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An assessment of vegetation, flora, vertebrate fauna and wetlands on Erf 349 of the Farm The Willows 340 JR, City of Tshwane, Gauteng.

March 2021 (Rev#1: September 2021)

An assessment of vegetation, flora, vertebrate fauna and wetlands on Erf 349 of the Farm The Willows 340 JR, City of Tshwane, Gauteng.

by
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Commissioned by

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March 2021 & rev#1 September 2021

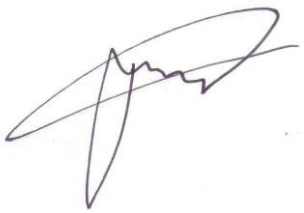
TABLE OF CONTENTS

DECLARATION OF INDEPENDENCE

We, George Johannes Bredenkamp, Id 4602105019086, SACNASP Reg No 400086/83
Jacobus Casparus Petrus Van Wyk, Id 680804 5041084, SACNASP Reg No 400062/09 and
Catharina Elizabeth Venter, Id 7912290014082, SACNASP Reg No 400048/08
declare that we:

- Hold higher degrees (MSc and DSc) in the biological sciences, which allowed registration by South African Council for National Scientific Professions as Professional Ecologist that sanction me to function independently as specialist scientific consultant;
- Act as an independent specialist consultant in the field of ecology, vegetation science, botany zoology and wetlands;
- Are employed by Eco-Agent CC, CK 95/37116/23, of which GJ Bredenkamp is the owner;
- Abide by the Code of Ethics of the SACNASP;
- Are committed to biodiversity conservation but concomitantly recognize the need for economic development;
- Are assigned as specialist consultants by Pierre Joubert Landscape Architect and Environmental Planner for the project **"An assessment of vegetation, flora, vertebrate fauna and wetlands on Erf 349 of the Farm The Willows 340 JR, City of Tshwane, Gauteng**" described in this report;
- Declare that, as per prerequisites of the Natural Scientific Professions Act (Act No. 27 of 2003), as amended by the Science and Technology Laws Amendment Act (Act 7 of 2014), this investigation of vegetation exclusively reflects our own observations and unbiased scientific interpretations, and was executed to the best of our ability;
- Within our fields of expertise, we reserve the right to form and hold our own opinions within the constraints of our training and experience and therefore will not submit willingly to the interests of other parties or change our statements to appease or unduly benefit them;
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed;
- Do not have, and will not have any vested or conflicting interests in the proposed development;
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority with regard to the Environmental Impact Assessment requirements;
- Will provide the client and competent authority with access to all information at our disposal, regarding this project, whether favourable or not;
- Reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognise that written consent from the client(s) will be required for us to release any part of this report to third parties;
- In addition, remuneration for services provided by us is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.





GJ Bredenkamp CE Venter JPC van Wyk

DISCLAIMER:

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. The vegetation team can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. Although the author exercised due care and diligence in rendering services and preparing documents, he accepts no liability. The client, by receiving this document, indemnifies the authors against all actions, claims, demands, losses, liabilities, costs, damages, and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document. This report should therefore be viewed and acted upon with these limitations in mind.

ABSTRACT

It is proposed to develop two residential dwellings on Erf 349 on the Farm The Willows 340 JR, located in the City of Tshwane, Gauteng. Erf 349 is 1.12 ha in size and forms part of the Wapadrand Country Estates.

SANBI and DEAT (2009) and NEMBA, Government Notice 1002 (2011) indicate that the Bronberg Mountain Bushveld is **Critically Endangered**. The Andesite Mountain Bushveld therefore enjoys legal protection. In terms of the GDARD (2014) C-Plan 3.3 Erf 349, Wapadrand Country Estates is located within a Critical Biodiversity Area, namely an "Irreplaceable" area.

Due to the above the Department of Environment and Agriculture Management of the City of Tshwane indicated that the following will be needed before the proposed development can be authorised:

- A fauna and Flora study that *ipse facto* includes an ecological sensitivity assessment of the sensitive primary vegetation and sensitive fauna and flora habitats.
- A Record of Decision (RoD), Exemption and/or Environmental Authorization (EA) from GDARD for the proposed development.

Furthermore, the results of the National Environmental Screening Tool (NE MA Government Notices 648 (2019) and 655 (2020)) indicate Very High sensitivity for Terrestrial Biodiversity and for Animal Species sensitivity, and Medium sensitivity for Plant Species sensitivity. The sensitivity for Aquatic Biodiversity is indicated as low.

Vegetation

The relevant literature and databases were used to obtain data regarding threatened, protected, alien invasive and medicinal plant species, also regional vegetation, threatened status of vegetation types, protected and conservation areas, critical biodiversity areas, wetlands and water courses.

Standard methods for vegetation surveys were applied. Plant communities were mapped and described including total floristic composition per pant community. All the above data were applied in analyses to determine conservation status and ecological sensitivity per plant community.

The vegetation study of Erf 349 Wapadrand Country Estates resulted in the identification of six different plant communities (= ecosystems on the plant community level of organisation) that could be mapped. Three plant communities were identified in northern part of the Erf namely the Mountain Bushveld on the South-facing Ridge Crest, Mountain Bushveld on Higher Slopes and the Mountain Bushveld on Lower Slopes. These three plant communities occur on the Bronberg ridge within the Bronberg Conservation area. The rich plant species composition, including four protected species, are protected in this area. These three plant communities have **High** ecological sensitivity and **High** conservation value. The density of the alien invasive *Lantana camara* is a concern. This area is excluded from any development.

The results of an ecological sensitivity analysis indicate **Medium-Low** to **Low** sensitivity respectively for the **Historically Disturbed Plains Bushveld and Cleared Areas** on the plains. The vegetation ecology survey and analysis indicate that the plains bushveld **had been already been disturbed by 2004**. Considerable disturbance was evident over the southern part of the Erf during 2007 up to about 2014. From the images of May 2015 to August 2016 a (slight) recovery of woody vegetation on the plains can be seen, most probably dominated by **pioneer species** such as *Vachellia karroo* and **alien invasive** species such as *Melia azedarach* and *Lantana camara*, currently still prominent in the area.

More recently from September 2019 to November 2020 the southern disturbed areas have been densely covered by lush weedy species, particularly *Bidens pilosa*, as observed during the current survey.

A limited part (700m^2) of this **previously disturbed** area on Erf 349, have been cleared for the proposed development, as can be seen on November 2020 Google Earth image.

It is suggested that this clearing of vegetation **within the previously disturbed area not be regarded as a violation of a listed activity** as per Environmental Impact Assessment Regulations Listing Notice No. 3 of 2014.

It is suggested that the planned development accompanied by the development of an indigenous garden that will enhance suitable habitat for Juliana's golden mole, be supported. The remaining plains should remain in a natural state, with measures to control all alien and invasive plant species.

Fauna

Neamblysomus julianae, the Juliana's golden mole, is a Critically Endangered mammal species and the Wapadrand Country Estate (study site) forms part of the restricted distribution range of the Juliana's golden mole. GDARD is unlikely to sanction the development unless a reasonable conservation strategy is adopted, together with an Ecological Management Plant (EMP) and the appointment of an ECO.

Juliana's golden mole subsurface activities were recorded in a few localities on site. These subsurface activities were found around a diversity of habitat types on the study site and buffer areas. The golden mole occurs on the site in both natural veld and disturbed settings. Part of the study site includes the Bronberg Conservation Area where no development may occur and where activity signs of the Juliana's golden mole have been recorded. These golden mole individuals in the Bronberg Conservation Area would not be affected by the development since they occur outside the intended footprint of development.

The area on which the intended development will take place has been severely altered by invasive plant species and except for a small area, no subsurface activities of Juliana's golden mole were recorded. Near the white stinkwood trees at Erf 350, which is also a potential cultural site, golden mole activities were observed at 25°46'51"S; 28°20'05"E. This area must be excluded from development.

Golden moles are very well adapted to co-exist with human beings in rural settings on condition that the substrate consists of soft sand with no clay content and the soils kept

permanently moist by regular irrigation. The planned development for Erf 349 and Erf 350 should be, accompanied by the development of an indigenous garden that will enhance suitable habitat for Juliana's Golden Mole. The remaining plains should remain in a natural state, with measures to control all alien and invasive plant species.

Implementing the suggested Ecological Management Plan (included in this report) will stabilise the population at higher numbers and ensure year-round optimised ecological conditions in a structured manner. Connectivity with adjoining properties is good.

Wetland

Another ecosystem with legal protection (NWA Act 36 of 1998 and NEMA Act 107 of 1998), with **Medium**-**High** ecological sensitivity and consequently **High** conservation value, is the man-made (Drainage Line). This small and disturbed channel comes through an opening in the boundry wall to Erf 348, and leaves the site (Erf 349) about 30 m further towards Solomon Mahlangu Drive. The Preferred Lay-Out development plan implies that a large area of natural vegetation in the vicinity of the canal will remain intact. It is envisaged that the impact of the Preferred Lay-Out development will have no negative effect on the canal (Drainage Line).

The vegetation at and along the channel is indicative of disturbed conditions and not wetland conditions, and the soil is not hydromorphic. On the historical aerial photographs from 1964 no watercourse is visible on site. It is therefore highly likely that the channel indicated on the site is man-made and artificial. Although the indicated channel is not a wetland or riparian area, the construction activities must still remain outside the channel and the determined flood lines.

The man-made, artificial channel system on Erven 348 and 349 is weedy and modified by the surrounding land uses. The risk assessment indicates that proposed houses will not have any impact on this man-made, artificial channel, due to the distances of from the channel.

Ridge

The Class 2 Ridge on the site is protected in the Bronberg Conservation Area, no development will occur on the ridge, development is located on the valley plains with Historically Disturbed Plains Bushveld between the ridge and Solomon Mahlangu Drive.

Impact Assessment

The Impact Assessments provided indicate that the Preferred Layout development plan will have smaller impacts on vegetation, flora and mammals than the Alternative Lay-out Plan. This is mainly because less vegetation will be cleared, implying more natural vegetation will remain intact. This also provides adequate space for the development of an indigenous garden and implementing a management plan for Juliana's Golden Mole.

It is suggested that the Preferred Layout development plan be supported.

1. BACKGROUND AND ASSIGNMENT

A Preferred Lay-Out and an Alternative Lay-Out development plan for two residential dwellings is proposed for Erf 349 (Figure 1.1 below). Erf 349 is 1.12 ha in size of which 0.58 ha is located within the Bronberg Conservation Area on the Bronberg Ridge. The area within the Bronberg Conservation Area is excluded from any development. The Erf forms part of the Wapadrand Country Estates, which includes five erven, with a total size of 5.68 ha.

