indicates that a part of the site is located on a class 2 ridge.
- 1.6 The proposed development falls outside of the urban edge, as demarcated in the Gauteng Spatial Development Framework (2002). The proposed development is nevertheless consistent with the surrounding development in the area and is accordingly not considered as constituting urban sprawl.

Based on the above, the Department's conclusion is that this activity will not lead to substantial detrimental impact on the environment, alternatively, that potential detrimental impacts resulting from this activity can be mitigated to acceptable levels and that the principles contained in section 2 of NEMA can be upheld.

The Department has accordingly decided, to grant Runtogo (Pty) Ltd authorisation in terms of Regulations R1182 and R1183 (as amended) promulgated under sections 21, 22, 26 and 28 of the Environment Conservation Act (Act 73 of 1989) subject to the conditions and provisions listed below.

3. CONDITIONS

3.1. Description and extent of the activity

The authorisation applies in respect of the change of land use to allow for township development on Portion 5 of the farm Tyger Valley 334 JR to be known as Graystone Estate.

The above activity falls within the ambit of sub regulation 2(c) of Government Notice R1182 (as amended) promulgated under sections 21, 26 and 28 of the Act.

The proposed township development will occupy 6.2706ha of the 21.41ha site and will be developed at a minimum net density of 17 units per hectare.

3.2. Specific conditions

1. This authorisation is for Phase 1 development as described in 3.1 above.
2. No further development will be allowed on the property due to its ecological and biodiversity characteristics.
3. The development must adhere to the recommended buffer zone of 25 metres along the heritage site as indicated in the report. Any archaeological sites exposed during construction must not be disturbed during or after the construction period prior to authorisation from the South African Heritage Resources Agency (SAHRA). The removal, exhuming, destruction, altering or any other disturbance of heritage sites must be authorised by SAHRA in terms of the National Heritage Resources Act (Act No. 25 of 1999).
4. The development must adhere to all applicable Municipal by-laws.
5. To ensure that noise does not constitute a disturbance during construction it is instructed that construction activity may only take place between the hours of 8H00 and 17H00 weekdays, 8H00 and 13H00 Saturdays and no operation on Sundays and Public holidays.
6. The Department's Directorate of Conservation must be notified if any Red Data species found in the study area.
7. An Environmental Control Officer (ECO) must be appointed. The ECO, Developer and Contractor must be responsible for ensuring compliance with all the conditions of the Record of Decision, the provisions of the Environmental Management Plan (EMP) and other recommendations of the Environmental Impact Assessment (EIA) process. These people must also be familiar with the EMP.
8. A palisade fence must be erected to allow the movement of faunal species in the area not earmarked for the development during the construction phase.
9. A rehabilitation plan must be implemented during and after the construction activities so as to restore areas of natural vegetation. The disturbed areas must be covered with topsoil and re-vegetated with indigenous plant species, if all possible vegetated areas must be left undisturbed.

10. Provision for adequate facilities for the storage of oil, diesel etc. Such facilities must be designed in a way that would not pose threat to the environment. If any spillages occur, appropriate remediation must be followed.
11. To prevent release of hydrocarbon pollutants into the ground as well as storm water, no vehicle repairs must be undertaken on site during the construction phase.
12. If any groundwater or surface water pollution incident occurs, DWAF must be notified.
13. No development must be installed within the 1:50 and 1:100 year flood lines.
14. Water may not be extracted from a river for any activities related to the construction and operational phase of the development without the necessary permits from DWAF.
15. All recommendations made in the Report dated June 2005 and supporting documents with respect to the mitigation of potential environmental impacts must be strictly implemented. These recommendations are seen as an extension of this ROD and non-compliance therewith will constitute non-compliance with the conditions of this ROD.

3.3. General conditions

- a) Any changes to, or deviations from, the project description set out in this letter must be approved, in writing, by the Department before such changes or deviations may be effected. In assessing whether to grant such approval or not, the Department may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations.
- b) This Department may review the conditions contained in this letter from time to time and may, by notice in writing to the applicant, amend, add or remove a condition.
- c) The applicant must notify the Department, in writing, at least 10 (ten) days prior to the change of ownership, project developer or the alienation of any similar rights for the activity described in this letter. The applicant must furnish a copy of this document to the new owner, developer or person to whom the rights accrue and inform the new owner, developer or person to whom the rights accrue that the conditions contained herein are binding on them.
- d) Where any of the applicant's contact details change, including the name of the responsible person, the physical or postal address and/ or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant.
- e) Authorisation for the activity is granted in terms of the Environment Conservation Act, 1989 (Act 73 of 1989) only and does not exempt the holder from compliance with other relevant legislation.
- f) The applicant shall be responsible for ensuring compliance with the conditions contained in this letter by any person acting on his behalf, including but not limited to, an agent, servant, or employee or any person rendering a service to the applicant in respect the activity, including but not limited to, contractors and consultants.
- g) Departmental officials shall be given access to the property referred to in 1 above for the purpose of assessing and/ or monitoring compliance with the conditions contained in this document at all reasonable times.
- h) The applicant must notify the Department within 24 (twenty four) hours if any condition of this authorisation cannot, or is not, adhered to. The notification must be supplemented with reasons for non-compliance.

3.4. Duration of authorisation

If the activity authorised by this letter does not commence within 2 (two) years from the date of signature of this letter, the authorisation will lapse and the applicant will need to reapply for exemption or authorisation in terms of the above legislation or any amendments thereto.

4. CONSEQUENCES OF NON-COMPLIANCE

The applicant must comply with the conditions set out in this letter. Failure to comply with any of the above conditions may result in, *inter alia*, the Department withdrawing the authorisation, issuing directives to address the non-compliance – including an order to cease the activity – as well as instituting criminal and/or civil proceedings to enforce compliance.

5. APPEALS:

Appeals in respect of this decision must be directed to the MEC, Mr Khabisi Mosunkutu, Agriculture, Conservation and Environment, Gauteng Provincial Government within 30 (Thirty) days of the date of this decision. Appeals can be submitted utilizing one of the following methods:

By facsimile: (011) 333 0620;
 By post: P.O. Box 8769, Johannesburg 2000;
 By hand: 11th Floor, Diamond Corner Building, 68 Eloff Street, Johannesburg.

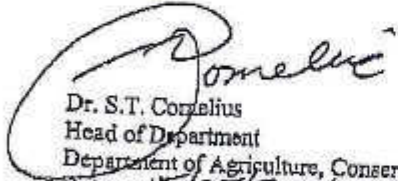
Please note that all appeals must comply with Section 35 of the Environment Conservation Act, Act No 73 of 1989, read together with Regulations R1182 and R1183 of 5 September 1997. In terms of the above section and regulations, your appeal must set out all the facts as well as the grounds of appeal. Furthermore, all the relevant documents or copies thereof must accompany the appeal and a commissioner of oaths must certify them as true.

The applicant is required to inform all registered interested and affected parties of the decision contained in this Record of Decisions as well as the process for appeal described above within 7 (Seven) calendar days of the date of signature of this Record of Decision. Failure to inform interested and affected parties within the stipulated time period will constitute non-compliance with this Record of Decision.

Should the applicant wish to appeal any aspect of this decision, the applicant must notify all registered interested and affected parties of the intended appeal, and furnish them with copies of the appeal on request. Proof of such notification must be submitted to the MEC with the appeal. Failure to comply with this provision may result in the MEC refusing to consider the appeal.

Please note that any development that commences prior to the expiry of the time period allowed for the submission of appeals, or before the MEC has reached a decision on an appeal submitted, is done so solely at the applicant's risk.

Yours faithfully


 Dr. S.T. Cornelius
 Head of Department
 Department of Agriculture, Conservation and Environment

Date: 15/05/2006

CC: Bokamoso Landscape Architects & Environmental Attn: Lizelle Gregory
 Consultants Fax: (012) 460 7079
 Kungwini Local Municipality Attn: Lynn Feneysey
 Fax: (012) 809 0871

Correspondance to SEF regarding the proposed road



Appendix Kv

LEBOMBO GARDENS BUILDING
36 LEBOMBO ROAD
ASHLEA GARDENS
0081

P.O. BOX 11375
MAROELANA
0161

Tel: (012) 346 3810
Fax: 086 570 5659
E-mail: lizelleg@mweb.co.za
Website: www.Bokamoso.biz



Landscape Architects, Environmental Consultants,
Environmental Auditing, Water License Applications

NEAS ref no: GAU/EIA/0001010/2014

GAUT ref nr. 002/14-15/0020

17 April 2015

Strategic Environmental Focus

**P.O. Box 74785
Lynnwood Ridge
0040**

**Tel: 012-349 1307
Fax: 012-349 1229**

Email: kagiso@sefsa.co.za

Attention: Ms. Jessica de Beer and Ms. Kagiso Mothasedi

RE: COMMENTS REGARDING THE FINAL EIA REPORT FOR THE PROPOSED CLASS 3 ROAD (TO BE CALLED HAZELDEAN BOULEVARD), FROM K34 (GRAHAM ROAD) TO THE HAZELDEAN NODE PRETORIA EAST, CITY OF TSHWANE METROPOLITAN MUNICIPALITY,
NEAS REF NO. GAU/EIA/0001010/2014
GAUT REF NR. 002/14-15/0020

Thank you for supplying Bokamoso with the Final EIA for the proposed road as described above.

Unfortunately the report was made available to the I&APs during the Easter School Holidays and it was impossible for the parties involved to meet regarding the report and the final comments. The idea was to discuss the Final EIA and to arrange a final focus group meeting

with your company prior to the compilation of the final comments and prior to the submission of the Final EIA Report to GDARD.

As you are well aware of, the objector/ I&AP already has an approved township development layout across Portion 5 of the Farm Tyger Valley 334 JR and the proposed road has a significant impact on such layout. The owner wishes to discuss the proposed mitigation measures of the proposed road in more detail, because the mitigation measures will determine the extent of the amendments to make to the original development layout.

The owner of Portion 5 therefore requested that we contact your office and request a meeting date for a final focus group meeting. It is not the intention of the owner to delay the application process and it is therefore suggested that the meeting be held within the next two weeks. The final comments regarding the EIA Report will then be submitted to GDARD.

Please do not hesitate to contact writer if there are any queries regarding this correspondence.

Regards

Lizelle Gregory

SEF Report



Appendix Kvi

**PROPOSED CLASS 3 ROAD BETWEEN THE K34 AND THE
HAZELDEAN NODE
Ecological Assessment**

SEF Reference No. 505648

Prepared for:

City of Tshwane
Isivuno Building
Cnr Lillian Ngoyi and Madiba Streets
Pretoria
0001



Prepared by:

Strategic Environmental Focus (Pty) Ltd
P.O. Box 74785
Lynnwood Ridge
0040
Tel. No.: (012) 349-1307
Fax. No.: (012) 349-1229
E-mail: sef@sefsa.co.za




S · E · F

S T R A T E G I C E N V I R O N M E N T A L F O C U S

May 2014

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Compiled by:	Authorised by:
Karin van der Walt <i>Cert. Sci. Nat.</i> Terrestrial Ecologist SACNASP Reg. No. 300028/12	Byron Grant <i>Pr. Sci. Nat.</i> Senior Natural Scientist SACNASP: Reg. No. 400275/08  Date: 29/25/2014

Declaration of Independence

I, **Karin van der Walt**, in my capacity as a specialist consultant, hereby declare that I -

- Conducted the faunal and floral field survey and report;
- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement;
- Reserve the right to modify aspects pertaining to the present investigation should additional information become available through ongoing research and/or further work in this field; and
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered.



Karin van der Walt *Cert. Sci. Nat.*
Terrestrial Ecologist
SACNASP Reg. No. 300028/12

29 May 2014
Date

EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental consultants and ecological specialists, was appointed by the City of Tshwane Metropolitan Municipality (CoT) to undertake an ecological survey for the construction of the proposed Class 3 road which is located in Pretoria East, Gauteng. The scope of work for the proposed project includes the construction of a Class 3 road with a total length of 2km and a road reserve of 32m. The proposed road will be a dual carriageway with a median where each carriageway is a roadway width of 8.3m. The preferred alternative will cut through a Class 2 ridge while alternative 2 passes around the Class 2 ridge.

The study area falls within the Savanna Biome which is further divided into smaller units known as vegetation types. The study area is situated within the Marikana Thornveld vegetation type (currently listed as Endangered). The study area also falls within the Bronberg Mountain Bushveld ecosystem which is currently listed as Critically Endangered as well as Marikana Thornveld ecosystem which is listed as Vulnerable in terms of Section 52 of National Environmental Management: Biodiversity Act (NEM:BA). According to the latest Gauteng Conservation Plan (C-Plan), Alternative 1 traverses a Critical Biodiversity Area (CBA) identified as Important as well as Ecological Support Areas (ESA), while Alternative 2 traverses a CBA identified as Irreplaceable as well as ESAs. Both alternative routes traverse a Class 2 Ridge. According to the development guidelines for ridges in Gauteng, the Bronberg ridge system which is located within the study area is classified as a Class 2 ridge. No further subdivisions will be allowed on these ridges while a no-go development policy is recommended for these areas with low impact developments (such as tourism developments) will only be considered once a full Environmental Impact Assessment (EIA) (including public participation and full specialist studies) have been conducted. In addition to this, a 200m buffer is required around all Class 2 ridges in Gauteng.

The study area consisted of two route alternatives of approximately 2.5km in length. Vegetation groups associated with Alternative 1 included a Class 2 Ridge: Natural, Riparian vegetation, Natural vegetation: Old fields and Modified: Alien plant infestations and landscaped areas. Alternative 2 traverses a Class 2 Ridge: Disturbed, Riparian vegetation, natural vegetation: Old fields as well as the modified area: Alien plant infestations and landscaped areas.

The study area provided suitable habitat for at least 10 plant species of conservation concern and/or Red/Orange List plant species. One of these, *Hypoxis hemerocallidea* (Common Starflower; currently listed as Declining) was confirmed within the study area while five species have been recorded within 5km of the study area and are therefore highly likely to occur within the study area based on the presence of suitable habitat.

One Critically Endangered species, *Neamblysomus julianae* (Juliana's Golden Mole), was given a very high likelihood of occurring in the study area. *N. julianae* (Juliana's Golden Mole) is endemic to South Africa and is a range-restricted species which has been recorded from only three localities, Pretoria (Bronberg), Nylsvlei region (Northern Province) and south-western parts of the Kruger National Park. This species' preferred habitat is mixed Bushveld associated with sandy soils below rocky outcrops. *N. julianae* (Juliana's Golden Mole) is found in extremely restricted habitat which is under threat from human development, with habitat being lost and fragmented by urban and infrastructure development. The study area occurs within the Bronberg ridge from which this species has been confirmed. The presence of suitable habitat within the study area makes it highly likely that the species will be present within the study area.

In addition to this, three mammal species of conservation concern, *Lutra maculicollis* (Spotted-neck Otter; currently listed as Near Threatened), *Atelerix frontalis* (South African Hedgehog; currently listed as Near Threatened) and *Dasymys incomtus* (Water Rat; currently listed as Near Threatened) were given a high probability of occurring in the study area based on the presence of suitable habitat. In addition to this, three avifaunal species of conservation concern, *Limosa limosa* (Black-tail Godwit; currently listed as Rare), *Coracias garrulous* (European Roller; currently listed as Near Threatened) and *Rostratula benghalensis* (Greater Painted Snipe; currently listed as Near Threatened) were also considered highly likely to occur in the study area based on the presence of suitable habitat.

Based on the results obtained, the proposed route alternatives are not considered feasible from an ecological perspective. Alternative 1, which is the preferred route, traverses a Class 2 Ridge: Natural which is classified as Important according to the Gauteng C-Plan and falls within two threatened ecosystems. In addition to this, the ridge as well as the natural vegetation: old fields and riparian vegetation provide suitable habitat for at least 10 plant species of conservation concern and/or Red/Orange List plant species, four mammal species of conservation concern, of which *Neamblysomus juliana* (Juliana's Golden Mole) is classified as Critically Endangered. The area also provides suitable habitat for at least three avifaunal species of conservation concern. Although the portion of the ridge associated with Alternative 2 was classified as disturbed, the area is classified as Irreplaceable according to the Gauteng C-Plan and was also considered to be suitable habitat for all the faunal and floral species of conservation concern associated with Alternative 1. Due to the significant impact that both Alternative routes are likely to have and the recorded biodiversity, mitigation measures will not necessarily achieve the ecological objectives and it is therefore suggested that alternatives are considered.

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LIST OF ABBREVIATIONS

ADU	Animal Demographical Unit
CBA	Critical Biodiversity Area
CR	Critically Endangered
CWAC	Coordinated Waterbird Counts
DDD	Data Deficient Distribution
DDT	Data Deficient Taxonomic
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
IBA	Important Bird Area
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
NEMBA	National Environmental Management: Biodiversity Act
NT	Near Threatened
PA	Protected Area
POSA	Plants of Southern Africa
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SEF	Strategic Environmental Focus
VM	Virtual Museum
VU	Vulnerable
WMM	With Mitigation Measures
WOMM	Without Mitigation Measures

1. INTRODUCTION

1.1 Project Description

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental consultants and ecological specialists, was appointed by the CoT to undertake an ecological survey for the Class 3 road which is located in Pretoria East, Gauteng. The scope of work for the proposed project includes the construction of a Class 3 road with a total length of 2km and a road reserve of 32m. The proposed road will be a dual carriageway with a median where each carriageway is a roadway width of 8.3m. The preferred alternative will cut through a Class 2 ridge while alternative 2 passes around the Class 2 ridge.

1.2 Terms of Reference

The terms of reference for the floral and faunal assessments were as follows:

- *Status quo* report comparing the faunal and floral assemblages that are expected to occur on the site to the actual communities present within the study site;
- Description and mapping of the broad vegetation communities identified during the field survey and their ecological connectivity;
- Mapping of the sensitivity of the vegetation communities and faunal habitat;
- List of plant and animal species identified during the field survey;
- List of threatened, rare or protected plant and animal species that could occur on the site as well as those confirmed to occur;
- Map(s) indicating the locality of confirmed populations and/or suitable habitat of threatened, rare or protected plants and animals; and
- Mitigation measures to aid the conservation of these species and to minimise the impacts on the natural environment during construction.

1.3 Methodology

The field survey was undertaken on the 23rd of April 2014. The methodology entailed the following:

Flora

The desktop studies entailed a literature survey of all plant species occurring in the Quarter Degree Grid Cell (QDGC) 2528CD according to the Plants of Southern Africa online checklist (SANBI, 2009). Additional data such as habitat preference and species descriptions were gathered for all plants of conservation concern which were included in the list. Background information on the regional vegetation was gathered using GIS and Mucina and Rutherford (2006).

The description of the regional vegetation relied on literature from Mucina and Rutherford (2006). Plant names follow Van Wyk and Malan (1997), Van Wyk and Van Wyk (1997), Van Wyk and Smith (2005) Pooley (1998), Henderson (2001), Schmidt *et*

al., (2002), Van Oudtshoorn (2004) and Manning (2009). The South African National Red List status follows the latest update of <http://redlist.sanbi.org> (2012).

Fauna

Avifauna

A list was compiled of the avifaunal species which are likely to occur within QDGC 2528CD by combining data generated from Roberts' Birds of Southern Africa version 7 (2011) and the South African Bird Atlas Project 2 (SABAP2). Barnes (2000), Hockey *et al.* (2005), Cillié *et al.* (2004), Tarboton and Erasmus (1998) and Chittenden (2007) were consulted for identification. Birds were recorded by sight (with 32 x 10 Lynx binoculars) and calls.

Mammals

Mammal surveys were limited to diurnal surveys with the presence of mammals within the study area noted by sightings, sounds and signs (tracks, dung, diggings and burrows). For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner and Chimimba (2005), Cillié *et al.* (2004), Apps (2000), Walker (1996), Stuart and Stuart (2000) and Liebenberg (1990) were consulted.

Reptiles

A list of reptiles which have been recorded from QDGC 2528CD was obtained from ReptileMAP which is a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012). During the field survey, different habitat types across the study area were surveyed. The reptile surveys used a combination of the following two techniques:

- Visual searches were conducted by slowly walking through different habitat types while scanning the area with 32 x10 Lynx binoculars. Exposed rocky areas were monitored since reptiles often bask on top of these structures;
- Refugia such as rocks, crevices and fallen branches within the study area were inspected by carefully lifting objects to determine if any reptiles were sheltering underneath it.

Branch (1998), Marais (2004), Alexander and Marais (2007) and Cillié *et al.* (2004) were used as identification guides.