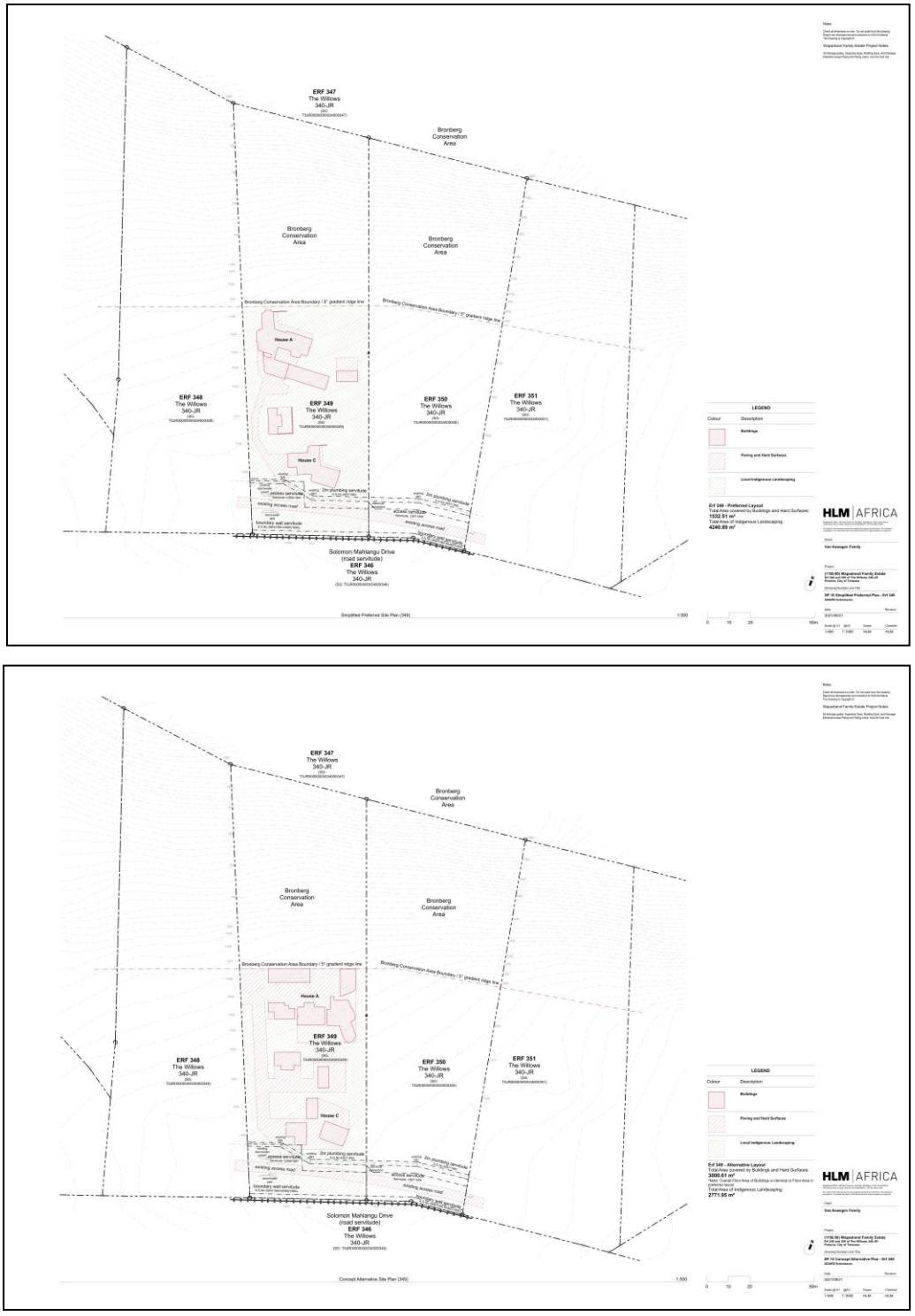


Figure 1.1: The proposed two residences on Erf 349, Preferred Lay-Out (top) and Alternative Lay-Out (bottom).

The Preferred Lay-Out development plan for Erven 349 and 350 is summarised in Figure 1.2 below.

Figure 1.2 The Preferred Lay-Out development plan for Erven 349 and 350.

In response to enquiries by a representative of the Wapadrand Country Estates, the Department of Environment and Agriculture Management of the City of Tshwane indicated that in terms of the Tshwane Open Space Framework the property is affected by the presence of:

- The Bronberg Ridge
- Protected Area
- Irreplaceable, Important and High Ecological Sensitivity :

In terms of the Environmental Impact Management Requirements the property is affected by the following ecologically sensitive areas:

- **GDARD C-Plan**: Critical Biodiversity Area namely an Irreplaceable area with Red Listed plants, Red Listed mammal habitat and Primary vegetation
- **Bioregional Plan for the City of Tshwane**: Critical Biodiversity Area 1, Irreplaceable area with Red Listed plants, Red Listed plant habitat, Orange Listed plant habitat, Red Listed mammal habitat and primary vegetation

Due to the above the Department of Environment and Agriculture Management of the City of Tshwane indicated that the following will be needed:

- A fauna and Flora study that *ipse facto* includes an ecological sensitivity assessment of the sensitive primary vegetation and sensitive fauna and flora habitats,

- A Record of Decision (RoD), Exemption and/or Environmental Authorization (EA) from GDARD for the proposed development.

An enquiry by the Environmental Practitioner on specialist studies needed for the site, **GDARD** responded in an e-mail dated 20 May 2021, that the following aspects must be investigated by specialists:

- Plants, with specific reference to *Ceropegia decidua, Eulophia coddii, Holothrix randii*.
- Mammals, with specific reference to *Neamblysomus julianae* (Juliana's golden mole).
- Primary Vegetation.
- Non-Perennial River.
- Ridges (Class 2).
- The absence of wetlands on site should be verified. Should a wetland be located, a wetland specialist study will be required.

A drainage line and associated flood lines were identified on the site, implying that an investigation into the drainage line was needed.

In accordance with the Natural Scientific Professions Act (Act 27 of 2003; and Science and Technology Laws Amendment Act (Act 7 of 2014) only a person registered with the South African Council for Natural Scientific Professions may practice in a consulting capacity. Eco-Agent CC was appointed by Pierre Joubert Landscape Architect and Environmental Planner to assess the vegetation, fauna and flora for the site relevant for this development.

Prof GJ Bredenkamp, Mr JPC van Wyk of and Ms CE Venter of EcoAgent CC undertook an independent and professional assessment of the vegetation, flora, fauna and wetland (drainage line).

The Terms of Reference for this assignment is interpreted as follows: Compile a study of the vegetation sensitivity, fauna and flora as well as the drainage line on the site, in accordance with all the requirements of relevant authorities, *i.e*. City of Tshwane (CoT) as well as the Gauteng Department of Agriculture and Rural Development (GDARD).

In the light of the above. the following had to be done:

1.1. Initial preparations:

- Obtain all relevant maps and information on the natural environment of the concerned area. **These include**:
- Information on **Red Data** listed plant species and other plant species of conservation concern that may occur in the area.
- Results of the **National Environmental Screening Tool** with relevance to biodiversity, plant species and animal species, and where relevant of aquatic systems.
- Information (maps) with regard to **Critical Biodiversity Areas and Ecological Support Areas, Conservation Areas, Protected Areas, ridge and hydrology**

(wetlands), and any other environmentally / ecologically sensitive areas in relation to the study site.

- Delimit the various **plant communities** that can be recognised on aerial photographs / Google Earth images of the site.

1.2. Vegetation and habitat survey:

- List the plant species (trees, shrubs, grasses and herbaceous species) present for plant community (ecosystem delimitation) and vegetation status assessment.
- Identify from this list any red data plant species, protected plant species, alien plant species, and medicinal plants that occur or may potentially occur on the study areas.

1.3. Plant community delimitation and description

- Process data (vegetation and habitat classification) to identify the plant communities that are present on the site, on an ecological basis.
- Prepare a vegetation map of the area.
- Describe the vegetation and habitat of each mapping unit.
- Determine the sensitivity of each mapping unit in terms of biodiversity and presence of rare or protected plant species, alien and weedy species.
- Determine the ecological status of each plant community in terms of primary, secondary, disturbed, degraded, transformed vegetation.
- Prepare a Site Sensitivity Verification Statement as required by Government Notice 648 (2019) and Government Notice 655 (2020),

1.4. Fauna survey

- List fauna species present on the site.
- List fauna species that may occur on the site.
- List Red data fauna species that occur or may possibly occur on the site.
- Put special emphasis on the presence of Juliana's Golden Mole

1.5. Wetland survey

- Verification of the presence or absence of a watercourses on site, and if present do a wetland analysis as prescribed by the authorities
- Development recommendations regarding the watercourses.

1.6. Notes on the Ridge

This report resulted from a site visit by the EcoAgent team on 10-11 March 2021 and 29 March 2021 to assess the vegetation, flora, fauna, ridge and drainage line (wetlands).

2. RATIONALE AND SCOPE

2.1 Rationale

It is widely recognised that to conserve natural resources it is of the utmost importance to maintain ecological processes and life support systems for plants, animals and humans. To ensure that sustainable development takes place, it is therefore important that possible impacts on the environment are considered before relevant authorities approve any

development. This led to legislation protecting the natural environment. In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. In South Africa, the Environmental Conservation Act (Act 73 of 1989), the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998) and the National Environmental Management Biodiversity Act, 2004 (Act 10 0f 2004) ensure the protection of ecological processes, natural systems and natural beauty, as well as the preservation of biotic diversity within the natural environment. They also ensure the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes, products or activities. In support of these Acts, a draft list of Threatened Ecosystems was published (Government Gazette 2009), as part of the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004), and these Threatened Ecosystems are described by SANBI & DEAT (2009) and a list of Threatened or Protected Species (TOPS) regulations is also available (NEMBA Notice 388 of 2013). International and national Red Data lists have also been produced for various plant and animal taxa.

All components of the ecosystems (physical environment, vegetation, animals) at a site are interrelated and interdependent. **A holistic approach is therefore imperative** to effectively include the development, utilisation and, where necessary, conservation of the given natural resources into an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001).

It is therefore necessary to make a thorough inventory of the plant communities, flora, fauna and wetlands on the site, to evaluate the plant diversity and possible presence of plant and fauna species of conservation concern, red listed plant and fauna species and protected plant and fauna species, alien species, invader species and weedy species. From the results of this evaluation the **sensitivity** of the vegetation and the conservation value can be determined.

2.2 Legal Framework

Authoritative legislation that lists impacts and activities on biodiversity and wetlands and riparian areas that requires authorisation includes *inter alia*:

- National Environmental Management Act, 1998 (Act No. 107 of 1998)(including all later amendments and additions);
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)(including all later amendments and additions);
- The older Environment Conservation Act, 1989 (Act 73 of 1989);
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983);
- National Water Act, 1998 (Act 36 of 1998);
- National Forests Act, 1998 (Act 84 of 1998);
- National Environmental Management: Protected Areas Act 2003 (Act 57 Of 2003) (as Amendment Act 31 of 2004 and Amendment Act 15 of 2009)
- Government Notice Regulation 1182 and 1183 of 5 September 1997, as amended (ECA);

- Government Notice Regulation 385, 386 and 387 of 21 April 2006 (NEMA);
- Government Notice Regulation 392, 393, 394 and 396 of 4 May 2007 (NEMA);
- Government Notice Regulation 398 of 24 March 2004 (NEMA);
- Government Notice Regulation 544, 545 and 546 of 18 June 2010 (NEMA)
- Government Notice Regulation 982, 983, 984 and 985 of 4 December 2014 (NEMA).
- Government Gazette 34809 Threatened Terrestrial Ecosystems of South Africa 9 December 2011 NEMBA)
- Government Notice 655 Government Gazette 42946, 10 January 2020 (Plants and Animals)(NEMA).
- Government Notice 648 Government Gazette 45421, 10 May 2019 (Biodiversity)(NEMA).

Specifically, in terms of wetlands / rivers / watercourses the following legislation applies:

- Wetlands and other watercourses are protected water resources in the National Water Act (NWA), Act 36 of 1998.
- Development or transformation of a watercourse is regarded as a water use, which can only be allowed through an approved Water Use License, irrespective of the condition of the affected watercourse.
- The NWA defines water use in a watercourse specifically related to wetlands and riparian areas as broad impacts that include the following:
- impeding or diverting the flow of water in a watercourse (Section 21 c); and
- altering the bed, banks, course or characteristics of a watercourse (Section 21 i);
- A recent DWA stipulation published in Government Gazette No 32805 on 18 December 2009 also require that a Water Use License should be applied for when any wetlands are present within a 500 m radius of water use activities as defined by section 21 (c) and section 21 (i) of the NWA. A Risk Matrix should by compiled for any development within 500 m of a wetland
- Risk assessment for developments that are located within 500 m of the edge of a wetland, in accordance with DWA Notice 509 of 2016 - general authorisation in terms of section 39 of the National Water Act, 1998 (act no. 36 of 1998) for water uses as defined in section 21(c) or section 21(i)]
- Wetlands are also protected in other environmental legislation, such as the National Environmental Management Act (NEMA), Act 107 of 1998. The act lists several activities that require authorisation before they can be implemented.
- NEMA lists various activities that require authorisation, when the activity is located within 32 m or less from the edge of a wetland or other watercourse.