Amphibians

A list of amphibian species which are likely to occur in QDGC 2528CD was obtained from FrogMAP (ADU, 2012) which is a continuation of the Southern African Frog Atlas Project and the study area was inspected for suitable amphibian habitat.

1.4 Limitations

The following limitations are applicable to this study:

- The field survey was conducted at the end of April and although it falls within the minimum requirements for biodiversity studies, it did not coincide with the flowering period for all Red/Orange List plant species that could occur within the area;
- Amphibian activity is generally high in spring and early summer with significant decrease in activity at the end of summer. Low amphibian activity recorded at the time of the survey are thus likely to not be reflective of the species diversity on site;
- Cool weather conditions experienced on the day of the survey limited reptile activity; and
- No nocturnal surveys were conducted.

It should also be noted that in order to obtain a comprehensive understanding of the dynamics of the biota on the site, studies should include investigations through different seasons, over a number of years and should include extensive sampling. The results presented in this report are based on a single one day survey.

2. BACKGROUND

2.1 Location

The study area is located on portion 3, 5 and 6 of the Farm Tyger Valley 334 as well as Portion 20 and 21 of the Farm Zwartkoppies 364 in Hazeldean, Pretoria East. The area falls within QDGC 2528CD between 25°47'07.8" – 25°47'53.5" south and 28°22'22.3" – 28°22'17.8" east (Figure 1).

2.2 Climate

The study area experiences a strong seasonal summer rainfall with dry winters with the mean annual precipitation between 550mm and 600mm. Frost is experienced fairly frequently with maximum temperatures in January up to 36°C while the minimum in July drops to -0.4°C (Mucina and Rutherford, 2006).

2.3 Regional Vegetation

The study area is situated within the Savanna Biome (Rutherford and Westfall, 1994). The Savanna Biome is the largest Biome in southern Africa, occupying over one-third of the surface area of South Africa (Mucina and Rutherford, 2006). It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are locally known as Bushveld (Mucina and Rutherford, 2006). The Savanna Biome is further divided into smaller units known as vegetation types. According to Mucina and Rutherford (2006), the majority of the study area is located in the Marikana Thornveld (Figure 2).

Marikana Thornveld occurs in the North-West and Gauteng provinces and consists of open *Acacia karroo* woodland with slightly undulating plains and some low hills. Important trees in this vegetation type include *Acacia burkei*, *A. karroo*, *Combretum molle*, *Peltophorum africanum*, *Terminalia sericea* and *Olea europaea* while herbaceous species includes *Pentarrhinum insipidum* and *Cyphostemma cirrhosum*. The grass layer is dominated by species such as *Elionurus muticus*, *Eragrostis lehmanniana*, *Setaria sphacelata*, *Themeda triandra* and *Fingerhuthia africana*. According to Mucina and Rutherford (2006), this vegetation type is Endangered with less than 1% statutorily conserved and more than 48% transformed.

2.4 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (Government Gazette, 2011). The main purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of threatened ecosystems.

Threatened terrestrial ecosystems have been delineated based on the following:

- The South African Vegetation Map;
- National forest types;
- Priority areas identified in a provincial systematic biodiversity plan (in this case the Mpumalanga Conservation Plan); or
- High irreplaceability forest patches and clusters.

The criteria used for identifying threatened terrestrial ecosystems was done through extensive stakeholder engagement and based on the best available science. The criteria for thresholds for critically endangered, endangered and vulnerable ecosystems are summarized in Table 1.

Table 1: Criteria used to identify threatened terrestrial ecosystems

Criterion	Critically Endangered	Endangered	Vulnerable
A1: Irreversible loss of natural habitat	Remaining natural habitat \leq biodiversity target	Remaining natural habitat \leq biodiversity target + 15%	Remaining natural habitat \leq 60% of original area
A2: Ecosystem degradation and loss of integrity	\geq 60% of ecosystem significantly degraded	\geq 40% of ecosystem significantly degraded	\geq 20% of ecosystem significantly degraded
C: Limited extent and imminent threat	-	Ecosystem extent \leq 3000ha and imminent threat	Ecosystem extent \leq 6000ha and imminent threat
D1: Threatened plant species associations	\geq 80 threatened Red List plant species	\geq 60 threatened Red List plant species	\geq 40 threatened Red List plant species
F: Priority areas for meeting explicit biodiversity targets as defined in a	Very high irreplaceability and high threat	Very high irreplaceability and medium threat	Very high biodiversity and low threat

systematic biodiversity plan			
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There are four main types of implications of listed ecosystems on development:

- Planning related implications, linked to the requirement in the National Environmental Management Biodiversity Act, Act 10 of 2008 (NEMBA) for listed ecosystems to be taken into account in municipal Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs);
- Environmental authorisation implications, especially in terms of NEMA and EIA 2010 Regulations;
- Proactive management implications, in terms of the NEMBA; and
- Monitoring and reporting implications, in terms of the NEMBA.

The EIA Regulations include three lists of activities that require Environmental Authorisation:

- Listing Notice 1: Activities that require a Basic Assessment (R544 of 2010);
- Listing Notice 2: Activities that require Scoping and Environmental Impact Report (EIR)(R545 of 2010);
- Listing Notice 3: Activities that require a Basic Assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m² of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of Section 52 of the NEMBA. This means any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a Basic Assessment in terms of the EIA regulations. It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

The study area falls within two listed ecosystems, namely Bronberg Mountain Bushveld and Marikana Thornveld ecosystems (Figure 3). The Bronberg Mountain Bushveld ecosystem (reference nr: GP3) is currently listed as a Critically Endangered ecosystem in terms of Section 52 of NEMBA (Government Gazette, 2011). The Bronberg Mountain Bushveld ecosystem is classified as a priority area for meeting explicit biodiversity targets within the province and is classified as having a very high irreplaceability and is highly threatened. A minimum of 19 threatened or endemic plant and animal species have been confirmed within this ecosystem. Red or Orange Listed plants include *Bowiea volubilis* subsp. *volubilis* and *Ceropegia decidua* subsp. *pretoriensis*. Red or Orange Listed mammals include *Neamblysomus julianae* (Juliana's Golden Mole; Bronberg subpopulation), *Lutra maculicollis* (Spotted-necked Otter) while Red or Orange Listed birds include *Sagittarius serpentarius* (Secretary bird).

The Marikana Thornveld ecosystem (reference nr: SVcb6) is currently listed as Vulnerable in terms of Section 52 of NEMBA (Government Gazette, 2011) due to irreversible loss of natural habitat, with only 60% of the original extent of the ecosystem remaining in a natural state.

The study area was found to support natural vegetation which is representative of both of these ecosystems.

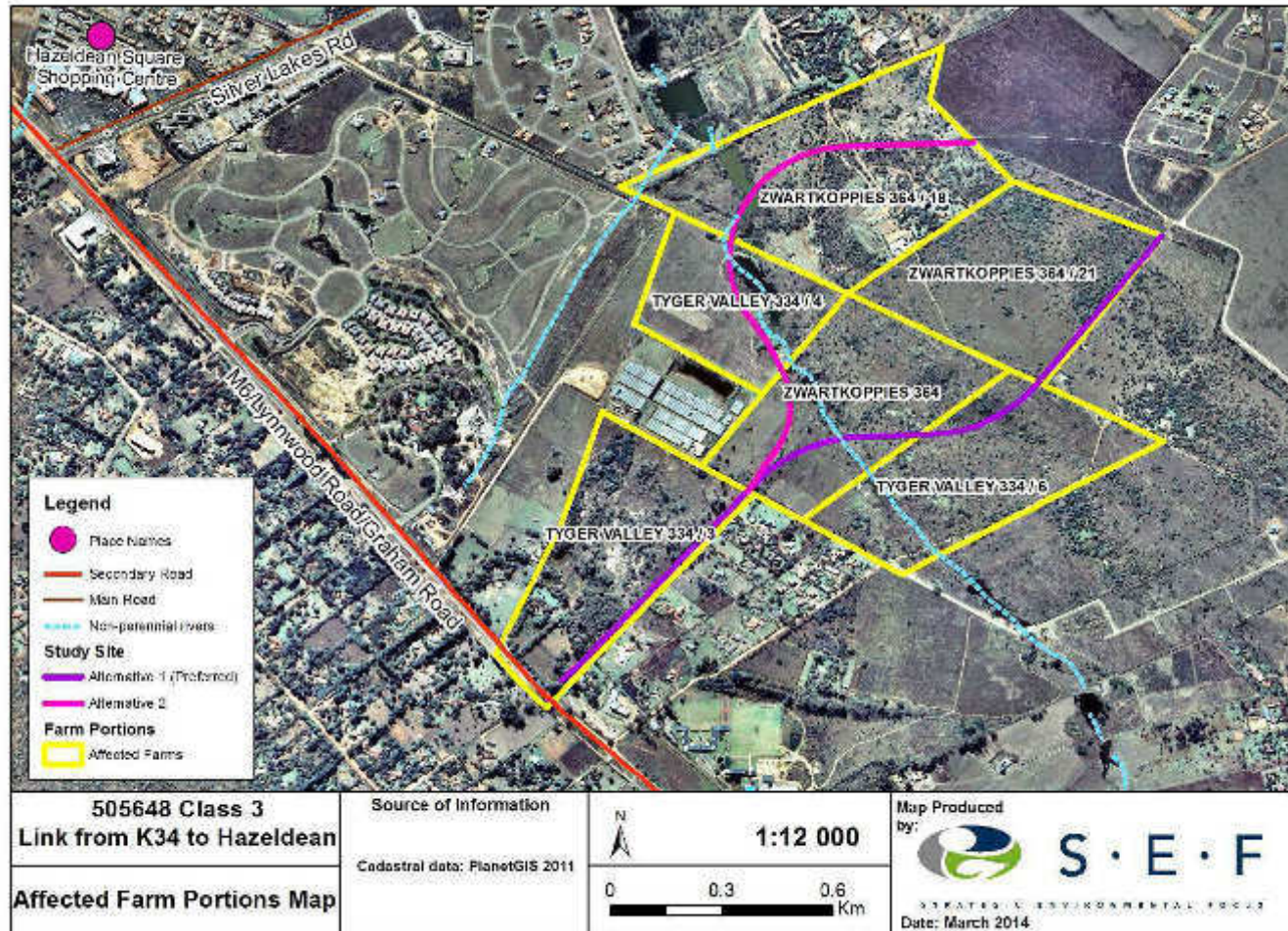


Figure 1: Location of the study site

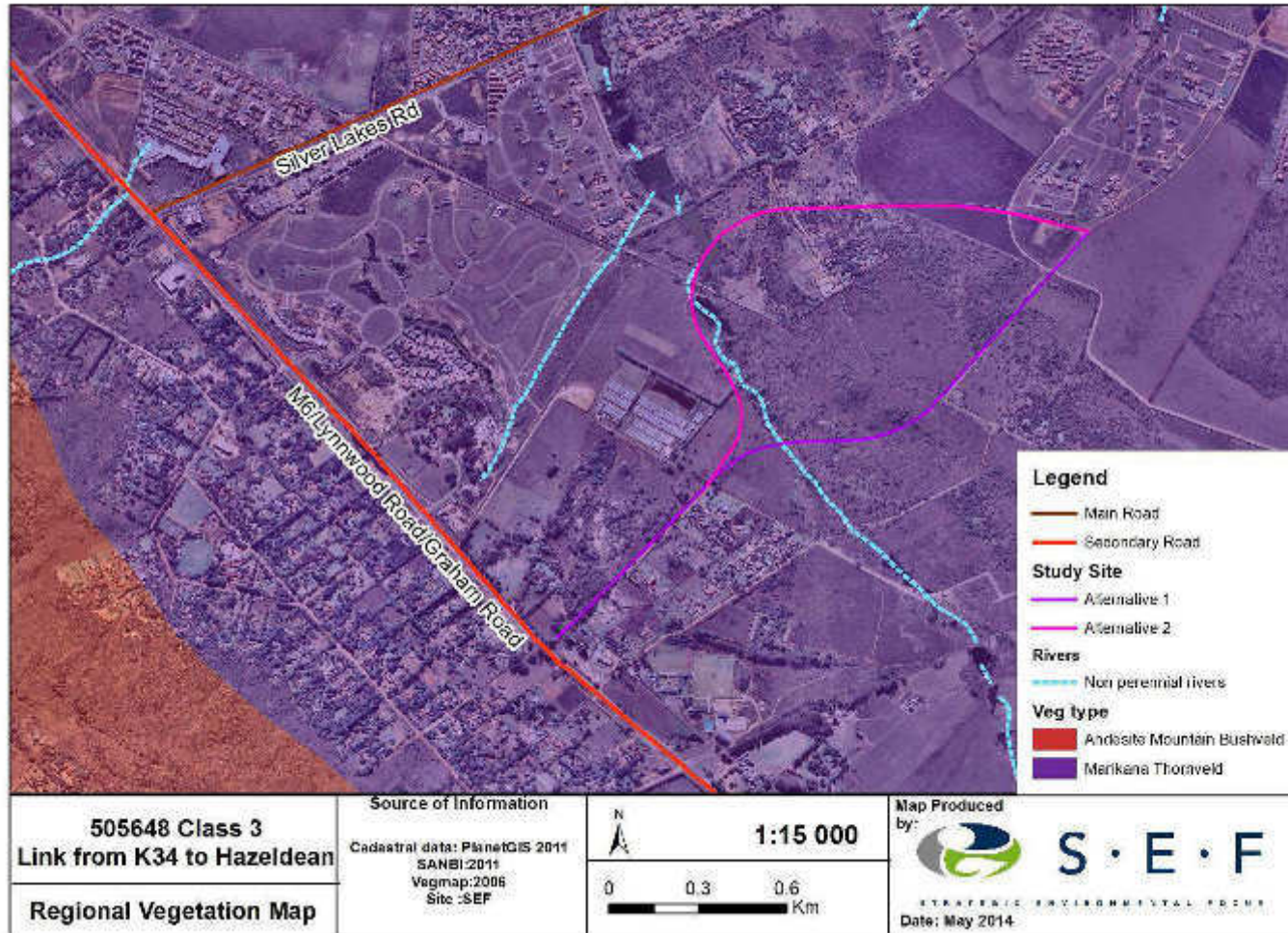


Figure 2: Regional vegetation in relation to the study area

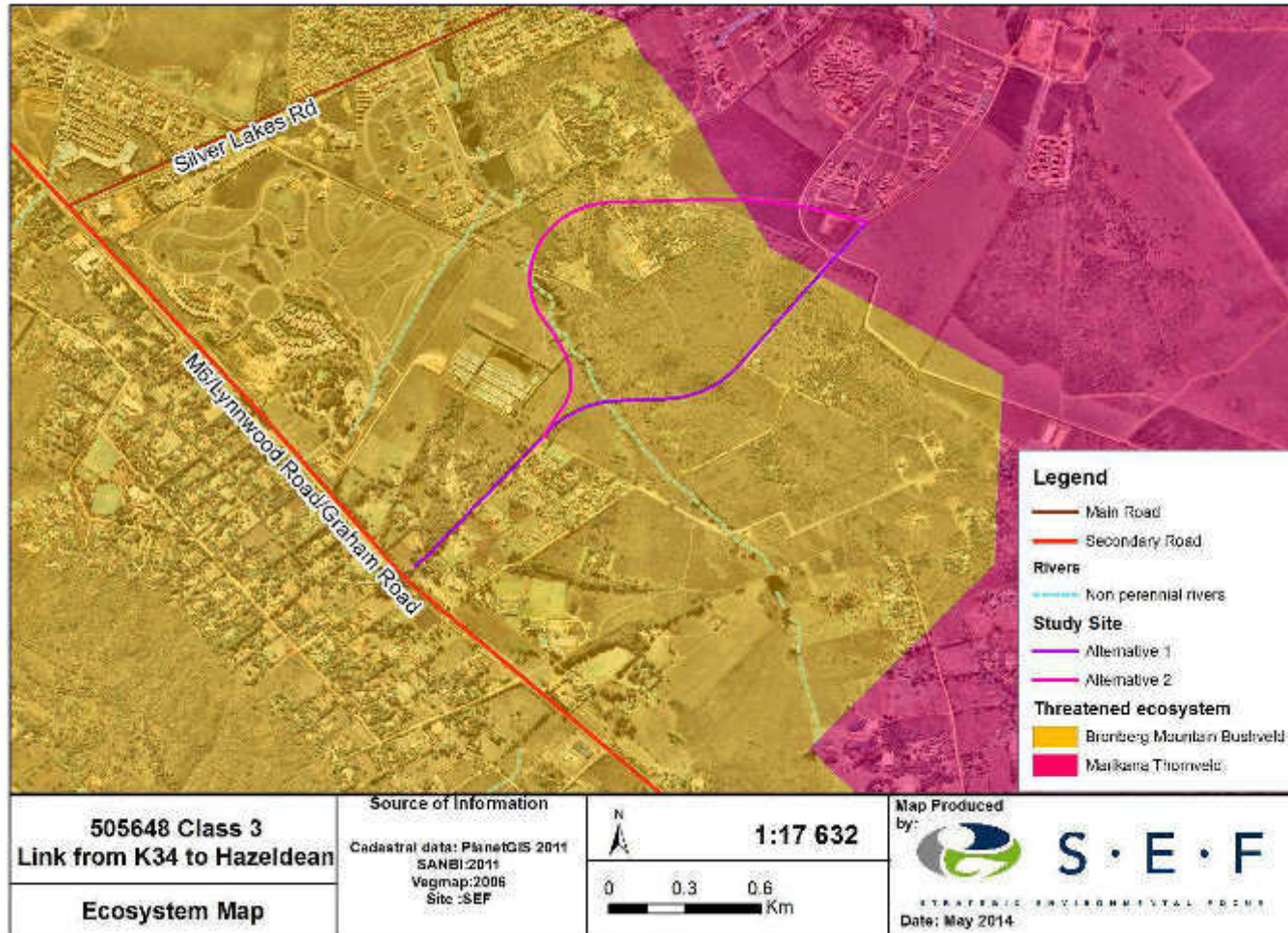


Figure 3: Threatened Ecosystems in relation to the study area

2.5 Gauteng Biodiversity Conservation Plan

The Gauteng Biodiversity Conservation Plan (C-Plan) was started in 2000 and the aim was to revise this plan at least every five years. The small size of Gauteng province made it feasible to conduct extensive biodiversity surveys which aimed to provide the information on spatial occurrence of biodiversity which was necessary for conservation planning. C-Plan 3 is based on the principles of complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability (GDARD, 2012).

Knowledge of the distribution of biodiversity, the conservation status of species, approaches for dealing with aspects such as climate change, methods of data analysis, and the nature of threats to biodiversity within the planning region, are constantly changing, especially in Gauteng province where development is taking place at a rapid rate. The main purposes of the C-Plan 3 are:

- To serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process;
- To inform protected area expansion and biodiversity stewardship programmes within the province; and
- To serve as a basis for development of Bioregional Plans in municipalities within the province.

The C-Plan 3 considers the following biodiversity features:

- Plants (Including priority ranking of species of conservation concern in Gauteng);
- Bird habitat models;
- Invertebrates;
- Fish;
- Herpetofauna;
- Pan clusters;
- Near pristine quaternary catchments;
- Bioclimatic zones;
- Carbon sequestration; and
- Primary vegetation.

The categories used in the CBA map are as follows:

- **Protected areas (PAs):** Areas that are already proclaimed under national or provincial legislation, including gazetted biodiversity stewardship sites. The land management objective of PAs is to maintain these areas in a natural state with limited or no biodiversity loss. Degraded areas should be rehabilitated to natural or near natural conditions and further degradations should be avoided. Compatible land-use within these areas are restricted to conservation activities (eco-tourism) and associated infrastructure;
- **Critical Biodiversity Areas (CBAs):** Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. These need to be kept in

a natural or near-natural state, with no further loss of habitat or species. This category is split into:

- **CBA Irreplaceable sites.** These areas are required to meet biodiversity pattern and/or ecological processes targets. No alternative sites are available to meet targets. The land management objective for CBA1 areas are to maintain these areas in a natural state with limited or no biodiversity loss, as well as rehabilitation of the degraded areas. Compatible land-use within CBA1 areas include conservation and associated activities such as extensive game farming and eco-tourism;
- **CBA Important sites:** – Areas selected to meet biodiversity pattern and/or biodiversity process targets. Alternative sites might be available to meet biodiversity targets. These areas can furthermore support suitable habitat for red and orange listed faunal and floral species.
- **Ecological Support Areas (ESAs):** Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs and for delivering ecosystem services. These areas usually consist of natural or near natural and degraded areas supporting CBAs by maintaining ecological processes.
- **Other Natural Areas (ONAs):** Areas are considered natural or intact but not required to meet conservation targets or identified as CBA or ESA. No management objectives or land-uses are described for these areas.
- **No natural habitat remaining:** Areas with no significant direct biodiversity value and includes areas which have been intensively farmed, urban industries and human infrastructure.

The Gauteng C-Plan indicates that Alternative 1 (Preferred Route) traverses a CBA - Important Area which provides suitable habitat for Red and Orange Listed Plant species, supports primary vegetation and provide suitable habitat for Red Listed Bird species. A small ESA is located in the southern portion of this route. Alternative 2 traverses a CBA – Irreplaceable Area which includes a class 2 ridge, as well as a large ESA (Figure 4).

According to the Development guidelines for ridges in Gauteng (Pfab, 2001), the Bronberg ridge system which is located within the study area is classified as a Class 2. Class 2 ridges represents approximately 40% of the ridges in Gauteng. No further subdivisions will be allowed on these ridges while a no-go development policy is recommended for these areas with low impact developments (such as tourism developments) will only be considered once a full EIA (including public participation and full specialist studies) have been conducted. In addition to this, a 200m buffer is required around all Class 2 ridges in Gauteng.

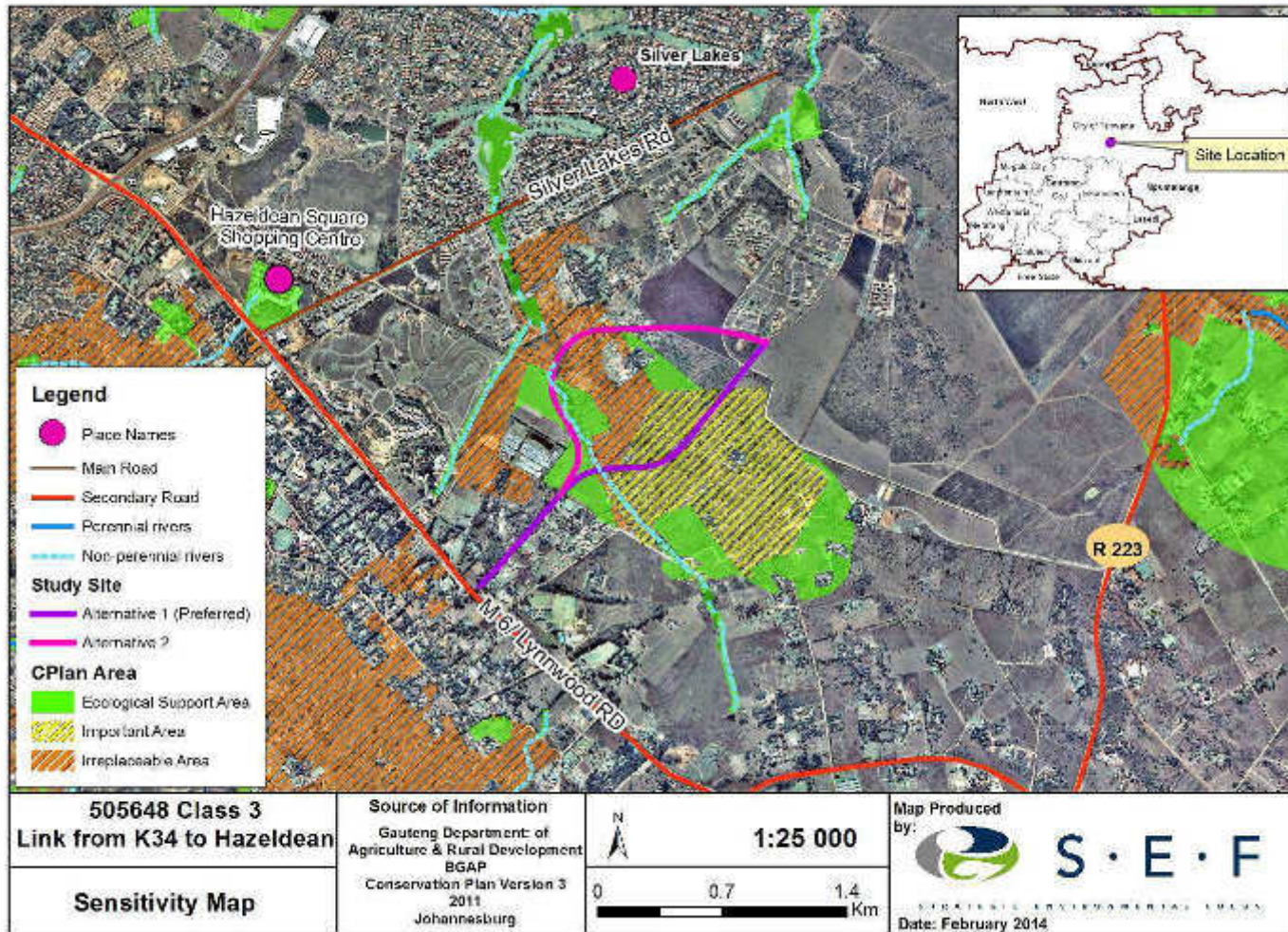


Figure 4: Gauteng Conservation Plan in relation to the study area

2.6 Plants of Conservation Concern and Red/Orange Listed Plant Species

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes. A plant taxon is of conservation concern when it is considered to be threatened, or close to becoming threatened with extinction and therefore classified as Critically Endangered, Endangered, Vulnerable or Near Threatened. Within the context of this report, plants that are Declining or Rare are also referenced under this heading. Rare and Endangered species are mostly small, very localized and visible for only a few weeks in the year when they flower (Ferrar and Lötter, 2007). As these plants might not have been visible at the time of the field survey, the probabilities of occurrence for these plants were based on distribution data and information gathered concerning the area.

The Plants of Southern Africa (POSA) website provides taxonomic information which is drawn from the National Herbarium Pretoria Computerised Information System (PRECIS) for plant species occurring in South Africa. Although this database can be used as a guide to establish if any species of conservation concern have been recorded in the QDGC, it is not a comprehensive list of all species occurring in the QDGC. According to Raimondo *et al.* (2009) and the Plants of Southern Africa (POSA, 2011), seventeen plant species of conservation concern have been recorded in QDGC 2528CD.

A number of plant species have been classified as Orange and Red List species by the Gauteng Department of Agriculture and Rural Development (GDARD, 2012). Most of these species occur in specialized habitats such as wetlands, marshes, ridges and pristine grassland. According to Red/Orange List plant information for the farms Tyger Valley 334-JR and Zwartkoppies 364-JR, six species have been confirmed within 5km of the study area while an additional 15 species have been recorded in QDGC 2528CD (GDARD, 2014). One of these, *Hypoxis hemerocallidea*, was confirmed within the study area, while the majority of the other species were considered to have a high likelihood of occurring in the study area based on the presence of suitable habitat. These species, their conservation status, habitat requirements, flowering period and likelihood of occurring in the study area is summarized in Table 2.

Table 2: Red/Orange listed species and species of conservation concern, their habitat requirements, flowering period and likelihood of occurring in the study area

Scientific Name	Conservation Status (species of conservation concern or Red/Orange Listed species)	Habitat Requirements	Flowering Period	Likelihood of occurring in the study area
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	Red/Orange Listed Species	Rocky crevices on rocky ridges	September to January	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area

<i>Argyrobium campicola</i>	Red/Orange Species	Listed	Highveld Grassland	November to February	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area
<i>Boophone disticha</i>	Declining Red/Orange Species	Listed	Widespread, grassland and open woodland	October to January	Medium. Although species has been confirmed from QDGC, this is a fairly large species which probably which were not observed within any of the route alternatives
<i>Boweia volubilis</i> subsp. <i>volubilis</i>	Declining Red/Orange Species	Listed	Steep rocky slopes	September to April	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area
<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i>	Declining Red/Orange Species	Listed	Grasslands and hillsides	January to March	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April which falls outside the flowering period for the species
<i>Callilepis leptophylla</i>	Declining Red/Orange Species	Listed	Grassland and open woodland	August to January and May	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April which falls outside the flowering period for the species
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Vulnerable Red/Orange Species	Listed	Rocky outcrops in pockets of soil among rocks	November to April	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area
<i>Cheilanthes deltoidea</i>	Red/Orange Species	Listed	South facing soil pockets	November to June	Medium. The species has been confirmed within the QDGC, however the portions of the ridge directly associated with the various route alternatives was considered to be marginal habitat for this species

<i>Crinum macowanii</i>	Declining Red/Orange Species	Listed	Grassland along rivers	October to January	Medium. Although species has been confirmed from QDGC, this is a fairly large species which probably which were not observed within any of the route alternatives
<i>Delosperma leendertziae</i>	Red/Orange Species	Listed	Rocky ridges, steep south facing slopes	October to April	Medium to low. The species has been confirmed within the QDGC, however the portions of the ridge directly associated with the various route alternatives was considered to be marginal habitat for this species
<i>Eucomis autumnalis</i>	Declining Red/Orange Species	Listed	Damp open grassland	November to April	Medium. Although species has been confirmed from QDGC, this is a fairly large species which probably which were not observed within any of the route alternatives
<i>Eulophia coddii</i>	Red/Orange Species	Listed	Steep hillsides, grassland or mixed bushveld	Early December	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April which falls outside the flowering period for the species
<i>Gunnera perpensa</i>	Declining Red/Orange Species	Listed	Along streambanks	October to March	Medium. Although species has been confirmed from QDGC, this is a fairly large species which probably which were not observed within any of the route alternatives
<i>Habenaria barbertoni</i>	Near Threatened Red/Orange Species	Listed	Grassland and rocky hillsides	February to March	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April which falls outside the flowering period for the

				species
<i>Habenaria bicolor</i>	Near Threatened Red/Orange Listed Species	Well-drained grassland	January to April	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area
<i>Habenaria kraenzliniana</i> :	Near Threatened Red/Orange Listed Species	Grassy hillsides	February to April	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April when the flowering period is mostly over
<i>Habenaria mossii</i>	Red/Orange Listed Species	Open grassland or in black soil	March to April	High. Species confirmed from QDGC, suitable habitat recorded on the ridge within the study area. The survey was however conducted towards the end of April when the flowering period is mostly over
<i>Hypoxis hemerocallidea</i>	Declining Red/Orange Listed Species	September to March	Grassland	Confirmed
<i>Searsia gracillima</i>	Near Threatened Red/Orange Listed Species	Rocky quartzitic outcrops in bushveld	January to April	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area
<i>Stenostelma umbelluliferum</i>	Near Threatened Red/Orange Listed Species	Deep black turf in open woodland mainly in the vicinity of drainage lines	September to March	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area
<i>Trachyandra erythrorrhiza</i>	Red/Orange Listed Species	Marshy areas, grassland, usually in black turf marshes	September to November	Very High. Species has been recorded within 5km of study area. Suitable habitat confirmed within the study area

2.7 Alien and Invasive Plants

Declared weeds and invaders have the tendency to dominate or replace the herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that all these transformers (as defined above) be eradicated and controlled by means of an eradication and monitoring

programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

The amended Regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) identifies three categories of problem plants:

- **Category 1** plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish, plant, maintain, propagate or sell/import any category 1 plant species;
- **Category 2** plants are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and
- **Category 3** plants are ornamentally used plants and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30m of a 1:50 year flood line and must be prevented from spreading.

The following categories are proposed on the revised CARA and the NEMBA, and are thus included within the present assessment:

- **Category 1a** plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned.
- **Category 1b** plants are widespread invasive species controlled by a management programme;
- **Category 2** plants are invasive species controlled by area. Can be grown under permit conditions in demarcated areas. All breeding, growing, moving, and selling are banned without a permit;
- **Category 3** plants are ornamental and other species that are permitted on a property but may no longer be planted or sold; and
- **Category X** plants which are proposed weeds or invaders are marked with an X followed by the category (example: X3).

Dense alien plant infestations were recorded in the modified areas as well as in sections of the riparian areas and included species such as *Pinus patula*, *Eucalyptus* sp., *Melia azedarach*, *Lantana camara*, *Solanum mauritianum* and *Arundo donax* (Photograph 1). Alien plant species which were recorded in the study area, together with their CARA and proposed NEMBA status, are listed in Table 3.



Photograph 1: Dense infestations of alien plant species such as *Pinus patula* in the modified areas (left) and *Eucalyptus* sp. in the riparian areas (right)

Table 3: Alien plant species recorded in the study area

Scientific name	Common name	Category	Proposed CARA/NEMBA
<i>Acacia dealbata</i>	Silver Wattle	Invader: 2	1b
<i>Agave americana</i>	Spreading century plant	None	2
<i>Amaranthus hybridus</i>		None	None
<i>Arundo donax</i>	Spanish Reed	None	None
<i>Bidens</i> sp.	Black Jack	Weed	None
<i>Campuloclinium macrocephalum</i>	Pom Pom Weed	Weed: 1	1b
<i>Conyza bonariensis</i>		No category	None
<i>Eucalyptus</i> sp.		Invader: 2	1b
<i>Ipomoea purpurea</i>		Weed – Category 1	None
<i>Lantana camara</i>	Common Lantana	Weed – Category 1	None
<i>Melia azedarach</i>	Syringa	Invader: 3	1b
<i>Morus alba</i>	Mulberry	None	None
<i>Pennisetum clandestinum</i>		X2	None
<i>Pinus patula</i>	Patula Pine	Invader: 2	2
<i>Populus alba</i>		Invader: 2	2
<i>Salix babylonica</i>	Weeping Willow	Invader: Category 2	None
<i>Solanum mauritianum</i>	Bugweed	Weed: 2	1b
<i>Verbena aristigera</i>	Wild Verbena	No	None
<i>Verbena bonariensis</i>	Fine-leaved Verbena	No	1b
<i>Xanthium strumarium</i>	Large Cocklebur	Weed	1
<i>Zinnia peruviana</i>		Weed	None

2.8 Ecosystem Services

Natural ecosystems provide people with important goods and services, including clear and plentiful supplies of water, high quality farming soil, genetic material for medicine and crop breeding, wild food and buffering against extreme weather events and climate change. These services along with a range of cultural, spiritual and aesthetic values that are derived from nature are called ecosystem services (Singh and Dudley, 2012).

Ecosystems are dynamic complexes of plant, animal and microorganism communities and the non-living environment which are interacting as a functional unit while ecosystem services are all the benefits that people obtain from ecosystems (Alcamo *et al.*, 2003). For the purpose of this report, ecosystem services within the study area were described along the functional lines of the Millennium assessment and include the following:

2.8.1 Provisional Services

Provisional services include the products which are obtained from ecosystems and include the following:

- Food and fiber: Includes food products derived from plants and animals as well as materials such as wood, silk and hemp;
- Fuel: Includes wood, dung and other biological materials which are used for the generation of energy;
- Genetic resources: The genes and genetic information which are used for animal and plant breeding;
- Biochemicals, natural medicines and pharmaceuticals: Medicines, food additives and biological materials which are derived from ecosystems;
- Ornamental resources: Animal products, skins, shells, flowers derived from ecosystems; and
- Fresh water: This is considered to be a linkage between provisioning and regulating services.

2.8.2 Regulating Services

Regulating services include the benefits that are obtained from the regulation of ecosystem processes and include:

- Air quality: Ecosystems contribute chemicals as well as extract chemicals from the atmosphere;
- Climate regulation: Ecosystems influence the climate on a local and global scale. At a local scale, changes in land cover can affect temperature and precipitation while at a global scale ecosystems play an important role by sequestering or emitting greenhouse gases;
- Water regulation: The timing and magnitude of runoff, flooding and aquifer recharge can be influenced by changes in land cover, in particular alterations that change the water storage potential of the systems such as the conversion of wetlands;

- Erosion control: Vegetative cover plays an important role in soil retention and prevention of landslides;
- Water purification and waste treatment: Ecosystems can contribute to impurities in fresh water but also help to filter out and decompose organic wastes;
- Regulation of human disease: Changes in ecosystems can change the abundance of human pathogens and abundance of disease vectors such as mosquitoes and ticks;
- Biological control: Ecosystem changes affect the prevalence of crop and livestock pests and disease;
- Pollination: Ecosystem changes the distribution, abundance and effectiveness of pollinators; and
- Storm protection: The presence of coastal ecosystems such as mangroves and coral reefs can dramatically reduce the damage caused by storms, hurricanes and large waves.

2.8.3 Cultural Services

Cultural services are nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences and include the following:

- Cultural diversity;
- Spiritual and religious values;
- Knowledge systems;
- Educational values;
- Inspirational: Ecosystems are often a source of inspiration for art, folklore, national symbols and advertising;
- Aesthetic values: In terms of parks, selection of housing locations ect.;
- Social relations: Ecosystems influence the types of social relations such as fishing societies, nomadic herding or agricultural societies;
- Sense of place;
- Cultural heritage values;
- Recreation and ecotourism.

2.8.4 Supporting Services

Supporting services are those that are necessary for the production of all other ecosystem services and their impacts on people are either indirect or occur over a long time and include services such as soil formation, production of oxygen gas, nutrient cycling, water cycling and provision of habitat.

Since the study area is located within an area which support a variety of habitats (ridge, riparian vegetation and grassland), the area is important for the provision of ecosystem services on a local and regional scale and included the following:

- Provisioning services: The study area is likely to provide food in the form of hunting of faunal specie and plant species which are used for medicinal purposes (Table 4);

- Regulating services: Since the study area consisted of indigenous vegetation, including riparian vegetation, numerous regulating services are provided which included air quality maintenance, climate regulation, water regulation, biological control and pollination; and
- Cultural services: The study area is used for educational values, is important for aesthetical values as well as recreation.

Table 4: Medicinal plant species recorded in the study area

Scientific Name	Common Name	Conservation Status (where applicable)
<i>Athrixia elata</i>		None
<i>Aloe zebrina</i>		None
<i>Bonatea speciosa</i>		None
<i>Helichrysum aureonitens</i>		None
<i>Hypoxis hemerocallidea</i>	Star-Flower/African Potato	Declining Red/Orange Listed species
<i>Satyrium</i> sp.		None
<i>Ehretia rigida</i>	Sandpaper Bush	None
<i>Lippia javanica</i>	Fever Tee	None
<i>Ziziphus mucronata</i>	Buffalo-Thorn	None

3. RESULTS: FLORA

3.1 Overview

The study area consisted of two route alternatives of approximately 2.5km in length. Vegetation groups associated with Alternative 1 included a Class 2 Ridge: Natural, riparian vegetation, natural vegetation: Old fields and Modified: Alien plant infestations and landscaped areas. Alternative 2 traverses a Class 2 Ridge: Disturbed, riparian vegetation, natural vegetation: Old fields as well as the modified area: Alien plant infestations and landscaped areas (Figure 5). Appendix A lists all the plant species recorded within the study area.

3.2 Class 2 Ridge: Natural

A Class 2 ridge was recorded towards the centre of the study area, the eastern portion of this ridge was classified as natural and would be affected by Alternative 1 route option. According to Samways and Hatton (2000), ridges are characterized by high heterogeneity due to various aspects, slopes and altitudes which result in a variety of soil, light and hydrological conditions. The ridges of Gauteng form vital habitat for many plant species of conservation concern with 65% of species of conservation concern

recorded on ridges (Pfab, 2001). As a result of this diversity commonly associated with ridges, the conservation of ridges in Gauteng will provide habitat for a high number of species and thus allow for their continued survival in a rapidly urbanizing province. The eastern portion of the ridge which was located within the study area was found to be in a natural condition, with very limited anthropogenic impacts observed at the time of the survey (Photograph 1).

Species recorded in this portion of the ridge included woody species such as *Acacia caffra*, *Acacia karroo*, *Ziziphus mucronata*, *Celtis africana*, *Searsia zeyheri* and *Gymnosporia tenuispina* while the herbaceous layer included species such as *Aloe zebrina*, *Bonatea speciosa*, *Gladiolus* sp., *Commelina* sp., *Dicoma anomala* and *Hypoxis colchicifolia*. The grass layer included species such as *Themeda triandra*, *Setaria sphacelata* var. *sericea*, *Diheteropogon amplectens*, *Cymbopogon plurinodis*, *Hyparrhenia hirta* and *Setaria sphacelata* var. *torta*. Although no species of conservation concern or Red/Orange List species were recorded at the time of the survey, four species have been recorded within 5km from the study area and were considered highly likely to occur on the ridge (GDARD, 2014). Table 5 summarizes the species associated with the Class 2: Natural ridge.