2.3 The Scope and objectives

The Scope of this study is therefore:

- To identify describe and map the vegetation (ecosystems) that occur on the site;
- To assess the ecological sensitivity of these ecosystems and comment on ecologically sensitive areas, in terms of their plant diversity and where needed ecosystem function;

- To provide a list of plant species that do occur on site and that may be affected by the development;
- To identify fauna and flora species of conservation concern that may occur on the site;
- Compile a list of fauna that occur on the site or may from time to time occur on the site;
- Put special emphasis on the occurrence of Juliana's Golden Mole and suggest management options to conserve the golden mole population.
- Confirm or dispute the environmental sensitivity as identified by the National web-based environmental screening tool;
- To confirm the presence/absence of wetlands/watercourses on the site;
- If relevant, provide management recommendations that might mitigate negative and enhance positive impacts, should the proposed development be approved.

2.4 Limitations

A limitation was the limited access to the very dense mountain bushveld, with high density of the alien invasive *Lantana camara*, forming almost impenetrable bush. Although many plant species, particularly tree and shrub species, could be listed in this vegetation, it is realised that more species could be present. This is regarded as not of much concern as this vegetation is protected in the Bronberg Conservation Area, and no development can occur here. The very dense vegetation limited the survey of the possible presence of Juliana's Golden Mole, though adequate signs of presence could be detected.

3. STUDY SITE

3.1 Location and the receiving environment

Erf 349 is part of the five Erven (Erven 348-352) that constitute the Wapadrand Country Estates (Figure 3.1 below).

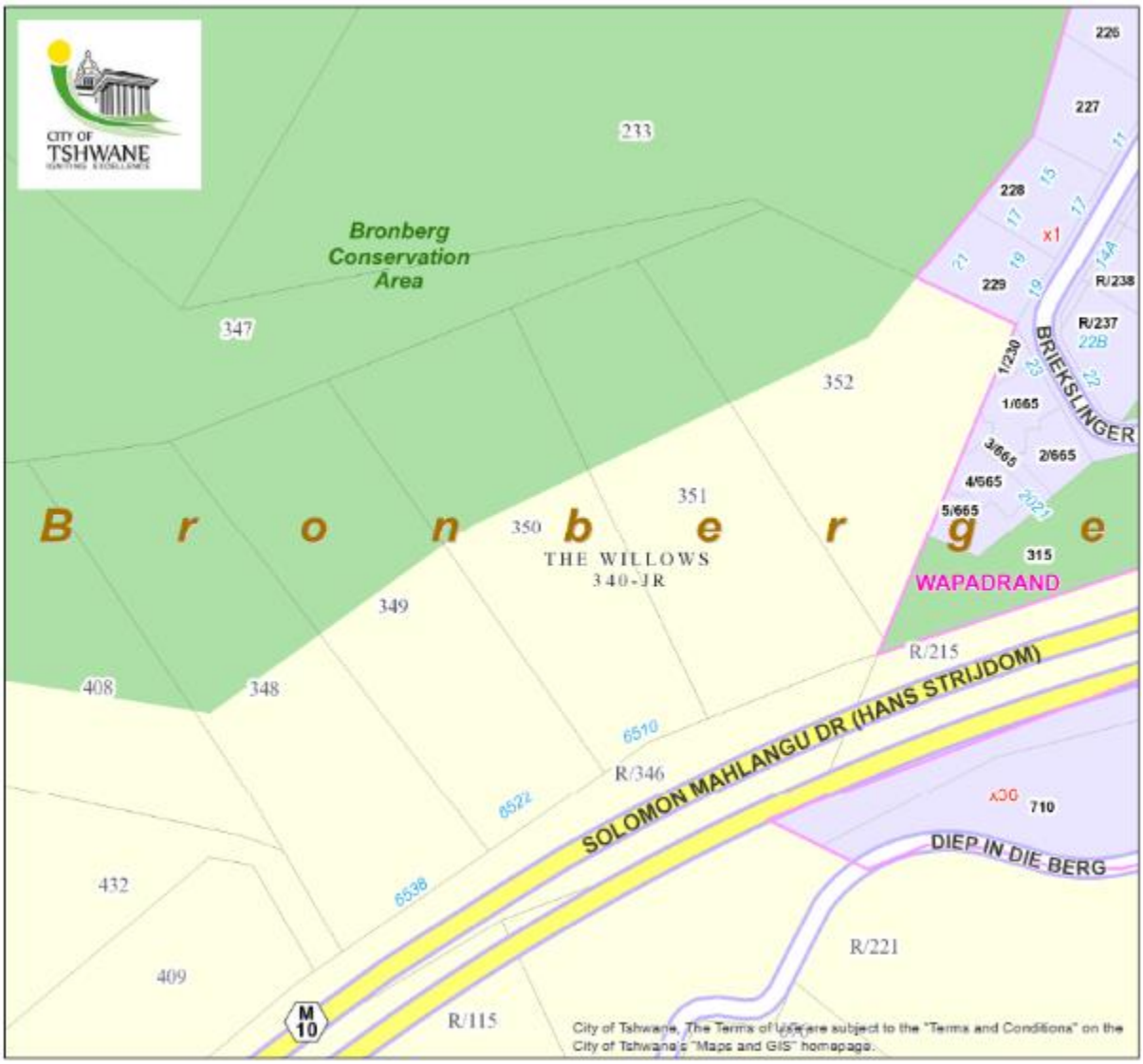


Figure 3.1: The Wapadrand Country Estates on the five Erven 348-352 The Willows 340 JR. The Erven are located on the northern side of Solomon Mahlangu Drive (M10) about 900 m west of the Lynwood Road intersection.

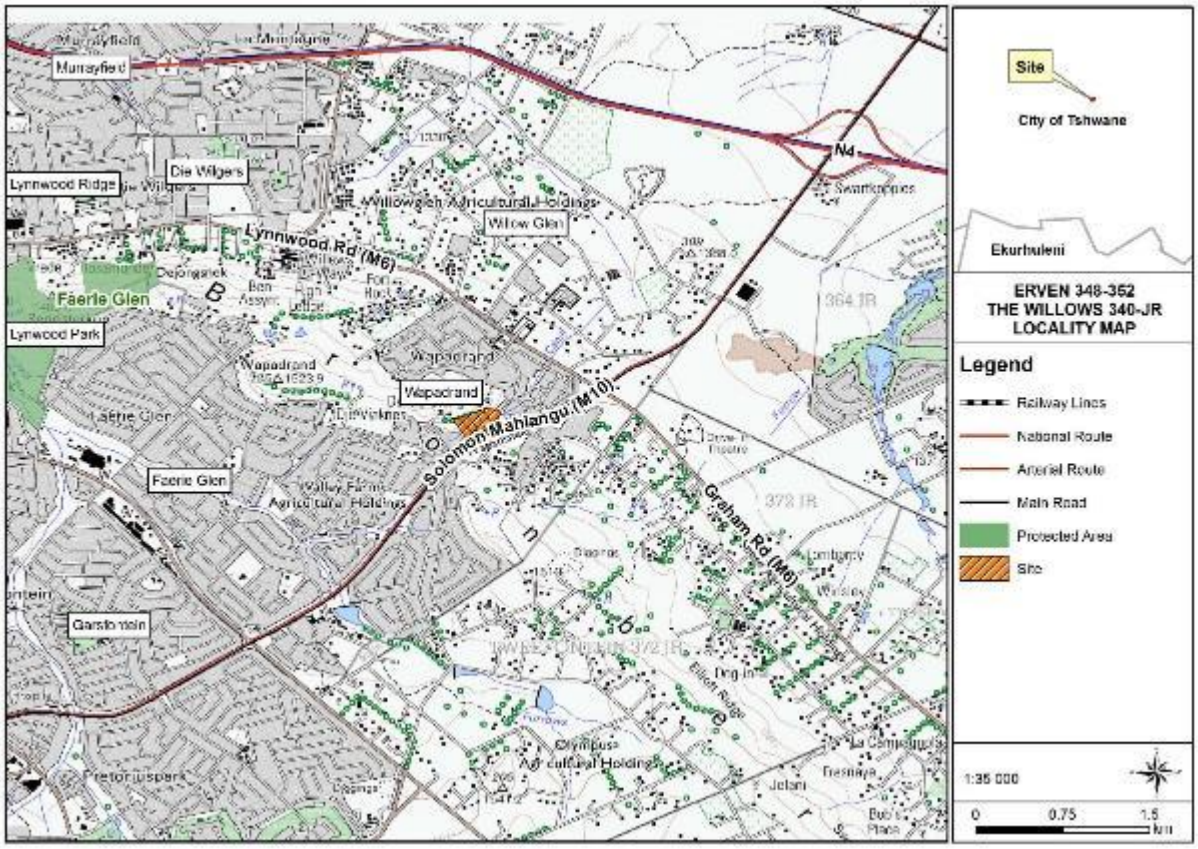


Figure 3.2: The locality of the Wapadrand Country Estates.

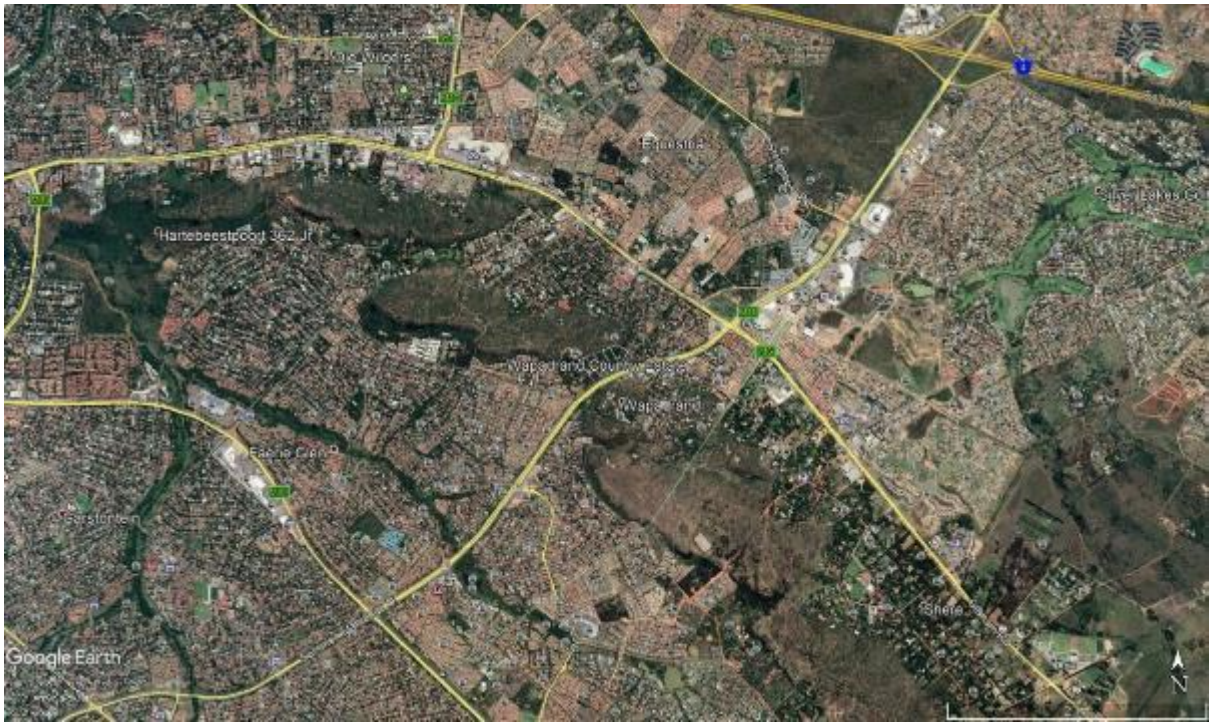


Figure 3.3: The locality of the Wapadrand Country Estates in relation to roads and adjacent developments and ridges.