Photograph 2: Class 2 ridge associated with route Alternative 1

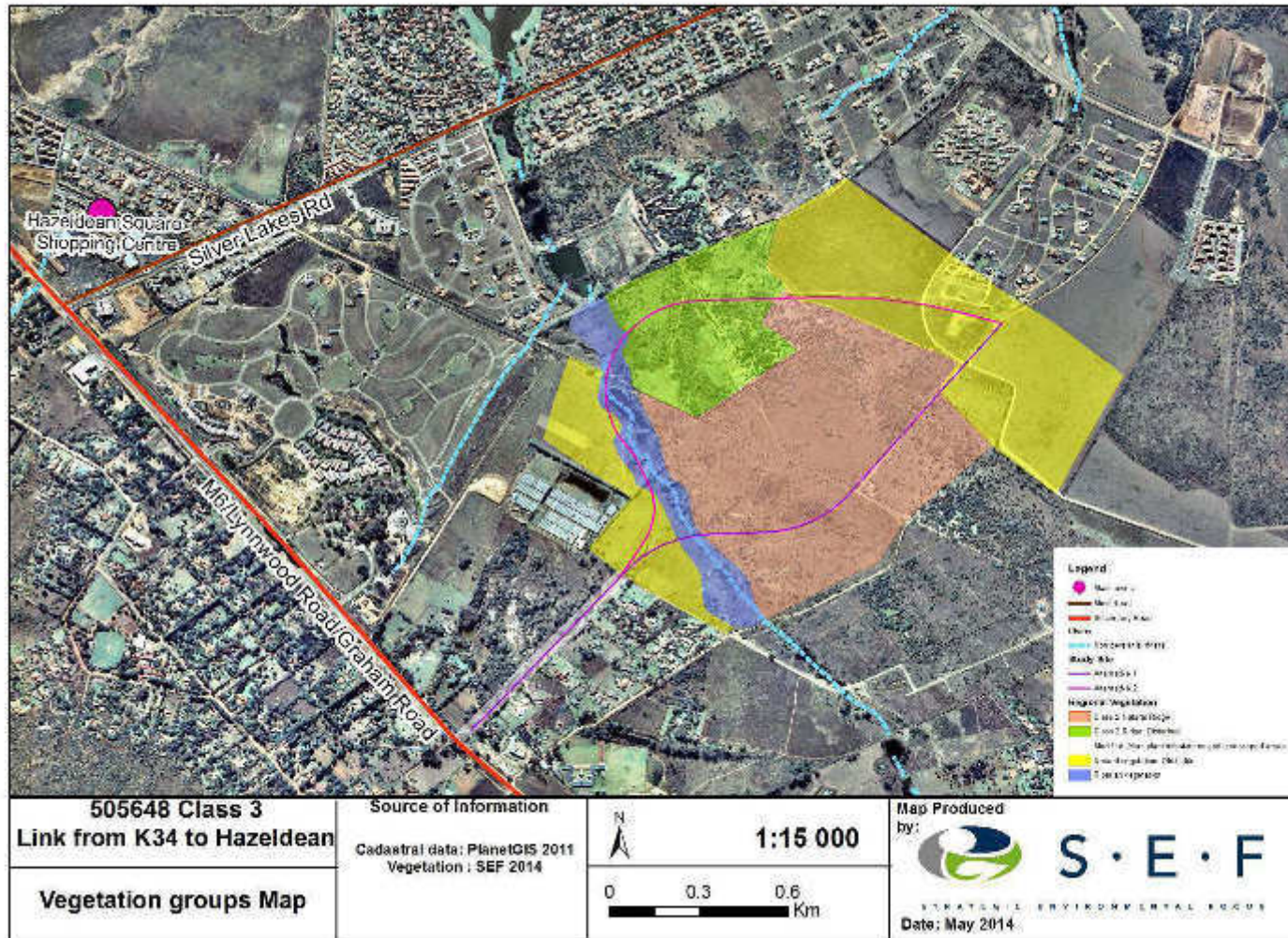


Figure 5: Vegetation groups recorded in the study area

Table 5: Summary of the floral species recorded on the Class 2 Ridge: Natural

Dominant species at the time of the survey:	<p><u>Trees and shrubs</u></p> <p><i>Acacia caffra</i> <i>Celtis africana</i> <i>Ehretia rigida</i> <i>Gymnosporia tenuispina</i> <i>Searsia lancea</i> <i>Searsia zeyheri</i> <i>Ziziphus mucronata</i></p> <p><u>Herbs:</u></p> <p><i>Aloe zebrina</i> <i>Bonatea speciosa</i> <i>Dicoma anomala</i> <i>Gladiolus</i> sp. <i>Hypoxis colchicifolia</i> <i>Pellaea calomelanos</i></p> <p><u>Grass:</u></p> <p><i>Cymbopogon plurinodis</i> <i>Digitaria eriantha</i> <i>Diheteropogon amplectus</i> <i>Themeda triandra</i> <i>Setaria sphacelata</i> var. <i>sericea</i></p>
Plants of conservation concern confirmed to occur:	None
Plants of conservation concern for which suitable habitat was observed:	<p><i>Boophone disticha</i> (Declining) <i>Boweia volubilis</i> subsp. <i>volubilis</i> (Declining) <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> (Declining) <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> (Vulnerable) <i>Habenaria barbertoni</i> (Near Threatened) <i>Habenaria kraenzliniana</i> (Near Threatened) <i>Searsia gracillima</i> (Near Threatened)</p>
Provincially protected plants confirmed to occur:	None
Provincially protected plants for which suitable habitat was found:	<p><i>Boophone disticha</i> <i>Boweia volubilis</i> subsp. <i>volubilis</i> <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> <i>Habenaria babertoni</i> <i>Habenaria kraenzliniana</i> <i>Searsia gracillima</i> <i>Eulophia coddii</i></p>
Alien species:	<p><i>Eucalyptus</i> sp. (one tree) <i>Lantana camara</i> <i>Zinnia peruviana</i></p>

3.3 Class 2 Ridge: Disturbed

The western portion of the study area was classified as disturbed. The Farm Inn wildlife sanctuary was located on the southern slope and crest of the ridge. The grass and herbaceous layers in this area was greatly reduced when compared to the eastern portion of the ridge. Numerous gravel roads and various predator (lion and tiger) camps were recorded on the top of the ridge. The area was dominated by *Searsia lancea*, *Acacia caffra*, *Acacia karroo*, *Hyparrhenia hirta*, *Melinis repens* and *Solanum panduriforme*. Alien plant species recorded in this area included *Bidens* sp., *Zinnia peruviana*, *Agave Americana* and *Melia azedarach*. Despite the disturbance within this area, this portion of the ridge was still classified as natural. Table 6 summarizes the species recorded on this portion of the ridge.

Table 6: Summary of the floral species recorded on the disturbed ridge

Dominant species at the time of the survey:	<p><u>Trees and shrubs</u></p> <p><i>Acacia caffra</i> <i>Celtis africana</i> <i>Searsia lancea</i> <i>Searsia zeyheri</i> <i>Ziziphus mucronata</i></p> <p><u>Herbs:</u></p> <p><i>Aloe zebrina</i> <i>Hypoxis colchicifolia</i> <i>Pellaea calomelanos</i> <i>Solanum panduriforme</i></p> <p><u>Grass:</u></p> <p><i>Cymbopogon plurinodis</i> <i>Diheteropogon amplectus</i> <i>Themeda triandra</i></p>
Plants of conservation concern confirmed to occur:	None
Plants of conservation concern for which suitable habitat was observed:	<p><i>Boophone disticha</i> (Declining) <i>Boweia volubilis</i> subsp. <i>volubilis</i> (Declining) <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> (Declining) <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> (Vulnerable) <i>Habenaria barbertoni</i> (Near Threatened) <i>Habenaria kraenzliniana</i> (Near Threatened) <i>Searsia gracillima</i> (Near Threatened)</p>
Provincially protected plants confirmed to occur:	None
Provincially protected plants for which suitable habitat was found:	<p><i>Boophone disticha</i> <i>Boweia volubilis</i> subsp. <i>volubilis</i> <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> <i>Habenaria babertoni</i> <i>Habenaria kraenzliniana</i></p>

	<p><i>Searsia gracillima</i> <i>Eulophia coddii</i></p>
Alien species:	<p><i>Agave americana</i> <i>Lantana camara</i> <i>Zinnia peruviana</i></p>

3.4 Riparian vegetation

A non-perennial river and associated riparian vegetation was recorded in the south western portion of the study area. Small artificial dams were located within the non-perennial river with portions of the riparian area dominated by alien plant species such as *Eucalyptus* sp., *Arundo donax*, *Salix babylonica*, *Populus alba*, *Melia azedarach* and *Pennisetum clandestinum* (Photograph 3). The northern portion of the non-perennial river within the study area was dominated by indigenous hydrological vegetation. It should be noted that since plant communities associated with the drier hydrological zones (temporary wet hydrological zone) contain plant species of wetland and terrestrial environments, it is not possible to define wetlands based on plant species alone (Collins, 2005). Therefore, the riparian vegetation referred to in this report is based on plant communities and does not intend to define the exact extent of any wetland. Plant species recorded within this hydrological zone included *Imperata cylindrica*, *Leersia hexandra*, *Andropogon eucomus*, *Sorghum bicolor* while areas which were inundated with water-supported species such as *Typha capensis*, *Phragmites australis*, *Persicaria attenuata* and various Cyperaceae species. A *Satyrium* sp. (Orchid) which was not in flower at the time of the survey was also confirmed within the hydrological zone.

Although not confirmed at the time of the survey, suitable habitat exists within the riparian areas for at least three species of conservation concern and/or Red/Orange List species. Species recorded in the riparian area is summarized in Table 7.



Photograph 3: Small dams located within the non-perennial stream (left) while portions of riparian vegetation was dominated by alien plant species such as *Salix babylonica* and *Pennisetum clandestinum* (right)

Table 7: Summary of the floral species recorded in Riparian areas

	<p><u>Herbaceous species:</u></p>
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Dominant species at the time of the survey:	<i>Persicaria attenuata</i> <i>Satyrium</i> sp. <i>Seriphium plumosum</i> <i>Typha capensis</i> <i>Phragmites australis</i>
Plants of conservation concern confirmed to occur:	None
Plants of conservation concern for which suitable habitat was observed:	<i>Stenostelma umbelluliferum</i> (Near Threatened)
Provincially protected plants confirmed to occur:	None
Provincially protected plants for which suitable habitat was found:	<i>Habenaria mossii</i> <i>Stenostelma umbelluliferum</i> <i>Trachyandra erythrorrhiza</i>
Alien species:	<i>Melia azedarach</i> <i>Populus alba</i> <i>Acacia dealbata</i> <i>Arundo donax</i> <i>Amaranthus hybridus</i> <i>Salix babylonica</i>

3.5 Natural vegetation: Old fields

Historically cultivated areas (old fields) were recorded in the south western and north eastern portions of the study area (Photograph 4). The old fields in the south western portion of the study area were dominated by various indigenous grass species such as *Hyparrhenia hirta*, *Cymbopogon plurinodis*, *Eragrostis gummiflua*, and *Pogonarthia squarrosa* while the herbaceous layer consisted of species such as *Aster harveyanus*, *Cleome gynandra*, *Commelina* sp., *Gladiolus* sp., *Seriphium plumosum*, *Vernonia galpinii* as well as *Hypoxis hemerocallidea* which is currently listed as Declining and is a Red/Orange Listed species. The old fields in the north eastern portion of the study area were more recently cultivated and although it supported similar grass species, numerous weedy alien species such as *Verbena bonariensis*, *Zinnia peruviana*, *Campuloclinium macrocephalum* and *Bidens* sp. were also recorded from these areas (Photograph 5). Although only one plant species of conservation was confirmed at the time of the survey, suitable habitat for at least eight species of conservation concern and/or Red/Orange List species were recorded in the south western portion. Table 8 summarizes the species associated with the Natural vegetation: Old fields.



Photograph 4: Natural vegetation: Old fields in the south western portion of the study area were dominated by indigenous vegetation (left) while those areas in the north eastern portion were recently cultivated with patches of alien vegetation (right)

Table 8: Summary of plant species associated with Natural vegetation: Old fields

Dominant species at the time of the survey:	<u>Grass species</u> <i>Hyparrhenia hirta</i> <i>Melinis repens</i> <i>Eragrostis gummiflua</i> <i>Pogonarthia squarrosa</i> <u>Herbaceous species:</u> <i>Aster harveyanus</i> <i>Berkheya radula</i> <i>Cleome gynandra</i> <i>Commelina sp.</i> <i>Seriphium plumosum</i>
Plants of conservation concern confirmed to occur:	<i>Hypoxis hemerocallidea</i> (Declining)
Plants of conservation concern for which suitable habitat was observed:	<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> (Declining) <i>Callilepis leptophylla</i> (Declining) <i>Habenaria barbertoni</i> (Near Threatened) <i>Habenaria bicolor</i> (Near Threatened) <i>Habenaria kraenzliniana</i> (Near Threatened) <i>Habenaria mossii</i> (Near Threatened)
Provincially protected plants confirmed to occur:	<i>Hypoxis hemerocallidea</i>
Provincially protected plants for which suitable habitat was found:	<i>Argyrolobium campicola</i> <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> <i>Callilepis leptophylla</i> <i>Habenaria barbertoni</i> <i>Habenaria bicolor</i> <i>Habenaria kraenzliniana</i> <i>Habenaria mossii</i>
Alien species:	<i>Melia azedarach</i> <i>Populus alba</i> <i>Acacia dealbata</i> <i>Arundo donax</i>

	<i>Amaranthus hybridus</i> <i>Salix babylonica</i>
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3.6 Modified areas: Alien plants and landscaped areas

According to the International Finance Corporations guidance to Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012), modified habitats are defined as “*areas that may contain a large proportion of plant and / or animal species of non-native origin, and / or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands*”.

The southern portion of the study area where both alternative route options join Graham Road was classified as modified and consisted of dense alien plant infestations on the northern side of the road. Species recorded within this area included *Eucalyptus* plantations, *Acacia dealbata*, *Pinus patula*, *Zinnia peruviana*, *Bidens* sp., *Verbena bonariensis* and *Campuloclinium macrocephalum*. The southern side of the road consisted of landscaped gardens (Photograph 5). No alien plant species and/or Red/Orange List species were confirmed within this area, neither was any suitable habitat for these species recorded.



Photograph 5: The existing gravel road which forms part of the southern section of both alternatives (left) with dense alien plant infestations (right)

4. RESULTS: FAUNA

4.1 Faunal Habitat

Faunal habitat within the study area included a non-perennial stream with small artificial dams, tall grassland, a ridge, as well as dense stands of alien plant species (Photograph 6). Watercourses and other water bodies are usually areas of high faunal diversity as the riparian environment and dense vegetation provides abundant cover, feeding and breeding habitat for many species of invertebrates, birds, mammals, reptiles and

amphibians. When it is available, surface water provides drinking water for many faunal species while the soft substrate provides perfect burrowing environments for fossorial animals. The increase in prey and vegetation attracts a high diversity of birds as well as terrestrial mammals and reptiles (including predators). Faunal communities associated with ridges are often diverse with a wide variety of bird groups utilizing ridges, koppies and hills for feeding, roosting and breeding. In addition to this, ridges provide important habitat for sensitive species such as bats and shrews.



Photograph 6: Faunal habitat included a non-perennial river with artificial dams (top left), tall grassland (top right), a ridge (bottom left) and dense stands of alien plants (bottom right)

4.2 Mammals

Approximately 79 terrestrial mammal species are expected to occur within the geographical area associated with the study site based on species distribution ranges of the IUCN (2013). These are listed in Appendix B and Appendix C along with the probability of each species occurring in the study area as well as their national (Friedmann and Daly, 2004; DEAT; 2007) and global (IUCN, 2013) conservation status. For the purpose of this report, categories for taxa of conservation concern was based on Raimondo *et al.* (2009) and included Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Data Deficient – Distribution (DDD), Data Deficient – Taxonomic (DDT) and Near Threatened (NT).

Three non-volant (non-flying) mammal species, *Herpestes sanguineus* (Slender Mongoose), *Raphicerus campestris* (Steenbok) and *Lepus saxatilis* (Savanna Scrub Hare), were identified in the study area during the field survey either by sight, field evidence such as spoor, droppings or burrows (Appendix B). It should however be noted that the Farm Inn wildlife sanctuary, is located within the study area and numerous mammal species which do not naturally occur within the study area or are unlikely to occur in the study area due to a lack of suitable habitat are kept in the sanctuary. These include species of conservation concern such as *Panthera leo* (African Lion; currently listed as Vulnerable), *Panthera pardus* (Leopard; currently listed as Near Threatened) and *Acinonyx jubatus* (Cheetah; currently listed as Vulnerable).

One Critically Endangered species, *Neamblysomus julianae* (Juliana's Golden Mole), was given a very high likelihood of occurring in the study area. *N. julianae* (Juliana's Golden Mole) is endemic to South Africa and is a range restricted species which has been recorded from only three localities, Pretoria (Bronberg), Nylsvlei region (Northern Province and south-western parts of the Kruger National Park. This species' preferred habitat is mixed Bushveld associated with sandy soils below rocky outcrops. *N. julianae* (Juliana's Golden Mole) is found in extremely restricted habitat which is under threat from human development with habitat being lost and fragmented by urban and infrastructure development. The study area occurs within the Bronberg ridge from which this species has been confirmed, the presence of suitable habitat within the study area makes it highly likely that the species will be present within the study area.

In addition to this, three species of conservation concern, *Lutra maculicollis* (Spotted-neck Otter; currently listed as Near Threatened), *Atelerix frontalis* (South African Hedgehog; currently listed as Near Threatened) and *Dasymys incomtus* (Water Rat; currently listed as Near Threatened) were give a high probability of occurring in the study area based on the presence of suitable habitat (Appendix E).

Chiroptera (volant mammals)

Bats are highly adaptable to their environment with 116 species recorded throughout South Africa. Of these 116 species, five species are globally listed as Vulnerable, 17 Near Threatened, 14 Data Deficient and three have not been evaluated (Monadjem *et al.*, 2010). Bats can be divided into three groups based on their foraging ecology which includes:

- **Frugivores:** Also referred to as pteropids, these species feed on fruits, leaves, flowers and nectar of a wide range of indigenous trees such as *Ficus* and *Podocarpus* as well as cultivated trees such as papayas, avocados, litchis, bananas and dates;
- **Carnivores:** Only a small number of species are carnivorous and feed on smaller vertebrates such as frogs, fish, mice, birds and other bats; and

- **Insectivores:** More than 70% of bats world wide are insectivores and feed on a wide range of insects with different species usually specializing in certain insect groups. The aerial hunters such as the families Vespertilionidae, Emballonuridae and Molossidae, hunt flying insects exclusively on the wing while families such as Hipposideridae and Rhinolophidae capture stationary prey from branches or on the ground and these species are capable of slow, manoeuvrable flight.

Different species of bats roosts in various places during the day, a short summary of which is provided below:

- **Foliage-roosting species:** Most Pteropodidae, which includes fruit bats hang or cling onto surfaces in trees or shrubs;
- **Hollow-roosting and Crevice-roosting species:** These species occupy underground caves, hollows in trees, and anthropogenic hollows such as roofs and basements of houses, tunnels or other cavities such as abandoned mine shafts; and
- **Specialised roost sites:** Night roosts or feeding stations which provide temporary shelter are often used by cave-dwelling bats and this usually includes open structures such as garages, outhouses, thatched game hides, culverts under roads and eaves of buildings.

Nineteen chiropteraen (bats) species have been confirmed to occur within the geographical area associated with the study area (IUCN, 2013), 17 of which are of conservation concern (Appendix C). Although no chiropterean species were confirmed at the time of the survey eleven species were given a high probability of occurring in the study area based on the presence of suitable foraging and/or roosting habitat. Of these, three are of conservation concern and include *Rhinolophus darling* (Darling's Horseshoe Bat; currently listed as Near Threatened), *R. clivosus* (Geoffroy's Horseshoe Bat; currently listed as Near Threatened) and *R. blasii* (Blasius's Horseshoe Bat; currently listed as Near Threatened).

4.3 Avifauna

The area has a high avifaunal diversity with approximately 408 bird species confirmed within QDGC 2528CD and in the region of the study area according to Roberts Multimedia version 7 (2011) and the South African Bird Atlas Project (SABAP) 1 and 2. During the field survey, 45 bird species were confirmed to occur within the study area and immediate surroundings, none of these were of conservation concern (Appendix D). It should however be noted that the survey was conducted towards the end of the summer period when avifaunal activity is decreasing and it is therefore likely that a higher number of species will be recorded during mid-summer surveys.