3.2 Geology and Soil

Andesite of the Pretoria Group, Transvaal Supergroup Karoo Supergroup volcanic rocks are dominant in the Bronberg aera and also on the Wapadrand Country Estates site. Locally shales and quartzites of the Vaalian Pretoria Group may be in the wider Bronberg area. Weathering of the rocky andesite hills gives rise to shallow loam to clayey soils, mainly Mispah and Glenrosa soil forms, though on the plains are deeper, red clay-loam soils present.

3.3 Regional Climate

Seasonal summer rainfall with dry winters and with a mean annual precipitation of about 700 mm. Summers are warm while winters are mild, Front may occur rather frequently on the plains, but less so on the hills.

3.4 Topography and Drainage

The site includes steep south to south-east facing slopes of the Bronberg ridge and a plain that slopes gently towards the south-east.

On the 1:50 000 cadastral map (Figure 3.2 above) a drainage line is indicated as a canal. The hydrology map from GDARD shows the drainage line that transects the southern portion of the site (Figure 3.4 below). The flood lines are also indicated in Figure 3.4.

The only indication of a (former) canal is a small and shallow drainage line present in the extreme south-western corner of the site, coming from the neighbouring Erf 348 and flowing in an easterly direction but soon leaves the site through the southern boundary of Erf 349, towards Solomon Mahlangu Drive. (See paragraph 5.2.5).

Figure 3.4: Left: A drainage line according to the GDARD website.
Right: The flood lines of the drainage line (Supplied by Environment and Agriculture Management Department, City of Tshwane)

3.5 Land-use

Upmarket residential areas replaced the former farms and agricultural holdings. These developments placed pressure on the endangered ecosystems of the Bronberg mountain range with its unique red data flora and fauna species, though the Bronberg Conservation Area and Fairy Glen Nature Reserve offer some protection of the ridge and its biodiversity.

August 2004

September 2007

September 2009

July 2011

May 2015

August 2016

February 2019

November 2020

Figure 3.5: Selected Historical Google Earth images of the site from 2004 to November 2020.

The historical Google Earth images (Figure 3.5 above) provide an indication of what the vegetation cover was and how it changed over the last 17 years:

- By 2004 the central to southern areas of Erven 348 – 350 were already **quite disturbed**, also, but less so, on Erf 351, while the south-eastern part of Erf 352 was already developed.
- In September 2007 and 2009 and even more so in 2011, **considerable disturbance** was evident over the southern halves of **all five** Erven (348-352). The bush along the drainage line in the south-western corner of Erf 348 and also on the rocky outcrop in the southern part of Erf 351 were clearly present. The central part of Erf 348 was cleared and terraces made and irrigated for agricultural purposes.
- From the images of May 2015 to August 2016 a (slight) recovery of woody vegetation on the plains can be seen, probably dominated by **pioneer species** such as *Vachellia karroo* and **alien invasive** species such as *Melia azedarach* and *Lantana camara*, currently still prominent in the area. This invasion of alien species is of particular interest for Erven 350 and 351, as this also involves a heritage site.
- More recently from September 2019 to November 2020 the southern disturbed areas have been covered densely by lush weedy species, particularly *Bidens pilosa*, as observed during the current survey.
- Limited parts of these **disturbed** areas, particularly Erven 349 and 350, have been cleared as can be seen on November 2020 Google Earth image.

The current vegetation is mapped and described in paragraph 5.2. The above historical changes in vegetation is considered to explain its current appearance and condition.

4. METHODS

4.1 VEGETATION AND FLORA

4.1.1 Literature studies and databases:

For background information, the relevant maps, aerial photographs, and other information on the natural environment of the concerned area were obtained though literature studies and data bases. These *inter alia* include:

- The relevant **vegetation types** in which the site is located using Mucina & Rutherford (2006, 2012).
- **Threatened ecosystems** are identified using Mucina & Rutherford (2006, 2012) SANBI & DEAT (2009) and NEMA Government Gazette 34809 (2011).
- Information (maps) about **Critical Biodiversity Areas and Ecological Support Areas,** and any other environmentally / ecologically sensitive areas in relation to the study site from the GDARD C-Plan.
- Results of the National Environmental Screening Tool with relevance to biodiversity, plant species and animal species, and where relevant of aquatic systems. (Government Notice 655 Government Gazette 42946, 10 January 2020 [Plants and Animals)(NEMA) and Government Notice 648 Government Gazette 45421, 10 May 2019 (Biodiversity)(NEMA)].
- **Species of Conservation Concern**, including:
    - Information on **Red and Orange Data** listed plant species data from. SANBI and GDARD data bases.
    - Critically Endangered, Endangered, Vulnerable and Protected Species (**NEMBA species, TOPS species**) are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007 (National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)).
    - **Nationally Protected Trees** as published in Government Notice No. 29062 3 (2006) (National Forests Act, 1998 (Act No. 84 0f 1998), as Amended (Department of Water Affairs Notice No 897, 2006).and that may occur in the area.
    - Other plant species of conservation concern, particularly **provincially protected species.**

4.1.2. Field studies: Vegetation and Flora surveys.

4.1.2.1 Vegetation and flora survey.

Prof GJ Bredenkamp and Mr JPC van Wyk of EcoAgent undertook the field survey on 10-11 March 2021 and on 29 March 2021. On 29 March Ms CE Venter of Kyllinga Consulting

undertook an investigation into the presence/absence of a drainage line on the southern boundary of Erven 348 and 349.

A Google Earth image was used to stratify and map different units representing differences in cover and vegetation. At several sampling plots and transects within each mapping unit a description of the dominant and characteristic plant species found was made. These descriptions were based on **total floristic** composition, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). Data recorded resulted in a list of the plant species present, including trees, shrubs, grasses and forbs. A comprehensive species list was therefore derived for the site, but it is realised that some species could have been missed. These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina *et al*. 2000, Brown *et al.* 2013) and are considered an efficient method of describing vegetation and capturing species information. Within each mapping unit noted were made of relevant habitat features, with emphasis on topography and some soil properties Additional notes were made of any other features that might have had an ecological influence, e.g. previous utilization and disturbance.

The identified units are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for plant species of conservation concern and in terms of the status of the vegetation.

4.1.2.2 Plant Species Status

Plant species recorded in each plant community with an indication of the status of the species by using the following symbols:
A Followed by Invasive category (1a, 1b, 2, 3) = Alien woody species
D = Dominant
d = subdominant
EG = Exotic Garden ornamental or Garden Escape
G = Indigenous Garden ornamental or Garden Escape
M= Medicinal plant species
N = Exotic, naturalized
P = Protected trees species
NP = nationally protected species (NEMBA)
p = provincially protected species
RD = Species of Conservation Concern, Red data listed plant
W = weed.

4.1.2.3 Species Richness

Species Richness is interpreted as follows: Number of indigenous species recorded in the sample plots representing the plant community. Alien woody species and weeds are not included (Table 4.1).

Table 4.1: Categories of plant species richness.

No of species	Category
1-24	Low
25-39	Medium
40-59	High
60+	Very High

4.1.2 4 Vegetation Status

The following criteria indicate vegetation status:

Primary vegetation is the original indigenous vegetation that occurred in the area, in this case the Andesite Mountain Bushveld. The vegetation is relatively undisturbed, or slightly disturbed, though the vegetation still consists of the original dominant, sub-dominant and associated plant species.

Disturbed primary vegetation is where the original indigenous vegetation that occurred in the area is disturbed but can still be identified by the original dominant, sub-dominant and most associated plant species. Some of the species that were present may have disappeared, however, some other species (species of lower successional status or weedy species) increased in abundance or invaded into the original vegetation. Disturbed primary vegetation may recover when well- managed.

Degraded vegetation is where the original indigenous vegetation is so severely disturbed by impacts (mostly man-induced) that the original dominant, sub-dominant and most associated plant species and vegetation structure are changed. Some of the originally occurring species are still sparsely present, but they are mostly replaced by other species of lower successional status, alien invasive species or weedy species. Degraded vegetation may not recover without active application of rehabilitation measures.

Transformed vegetation is where the original indigenous vegetation was destroyed with no or very little of the original plant species still remaining, e.g. cleared for development (construction, tilled for agriculture (e.g. maize), silviculture (e.g. pines), total cover by alien invasive plant species (e.g. black wattle), planted pasture (e.g. *Eragrostis*), sports fields (e.g. kikuyu grass). Recovery to the **original indigenous vegetation is almost impossible** though by active application of rehabilitation measures a vegetation cover (not representing the original indigenous vegetation!) can be established.

Secondary (indigenous) vegetation is where the original indigenous vegetation was destroyed but the transformed area was left unused and fallow. Vegetation, different from the original indigenous vegetation, can become (naturally) established and develop through successional processes to a specific plant community with a specific plant species composition and with good cover, hence secondary vegetation may fall within the definition of indigenous vegetation as provided for in NEMA. A good example is where species rich *Themeda triandra*-dominated indigenous grassland was transformed for agriculture, (e.g. maize production) and then left fallow. Through successional phases secondary *Hyparrhenia hirta* – dominated grassland can become established. By applying specific rehabilitation and management procedures, the development of secondary vegetation can be enhanced.

4.2 FAUNA

Three site visits were conducted on 10,11 & 29 March 2021. These days were warm, with clear skies and a light wind. During these visits, the observed and derived presence of mammals, birds, reptiles and amphibians associated with the recognised habitat types of the study site was recorded. This study paid special attention to the possible presence of Juliana's golden mole, which occurs on and in the vicinity of the site. Juliana's golden mole has the status of a Critically Endangered Mammal Species. This was done with due regard to the well-recorded global distributions of Southern African vertebrates, coupled with the qualitative and quantitative nature of recognised habitats.

The 500 meters of adjoining properties were scanned for possible additional fauna habitats.

4.2.1 Field Surveys

During the site visit, mammals, birds, reptiles and frogs were identified by visual sightings through random transect walks. No trapping or mist netting was conducted as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites, birds by their calls, old nests, moulted feathers, spoor, droppings and food remains, and frogs by their calls.

4.2.2 Desktop Surveys

As many mammals and herpetofauna are either secretive, nocturnal, hibernators and/or seasonal, and some birds are seasonal migrators, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of such species based on authoritative tomes, scientific literature, field guides, atlases and data bases. This can be done with a high level of confidence irrespective of season.

The probability of the occurrence of mammal, reptile and amphibian species was based on their respective geographical distributional ranges and the suitability of on-site habitats:
High probability would be applicable to a species with a distributional 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 to the area, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal and herpetofaunal species with its distributional range peripherally overlapping the study site, or its 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 are taken into consideration. Species categorised as *medium* normally do not occur at high population numbers - but cannot be deemed as rare.

Low probability of occurrence would imply that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals, reptiles and amphibians categorised as low are generally deemed to be rare.

Mammals

Based on the impressions gathered during the site visit, as well as publications such as The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005), Smithers' Mammals of Southern Africa; A Field Guide (Apps, 2012) and Stuarts' Field Guide to Mammals of Southern Africa (Stuart & Stuart, 2015), a list of species which may occur on the site was compiled. The latest taxonomic nomenclature was used. The vegetation type was defined according to the standard handbook by Mucina and Rutherford (eds) (2006).