Thirty one species of conservation concern have been recorded from the QDGC, and although none of these were confirmed during the survey, three species were given a

high probability of occurring in the study area based on the presence of suitable habitat (Appendix E). These included *Limosa limosa* (Black-tailed Godwit; currently listed as Rare), *Coracias garrulus* (European Roller; currently listed as Near Threatened), *Rostratula benghalensis* (Greater Painted Snipe; currently listed as Near Threatened).

4.4 Reptiles

According to ReptileMAP, a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012), 54 reptile species have been confirmed to occur within QDGC 2528CD (Appendix F). Cool windy conditions experienced at the time of the survey limited reptile activity and although no reptile species were observed at the time of the survey, 36 species were given a high probability of occurring within the study area based on the presence of suitable habitat. None of these species are of conservation concern.

4.5 Amphibians

According to Minter *et al.* (2004), 13 amphibian species have been confirmed to occur within QDGC 2528CD, none of which are of conservation concern (Appendix G). Since the survey was conducted at the end of summer when amphibian activity is generally very low, no amphibian species were recorded at the time of the survey. However, the non-perennial river as well as permanent water provided by the artificial dams are highly likely to provide suitable habitat for to all 13 species and it is recommended that early summer surveys are conducted to determine amphibian diversity within the study area.

4.6 Lepidoptera

South Africa is home to approximately 666 species of butterflies (Woodhall, 2005). Butterflies, like most invertebrates are highly sensitive to environmental change making them more Vulnerable to the presence of toxins in the ecosystem. The most significant causes of habitat loss for butterflies include invasive alien vegetation, changing fire regimes, agricultural activities, urbanisation, plantation forestry, increased grazing and road construction (Henning *et al.*, 2009).

According to Henning *et al.* (2009), 211 Lepidoptera species have been recorded in the Gauteng Province, of which six are species of conservation concern. One of these, *Metisella meninx*, was given a medium probability of occurring within the riparian areas in the study area. Small patches of the host plant for this species, *Leersia hexandra* was confirmed around the artificial dams but since the survey was not conducted within the peak flight period for *Metisella meninx*, it is recommended that spring surveys are conducted to confirm its presence within the study area. The remaining five species of conservation concern were given a low likelihood of occurring within the study area due to a lack of suitable habitat (Table 9).

Table 9: Threatened butterflies recorded in the Gauteng Province, habitat requirements and likelihood of occurring in the study area

Scientific Name	Conservation	Habitat requirements	Likelihood of occurring
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	Status		in study area
<i>Aloeides dentatis dentatis</i>	Vulnerable	Known only from Roodepoort and Heidelberg and found in Carletonville Dolomite Grassland	Low
<i>Chrysoritis aureus</i>	Vulnerable	Near Heidelberg. Species require a very stable environment consisting of south facing well-drained slopes	Low
<i>Lepidochrysops praeterita</i>	Endangered	Only found in a few koppies and rocky areas between Potchefstroom and the North West Province	Low
<i>Orachrysops mijburghii</i>	Vulnerable	Occurs in Central Free State Grassland and Dry Highveld Grassland Bioregions where it is restricted to a few south-facing grassy slopes	Low
<i>Metisella meninx</i>	Rare	Species inhabits marshes in wetlands located in open grasslands. The presence of the host plant, <i>Leersia hexandra</i> is essential	Medium
<i>Platylesches dolomitica</i>	Vulnerable	In Gauteng recorded from Carletonville and Hillshaven and is a habitat specialist of dolomite ridges in bushveld	Low

5. CONSERVATION IMPORTANCE, ECOLOGICAL SENSITIVITY AND PROVISION OF ECOSYSTEM SERVICES

The site was assessed in terms of its conservation importance as well as the ecological function and ecological sensitivity of the site (Figure 6). Ecosystem services provided by the site were also assessed.

Ecological Function: The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

High – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.

Medium – Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

Low – Degraded and highly disturbed vegetation with little ecological function.

Ecological Sensitivity: The ecological sensitivity was assessed in terms of the sensitivity of the ecosystem in terms of the proposed route alternatives. The sensitivity classes were based on the following criteria:

High – The biodiversity recorded on site is highly sensitive to the construction of the proposed route alternatives and the proposed development is likely to result in significant loss of biodiversity.

Medium – The biodiversity recorded on site has a medium sensitivity in relation to the proposed project and it is likely that the majority of the species recorded will persist. Although ecosystems will be affected, it is likely that ecosystems will continue to function provided that recommended mitigation measures are implemented.

Low - The biodiversity recorded within the study area has a low sensitivity towards the proposed mining project and species recorded within the area are likely to persist while ecosystems are highly likely to continue function.

Conservation Importance: The conservation importance of the site gives an indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area (degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation.

High – Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. These areas should be protected.

Medium – Ecosystems with intermediate levels of species diversity without any threatened species.

Low – Areas with little or no conservation potential and usually species poor (most species are usually exotic).

Ecosystem services: Ecosystem services are the benefits that people obtain from ecosystems and include provisioning of the following services:

Provisioning Services – Includes food, fresh water, fuelwood, fibre, biochemical and genetic resources;

Regulating Services – Includes climate regulation, disease regulation, water regulation, water purification and pollination;

Cultural Services – Spiritual and religious, recreation and ecotourism, aesthetic, inspirational, educational, sense of place and cultural heritage; and

Supporting Services – Soil formation, nutrient cycling and primary production.

Based on the findings of the ecological assessment and the following criteria, ecologically sensitive habitats or areas of conservation importance and ecological sensitive areas were mapped (Figure 6) and are described below.

5.1 Areas of High Conservation Importance and Ecological Sensitivity

The Class 2 ridge containing natural vegetation which is associated with Alternative 1, was classified to be of high conservation importance and ecological sensitivity. This area is classified as “Important” according to the latest Gauteng C-Plan and is also located within the Bronberg Mountain Bushveld Ecosystem which is currently listed as Critically Endangered in terms of Section 52 of NEM:BA. Furthermore, the area contained natural vegetation which provided suitable habitat for at least eight plant species of conservation concern and/or Red/Orange Listed plant species which have been confirmed in close proximity of the study area.

One Critically Endangered mammal, *Neamblysomus julianae* (Juliana’s Golden Mole) is known to occur within the Bronberg ridge in which the study area is located and are therefore considered to have a very high likelihood of occurring within the study area.

A network of farmlands, riparian areas and other open spaces provide a movement corridor for various faunal and floral species which connect this ridge to the remainder of the Bronberg ridge system located to south and south west of the study area.

The biodiversity associated with this portion of the study area was considered to be highly sensitive to the construction of a road through the area and the proposed development is therefore considered to be highly detrimental to the persistence of biodiversity within the area.

Ecosystem services provided by the site includes regulating services such as climate regulation through the presence of natural vegetation, disease control through predacious insects, bats and birds as well as pollination services by insects and birds.

5.2 Areas of Medium Sensitivity and Conservation Importance

The eastern portion of the study area which is associated with Alternative 2 was classified to be of a medium to high conservation importance and ecological sensitivity. This area included the disturbed portion of the Class 2 ridge, natural vegetation – old

fields as well as riparian vegetation. Although portions of this area have been historically disturbed (old fields), the vegetation was found to be indigenous with one species of conservation concern, *Hypoxis hemerocallidea* (currently listed as Declining) confirmed within this area. In addition to this, this area provide suitable habitat for at least ten plant species of conservation concern and/or Red/Orange Listed species. Furthermore, this portion of the study area was classified as “Irreplaceable” by the Gauteng C-Plan and is located within the Marikana Thornveld Ecosystem which is currently listed as Vulnerable in terms of Section 52 of NEM:BA.

Three mammal species of conservation concern, *Lutra maculicollis* (Spotted-necked Otter; currently listed as Near Threatened), *Atelerix frontalis* (South African Hedgehog; currently listed as Near Threatened) and *Dasymys incomatus* (Water Rat; currently listed as Near Threatened) were given a high probability of occurring in this portion of the study area based on the presence of suitable habitat. In addition to this, three avifaunal species of conservation concern, *Limosa limosa* (Black-tailed Godwit; currently listed as Rare), *Coracias garrulus* (European Roller; currently listed as Near Threatened) and *Rostratula benghalensis* (Greater-Painted Snipe; currently listed as Near Threatened) were also considered highly likely to occur within this portion of the study area.

5.3 Areas of Low Sensitivity and Conservation Importance

The cultivated field in the northern portion of the study area was dominated by alien weedy species such as *Zinnia peruviana*, *Campuloclinium macrocephalum*, *Verbena bonariensis* and *Bidens* sp. and due to the lack of indigenous vegetation it was classified to be of medium to low conservation importance and ecological sensitivity. The south western portion of the study area which links up with Graham road was dominated by dense stands of alien woody species such as *Eucalyptus* sp., *Acacia dealbata* and was therefore also considered to be of medium to low conservation importance and ecological sensitivity.

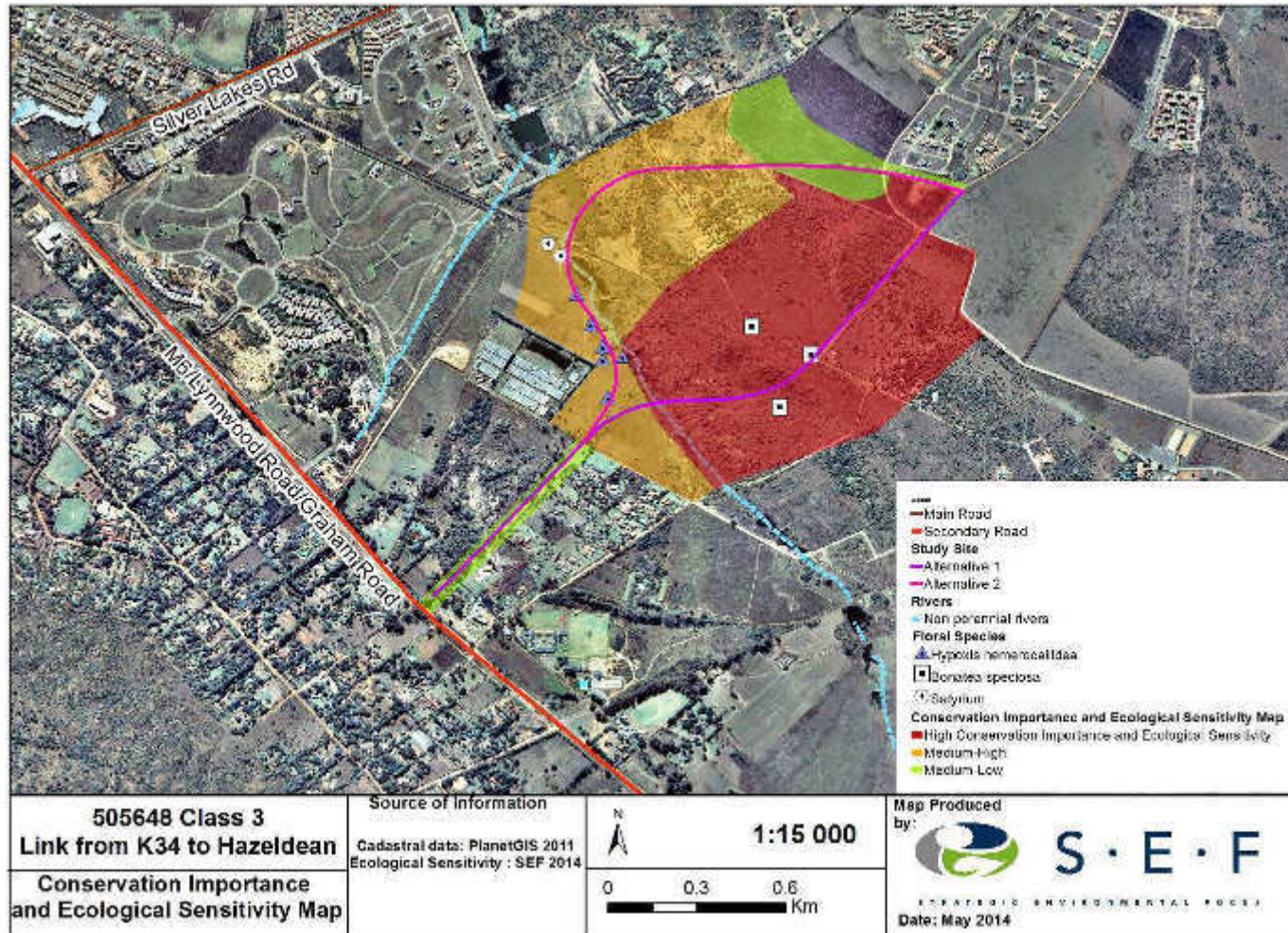


Figure 6: Ecological sensitivity and conservation importance in relation to the study area

6. IMPACT ASSESSMENT AND MITIGATION

Any developmental activities in a natural system will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the impacts caused by the proposed activity and to provide a description of the mitigation required so as to limit the perceived impacts on the natural environment.

There are various impacts on fauna which results from the proposed development and these can be divided into the following two categories:

- **Direct Impacts:** These impacts are directly as a result of the construction of the development and include habitat destruction, destruction of species of conservation concern and displacement; and
- **Indirect Impacts:** These impacts are not directly associated with this proposed development but affects the species recorded within the area and include impacts resulting due to a change in the hydrology and effecting species on a population level especially for species of conservation concern;

Once the risk levels of the proposed development on the biodiversity within the area are deemed acceptable, then the mitigation hierarchy of avoidance, minimisation/mitigation and rehabilitation/restoration and offset where residual impacts remain should be adhered to. This hierarchy is described below:

Mitigation measures should aim to achieve “no net loss” of biodiversity which is defined by the International Finance Corporation (IFC) as *“the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimise the project’s impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale”*.

Mitigation is a broad term and involves the following steps of the mitigation hierarchy:

1. Avoid or prevent loss to biodiversity and ecosystem services: This is the first option and refers to project location and layout of the project, phasing to avoid impacts on biodiversity. These areas need to be identified early in the development’s lifecycle so that impacts can be avoided;
2. Minimise impacts on biodiversity and ecosystem services: The location, layout, technology and phasing of the project should minimise the impacts on biodiversity. This should be considered even in areas where the environmental constraints are not particularly high and every effort should be made to minimise these impacts;
3. Rehabilitate concurrently or progressively with the activity and on cessation of the activity: This refers to the rehabilitation of areas where impacts were unavoidable and impacted areas should be returned to a condition ecologically similar to their “pre-development natural state”. Unfortunately, rehabilitation is a

limited process that usually falls short of replicating the diversity of natural systems. Rehabilitation should occur progressively; and

4. Offset significant residual negative impacts on biodiversity or ecosystem services: This refers to the compensation for the remaining and unavoidable negative impacts on biodiversity.

6.1 Assessment Criteria

The environmental impacts are assessed with mitigation measures (WMM) and without mitigation measures (WOMM) and the results presented in impact tables which summarise the assessment. Mitigation and management actions are also recommended with the aim of enhancing positive impacts and minimising negative impacts.

The following risk assessment was used to determine the significance of impacts.

$$\text{Significance} = (\text{Magnitude} + \text{Duration} + \text{Scale}) \times \text{Probability}$$

The maximum potential value for significance of an impact is 100 points. Environmental impacts can thus be rated as high, medium or low significance on the following basis:

- High environmental significance 60 – 100 points
- Medium environmental significance 30 – 59 points
- Low environmental significance 0 – 29 points

Table 10 illustrates the scale used to determine the overall ranking:

Table 10: Scale used to determine significance ranking

Magnitude (M)		Duration (D)	
Description	Numerical value	Description	Numerical value
Very high	10	Permanent	5
High	8	Long-term (ceases at end of operation)	4
Moderate	6	Medium-term	3
Low	4	Short-term	2
Minor	2	Immediate	1
Scale (S)		Probability (P)	
Description	Numerical value	Description	Numerical value
International	5	Definite (or unknown)	5
National	4	High	4
Regional	3	Medium	3
Local	2	Low	2
Site	1	Improbable	1
None	0	None	0

The criteria against which these activities were assessed are discussed below.

Nature of the Impact

This is an appraisal of the type of effect the project would have on the environment. This description includes what would be affected and how and whether the impact is expected to be positive or negative.

Scale of the Impact

A description of whether the impact will be local, limited to the study area and its immediate surroundings, regional, national or international scale.

Duration of the Impact

This provides an indication of whether the lifespan of the impact would be immediate, short term (0-5 years), medium term (6-15 years), long term (cesses at end of operational phase) or permanent.

Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as none, improbable (low likelihood), low, medium, high and definite.

Significance

This describes the degree of significance for the predicted impact based on the available information and level of knowledge and expertise. It has been divided into low, medium or high.

6.2 Impact Assessment

The proposed development includes the construction of a Class 3 road with a total length of 2km and a road reserve of 32m. The proposed road will be a dual carriageway with a median where each carriageway is a roadway width of 8.3m. The preferred alternative will cut through a Class 2 ridge while alternative 2 passes around the Class 2 ridge.

Impacts described below are based on a single ecological survey which was conducted in April 2014. Possible impacts and their sources are provided in Table 11 (construction and operational phases) and Table 12 (cumulative impacts) and discussed below.

Table 11: Impacts likely to occur during the construction and operation of the proposed Class 3 link road

Impact description	Source of impact	Areas to be affected	Relevant Phase
Destruction of natural vegetation, ecosystems and ecosystems services	Ground clearing for roads	Study area	Construction phase
Habitat Fragmentation	Construction and operation of the proposed road	Study area and surrounding areas	Construction and operational phases

Interference with fauna and faunal behavioural activities	Ground clearing activities, construction crew, contractors and disruptions caused during the operational phase	Study area	Construction and operational phases
Spread of alien invasive plant species	Ground clearing activities and introduction of alien species by vehicles and people	Study area	Construction and operational phases
Pollution of areas containing natural vegetation	Rubble and dust generated during construction, fuel and oil from vehicles used during construction, coal stock piles	Study area and immediate surroundings	Construction and operational phases

Table 12: Possible cumulative impacts related to the development

Impact Description	Source of Impact	Area to be Affected	Relevant Phase
Loss of biodiversity due to destruction and degradation of natural vegetation	Habitat fragmentation by haul road; unsuccessful rehabilitation	Study area and greater surroundings (region)	All phases
Loss of floral species including populations of species of conservation concern	Habitat destruction and degradation	Study area and greater surroundings (region)	All phases
Loss of ecosystem services such as filtering of water, insect pollination and pest control by bats and birds	Loss of key faunal species; pollution of surrounding natural areas	Biodiversity will be affected on a regional scale	All phases

6.2.1 Impacts relevant during the developmental phase

6.2.1a Destruction of natural vegetation, ecosystems and ecosystem services

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	National (4)	Permanent (5)	Very High (10)	Definite (5)	Very High (90)	High
WMM	NO MITIGATION POSSIBLE					

Description of impact

The construction of the Class 3 road (both alternatives) will lead to the destruction of natural vegetation and associated biodiversity within the study area. In addition to this, the study area also falls within the Bronberg Mountainland ecosystem which is currently listed as Critically Endangered as well as the Marikana Thornveld ecosystem which is listed as Vulnerable. This area is furthermore classified as an irreplaceable and important Critical Biodiversity Area in terms of the Gauteng Conservation Plan. One faunal species, *Neamblysomus julianae* (Juliana's Golden Mole) which is currently listed as Critically Endangered has been confirmed within the Bronberg ridges in which the study area is located, and it is therefore highly likely that this subterranean species will occur on and below the Class 2 ridge. Suitable habitat exists within the study area for at least 10 Red/Orange listed plant species, 11 mammal and 3 avifaunal species. Due to the significant impact of Alternative 1 on the biodiversity it is not considered a feasible option from an ecological perspective and although Alternative 2 is likely to also have significant impacts on the faunal and floral species, it is the preferred option for the two alternatives. However, it is strongly recommended that other alternatives are investigated.

Mitigation Measures

The proposed Class 3 road will lead to the destruction of natural vegetation which include suitable habitat for at least 10 Red/Orange Listed plant species, 11 mammal and three avifaunal species of conservation concern. No mitigation can be provided for the loss of primary vegetation or irreplaceable and important Critical Biodiversity Areas designated in terms of the Gauteng C-Plan, as the loss of the natural vegetation will result in permanent loss of defining characteristics with no chance for rehabilitation.

Buffer Zones

According to the sensitivity mapping rules for biodiversity assessments in Gauteng (GDARD, 2012), the following buffer zones will be applicable to the study area:

- 200m for Red/Orange list plant populations occurring within urban areas. Suitable habitat for expected Red/Orange List plant species must be mapped and designated as sensitive;
- All suitable habitat for terrestrial Red List mammal species within the study area are marked as sensitive with 100% of the suitable habitat for *Neamblysomus julianae* (Juliana's Golden Mole) to be conserved;
- A 200m buffer zone of low impact development is required around Class 2 ridges;
- A 32m buffer from the edge of the riparian zone (non-perennial/perennial rivers) as defined by a wetland specialist.

6.2.1b Habitat fragmentation

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	High (8)	High (4)	High (60)	High
WMM	Local (2)	Long term (4)	Medium (4)	High (2)	Medium (20)	High

Description of impact

The construction of the Class 3 road (both alternatives) will result in habitat fragmentation through the destruction of natural vegetation. This will result in the disruption of faunal movement corridors as well as floral dispersal networks. In addition to this, during the operational phase, faunal species are unlikely to cross the roads and/or crossing of these roads is likely to result in mortalities and death.

Mitigation Measures

- It is recommended that additional route options are investigated which will have a smaller impact on sensitive areas as defined in this report.

6.2.1c Interference with fauna and faunal behavioural activities

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	High (8)	High (4)	High (60)	High
WMM	Local (2)	Long term (4)	Medium (4)	High (2)	Medium (20)	High

Description of impact

The presence of the construction site and vehicles on the Class 3 road during the operational phase will result in negative faunal interactions that could be associated with construction personnel including poaching, trapping and hunting of faunal species, as well as possible collisions of fauna with vehicles. This includes on site at the onset of construction and in the surrounding natural areas during the operational phase. Furthermore, construction will result in high levels of noise, vibrations and the operation of floodlights, should construction continue in the night. This will disturb the fauna utilising the surrounding vegetation, especially nocturnal species, and could result in a localised decrease in biodiversity as faunal species move away from the disturbance. Food and rubbish can attract wildlife to the area, increasing risk of negative interactions.

Roads generally have a negative impact on fauna as many animals are killed by collisions with vehicles while trying to cross busy roadways. Road-users may also be at risk when trying to avoid collisions or if collisions cause damage to vehicles. Increasing the width of the road not only increases the distance over which crossing fauna need to travel, but will also lead to an increase in traffic volume as well as an overall increase in speed of the vehicles. Furthermore, the temporary and seasonal or permanent zones

identified by the wetland specialist (see wetland report) are likely to support amphibian species during summer. The construction of roads has many impacts on amphibians and reptiles which includes high rates of road mortality which usually occurs over a large geographical area (Malt, 2012). Road underpasses and drift fencing are common mitigation measures in road construction and the following is recommended by Malt (2012) for the construction of these underpasses and fences.

Mitigation Measures

- Detailed amphibian and reptile surveys should be conducted during early summer to determine the species diversity within the study area. Species-specific mitigation measures should be recommended to minimize the impact of road kills;
- The environmental conditions within the artificial passageways should not be different from the environmental conditions in the adjacent habitat. This includes the lack of light which might deter amphibians from using the passageways. It is therefore recommended that larger tunnels are constructed to provide sufficient light;
- Cooler temperatures within the tunnels relative to the outside environment may also deter amphibians from using the passages while a lack of moisture within the tunnels will make it unsuitable for amphibians which are dependent on moist habitats for movement. It is therefore it is important to consider the site and landscape, local topography and behaviour of the amphibian species involved when constructing the passageways;
- Where possible, the passageways should be vegetated to encourage use by amphibians;
- Passages and fences should be complementary to each other since fences are used to guide the amphibians towards the passageways;
- No holes or gaps should be present in the fences which are intended to exclude amphibians, especially where these fences are constructed close to the culvert or passageways.
- Construction activities should commence during the winter months to minimise the impacts on breeding fauna and flora;
- No wild animal may under any circumstance be handled, removed or be interfered with by construction workers and mine personnel;
- No wild animal may under any circumstance be hunted, snared, captured, injured or killed, including animals perceived to be vermin. Checks of the surrounding natural areas must be regularly undertaken to ensure no traps have been set. Any snares or traps found on or adjacent to the site must be removed and disposed of; and
- All food should be securely stored away to prevent attraction of faunal species and all rubbish should be disposed of away from the site. Bins located around the infrastructure should have tightly fitting lids to prevent faunal species raiding the bins and thereby becoming habituated to humans.

6.2.1d Potential increase in invasive vegetation

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	Moderate (6)	Medium (3)	Medium (45)	High
WMM	Site (1)	Short term (2)	Low (4)	Low (2)	Low (14)	High

Description of impact

Alien plant species such as *Melia azedarach*, *Acacia dealbata*, *Solanum mauritianum* and *Campuloclinium macrocephalum* which were recorded within the study area have the potential to spread rapidly and form dense infestations especially when natural vegetation is disturbed. It is therefore recommended that these species are eradicated from the study area as well as the surrounding natural vegetation. It should also be noted that *Melia azedarach* produces copious amounts of seed and follow-up control will be essential in the successful eradication of this species.

Mitigation measures

- During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation;
- Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation;
- All alien seedlings and saplings must be removed as they become evident for the duration of construction phase;
- Manual / mechanical removal is preferred to chemical control;
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction site. This should be verified by the ECO;
- An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning.

6.2.1e Pollution of areas containing natural vegetation

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	Medium (6)	High (4)	Medium (52)	High
WMM	Site (1)	Short term (2)	Low (4)	Low (2)	Low (14)	High

Description of impact

During the construction phase vegetation will be removed and this coupled with the sloping hillsides within the study area will result in an increase of erosion. In addition to this, spills from vehicles used during the construction phase as solid waste generated by motorists and pedestrians will contaminated the natural vegetation.

Mitigation Measures

- An ecologically-sound stormwater management plan must be implemented during construction and appropriate water diversion systems put in place;
- Erosion must not be allowed to develop on a large scale before effecting repairs;
- Runoff from roads must be managed to avoid erosion and pollution problems;
- All areas susceptible to erosion must be protected and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas;
- Natural trees, shrubbery and grass species must be retained wherever possible;
- Areas exposed to erosion due to construction should be vegetated with species naturally occurring in the area;
- Surface water or stormwater must not be allowed to concentrate, or flow down cut or fill slopes without erosion protection measures being in place; and
- Vehicles used during the construction phase must be parked in a designated area and containers should be used to prevent any oil leaks.

6.2.2 Possible Cumulative Impacts Related to the Proposed Development

According to the IFC Good Practice Handbook, cumulative impacts are: *“those that result from successive, incremental and or combined effects of a development when added to other existing, planned, and/or reasonably anticipated future ones”*.

6.2.2a Loss of biodiversity, including species of conservation concern and/or Red/Orange List species, due to the destruction and degradation of natural vegetation

	Scale	Duration	Magnitude	Probability of Occurrence	Significance	Confidence
WOMM	National (4)	Permanent (5)	Moderate (6)	Definite (5)	Medium (50)	High
WMM	Local (2)	Long term (4)	Medium (6)	Medium (3)	Medium (36)	High

Description of Impact

The study area supported plant species of conservation concern as well as suitable habitat for various Red/Orange List species as well as ecosystem services. In addition to this, the study area provided suitable habitat for the Critically Endangered *Neamblysomus julianae* (Juliana's Golden Mole) as well as various other faunal species of conservation concern. If mitigation measures are not strictly adhered to and these areas are destroyed and degraded, loss of biodiversity and ecosystem services will occur at a national scale.

Mitigation Measures

To limit the impact on natural vegetation which provide suitable habitat for plant and animal species of conservation concern, a third Alternative for the Class 3 link road should be investigated and placed outside all appropriate buffers (riparian vegetation, ridges, Red/Orange List plant and animal populations) as described in this report.

6.2.2b Loss of ecosystem services such as water filtration, pollination and pest control

	Scale	Duration	Magnitude	Probability of Occurrence	Significance	Confidence
WOMM	Regional (3)	Permanent (5)	High (8)	Definite (5)	High (80)	High
WMM	Local (2)	Long term (4)	Medium (6)	Medium (3)	Medium (36)	High

Description of Impact

The study area provides essential ecosystem services such as filtering of water, faunal pollinators such as insects (particularly bees and butterflies) and birds, and insectivorous bats provide essential pest control services to farmers and settlements on a regional scale. Although no major bat roosting areas were confirmed within the area, the presence of natural habitat is likely to serve as important foraging area for these species. Since pollination services and insect control is not restricted to the study site, this impact is considered to be significant on a regional scale. Provisional services included food, medicinal plants and grazing areas for cattle. These services would be lost to the greater surrounding areas with the loss of biodiversity if the study site were to become degraded.

Mitigation Measures

To limit the loss of ecosystem services associated with the study area, it is recommended that an alternative route option is investigated and placed outside all areas designated as highly sensitive in this report.

7. CONCLUSION

The study area consisted of two route alternatives of approximately 2.5km in length. Vegetation groups associated with Alternative 1 included a Class 2 Ridge: Natural, Riparian vegetation, Natural vegetation: Old fields and Modified: Alien plant infestations and landscaped areas. Alternative 2 traverses a Class 2 Ridge: Disturbed, Riparian vegetation, natural vegetation: Old fields as well as the modified area: Alien plant infestations and landscaped areas.

The study area provided suitable habitat for at least 10 plant species of conservation concern and/or Red/Orange List plant species. One of these, *Hypoxis hemerocallidea* (Common Starflower; currently listed as Declining) was confirmed within the study area while five species have been recorded within 5km of the study area and are therefore highly likely to occur within the study area based on the presence of suitable habitat.

One Critically Endangered species, *Neamblysomus julianae* (Juliana's Golden Mole), was given a very high likelihood of occurring in the study area. *N. julianae* (Juliana's Golden Mole) is endemic to South Africa and is a range-restricted species which has been recorded from only three localities, Pretoria (Bronberg), Nylsvlei region (Northern Province) and south-western parts of the Kruger National Park. This species' preferred habitat is mixed Bushveld associated with sandy soils below rocky outcrops. *N. julianae* (Juliana's Golden Mole) is found in extremely restricted habitat which is under threat from human development, with habitat being lost and fragmented by urban and infrastructure development. The study area occurs within the Bronberg ridge from which this species has been confirmed. The presence of suitable habitat within the study area makes it highly likely that the species will be present within the study area.

In addition to this, three mammal species of conservation concern, *Lutra maculicollis* (Spotted-neck Otter; currently listed as Near Threatened), *Atelerix frontalis* (South African Hedgehog; currently listed as Near Threatened) and *Dasymys incomtus* (Water Rat; currently listed as Near Threatened) were given a high probability of occurring in the study area based on the presence of suitable habitat. In addition to this, three avifaunal species of conservation concern, *Limosa limosa* (Black-tail Godwit; currently listed as Rare), *Coracias garrulous* (European Roller; currently listed as Near Threatened) and *Rostratula benghalensis* (Greater Painted Snipe; currently listed as Near Threatened) were also considered highly likely to occur in the study area based on the presence of suitable habitat.

Based on the results obtained, the proposed route alternatives are not considered feasible from an ecological perspective. Alternative 1, which is the preferred route, traverses a Class 2 Ridge: Natural which is classified as Important according to the Gauteng C-Plan and falls within two threatened ecosystems. In addition to this, the ridge as well as the natural vegetation: old fields and riparian vegetation provide suitable habitat for at least 10 plant species of conservation concern and/or Red/Orange List plant species, four mammal species of conservation concern, of which *Neamblysomus juliana* (Juliana's Golden Mole) is classified as Critically Endangered. The area also provides suitable habitat for at least three avifaunal species of conservation concern. Although the portion of the ridge associated with Alternative 2 was classified as disturbed, the area is classified as Irreplaceable according to the Gauteng C-Plan and was also considered to be suitable habitat for all the faunal and floral species of conservation concern associated with Alternative 1. Due to the significant impact that both Alternative routes are likely to have and the recorded biodiversity, mitigation measures are not considered feasible and it is recommended that alternative route options are investigated.

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GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity.
Biodiversity	Biodiversity is the variability among living organisms from all sources including <i>inter alia</i> terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Climax community	<p>The presumed end point of successional sequence; a community that has reached a steady state, the most mature and fully developed vegetation that an ecosystem can achieve under the prevailing conditions. It is reached after a sequence of changes in the ecosystem, known as succession. Once climax vegetation develops, the changes are at a minimum and the vegetation is in dynamic equilibrium with its environment.</p> <p>Very few places show a true climax because physical environments are constantly changing so that ecosystems are always seeking to adjust to the new conditions through the process of succession.</p>
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see Threatened), Extinct in the wild, Data deficient, Near threatened , Critically rare, Rare and Declining . These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are Declining are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Correspondence Analysis	Correspondence Analysis simultaneously ordines species and samples.

Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo <i>et al.</i> , 2009).
Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible.
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution.
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.
Fauna	The animal life of a region.
Flora	The plant life of a region.
Forb	A herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live.
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas.
Least Concern	A taxon is Least Concern when it has been evaluated against five IUCN criteria and does not qualify for the Threatened or Near threatened Categories (Raimondo <i>et al.</i> , 2009).
Mitigation	The implementation of practical measures to reduce adverse impacts.
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo <i>et al.</i> , 2009).

Plant community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance.
Protected Plant	According to Provincial Nature Conservation Ordinances, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations and species which have been reduced to small (often unsustainable) population by man's activities.
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. Now termed Plants of Conservation Concern.
Species diversity	A measure of the number and relative abundance of species.
Species richness	The number of species in an area or habitat.
Succession	Progressive change in the composition of a community of plants, e.g. from the initial colonisation of a bare area, or of an already established community towards a largely stable climax. The complete process of succession may take hundreds or thousands of years and entails a number of intermediate communities - each called a seral community. The replacement of one seral community by another in most cases leads to the eventual formation of a climax community, a relatively stable community of plants and animals.
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition".
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo <i>et al.</i> , 2009).
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and is therefore facing a high risk of extinction in the wild in the future (Raimondo <i>et al.</i> , 2009).

APPENDICES

APPENDIX A	Plant species identified within the study area
APPENDIX B	Mammal species occurring within QDGC 2528CD, with provincial, national and global conservation status, and probability of occurring on site and habitat preference
APPENDIX C	Chiroptera species associated with the QDGC, their national and global conservation status, roosting requirements, foraging habits, call frequencies and likelihood of occurring in the study area
APPENDIX D	Bird species observed in the study area
APPENDIX E	Bird species of conservation concern occurring within QDGC 2528CD, national and global conservation status, habitat preference and probability of occurring on site
APPENDIX F	Reptile species occurring within QDGC 2528CD, provincial, national and global conservation status, probability of occurring within the study area and habitat preference
APPENDIX G	Amphibian species occurring within QDGC 2528CD, national conservation status, habitat preference and probability of occurring within the study area

APPENDIX A: PLANTS IDENTIFIED WITHIN THE STUDY AREA**APPENDIX B:**Plants in **RED** = Species of conservation concern and/or nationally or provincially protected species

Scientific Name	Locality in Study area				
	Class 2 Ridge: Natural	Class 2 Ridge: Disturbed	Riparian Vegetation	Natural Grassland: Old fields	Modified
Herbaceous Species					
<i>Aloe zebrina</i> (M)	X	X		X	
<i>Asparagus laricinus</i>	X	X		X	X
<i>Aster harveyanus</i>				X	X
<i>Athrixia elata</i> (M)	X	X		X	
<i>Berkheya radula</i>				X	
<i>Bonatea speciosa</i> (M)			X	X	X
<i>Cleome gynandra</i>				X	
<i>Commelina</i> sp.	X				
<i>Dicoma anomala</i>	X				
<i>Felicia muricata</i> subsp. <i>muricata</i>	X	X		X	
<i>Gladiolus</i> sp.	X		X	X	
<i>Gomphocarpus fruticosus</i>		X	X	X	X
<i>Helichrysum aureonitens</i>			X		
<i>Hypoxis colchicifolia</i>	X				
<i>Hypoxis hemerocallidea</i> (PP)(Dec)(M)			X	X	
<i>Leucas lavandulifolia</i>				X	
<i>Osteospermum muricatum</i> subsp. <i>muricatum</i>			X	X	
<i>Pellaea calomelanos</i>	X				
<i>Persicaria attenuata</i>			X		
<i>Polygala hottentotta</i>	X	X			
<i>Raphionacme</i> sp.	X				
<i>Satyrium</i> sp.(M)			X		
<i>Seriphium plumosum</i>	X	X	X	X	X
<i>Solanum panduriforme</i>		X	X	X	

Scientific Name	Locality in Study area				
	Class 2 Ridge: Natural	Class 2 Ridge: Disturbed	Riparian Vegetation	Natural Grassland: Old fields	Modified
<i>Solanum sisymbriifolium</i>			X		X
<i>Typha capensis</i>			X		
<i>Vernonia galpinii</i>	X				
Trees and shrubs					
<i>Acacia caffra</i>	X				
<i>Acacia karroo</i>	X				
<i>Acacia nilotica</i>	X				
<i>Acacia sieberiana</i>	X	X		X	
<i>Celtis africana</i>	X	X	X		
<i>Clematis brachiata</i>	X	X			
<i>Dichrostachys cinerea</i>	X	X	X	X	
<i>Ehretia rigida</i>	X				
<i>Gymnosporia tenuispina</i>	X				
<i>Lippia javanica</i> (M)	X	X	X		
<i>Rhoicissus tridentata</i>	X				
<i>Searsia pyroides</i> var. <i>gracilis</i>	X	X			
<i>Searsia zeyheri</i>	X				
<i>Searsia lancea</i>	X	X			
<i>Ziziphus mucronata</i> (M)	X	X			
Grass Species					
<i>Andropogon eucomus</i>			X		
<i>Cymbopogon plurinodis</i>	X				
<i>Digitaria eriantha</i>	X				
<i>Diheteropogon amplexans</i>	X				
<i>Eragrostis gummiflua</i>			X	X	
<i>Eragrostis plana</i>			X	X	
<i>Hyparrhenia hirta</i>	X	X		X	X
<i>Imperata cylindrica</i>			X		
<i>Leersia hexandra</i>			X		
<i>Melinis repens</i>	X	X		X	X
<i>Pennisetum clandestinum</i>			X		X
<i>Pogonarthia squarrosa</i>				X	
<i>Setaria sphacelata</i> var	X	X	X		

Scientific Name	Locality in Study area				
	Class 2 Ridge: Natural	Class 2 Ridge: Disturbed	Riparian Vegetation	Natural Grassland: Old fields	Modified
<i>sericea</i>					
<i>Setaria sphacelata</i> var <i>torta</i>	X	X			
<i>Sorghum bicolor</i>			X		
<i>Themeda triandra</i>	X	X			
Alien Species					
<i>Acacia dealbata</i>			X		X
<i>Agave americana</i>		X			
<i>Amaranthus hybridus</i>			X		
<i>Arundo donax</i>			X		
<i>Acacia dealbata</i>					X
<i>Agave americana</i>		X			
<i>Amaranthus hybridus</i>					
<i>Arundo donax</i>					
<i>Bidens</i> sp.		X	X	X	X
<i>Bidens</i> sp.					
<i>Campuloclinium macrocephalum</i>			X	X	X
<i>Conyza bonariensis</i>				X	X
<i>Eucalyptus</i> sp.	X	X	X		X
<i>Ipomoea purpurea</i>			X		X
<i>Lantana camara</i>			X		X
<i>Melia azedarach</i>			X		X
<i>Morus alba</i>			X		
<i>Pinus patula</i>				X	X
<i>Populus alba</i>			X		
<i>Salix babylonica</i>			X		
<i>Solanum mauritianum</i>			X		X
<i>Verbena aristigera</i>			X	X	X
<i>Verbena bonariensis</i>			X	X	
<i>Xanthium strumarium</i>				X	
<i>Zinnia peruviana</i>		X	X	X	X

APPENDIX B: MAMMAL SPECIES OCCURRING IN QDGC 2528CD, WITH PROVINCIAL, NATIONAL AND GLOBAL CONSERVATION STATUS, WITH THEIR HABITAT PREFERENCE AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; Pr = Protected; En = Endemic; NBM = Non-breeding Migrant