Birds

A list of bird species expected to occur on site was derived initially from the quarter-degree grid records presented in an atlas of southern African birds (Harrison *et al*. 1997). Based on an assessment of the habitats present at the site, as well as publications such as Birds of the Transvaal, (Tarboton, Kemp & Kemp, 1987), The Atlas of Southern African Birds. Vol. 1 & 2. (Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown (eds.). 1997), Roberts – Birds of Southern Africa, VIIth ed. (Hockey, Dean, & Ryan, (eds) 2005), The Chamberlain Guide to Birding Gauteng (Marais & Peacock 2008), Sasol Birds of Southern Africa. 4th ed. (Sinclair, Hockey, Tarboton & Ryan, 2011), The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Taylor, Peacock & Wannless, 2015) &.www.sabap2.org.za, the list was then reduced to those species that were judged as 'possible' or 'likely' to occur within those habitats as residents or regular visitors. Due to the considerable aerial mobility of birds, a number of additional species might be expected as infrequent nomads or vagrants, but these were not included on the list. It was judged that the habitats available would offer no significant material support or conservation assistance to these species, and that if they did occur, it would be temporarily and in insignificant numbers. **'Possible'** refers to species that might use their mobility to make intermittent use of the habitats available when they are in a particular condition (during or after rain, flood, drought, burning, grazing, seeding, flowering) or season (regional, intra-African or inter-continental migrants). **'Likely'** refers to species that are expected to make regular use of the site for feeding, roosting and/or breeding. Species actually recorded on site during the field survey are expected to fall into the latter category unless annotated otherwise.

No objective assessment was made of the carrying capacity of the habitat for any species, since this varies through time and birds are capable of arriving or departing as conditions change. Special attention was paid to species considered as threatened internationally or nationally (Taylor *et al.* 2015), and to those considered as species of conservation priority within Gauteng (GDARD 2014a & b). The category assigned to these species was raised to include infrequent visitors as 'likely', based on the precautionary principle. Further details of the extent and limits of various habitat types detected during the field survey and on adjacent properties were also obtained by study of satellite images from Google Earth.

Herpetofauna

A list of herpetofauna (reptile and amphibian) species that may occur on the site was compiled, based on the impressions gathered during the site visit, as well as publications such as FitzSimons' Snakes of Southern Africa (Broadley, 1990), Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998), A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007), Atlas and Red List of the Reptiles of South Africa, Lesotho and

Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014), Amphibians of Central and Southern Africa (Channing 2001), Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter, Burger, Harrison, Braack, Bishop & Kloepfer, 2004, 2004) and A Complete Guide to the Frogs of Southern Africa (Du Preez & Carruthers, 2009). The latest taxonomic nomenclature was used. The vegetation type was defined according to the standard handbook by Mucina and Rutherford (eds) (2006).

4.2.3 Specific Requirements

Mammals: During the visit, the site was surveyed and assessed for the potential occurrence of Red Data species in the Gauteng Province such as African marsh rat (*Dasymys incomtus*); white-tailed rat (*Mystromys albicaudatus*); shrews such as the swamp musk shrew (*Crocidura mariquensis*); Southern African hedgehog *(Atelerix frontalis*); a number of bats such as the Short-eared trident bat (*Cloeotis percivali*); Blasius's or peak-saddle horseshoe bat (*Rhinolophus blasii*); African clawless otter (*Aonyx capensis*); spotted-necked otter (*Lutra maculicollis*); ground pangolin (*Mantis temminckii*) African striped weasel (*Poecilogale albinucha*); tsessebe (*Damaliscus lunatus*); roan (*Hippotragus equinus*); sable (*Hippotragus niger);* mountain reedbuck (*Redunca fulvorufula*); grey rhebok (*Pelea capreolus*); white rhino (*Ceratotherium simum*), black rhino (*Diceros bicornis*) serval (*Leptailurus serval*), black-footed cat (*Felis nigripes*); leopard (*Panthera pardus*); cheetah (*Acinonyx jubatus*); African wild dog (*Lycaon pictus*) spotted hyena (*Crocuta crocuta*) and brown hyena (*Parahyaena brunnea*).

This study has placed special emphasis on the Juliana's golden mole (*Neamblysomus julianae*), whose restricted distribution range includes the study site, and has the status of a Critically Endangered mammal species.

Birds: To identify Red Data species likely to occur on the site and to express an opinion regarding their probable occurrence, based on specific habitat requirements and guided by the existing lists compiled for such species within the relevant quarter-degree grid and pentad cells by regional and national bird atlases (Tarboton *et al*. 1987; Harrison *et al*. 1997; www.sabap2.org.za) the most recent assessment of the threatened status of South Africa's avifauna, The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor, Peacock & Wanless, 2015), was used.

Herpetofauna: During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data species in Gauteng (Alexander and Marais, 2007; Minter, *et al*, 2004, Du Preez & Carruthers, 2017 and Hofmeyr, M.D. & Boycott, R.C. 2018), such as: Giant Bullfrogs (*Pyxicephalus adspersus*); Lobatse Hinged Tortoise (*Kinixys lobatsiana*); Striped Harlequin Snake (*Homoroselaps dorsalis*); Coppery Grass Lizard (*Chamaesaura aenea*); Nile crocodile (*Crocodylus niloticus*) and Southern African Python (*Python natalensis*).

4.3 WETLANDS

4.3.1 Wetland Delineation

Aerial photographs of the site were investigated prior to the site visit. The site visit took place on 29 March 2021. All the wetland areas on site and within 500m of the site were delineated based on the aerial photographs.

Verification of the presence or absence of wetland on site took place by checking for wetland indicators as per to the Department of Water Affairs (DWA) wetland delineation guideline (DWAF 2005). Several wetland indicators are used to delineate the wetland area. The wetland indicators used are the:

- Vegetation indicator;
- Terrain unit indicator;
- Soil wetness indicator.

In addition to the field verification, historical aerial photographs of the site were used to determine if a wetland area was present in the area prior to the residential development of the area. An aerial photograph from 1964 was used during the assessment.

4.3.2 Risk Assessment

A Risk Assessment was conducted for the wetland units on site only. The Risk Assessment took the consequence and likelihood of the impact into consideration to determine the risk. The risk assessment took place according to the DWS protocol (2014b). The risk assessment is completed as per Notice of 509 of 2016 under the Department of Water and Sanitation with regards to General Authorisations for Section 21 (c) and (i) water uses. Scores were allocated as follows:

Consequence:

Consequence = Severity + Spatial scale + duration

Severity:

- Insignificant / non-harmful: 1
- Small / potentially harmful: 2
- Significant / slightly harmful: 3
- Great / harmful: 4
- Disastrous / extremely harmful and/or wetland involved: 5

Spatial scale:

- Area specific: 1
- Whole site: 2
- Regional / neighbouring areas: 3
- National: 4
- Global: 5

Duration:

- One day a month, PES, EIS and REC not impacted: 1
- One month to a year, PES, EIS and REC impacted but no change in status: 2
- One to 10 years, PES, EIS and REC impacted to a lower status but can be improved over this period through mitigation: 3
- Life of the activity, PES, EIS and REC permanently lowered: 4
- More than life of the organisation / facility, PES and EIS scores a E or F: 5

Likelihood:

Likelihood = Frequency of the activity + Frequency of impact + Legal issues + Detection

Frequency of the incident / impact:

- Almost never / almost impossible / >20%: 1
- Very seldom / highly unlikely / >40%: 2
- Infrequent / unlikely / seldom / >60%: 3
- Often / regularly / likely / possible / >80%: 4
- Daily / highly likely / definitely / >100%: 5

Legal issues:

- No legislation: 1
- Fully covered by legislation: 2

Detection:

- Immediately: 1
- Without much effort: 2
- Need some effort: 3
- Remote and difficult to observe: 4
- Covered: 5

Frequency of the activity:

- Annually or less: 1
- 6 Monthly: 2
- Monthly: 3
- Weekly: 4
- Daily: 5

RISK:

The significance of each potential impact was calculated as follows: Risk = Consequence x Likelihood. The significance rating classes should influence the development project as described below (Table 1.2).

Table 1.2: Significance rating categories showing values for Low, Medium and High significance

Significance	Rating
Low Environmental Significance	0 - 55
Medium Environmental Significance	56 – 169
High Environmental Significance	170 -300

4.4 IMPACT ASSESSMENT

The methods and format of the impact tables used in this chapter are in accordance with the requirements of the 2014 EIA Regulations.

The Impact Assessment is based on the following **criteria**:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **probability (P)** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **duration (D)**, wherein it will be indicated whether:
    - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
    - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
    - medium-term (5–15 years) – assigned a score of 3;
    - long term (> 15 years) - assigned a score of 4; or
    - permanent - assigned a score of 5;
- The **extent (E)**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **magnitude (M)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the

extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

- The **significance (S)**, which shall be determined through a synthesis of the characteristics described above.

  The significance rating is calculated by the following formula:

  S (significance) = (D + E + M) x (P)

- The **status**, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The *degree* to which the impact can be *mitigated.*

The numerical value of the calculation is assigned to a significance category.

Table 6.1: Significance ranking of impacts

SIGNIFICANCE	**Very High**	**High**	**Moderate**	**Low**	**Minor**
	80-100	**60-79**	**40-59**	**20-39**	**1-19**

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

5. RESULTS VEGETATION AND FLORA

5.1 RESULTS OF THE LITERATURE STUDY AND DATABASE SURVEY

5.1.1 Vegetation Type

The site is situated within the Andesite Mountain Bushveld (SVcb11) vegetation type (Mucina & Rutherford 2012) (Figure 5.1 below).

Figure 5.1: All five Erven 348-352 of the Wapadrand Country Estates are located within the Andesite Mountain Bushveld (Mucina & Rutherford 2006).

5.1.2 Threatened Ecosystems

According to Mucina & Rutherford (2012) Andesite Mountain Bushveld as a whole is **Least Concern**, as about 9% is conserved in large nature reserves such as the Suikerbosrand Nature Reserve, while only about 15% is transformed by agriculture or urban development.

However, SANBI and DEAT (2009) and NEMBA, Government Notice 1002 (2011) indicate that the Bronberg Mountain Bushveld is **Critically Endangered** and therefore enjoys legal protection.

5.1.3 Critical Biodiversity Areas and Ecological Support Areas

In terms of the GDARD (2014) C-Plan 3.3 all Five Erven 348-352 of the Wapadrand Country Estates are located in the Irreplaceable Area (Figure 5.2 below). This is mainly because of the presence of or suitable habitat for the Juliana's Golden Mole. This implies that an Environmental Impact Assessment would need to be conducted [i.e. either a scoping and environmental impact reporting process or a Basic Assessment process]. in order to supply

adequate information to the relevant authorities to make an informed decision about authorising the proposed development.

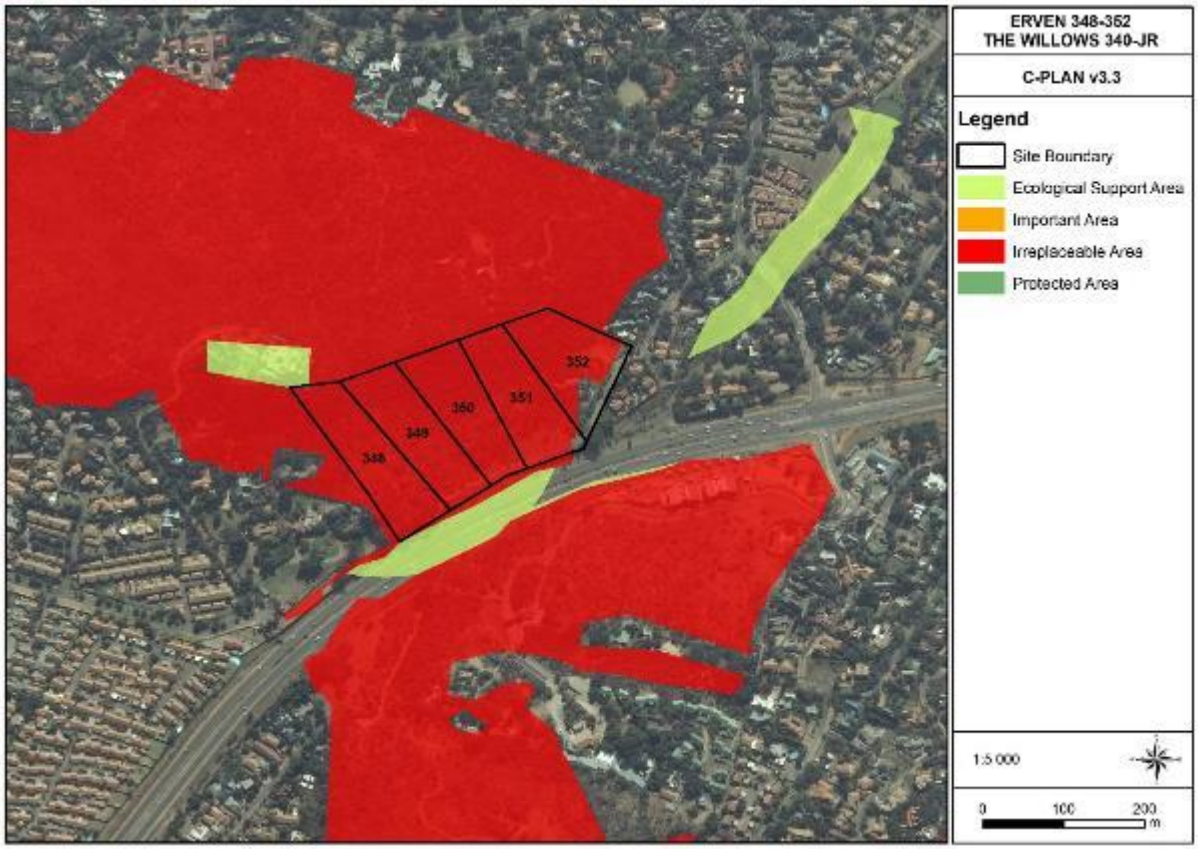


Figure 5.2: Erven 348-352 Wapadrand Country Estates are located on “Irreplaceable” Critical Biodiversity Areas.