Scientific Name	Common Name	Global Conservation Status	Regional Conservation Status (SA)	Habitat requirements	Likelihood of occurring in study area
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC	Savanna, desert, urban areas, invertebrates and small vertebrates	Confirmed
<i>Raphicerus campestris</i>	Steenbok	LC	LC	Savanna, shrubland, grassland, drier areas	Confirmed
<i>Lepus saxatilis</i>	Scrub Hare, Savannah Hare	LC	LC	Arable land, savanna, grassland, desert, grazer	Confirmed
<i>Neamblysomus julianae</i>	Juliana's Golden Mole (Pretoria)	CR	CR	Subteranean, Rocky Highveld Grassland, gardens	Very High
<i>Rattus rattus</i>	Black Rat, House Rat	LC	LC	Widespread	High
<i>Lutra maculicollis</i>	Spotted-necked Otter	LC	NT	Aquatic areas, natural and man-made, fish, crab, frogs, in low densities	High
<i>Crocidura silacea</i>	Lesser Gray-brown Musk Shrew	LC	DD	This species occurs in montane forest, savanna, bush, grassland and coastal forest. It appears to tolerate a wide range of habitats.	High

<i>Crocidura cyanea</i>	Reddish-gray Musk Shrew	LC	DD	This species occurs in a wide variety of montane grasslands and temperate and subtropical forests. In Namibia, a population has been found inhabiting a cave, where they feed on cave invertebrates and possibly dead bats (Marais and Irish 1990).	High
<i>Crocidura hirta</i>	Lesser Red Musk Shrew	LC	DD	This species is found in grassland, savanna and bush savanna. The Nambian subspecies <i>Crocidura hirta deserti</i> occurs in arid areas	High
<i>Atelerix frontalis</i>	Southern African Hedgehog	LC	NT	Dry habitats with groundcover for nesting, nocturnal	High
<i>Pronolagus randensis</i>	Jameson's Red Rock Hare	LC	LC	Grassland, rocky highveld grassland, slopes of rocky outcrops	High
<i>Leptailurus serval</i>	Serval	LC	NT	Wide distribution range but restricted by habitat requirements. Proximity to water essential as well as availability of adequate cover	High
<i>Felis silvestris</i>	Wild Cat, Wildcat	LC	LC	Savanna, shrubland, desert, broad habitat, small mammals, reptiles, birds and invertebrates	High

<i>Sylvicapra grimmia</i>	Common Duiker, Grey Duiker	LC	LC	Widespread, thickets, savanna, widespread, karroid, forest and savanna	High
<i>Atilax paludinosus</i>	Marsh Mongoose, Water Mongoose	LC	LC	Coastline, rocky shores, intertidal, estuarine, brackish, bogs, marshes, swamps, freshwater and saltwater, eats invertebrates and small vertebrates	High
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	Savanna, shrubland, grassland, drier areas, omnivore, extreme generalist	High
<i>Elephantulus myurus</i>	Eastern Rock Elephant Shrew	LC	LC	Shrubland, grassland, crevices and crannies	High
<i>Genetta genetta</i>	Common Genet	LC	LC	Forest, savanna, omnivorous	High
<i>Elephantulus brachyrhynchus</i>	Short-snouted Elephant Shrew	LC	DD	Heavy cover in grass and scrubs	High
<i>Aethomys namaquensis</i>	Namaqua Rock Rat	LC	LC	Rocky outcrops and koppies	High
<i>Aethomys ineptus</i>	Tete Veld Aethomys	LC	LC	Rocky crevices and piles of boulders	High
<i>Cryptomys hottentotus</i>	African Mole Rat/Common mole-rat	LC	LC	Subterranean, widespread	High
<i>Hystrix africae australis</i>	Cape Porcupine	LC	LC	Arable land, savanna, grassland, temperate, desert, throughout southern Africa	High

<i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC	This species is found in the subtropical and wooded grasslands of most South Africa (excluding some of the south), western Zimbabwe, Botswana, central and eastern Namibia, southeastern Angola and southwestern Zambia. There is a record from northern Mozambique.	High
<i>Dasymys incomtus</i>	African Marsh Rat /Water Rat	LC	NT	Bogs, marshes, swamps, fens, peatlands, nocturnal, semi-aquatic	High
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	DD	Sandy soils	High
<i>Graphiurus microtis</i>	Small-eared Dormouse	LC	0	Savanna and woodland habitats	High
<i>Mus musculus</i>	House Mouse	LC	0	Widespread	High
<i>Mastomys coucha</i>	Southern African Mastomys	LC	LC	Widespread, nocturnal	High
<i>Steatomys krebsii</i>	Kreb's Fat Mouse	LC	LC	Temperate, sandy substrates, wide tolerance	High
<i>Steatomys pratensis</i>	Fat Mouse	LC	LC	Fringes of rivers and swamps with sparse to tall and dense grass cover. Common on cultivated land suggesting they prefer loose, sandy substrates.	High
<i>Thallomys paedulcus</i>	Acacia Rat	LC	LC	Widespread	High

<i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	Savanna, shrubland, grassland, temperate, nocturnal seed eater	High
<i>Thryonomys swinderianus</i>	Greater Cane Rat	LC	LC	Savanna, Grassland, Seasonally wet or flooded wetlands, usually near water	High
<i>Mastomys natalensis</i>	Natal Mastomys	LC	LC	Cosmopolitan, nocturnal	High
<i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	LC	LC	Temperate, grassland with good cover, diurnal	High
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	Savanna, shrubland, grassland, desert, insectivorous	High
<i>Aepyceros melampus</i>	Common Impala	LC	LC	Light woodlands and savanna, open acacia savannas with nutrient rich soils, water-dependent	High*
<i>Chrysothalax villosus</i>	Rough-haired Golden Mole	VU	CR	Grassland, preferring dry, sandy ground on the fringes of marshes and vleis. Also in gardens and golf courses	Medium
<i>Procavia capensis</i>	Rock Hyrax, Rock Dassie	LC	LC	Krantzes and rocky outcrops throughout the fynbos, karroid habitats, generalist herbivore	Medium
<i>Ictonyx striatus</i>	Zorilla, Striped Pole Cat	LC	LC	Savanna, grasslands, desert, forest, insects and mince, reptiles	Medium

<i>Mellivora capensis</i>	Honey Badger	LC	NT	Widespread, only absent from dune deserts. Seems to be absent from the Free State	Medium
<i>Poecilogale albinucha</i>	African Striped Weasel	LC	DD	Grassland, savanna, shrubland, birds and eggs	Medium
<i>Mungos mungo</i>	Banded Mongoose	LC	LC	Savanna, social, termites and beetle larvae, other invertebrates	Medium
<i>Ichneumia albicauda</i>	White-tailed Mongoose	LC	LC	Savanna, urban areas, grasslands, invertebrates and small vertebrates	Medium
<i>Vulpes chama</i>	Cape Fox, Silver Fox	LC	LC	Savanna, shrubland, grassland, desert, omnivorous, small vertebrates and invertebrates	Medium
<i>Desmodillus auricularis</i>	Cape Short-eared Gerbil	LC	LC	Compact soil, nocturnal, in semi-arid karroid grassland	Medium
<i>Graphiurus platyops</i>	Rock Dormouse	LC	DD	Temperate, rocky areas	Medium
<i>Crocidura maquassiensis</i>	Makwassie Musk Shrew	LC	VU	Montane grassland, rocky areas, coastal forest, garden, terrestrial	Medium
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	LC	DD	Bogs, marshes, swamps, peatlands, marshy areas in savannas, terrestrial, nocturnal	Medium
<i>Pedetes capensis</i>	Springhaas, Springhare	LC	LC	Sandy, hard soils, cultivated areas or open shrublands, deserts	Medium

<i>Otomys irroratus</i>	Southern African Vlei Rat	LC	LC	Grassland species occurring in submontane as well as coastal areas.	Medium
<i>Caracal caracal</i>	Caracal, African Caracal	LC	LC	Savanna, shrubland, eats small mammals and birds	Medium
<i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	DD	Particularly associated with mounds of snouted harvester termites but have also been recorded in areas without termite mounds	Medium
<i>Myodomys albicaudatus</i>	White-tailed Mouse	EN	EN	Temperate, sandy soils with good cover	Medium
<i>Felis nigripes</i>	Black-footed Cat	VU	LC	Savanna, shrubland, desert, short-grass specialist feeding on small mammals, reptiles, birds and invertebrates	Low
<i>Connochaetes taurinus</i>	Common Wildebeest	LC	LC	Savanna, short grass grazer, prefers open savanna woodlands/bushveld	Low
<i>Aonyx capensis</i>	African Clawless Otter	LC	LC	Permanent streams and rivers, coastline, rocky shores,, frshwater and marine, crustaceans and fish	Low
<i>Orycteropus afer</i>	Aardvark, Antbear	LC	LC	Savanna, shrubland, grassland, vital association between ants and termites	Low

<i>Suricata suricatta</i>	Meerkat, Slender-tail	LC	LC	Savanna, shrubland, grassland, desert, invertebrates, small vertebrates	Low
<i>Hyaena brunnea</i>	Brown Hyaena	NT	NT	Savanna, grasslands, urban areas, scavenger	Low
<i>Proteles cristata</i>	Aardwolf	LC	LC	Occur in Nama-Karoo, Succulent Karoo, Grassland and Savanna biomes. Associated with diverse habitats.	Low
<i>Damaliscus pygargus</i>	Blesbok	LC	LC	Grassland, grazers with a preference for shortgrass	Low
<i>Pelea capreolus</i>	Grey Rhebok, Common Rhebok	LC	LC	Savanna, grassveld and renosterveld, hilly and mountainous terrain, ecotonal	Low
<i>Papio ursinus</i>	Grey-footed Chacma Baboon	LC	LC	Savanna and grassland, forest edges, omnivore	Low
<i>Tragelaphus strepsiceros</i>	Greater Kudu	LC	LC	Savanna woodlands with high shrub/tree density, grasslands, desert	Low
<i>Redunca fulvorufula</i>	Southern Mountain Reedbuck	LC	LC	Temperate grassland habitats, selective grazer	Low
<i>Tragelaphus scriptus</i>	Bushbuck	LC	LC	Closed canopy forests, thickets and woodlands, coastal sand forests	Low

<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC	LC	Woody savanna, tall grasses and shrubs, shrub dominated wetlands, bogs, marshes swamps, fens, peatlands with good grass cover	Low
<i>Equus quagga</i>	Plains Zebra, Burchells Zebra	LC	0	Savanna, temperate grasslands, grasslands or open woodlands near water. Prefers short grasses and flat to gentle hills.	Low
<i>Ceratotherium simum</i>	Southern White Rhino	NT	LC	Temperate grasslands, short rass areas in savanna and busgveld, prefers woody cover, water, bulk grazer	Zero
<i>Diceros bicornis</i>	Southern-central Black Rhino	CR	VU	Savanna, bushveld habitats of Limpopo, Mpumalanga and KZN, prefers dense cover and permanent water, browser	Zero
<i>Panthera pardus</i>	Leopard	NT	LC	Forest, savanna, desert, predated small to medium mammals	Zero
<i>Syncerus caffer</i>	African Buffalo	LC	LC	Savanna, temperate shrublands, bulk feeder occuring throughout savannas lowveld and Eastern Cape thickets	Zero
<i>Antidorcas marsupialis</i>	Springbok	LC	LC	Arid regions and dry open grassland, savanna, open plains, mixed feeder	Zero

<i>Alcelaphus buselaphus</i>	Lichtenstein's Hartebeest	LC	LC	Grassland, temperate areas, shrublands, karroid semi arid areas and coastal shrubland.	Zero
<i>Tragelaphus oryx</i>	Common Eland, Eland	LC	LC	Woodlands and woodland mosaics, grasslands and thickets	Zero
<i>Connochaetes gnou</i>	Black Wildebeest	LC	LC	Temperate grasslands, selective grazer in open areas with short grass, open plains.	Zero
<i>Ourebia ourebi</i>	Oribi	LC	EN	Grassland, Lowlands and montane grasslands, open grasslands with gentle topography at lower altitudes, selective feeders.	Zero

APPENDIX C: CHIROPTERA SPECIES WITH DISTRIBUTION RANGES IN QDGC 2528CD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS, ROOSTING and FORAGING HABITS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Common Name	SA	IUCN	Habitat	Roosting	Foraging	Likelihood of occurring in study area
<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	LC	LC	Widespread in the eastern and northern parts. Occur in a variety of savanna woodlands, preferring open habitats and avoiding closed forest interior. Appears to be dependant on surface water	Variety of locations including rock faces, tree trunks, and walls	Open air forager	High
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	Vegetation appears not to affect this species since it forages above the canopy. Has been recorded in desert, semi-arid scrub, savanna, grassland and agricultural land. Avoids forests	Roosts communally in small to medium sized groups in caves, rock crevices, under exfoliating rocks in hollow trees and behind bark of dead trees. Also recorded from buildings	Forages over a wide range of habitats usually flying well above the canopy of vegetation.	High
<i>Scotophilus dinganii</i>	African Yellow Bat	LC	LC	Occur throughout the savanna biome but avoid open habitats	Variety of shelters but including holes in tees, roofs of houses	Clutter-edge forager	High

<i>Rhinolophus simulator</i>	Bushveld Horseshoe Bat	LC	LC	Associated with savanna woodland, mostly netted in riparian forest and along wooded drainage lines	Caves and mine adits where it forms colonies of up to 300. Also roost singly or in small groups in caverns in rocky outcrops and culverts under the road	Clutter forager	High
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	NT	LC	Wide distribution in SA associated with arid savanna and woodland	Roosts in caves and mine adits or in cavities in piles of boulders requires specific temperature range of 24 degrees C	Clutter feeder, Lepidoptera and Coleoptera dominant in diet	High
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	NT	LC	Associated with a wide variety of habitats including arid savanna, woodland and riparian forests. Primarily a temperate species, absent from hot, low-lying areas	Caves and mine adits. May form large colonies of up to several thousand	Clutter forager, diet comprises of Lepidoptera and Coleoptera	High
<i>Rhinolophus blasii</i>	Blasius's Horseshoe Bat	NT	NT	Known from savanna woodland	Roosts in caves and mine adits in small groups of up to 4 individuals	Clutter forager	High

<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC	LC	Appears to occur throughout the savanna and karoo biomes but avoids open grasslands.	Variety of shelters including caves, aardvark burrows, culverts and trunks of large trees. Day roosts are often not completely dark and caves do not need to be extensive or deep	Forages by flying low above the ground, listening for prey scurrying on the surface	High
<i>Neoromicia zuluensis</i>	Aloe Bat / Zulu Serotine	LC	LC	Associated with woodland, closely tied to riparian vegetation	Roosting sites are not well know. Previously wrongly identified as <i>N.capensis</i> (aloe bat) hence the common name. Doesn't appear to roost in aloe leaves	Clutter-edge forager	High
<i>Neoromicia nana</i>	Banana Bat	LC	LC	Associated with well wooded habitats such as riparian vegetation and forest pathces	Typically roosts in furled banana leaves. Males roost singly. May also roost in leaves of other plants, roofs	Clutter-edge forager, diet consists mostly of Coleoptera and Lepidoptera	High
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	LC	Appears to tolerate a wide range of environmental conditions from arid semi-dsert to montane grasslands. Less abundant in low-lying, hot savannas in the far east region	Roosts singly or in small groups under the bark of trees, athe base of aloe leaves and under roofs of houses	Clutter-edge forager. Various prey species	High

<i>Myotis welwitschii</i>	Welwitch's Bat	NT	LC	Appears to be tied to mountains in areas covered by woodland or woodland-forest mosaic vegetation	Roosting habitats are poorly known; it has been collected from furled banana leaves	Clutter-edge forager	Medium-High
<i>Kerivoula lanosa</i>	Lesser Woolly Bat	NT	LC	Habitat is not well known, one specimen has been caught in riparian woodland	Number of specimens have been taken while roosting in weaver and sunbird nests	Clutter forager but no other info is available	Medium-High
<i>Hipposideros caffer</i>	Sundevall's Roundleaf Bat	DD	LC	Closely associated with woodland savanna and riparian vegetation within woodlands	Wide range of roosting sites including caves, sinkholes, cavities and anthropogenic sites such as mines and culverts	It appears to forage in and around thickets and well-developed undergrowth vegetation, avoiding open areas. Cluttered environments	Medium-High
<i>Eidolon helvum</i>	Straw-coloured Fruit Bat	NE	LC	Wooded areas providing suitable wild and cultivated fruit	Not well documented	Travels up to 60km per night from roost	Medium-High
<i>Cloeotis percivali</i>	Percival's Trident Bat	CR	VU	Not well know but associated with woodland	May roost in narrow crevices	Clutter forager. Feed exclusively on Leptidoptera	Medium-High
<i>Myotis tricolor</i>	Cape Hairy Bat	NT	LC	Mountainous areas, absent from flat and featureless habitat	Highly dependant on caves for suitable roosting sites. Alternate between maternity and winter hibernacula sites	Clutter-edge forager, feeding a variety of prey species	Low

<i>Miniopterus natalensis</i>	Natal Long-fingered Bat	NT	NT	Temperate regions including higher laying grassland and savanna	Cave dependant and distribution determined by availability of sites. Congregates in huge numbers of up to 260 000 at De Hoop in the Western Cape	Clutter-edge feeder and feeds on a variety of prey species	Low
<i>Epomophorus wahlbergi</i>	Wahlberg's Epauletted Fruit Bat	LC	LC	Eastern parts of the region. Associated with forest and forest-edge habitat including riparian forests	In dense foilage of large, leafy trees	May travel several km per night to find suitable fruit trees	Low

APPENDIX D: BIRD SPECIES RECORDED IN THE STUDY AREA

Scientific	English Family
<i>Lybius torquatus</i>	Barbet Black-collared
<i>Trachyphonus vaillantii</i>	Barbet Crested
<i>Merops apiaster</i>	Bee-eater European
<i>Merops bullockoides</i>	Bee-eater White-fronted
<i>Telophorus zeylonus</i>	Bokmakierie Bokmakierie
<i>Pycnonotus tricolor</i>	Bulbul Dark-capped
<i>Cisticola chiniana</i>	Cisticola Rattling
<i>Fulica cristata</i>	Coot Red-knobbed
<i>Microcarbo africanus</i>	Cormorant Reed
<i>Phalacrocorax lucidus</i>	Cormorant White-breasted
<i>Amaurornis flavirostra</i>	Crake Black
<i>Corvus albus</i>	Crow Pied
<i>Streptopelia capicola</i>	Dove Cape Turtle-
<i>Spilopelia senegalensis</i>	Dove Laughing
<i>Dicrurus adsimilis</i>	Drongo Fork-tailed
<i>Dendrocygna viduata</i>	Duck White-faced
<i>Ardea alba</i>	Egret Great
<i>Egretta garzetta</i>	Egret Little
<i>Lanius collaris</i>	Fiscal Common
<i>Dendroperdix sephaena</i>	Francolin Crested
<i>Corythaixoides concolor</i>	Go-away-bird Grey
<i>Alopochen aegyptiaca</i>	Goose Egyptian
<i>Numida meleagris</i>	Guineafowl Helmeted
<i>Ardea melanocephala</i>	Heron Black-headed
<i>Indicator indicator</i>	Honeyguide Greater
<i>Threskiornis aethiopicus</i>	Ibis African Sacred
<i>Bostrychia hagedash</i>	Ibis Hadedda
<i>Ceryle rudis</i>	Kingfisher Pied
<i>Elanus caeruleus</i>	Kite Black-shouldered
<i>Vanellus armatus</i>	Lapwing Blacksmith
<i>Vanellus coronatus</i>	Lapwing Crowned
<i>Colius striatus</i>	Mousebird Speckled
<i>Acridotheres tristis</i>	Myna Common
<i>Prinia subflava</i>	Prinia Tawny-flanked
<i>Erythropygia leucophrys</i>	Robin White-browed Scrub-
<i>Cossypha humeralis</i>	Robin-Chat White-throated
<i>Passer domesticus</i>	Sparrow House
<i>Pternistis swainsonii</i>	Spurfowl Swainson's
<i>Lamprotornis nitens</i>	Starling Cape Glossy
<i>Saxicola torquatus</i>	Stonechat African
<i>Burhinus capensis</i>	Thick-knee Spotted

<i>Motacilla capensis</i>	Wagtail Cape
<i>Uraeginthus angolensis</i>	Waxbill Blue
<i>Amblyospiza albifrons</i>	Weaver Thick-billed
<i>Ploceus cucullatus</i>	Weaver Village