5.1.4 Protected and Conservation Areas

The protected Fairy Glen Nature Reserve is located 3.5 km (as the bird lies) west of the Wapadrand Country Estates (Figure 3.2 above). The northern half of the Estate is located within the Bronberg Conservation Area (Figure 3.1 above).

5.1.5 Species of Conservation Concern (CCS), Red Listed plant species

Red Data listed plant species and Orange listed plant species (= plant species of conservation concern) are those plants that are important for South Africa’s conservation decision making processes. These plants are nationally protected by the National Environmental Management: Biodiversity Act (Raimondo *et al*, 2009).

Threatened species (Red Data listed species) are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species.

Additionally, the Orange listed categories are Near Threatened (NT), Data Deficient (DD), (DDT = lack of taxonomic data), Critically Rare (CR), Rare (R) and Declining (D). This is in

accordance with the new Red List for South African Plants (Raimondo *et al*. 2009 upgraded on SANBI website).

Lists of Red Data plant species (Raimondo *et al* 2009) for the Bronberg area were obtained GDARD and SANBI.

GDARD particularly mentioned that the possible presence of *Ceropegia decidua* subspecies *pretoriansis, Eulophia coddii* and *Holothrix randii* must be investigated.

List of Red Data plant species for the Bronberg area.

Family	Species	Status	Habitat on site
Amaryllidaceae	*Boophone disticha* (L.f.) Herb.	Declining	Yes, not found
Hyacinthaceae	*Bowiea volubilis* Harv. ex Hook.f. subsp. *volubilis*	VU	Yes, not found
Orchidaceae	*Brachycorythis conica* (Summerh.) Summerh. subsp. *transvaalensis* Summerh.	EN	Doubtful
Asteraceae	*Callilepis leptophylla* Harv.	Declining	No
Apocynaceae	*Ceropegia decidua* E.A.Bruce subsp. *pretoriensis* R.A.Dyer	VU	Marginally, not found
Amaryllidaceae	*Crinum macowanii* Baker	Declining	No
Gunneraceae	*Gunnera perpensa* L.	Declining	No
Orchidaceae	*Habenaria barbertoni* Kraenzl. & Schltr.	NT	No
Orchidaceae	*Habenaria bicolor* Conrath & Kraenzl.	NT	No
Orchidaceae	*Habenaria kraenzliniana* Schltr.	NT	`Doubtful
Hypoxidaceae	*Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall.	Declining	Yes, not found
Aquifoliaceae	*Ilex mitis* (L.) Radlk. var. mitis	Declining	No
Anacardiaceae	*Searsia gracillima* (Engl.) Moffett var. *gracillima*	NT	No
Apocynaceae	*Stenostelma umbelluliferum* (Schltr.) S.P.Bester & Nicholas	NT	No

There is suitable habitat for *Boophane disticha* and *Hypoxis hemerocallidea* on the plains area of the site, however none of these generally widespread and not rare species were noted, probably due to the fairly disturbed nature of this area. There is also suitable habitat on the hillslope for *Bowiea volubilis*, though due to the very dense vegetation and dominance of the alien invasive *Lantana camara,* access for a more detailed search is not possible. The hillslope habitats on the site are also only marginally suitable for *Ceropegia decidua.* As no development will occur on the hillslope, all plant species that may occur here will be safe and protected. None of the listed species of conservation concern were noted on Erf 349 Wapadrand Country Estates. The current vegetation on the hillslope is primary indigenous mountain bushveld, though it is severely encroached by particularly Category 1b Alien and Invasive plant species *Lantana camara* while some individuals of other Alien Invasive plant species are also present. This invasion of Alien Invasive plant species resulted in loss of habitat for some Red Data plant species. Also, no further suitable habitat was found for *Eulophia coddii* and *Holothrix randii*.

5.1.6 NEMBA / TOPS plant species

These species are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007, Government Gazette 574 of 2013 and Notice 256 of 2015 and National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004).
No NEMBA/TOPS plant species occur on the site

5.1.7 Nationally Protected Trees

The National Forest Act, 1998 (Act No. 84 of 1998) enforces the protection of several indigenous trees. The removal, thinning or relocation of protected trees will require a permit from the Department of Agriculture, Forestry and Fisheries (DAFF) (Notice of the List of Protected Tree Species under the National Forests Act, 1998, Notice 835, Government Gazette 39741, No 19, 29 August 2014).

Individuals of *Pittosporum viridiflorum* (Cheesewood) were found high up on the south-east facing hillslope close to the northern boundary fence. The trees were in good condition. As no development will occur on the hillslope, all plant species that may occur here will be safe and protected.

5.1.8 Provincially Protected Plants

Provincially protected plant species that were found on the hillslope are *Aloe pretoriensis, Scadoxis puniceus* and *Haemanthus humilis* subsp *hirsutus.* As no development will occur on the hillslope, all plant species that may occur here will be safe and protected.

5.1.9 Notes on the Class 2 Ridge

The Bronberg Ridge is classified as a Class 2 Ridge (GDARD 2019 Hills and Ridges Policy). Class 2 ridges include ridges of which more than 5%, but less than 35%, of their surface area has been converted to urban development, quarries and/or alien vegetation. The consolidation of properties on Class 2 ridges is supported.

The western part of the Bronberg Ridge runs east-west up to Solomon Mahlangu Drive, but east of Solomon Mahlangu Drive, the Ridge is orientated northwest-southeast. At Solomon Mahlangu Drive there is a shallow valley or plain between the western and eastern parts of the Ridge. The large double-carriage M10 Main Road (Solomon Mahlangu Drive) transects the ridge area through this plain. The proclaimed Wapadrand Country Estates, consisting of five Erven, is located directly on Solomon Mahlangu Drive (Figures 3.1 and 3.2 above). The adjacent residential areas are well developed (Figure 3.3 above).

Erf 349 stretches from Solomon Mahlangu Drive north-westwards over the plains area and up the south-facing slope to the top of the Bronberg Ridge (Figure 5.3 below). The northern half of the Erf is located within the Bronberg Conservation Area and is excluded from any development. (Figure 3.1 above and Figures 5.3 and 5.4 below). The ecological sensitivity of the three pant communities that were identified and mapped on the mountain slopes is High (Figure 5.4 below), and these areas are excluded from any development. The planned development is restricted to the Historically Disturbed Plains Bushveld below the Bronberg Conservation Area line.

The specialist study of the site included the ecology of the site, including the ridge and the plains, the vegetation, flora, fauna, red data taxa for both flora and fauna (including a management plan for the Juliana's Golden Mole), critical biodiversity areas, screening tool assessment, ecological sensitivity, threatened and protected taxa for both flora and fauna, alien invasive plant species and drainage line and wetlands, risk assessment and impact assessment.

To conclude, the entire ridge area is regarded as ecologically sensitive, protected and excluded from the proposed development. The plains area is, on the contrary, historically disturbed, of much lower ecological sensitivity and is regarded as **suitable** for the proposed development.

5.2 RESULTS OF THE VEGETATION AND FLORA SURVEY

EcoAgent CC was appointed to investigate the biodiversity of all five Erven (Erven 348-352) on the Wapadrand Country Estates property. The vegetation study was based on the vegetation science principle that any plant community has a specific plant species composition that is linked to a specific habitat (set of environmental / ecologic variables) and that this specific plant species composition is by large similar at various plots within the plant community. Of course, some smaller variations do occur but the variation and differences in species composition is much larger between different plant communities, than within a single plant community. Some of the plant communities on the entire Wapadrand Country Estates property occurs on several of the erven, but others are restricted to one or two erven. As the vegetation of all five Erven was surveyed together, it was possible to compile an overview vegetation map and ecological sensitivity map, showing the relationships, similarities and differences in vegetation in the five erven. However, separate vegetation and ecological sensitivity maps were compiled for each of the erven. Due to overlapping distribution of some of the plant communities on different erven, the descriptions, and species composition of these plant communities on different erven are similar, maybe with small variations.

The vegetation of particularly Erven 348, 349 and 350 is remarkably similar. Some plant communities are, however, restricted to one or two Erven (see Figure 8.1 below). Where plant communities occur on more than one Erf, the community description and plant species present for those plant communities are essentially similar.

Six plant communities were identified and mapped (Table 5.1 below):

Table 5.1: List of mapping units with ecological sensitivity and size in hectares:

	Vegetation mapping unit	**Sensitivity result**	**Size (ha)**
1	Mountain Bushveld on South-facing Ridge Crest	High	0,06
2	Mountain Bushveld on Higher Slopes	High	0,20
3	Mountain Bushveld on Lower Slopes	High	0,32
4	Historically Disturbed Plains Bushveld	Medium-Low	0,43
5	Recently Cleared Areas	Low	0,07
6	Drainage Line	Medium-High	0,05

A vegetation map showing the distribution of the mapping units is presented in Figure 5.3 (below) while the ecological sensitivity is given in Figure 5.4 (below).

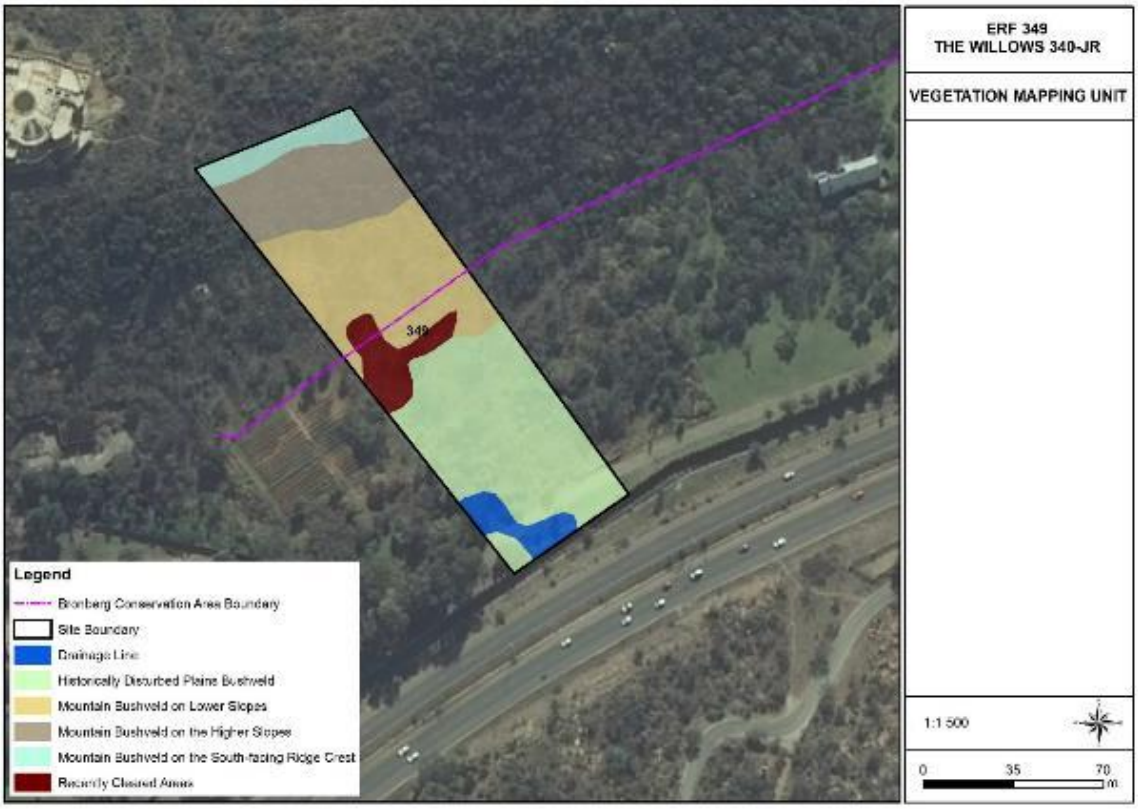


Figure 5.3: A vegetation map of Erf 349.