APPENDIX E: BIRD SPECIES OF CONSERVATION CONCERN RECORDED IN 2528CD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific	English Family	Regional	IUCN	Habitat Requirements	Likelihood of occurring in study area
<i>Limosa limosa</i>	Godwit Black-tailed	Rare	0	A wide variety of habitats, even small highveld pans. Primarily inland, favouring lake margins, marshes, swamps and irrigated lands where substratum soft enough to allow probing. Also at coastal wetlands, incl estuaries, sheltered embayments and salt pans.	High
<i>Coracias garrulus</i>	Roller European	LC; NBM	NT	Open, broadleaved and Acacia woodlands with grassy clearings	High
<i>Rostratula benghalensis</i>	Snipe Greater Painted-	NT	LC	Waterside habitats with substantial cover	High
<i>Hieraaetus ayresii</i>	Eagle Ayres's Hawk-	NT	LC	Dense woodland and forest edge, often in hilly country. In Zimbabwe, frequently in treed suburbia outside br season. Often roosts in <i>Eucalyptus</i> stands	Medium-High
<i>Circus maurus</i>	Harrier Black	NT; En	VU	Dry grassland, Karoo scrub, agricultural fields and high-altitude grasslands; intolerant of burnt areas	Medium-High
<i>Mirafra cheniana</i>	Lark Melodious	NT; En	NT	Grassland dominated by <i>Themeda triandra</i> ; avoids wet lowlands, favouring fairly short grassland (< 0.5 m), with open spaces between tussocks, at 550-1 750 m altitude, with annual rainfall 400-800 mm	Medium-High

<i>Sagittarius serpentarius</i>	Secretarybird Secretarybird	VU	VU	Open grassland (< 0.5 m) with scattered trees, shrubland, open Acacia and bushwillow (<i>Combretum</i> spp) savanna; absent from dense woodland and rocky hills	Medium-High
<i>Mycteria ibis</i>	Stork Yellow-billed	NT; NBM	LC	Wetlands, incl alkaline and freshwater lakes, rivers, dams, pans, flood plains, marshes, flooded grassland and small pools or streams	Medium-High
<i>Botaurus stellaris</i>	Bittern Eurasian	CR	LC	Tall, dense emergent vegetation in interior of seasonal and permanent large wetlands	Medium
<i>Oxyura maccoa</i>	Duck Maccoa	Rare	DD	Prefers permanent wetlands in open grassland and semi-arid country (incl fynbos, succulent Karoo, Nama Karoo) that support rich concentrations of benthic invertebrates. Breeding habitat usually contains stands of young, emergent vegetation, mainly rushes and sedges ⁴⁸ . In KwaZulu-Natal, br recorded only at farm dams ¹⁵ .	Medium
<i>Polemaetus bellicosus</i>	Eagle Martial	VU	NT	Open woodland, arid and mesic savanna, forest edges	Medium
<i>Falco biarmicus</i>	Falcon Lanner	NT	LC	Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs favour habitats where cliffs available as nest and roost sites, but will use alternative sites (eg trees, electricity pylons, buildings) if cliffs absent	Medium
<i>Circus macrourus</i>	Harrier Pallid	NT; NBM	NT	Grasslands associated with pans or floodplains; also croplands	Medium

<i>Falco naumanni</i>	Kestrel Lesser	VU; NBM	LC	Warm, dry, open or lightly wooded environments; concentrated in grassy Karoo, w fringes of grassland biome and se Kalahari; generally avoids foraging in transformed habitats but occurs in some agricultural areas, incl croplands in fynbos and renosterveld of W Cape	Medium
<i>Ciconia nigra</i>	Stork Black	NT	LC	Dams, pans, floodplains, flooded grassland, associated with mountainous areas	Medium
<i>Crex crex</i>	Crake Corn	VU; NBM	LC	Rank grassland and savanna, grassland bordering marshes and streams incl long grass areas of seasonally flooded grassland and occasionally wet clay patches and soft mud fringing ponds	Medium
<i>Anthropoides paradiseus</i>	Crane Blue	VU; En	VU	Open grassland and grassland/Karoo ecotone; wetlands, cultivated pastures and crop lands; tolerant of intensively grazed and burnt grassland	Medium
<i>Falco peregrinus</i>	Falcon Peregrine	NT	LC	Resident birds mostly restricted to mountainous, riparian or coastal habitats, where high cliffs provide br and roosting sites; breeding pairs prefer habitats that favour specialised, high-speed, aerial hunting, e.g. high cliffs overlooking vegetation with raised and/or discontinuous canopy, or expanses of open water	Medium

<i>Podica senegalensis</i>	Finfoot African	VU	LC	Mostly quiet, wooded streams and rivers flanked by thick riparian vegetation and overhanging trees. Also dam verges, especially with sufficient overhanging vegetation and reed cover	Low
<i>Phoenicopterus roseus</i>	Flamingo Greater	NT	LC	Large, shallow, eutrophic wetlands, salt pans, saline lakes, coastal mudflats	Low
<i>Phoeniconaias minor</i>	Flamingo Lesser	NT	NT	Primarily open, eutrophic, shallow wetlands; breeds on saline lakes and salt pans	Low
<i>Circus ranivorus</i>	Harrier African Marsh-	VU	LC	Almost exclusively inland and coastal wetlands	Low
<i>Alcedo semitorquata</i>	Kingfisher Half-collared	NT	LC	Clear, fast-flowing perennial streams, rivers and estuaries, usually narrow and secluded, with dense marginal vegetation; often near rapids	Low
<i>Tyto capensis</i>	Owl African Grass-	VU	LC	Treeless areas associated with damp substrata, mainly marshes and vleis. Favours patches of tall, rank grass, sedges or weeds. Also areas with dense ground cover in scattered thorn scrub, low fynbos and renosterveld, usually close to water and among thick stands of grass (<i>Stenotaphrum</i> sp) and sedge (<i>Juncus</i> sp)	Low
<i>Pelecanus onocrotalus</i>	Pelican Great White	NT	LC	Shallow lakes, flood plain pans, estuaries and dams; sheltered coastal bays and lagoons; roosts on dry land in open areas, usually on islands or peninsulas where access by terrestrial predators limited	Low

<i>Pelecanus rufescens</i>	Pelican Pink-backed	VU	LC	Wide range of wetlands, incl lakes, dams and slow-flowing rivers, saline pools, lagoons, estuaries and sheltered bays	Low
<i>Charadrius pallidus</i>	Plover Chestnut-banded	NT	NT	Natural and man-made salt pans; rare at freshwater habitats	Low
<i>Glareola nordmanni</i>	Pratincole Black-winged	NT; NBM	NT	Open grassland, edges of pans and cultivated fields, but most common in seasonally wet grasslands and pan systems	Low
<i>Leptoptilos crumeniferus</i>	Stork Marabou	NT	LC	Both aquatic and terrestrial habitats, favouring open and semi-arid areas; largely absent from forest areas and true desert; common at wetlands, incl dams, pans and rivers, and in wildlife reserves and ranching areas	Low
<i>Hydroprogne caspia</i>	Tern Caspian	NT	LC	Along coast, mostly in sheltered bays and estuaries; inland, at large water bodies, both natural and man-made, with preference for saline pans and large impoundments	Low
<i>Gyps coprotheres</i>	Vulture Cape	VU; En	VU	Wide habitat range; cliffs	Low

APPENDIX F: REPTILE SPECIES RECORDED IN QDGC 2528CD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Common Name	Conservation Status	Habitat Requirements	Likelihood of occurring in the study area
<i>Aparallactus capensis</i>	Black-headed Centipede-eater	Least Concern	Varied, highveld, montane grassland, savanna and coastal bush	High
<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Least Concern	Varied, highveld grassland and semi-desert to coastal bush	High
<i>Chamaeleo dilepis dilepis</i>	Common Flap-neck Chameleon	Least Concern	Prefers savanna	High
<i>Boaedon capensis</i>	Brown House Snake	Least Concern	Wide range of habitats and tolerant to human activities	High
<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern	Savanna and open woodland	High
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern	Absent only from closed canopy and desert areas	High
<i>Lycodonomorphus rufulus</i>	Brown Water Snake	Least Concern	Small streams, pans and vleis	High
<i>Lycophidion capense capense</i>	Cape Wolf Snake	Least Concern	Variety of habitats including lowland forest, fynbos, moist savanna, grassland and karoo scrub	High
<i>Philothamnus hoplogaster</i>	South Eastern Green Snake	Least Concern	Varied, coastal bush, fynbos, arid and mesic savanna	High
<i>Philothamnus semivariatus</i>	Spotted Bush Snake	Least Concern	Open forest or savanna, arid regions	High
<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	Least Concern	Widely distributed over much of southern Africa	High
<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	Least Concern	Habitat generalist, widespread and common throughout SA	High
<i>Psammophylax rhombeatus rhombeatus</i>	Spotted Grass Snake	Least Concern	Highveld grassland, mesic thicket, fynbos, karroid areas	High
<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	Least Concern	Open grassland and savanna	High

<i>Pseudaspis cana</i>	Mole Snake	Least Concern	Sandy scrubland in SW Cape, highveld grassland, mountainous and desert areas	High
<i>Hemachatus haemachatus</i>	Rinkhals	Least Concern	Grassland	High
<i>Naja annulifera</i>	Snouted Cobra	Least Concern	Very common in bushveld and Lowveld areas	High
<i>Naja mossambica</i>	Mozambique Spitting Cobra	Least Concern	Savanna, cleared areas in former forest	High
<i>Hemidactylus mabouia</i>	Common Tropical House Gecko	Least Concern	Varied habitat including wet and dry savannas	High
<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	Least Concern	Prefers well wooded savanna	High
<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern	Varied, karroid veld, grassland	High
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern	Varied, montane and highveld grassland, savanna, bushveld and coastal forest	High
<i>Nucras holubi</i>	Holub's Sandveld Lizard	Least Concern	Broken rocky ground in mesic savanna	High
<i>Nucras ornata</i>	Ornate Sandveld Lizard	Least Concern	Broken montane grassland and mesic savanna on sandy soils	High
<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	Least Concern	Very varied, karroid veld, mesic thicket and arid savanna	High
<i>Leptotyphlops distanti</i>	Distant's Thread Snake	Least Concern	Occur throughout most of SA	High
<i>Leptotyphlops scutifrons conjunctus</i>	Eastern Thread Snake	Not listed	Varied, grassland, coastal bush, mesic and arid savanna	High
<i>Leptotyphlops scutifrons scutifrons</i>	Peters' Thread Snake	Not listed	Varied, grassland, coastal bush, mesic and arid savanna	High
<i>Pelomedusa subrufa</i>	Marsh Terrapin	Least Concern	Wide variety of temporary and permanent water bodies and will take up residence in artificial dams and sewage treatment plants	High
<i>Trachylepis capensis</i>	Cape Skink	Least Concern	Habitat generalist	High

<i>Trachylepis sp. (Transvaal varia)</i>	Skink sp. 1	Not listed	Habitat generalist, widespread and common throughout SA	High
<i>Trachylepis varia</i>	Variable Skink	Least Concern	Varied, grassland to arid and mesic savanna	High
<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern	Wide range of habitats throughout SA	High
<i>Varanus albigularis albigularis</i>	Rock Monitor	Least Concern	Common throughout savanna areas	High
<i>Bitis arietans arietans</i>	Puff Adder	Least Concern	Absent only from desert, dense forest and mountain tops	High
<i>Causus rhombeatus</i>	Rhombic Night Adder	Least Concern	Mesic savanna	High
<i>Agama aculeate distanti</i>	Distant's Ground Agama	Least Concern	Semi-desert and sanded savanna	Medium
<i>Agama atra</i>	Southern Rock Agama	Least Concern	Lives in colonies on rocky outcrops throughout SA except in sandy areas in the Northern Cape, some parts of Gauteng, Mpumalanga and KwaZulu-Natal	Medium
<i>Dispholidus typus typus</i>	Boomslang	Least Concern	Widely distributed throughout much of southern Africa excluding the central Highveld and drier western half of South Africa	Medium
<i>Lamprophis aurora</i>	Aurora House Snake	Least Concern	Restricted to the southern and eastern parts of South Africa	Medium
<i>Psammophis crucifer</i>	Cross-marked Grass Snake	Least Concern	Highveld and montane grassland, entering fynbos	Medium
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	Near Threatened	Very habitat specific and restricted to montane and highveld grassland and fynbos on rocky hillsides. Limited to the eastern and southern parts of Africa	Medium
<i>Cordylus jonesii</i>	Jones' Girdled Lizard	Least Concern	Rocky outcrops	Medium

<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern	Rocky outcrops and termite mounds in grassland	Medium
<i>Ichnotropis capensis</i>	Ornate Rough-scaled Lizard	Least Concern	Arid and mesic savanna	Medium
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Least Concern	Prefers rocky areas	Medium
<i>Afrotrophlops bibronii</i>	Bibron's Blind Snake	Least Concern	Found mainly in the eastern half of southern Africa	Medium
<i>Varanus niloticus</i>	Water Monitor	Least Concern	Rivers, pans and major lakes	Medium
<i>Psammophis trinasalis</i>	Fork-marked Sand Snake	Least Concern	Kalahari thornveld	Low
<i>Chamaesaura anguina anguina</i>	Cape Grass Lizard	Least Concern	Grassy or fynbos covered gentle slopes in Cape, KwaZulu-Natal and Mpumalanga	Low
<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern	Lives in cracks on small rocky outcrops	Low
<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-eyed Skink	Least Concern	Restricted to the northern and eastern parts of southern Africa (Limpopo)	Low
<i>Mochlus sundevallii sundevallii</i>	Sundevall's Writhing Skink	Least Concern	Arid sandy areas	Low
<i>Crocodylus niloticus</i>	Nile Crocodile	Vulnerable (SARCA 2014)	Large, rivers, lakes and swamps, river mouths, estuaries and mangrove swamps	Zero

APPENDIX G: AMPHIBIAN SPECIES RECORDED IN QDGC 2528CD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Common name	Red list category	Habitat requirements	Likelihood of occurring in the study area
<i>Amietophrynus garmani</i>	Olive Toad	Least Concern	Vleis and pans in bushveld savanna with relatively high rainfall > 600mm pa; suburban gardens	High
<i>Amietophrynus gutturalis</i>	Guttural Toad	Least Concern	Around open pools, dams, vleis and other semi-permanent bodies of water in grassland, thicket and savanna; suburban gardens and farmland	High
<i>Schismaderma carens</i>	Red Toad	Least Concern	Widespread in savanna and woodland, readily adapts to human habitation	High
<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern	Grassland around vleis and pans; breeds in temporary and permanent water bodies including vleis, marshes, pans, ponds and dams	High
<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	Least Concern	Hot, semi-arid to subtropical environments; savanna woodland, grassland and wide variety of bushveld vegetation types; also agriculturally developed areas	High

<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	Least Concern	Margins of permanent and temporary water bodies including shallow marshes, lakes, rivers, streams and pools; also semi-desert scrub, arid and humid savanna, agricultural land and forest clearings	High
<i>Xenopus laevis</i>	Common Platanna	Least Concern	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland	High
<i>Amietia angolensis</i>	Common or Angola River Frog	Least Concern	Banks of slow-moving streams or other permanent bodies of water in a wide variety of wetland habitats in grassland, savanna and forest edge	High
<i>Amietia fuscigula</i>	Cape River Frog	Least Concern	Widespread around permanent rivers and streams in grassland, fynbos and Karoo scrub including farm dams and other artificial water bodies	High
<i>Cacosternum boettgeri</i>	Common Caco	Least Concern	Variety of habitats in Nama Karoo, succulent Karoo, grassland and thicket favouring open areas and especially abundant in grassland areas; occasionally forest clearings	High
<i>Strongylopus fasciatus</i>	Striped Stream Frog	Least Concern	Open, grassy areas near dams, ponds or streams in forest, thicket, grassland and savanna, sometimes parks and gardens	High
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern	Variety of habitats in savanna and grassland	High









<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern	Variety of habitats in savanna and grassland; breeds in shallow permanent furrows, canals or streams in grassland and agricultural land	High
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SEF Juliana Golden Mole Map



Appendix Kvii

Legend

-  Affected farm
-  Alternative 1
-  Alternative 2
-  Stream
-  A Suitable for *N. julianae*
-  B Non suitable habitat
-  C Suitable for *C. villosus*
-  D Non suitable habitat



SEF Fauna and Flora Map



Appendix Kviii

**Graystone Study Area
Included as part of the Fauna
and Flora Assessment
conducted for the proposed
Hazeldean Road – Take note
that this assessment was
conducted in 2014**

The assessment regarded the ridge area as the most sensitive and the ridge area was excluded in the final layout approved by GDARD in the former authorisations that were issued. The assessment also confirmed that no Juliana Golden Mole were identified on the ridge area (**Refer to Appendix Kvi for Map compiled by SEF**)

Appendix Kviii

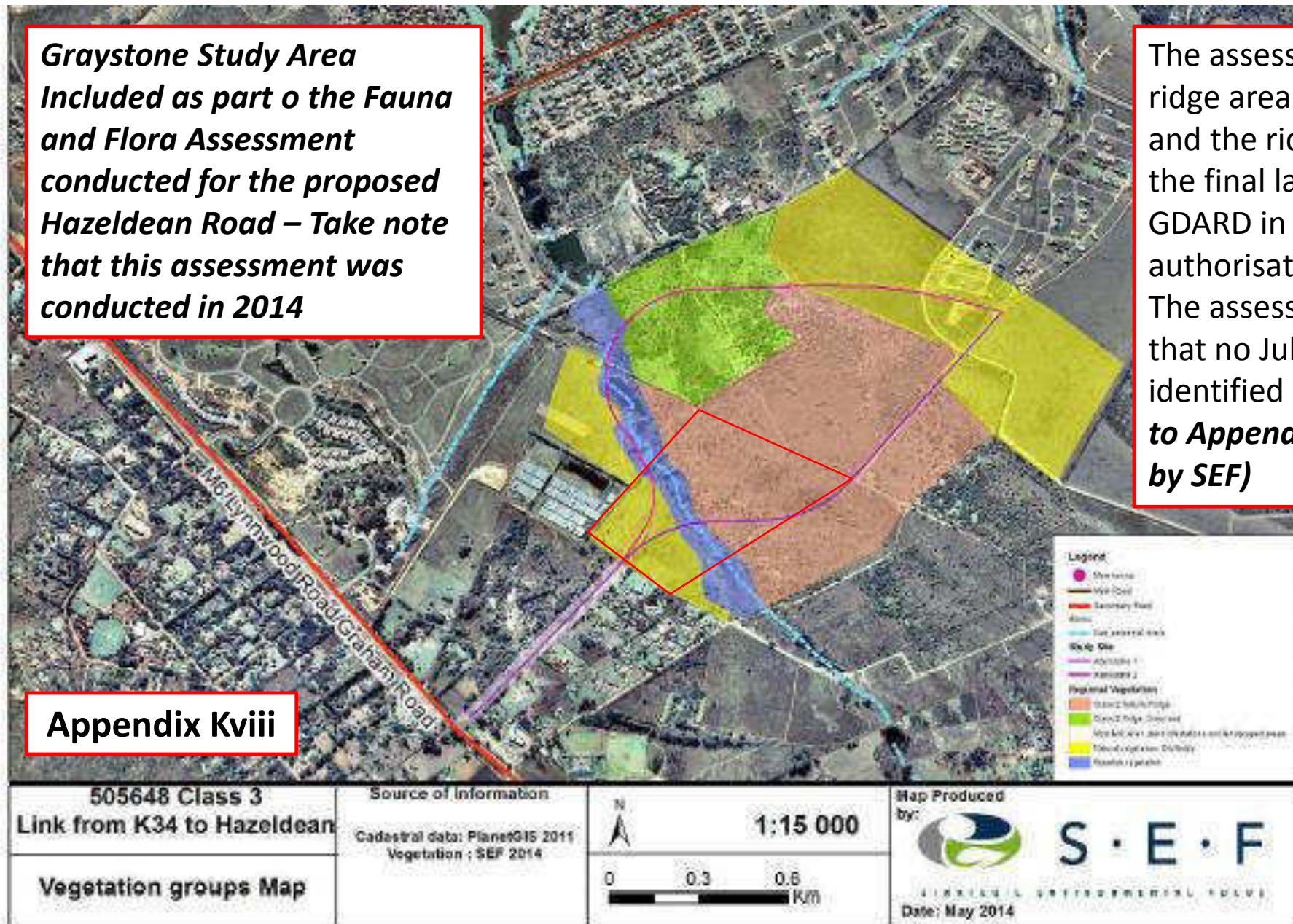


Figure 5: Vegetation groups recorded in the study area