Figure 5.4: Ecological sensitivity of Erf 349.

5.2.1. Mountain Bushveld on South-facing Ridge Crests

The Mountain Bushveld on South-facing Ridge Crests plant community is restricted to the narrow strip of ridge crest that occurs within the property and stretches up to the northern boundary fence (Figure 5.3 above). The ridge is part of the Critically Endangered Bronberg Mountain Bushveld and is located within the Bronberg Conservation Area (Figure 3.1 above). This area is excluded from any development. The vegetation is dense bush on an area with large rocks and boulders. Indigenous woody species are dominant, though the alien invasive bush *Lantana camara* is present. Conspicuous trees in the ridge crest include *Protea caffra* and *Calodendron capensis.* Grasses and forbs are sparse or even absent. This area is excluded from any development. The following species were noted in this plant community:

Trees, shrubs and woody creepers

Afrocanthium mundianum		*Gymnosporia tenuispina*	
Calodendron capensis	d	*Lantana camara*	A, 1b
Canthium gilfillanii		*Opuntia ficus-indica*	A, 1b
Combretum molle		*Protea caffra*	d
Diospyros lycioides		*Searsia zeyheri*	
Ehretia rigida		*Senegalia caffra*	
Ficus burkei		*Vangueria infausta*	
Grewia occidentalis		*Zanthoxylum capense*	M
Gymnosporia buxifolia			

The following plant species were recorded in the area:

Grasses and sedges

Aristida transvaalensis	*Eragrostis curvula*
Chrysopogon serrulatus	*Melinis nerviglume*
Cymbopogon sp cf *prolixus*	

Forbs

Asparagus transvaalensis	
Cheilanthes hirta	
Clutia pulchella	
Haemanthus humilis ssp *hirsutus*	p
Harrisia martinii	A, 1b
Helichrysum kraussii	
Kalanchoe paniculata	
Pellaea calomelanos	M
Scadoxis puniceus	p, M
Selaginella dregei	
Xerophyta retinervis	M

Table 5.2: Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	15	2	17	0	0	1
Grasses	5	0	5	0	0	0
Forbs	10	1	11	0	2	3
Total	30	3	33	0	2	4

The recorded species richness is medium, but due to the very dense vegetation the survey is considered not detailed. No listed red data species was found, but four protected species were noted

Table 5.3: Mountain Bushveld on South-facing Ridge Crests: Summary			
Status	Primary mountain bushveld, protected in Bronberg Conservation Area. Also a Critical Biodiversity Area.		
Soil	Shallow and rocky soil	**Rockiness**	20-30%
Conservation value:	High	**Ecological sensitivity**	High
Species richness:	Medium	**Need for rehabilitation**	Alien Invasive species control
Dominant spp.	*Protea caffra, Calodendron capensis*		

Discussion

As this area is part of the Bronberg Conservation Area, no development will occur here. The alien invasive species, particularly *Lantana camara* and *Harrisia martinii* (and all other alien invasive plant species) should be controlled.

Figure 5.5: The provincially protected *Haemanthus humilis* subsp *hirsutus* amongst large rocks on the ridge crest.

5.2.2. Mountain Bushveld on Higher Slopes

The Mountain Bushveld on Higher Slopes plant community occurs on the ridge slopes just below the crest (Figure 5.3 above). The entire ridge is part of the Critically Endangered Bronberg Mountain Bushveld and is located within the Bronberg Conservation Area (Figure 3.1 above). The vegetation is extremely dense bush on an area with large rocks and boulders. Many indigenous woody species are present, though the vegetation is severely encroached by the alien invasive bush *Lantana camara,* making access for detailed surveys almost impossible (Figure 5.7 below). The dense *Lantana camara* encroachment caused damage to the indigenous vegetation, several individuals of the protected *Aloe pretoriensis* were killed. Grasses and forbs are sparse or even absent. This area is excluded from any development.

The following species were noted on the Higher Slopes:

Trees, shrubs and woody creepers

Acacia mearnsii	A, 1b	*Ehretia rigida*
Afrocanthium mundianum		*Euclea crispa*
Aloe pretoriensis	p	*Ficus burkei*
Calodendron capensis		*Grewia occidentalis*
Canthium gilfillanii	d	*Gymnosporia buxifolia*
Diospyros lycioides		*Gymnosporia tenuispina*

Lantana camara	D, A, 1b	*Searsia zeyheri*	
Opuntia ficus-indica	A, 1b	*Senegalia caffra*	
Pittosporum viridiflorum	P, M	*Solanum mauritianum*	A, 1b
Rhoicissus tridentata	M	*Vangueria infausta*	
Sarcostemma viminale		*Zanthoxylum capense*	M
Searsia pyroides			

Grasses and sedges

Aristida transvaalensis	*Eragrostis curvula*
Chrysopogon serrulatus	*Melinis nerviglume*
Cymbopogon sp cf *prolixus*	

Forbs

Aloe transvaalensis		*Helichrysum kraussii*	
Asparagus transvaalensis		*Hilliardiella poskeana*	
Bidens pilosa	W	*Kalanchoe paniculata*	
Justicia betonica		*Ledebouria* sp	
Cheilanthes hirta		*Pellaea calomelanos*	M
Clutia pulchella		*Scadoxis puniceus*	p, M
Haemanthus humilis ssp *hirsutus*	p	*Selaginella dregei*	
Harrisia martinii	A, 1b	*Xerophyta retinervis*	M

Table 5.4: Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	19	4	23	0	2	3
Grasses	5	0	5	0	0	0
Forbs	14	2	16	0	2	3
Total	38	6	44	0	4	6

The recorded species richness is medium, but due to the very dense vegetation the survey is considered not detailed. No red data listed species was found, but four protected species were noted.

Table 5.5: Mountain Bushveld on Higher Slopes: Summary			
Status	Primary mountain bushveld, though severely encroached by *Lantana camara,* protected in Bronberg Conservation Area. Also a Critical Biodiversity Area.		
Soil	Shallow and rocky soil	**Rockiness**	5-30%
Conservation value:	High	**Ecological sensitivity**	High
Species richness:	Medium-High	**Need for rehabilitation**	Alien Invasive species control
Dominant spp.	*Lantana camara, Canthium gilfillanii*		

Discussion

As this area is part of the Bronberg Conservation Area, no development will occur here. The alien invasive species, particularly *Lantana camara* and *Harrisia martinii* (Figure 5.6), and all other alien invasive plant species, should be controlled.

Figure 5.6: The alien invasive *Harrisia martinii.*

Figure 5.7: The dense bush of the Mountain Bushveld on Higher Slopes in the background. The dense bush in the foreground is representative of the Mountain Bushveld on Lower Slopes.

5.2.3. Mountain Bushveld on Lower Slopes.

The Mountain Bushveld on Lower Slopes plant community is located lower down the slope, below the Bushveld on the Steep Upper Slopes (Figure 5.3 above). This part of the ridge is still part of the Critically Endangered Bronberg Mountain Bushveld and is located within the Bronberg Conservation Area (Figure 3.1 above). This area is also excluded from any further development. The vegetation is still dense bush (Figure 5.8 below). Indigenous woody species are present, though the vegetation is also encroached by the alien invasive bush *Lantana camara* and several other alien and invasive species (see species list below). Grass-dominated patches occur scattered about. In general the area is regarded as somewhat disturbed.

The following plant species were recorded on the gradual lower slopes area:

Trees, shrubs and woody creepers

Acacia mearnsii	A, 1b	*Melia azedarach*	A, 3
Canthium gilfillanii		*Pinus* sp	A, 2
Cotoneaster frigidus	A, 1b	*Polygala virgata*	G
Diospyros lycioides		*Rhoicissus tridentata*	M
Ehretia rigida		*Searsia pyroides*	
Eucalyptus camaldulensis	A, 2	*Senegalia caffra*	d
Euclea crispa		*Solanum mauritianum*	A, 1b
Grewia occidentalis		*Vachellia karroo*	M
Gymnosporia buxifolia		*Zanthoxylum capense*	M
Lantana camara	D, A, 1b		

Grasses and sedges

Chrysopogon serrulatus	*Eragrostis curvula*
Cymbopogon pospischilii	*Melinis repens*

Forbs

Aloe transvaalensis		*Kalanchoe paniculata*	
Asparagus cooperi		*Pellaea calomelanos*	M
Bidens pilosa	W	*Tagetes minuta*	W
Hilliardiella poskeana			

Table 5.6: Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	12	7	19	0	0	3
Grasses	4	0	4	0	0	0
Forbs	9	2	7	0	0	1
Total	25	9	34	0	0	4

The recorded species richness is medium. No red data listed or protected plant species were recorded.

Table 5.7: Mountain Bushveld on Lower Slope: Summary

Status	Somewhat disturbed mountain bushveld, encroached by *Lantana camara* and other invasive species, protected in Bronberg Conservation Area. Also Critical Biodiversity Area.		
Soil	Shallow and rocky soil	**Rockiness**	5-10%
Conservation value:	High	**Ecological sensitivity**	High
Species richness:	Medium	**Need for rehabilitation**	Alien Invasive species control
Dominant spp.	*Lantana camara*		

Discussion

As this area is part of the Bronberg Conservation Area, no development may occur here. *Lantana camara* and other alien invasive plant species should be controlled.

Figure 5.8: Mountain Bushveld on the Lower Slopes. Photograph from Erf 350.

5.2.4. Historically Disturbed Plains Bushveld

The vegetation on the plain located on the southern part of the site (Figure 5.3 above) was **disturbed and cleared since 2007**. Some indigenous woody species were left and currently still occur scattered over the area (compare Figure 3.5 above). Since 2015 there was an increase in woody vegetation, particularly of **alien species** such as *Lantana camara* and *Melia azedarach*. Little of the original grassy vegetation remained. Weeds, mostly *Bidens*

pilosa (Figure 5.9 below) is now very prominent. Indigenous trees that were left and are still present in this plant community include *Senegalia caffra, Vachellia karroo* and *Celtis africana*. Storage facilities were constructed on the eastern boundary of the site. Recently an area within this Historically Disturbed Plains Bushveld was totally cleared (see paragraph 5.2.5 below) for part of the proposed development.

The following plant species occur on the Disturbed Plains:

Trees and shrubs, woody climbers

Acacia mearnsii	A, 1b	*Lantana camara*	A, 1b
Araujia sericifera	A, 1b	*Melia azedarach*	A, 3
Celtis africana	d	*Sarcostemma viminalis*	
Clematis brachiata		*Searsia pyroides*	
Cussonia paniculata		*Senegalia caffra*	
Diospyros lycioides		*Solanum mauritianum*	A, 1b
Dombeya rotundifolia	M	*Vachellia karroo*	M, d
Eucalyptus camaldulensis	A, 2	*Ziziphus mucronata*	M

Grasses and sedges

Cynodon dactylon	*Panicum maximum*
Melinis repens	*Urochloa mosambicensis*

Forbs

Aloe davyana		*Hilliardiella oligocephala*	M
Asparagus sp		*Solanum incanum*	W
Bidens pilosa	W, D	*Tagetes minuta*	W

Table 5.8: Number of species recorded:

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	10	6	16	0	0	3
Grasses	4	0	4	0	0	0
Forbs	3	3	6	0	0	1
Total	17	9	26	0	0	4

The species richness is low. No red data listed or protected plant species were found.

Table 5.9 Historically Disturbed Plains Bushveld - summary			
Status	Degraded to Transformed		
Soil	Deep loam soil	**Rockiness**	0%
Conservation value:	Low	**Ecological sensitivity**	Medium-Low
Species richness:	Low	**Need for rehabilitation**	Pending proposed development

Dominant spp.	*Bidens pilosa, Celtis africana, Vachellia karroo*

Discussion

The herbaceous layer is dominated by the weed *Bidens pilosa.* A limited part of the area is earmarked for the development of residences and was recently cleared.

Figure 5.9: Disturbed Plains Bushveld.

5.2.5. Recently Cleared Areas on Plains

Vegetation was cleared and some levelling was done on an area within the Historically Disturbed Plains Bushveld area (Figure 5.3 above). Weeds occur in patches on the cleared area (Figure 5.10 below).

This cleared area is 0.07 ha (700 m^2) in size (Table 5.1 above). The cleared area is principally located on an area that was historically quite disturbed, where the ecological sensitivity is Medium-Low. It is suggested that this area can be considered as suitable for development, without damage to the more sensitive mountain bushveld vegetation.

Figure 5.10: Recently Cleared Area on the Historically Disturbed Plains Bushveld.

5.2.6. Drainage Line

This paragraph reports only on the vegetation along the drainage line. For a more detailed account of the drainage line see the Wetland Report in Paragraph 7 below. The hydrology map from GDARD shows a drainage line that transects the southern portion of the site (Figure 3.4 above). On the 1:50 000 cadastral map (Figure 3.2 above) this drainage line is indicated as a canal. The only indication of a (former) canal is a small and shallow drainage line present in the extreme south-western corner of the site. This drainage line comes from the neighbouring Erf 348 through an opening in the boundary wall (Figure 5.11 below). Within 10 m the drainage line crosses the road through an existing culvert (Figure 5.11 below) and then flows in an easterly direction for about 25 m (Figure 5.12 below) before it leaves the site through an opening in the southern boundary wall, towards Solomon Mahlangu Drive (Figure 5.3 above). The rest of the former drainage line (eastwards) is apparently replaced by a sewer pipeline within a 2 m wide sewer servitude, just north of the unnamed paved road. The entire length of the drainage line within the boundaries of Erf 349 is about 25-30 m.

The vegetation along the short drainage line consists of a few indigenous and alien trees, few grasses and weedy herbaceous plant species.

The following plant species occur along the Drainage Line:
Trees and shrubs, woody climbers

Celtis africana		*Ricinus communis*	A, 1b
Diospyros lycioides		*Searsia pyroides*	
Eucalyptus camaldulensis	A, 2	*Senegalia caffra*	
Melia azedarach	A, 3	*Solanum mauritianum*	A, 1b

Grasses and sedges

Panicum maximum		*Pennisetum clandestinum*	A1b
Paspalum dilatatum			

Forbs

Bidens pilosa	W, D	*Solanum panduriforme*	
Ipomoea purpurea	A, 1b		

Table 5.10: Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	4	4	8	0	0	0
Grasses	2	1	3	0	0	0
Forbs	1	2	3	0	0	0
Total	10	9	19	0	0	0

The species richness is low. No listed red data or protected plant species were found in this plant community.

Table 5.11 Drainage Line - summary			
Status	Transformed Drainage Line		
Soil	Deep loam soil	**Rockiness**	0%
Conservation value:	High	**Ecological sensitivity**	Medium-High
Species richness:	Low	**Need for rehabilitation**	Low
Dominant spp.	*Searsia pyroides*		

Discussion

All drainage lines in South Africa are regarded as ecologically sensitive are consequently protected by law (NWA). The proposed development will not affect the drainage line. (See Wetland report Paragraph 7 below).

Figure 5.11: The opening in the boundary wall to Erf 348 and the culvert under the unnamed road.

Figure 5.12: The Drainage Line on Erf 349.

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5.3 ANALYSIS

5.3.1 Alien and Invasive plants species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants be controlled and eradicated by means of an eradication and monitoring program. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

Previously declared weeds and invasive plants were controlled by regulations of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA). Later Alien and Invasive Species Regulations, as well as a new draft list of categories of invasive species in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) was published in the Government Gazette No. 32090, in April 2009. Several amendments followed. Considering Sections 66(1), 67(1) 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act (Act 10 of 2004) the latest Alien and Invasive plant **species list** was published in 2016 (Government Gazette 40166, Notice 864, 29 July 2016) This notice replaces and repeals any Alien and Invasive **species lists** published under the Act, including Notice 599 of 1 August 2014, (Government Gazette 37886) and Notice R507, 508 and 509 of 19 July 2013 (Government Gazette 36683).

Below is a brief explanation of the categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) and described in Regulation Gazette 10244, Vol 590, and No 37885 (1 August 2014):

Category 1a: Invasive species requiring **compulsory** control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. A person in control of a Category 1a Listed Invasive Species must **immediately** take steps to combat or **eradicate** listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and allow an authorised official from the Department to enter onto land to monitor, assist with or implement the combatting or eradication of these listed invasive species. No permits will be issued.

Category 1b: Invasive species require **compulsory** control as part of an invasive species **control program** that will result in **removal and destruction** of all such listed species. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management program. No permits will be issued.

Category 2:
Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a **permit** to carry out a restricted activity within an area specified in the Notice or an area specified in the permit (e.g. a plantation, woodlot, orchard etc.), as the case may be.

Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 Listed Invasive Species without a permit.

A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.

If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3.

Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, according to Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.

In summary: Category 2 Invasive species are regulated within a specific **area**. A **permit** for this specific area is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. A landowner on whose land a Category 2 Listed Invasive Species occurs, or a person in possession of a permit, **must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.**

Category 2 Listed Invasive Species that occur outside the specified area contemplated, must, for purposes of these regulations, be considered as Category 1b listed invasive species and must be managed accordingly.

No permits will be issued for Category 2 species to exist in riparian zones. These are considered as Category 1b listed invasive plants species and must be managed accordingly.

Category 3: Invasive species regulated by activity. Category 3 Listed Invasive Species are species that are subject to **exemptions** in terms of section 71(3) and **prohibitions** in terms of section 71A of Act. This means that a permit to have these species on the particular property is **not required**, though the landowner is still responsible to control this species and is prohibited of growing, breeding or in any other way propagating these listed invasive species, or allow it to multiply and spread. Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any way acquiring or disposing of any specimen of these listed invasive species are also prohibited.

Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered as a Category 1b Listed Invasive Species and must be managed accordingly.

In terms of the amendments to the regulations under the Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983) and Regulation 598, Government Gazette 37885, August 2014) (Alien and Invasive Species Regulations), landowners are legally responsible for the control of alien species on their properties.

It should further be noted that the National Environmental Management: Biodiversity Act (2004), Chapter 5, Part 2, Section 73(2), states that a person who is the owner of land on which a listed invasive species occurs must notify any relevant competent authority in writing of the listed invasive species that occur on that land.

Furthermore, that according to the National Environmental Management: Biodiversity Act (2004), Alien and Invasive species Regulations (2017), Chapter 7, Section 29 (1), (2) and (3), the seller of any immovable property must, prior to the conclusion of the relevant sale agreement, notify the purchaser of that property in writing of the presence of listed invasive species on that property. Several listed alien and invasive plant species were observed on the study site.

Alien and Invasive woody species recorded on Erf 349 and 350 Wapadrand Country Estates:

Species name	**Common name**	**Category**
Acacia mearnsii	Black wattle	2
Araujia sericifera	Moth catcher	1b
Cotoneaster frigidus	Cotoneaster	1b
Eucalyptus camaldulensis	River gum	2, 1b in Grassland biome
Harrisia martinii	Moon cactus	1b
Lantana camara	Lantana	1b
Melia azedarach	Syringa	3 in urban areas
Opuntia ficus-indica	Prickly pear	
Pinus sp	Patula pine	2
Solanum mauritianum	Bugweed	1b

5.3.2 Medicinal Plants

Only medicinal plants listed by Van Wyk, Van Oudtshoorn & Gericke (2005), and rare medicinal plants as indicated by Williams, Victor & Crouch (2013) were indicated with the letter “M” in the list of species for each plant community.

4.3.3 Ecological Sensitivity

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

The vegetation sensitivity assessment aims to identify whether the vegetation within the study area is of conservation concern and thus sensitive to development:

In order to determine the sensitivity of the vegetation (ecosystem) on the site, weighting scores are calculated per plant community. The following six criteria are used, and each allocated a value of 0-3.

- Conservation status of a regional vegetation unit;
- Listed ecosystem (e.g. wetlands, hills and ridges etc)
- Legislative protection (e.g. threatened ecosystems, SANBI & DEAT 2009, Government Gazette NEMA 2011)
- Plant species of conservation concern (e.g. red listed, nationally or provincially protected plant species, habitat or potential habitat to plants species of conservation concern, protected plants or protected trees);
- Situated within ecologically functionally important features (e.g. wetlands or riparian areas; important habitat for rare fauna species);
- Conservation importance (e.g. untransformed and un-fragmented natural vegetation, high plant species richness, important habitat for rare fauna species, Critical Biodiversity Areas).

Sensitivity is calculated as the sum the values of the criteria. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity). A maximum score of 18 can be obtained, a score of 15-18 indicated high sensitivity. The sensitivity scores are as follows (Table 5.12):

Table 5.12: Sensitivity Weighting scores for vegetation.

Scoring	15-18	12-14	9-11	6-8	0-5
Sensitivity	High	Medium-High	Medium	Medium-Low	Low

Development on vegetation that has High sensitivity will normally not be supported, except that specific circumstances may still lead to support of the proposed development. Portions of vegetation with Medium-High or Medium sensitivity should be conserved**.** Development may be supported on vegetation considered to have Medium-Low or Low sensitivity.

The result of the sensitivity assessment (Table 5.13 below) indicates that the vegetation on the Bronberg Mountain has **High ecological sensitivity**, scoring 3 in all six criteria. Due to its degraded to transformed condition, the Drainage line scores 14, which is **Medium-High**, though in accordance with legislation it has **High** ecological sensitivity. (See Wetland Report in Paragraph 7 below). The Historically Disturbed Plains Bushveld has **Medium-Low** ecological sensitivity and the Recently Cleared Areas **Low** ecological sensitivity, due to its transformed status.

Table 5.13: Scoring of vegetation that occurs within the study area (see Table 5.12).

Vegetation	Conservation Status of regional Vegetation unit	Listed Ecosystem	Legislated Protection	Species of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18
5.2.1. Mountain Bushveld on South-facing Ridge Crest	3	3	3	3	3	3	18 High
5.2.2. Mountain Bushveld on Higher Slopes	3	3	3	2	3	3	17 High
5.2.3. Mountain Bushveld on Lower Slopes	3	3	3	2	3	3	17 High
5.2.4. Historically Disturbed Plains Bushveld	3	1	3	0	1	1	9 Medium-Low
5.2.5. Recently Cleared Areas on Plains	3	0	2	0	0	0	5 Low
5.2.6. Drainage Line	3	3	3	0	2	3	14 Medium-High

5.3.4 Conservation Value

The following **conservation value** categories were used for assessing the study site:
High: Ecologically sensitive and valuable land with high species richness and/or sensitive ecosystems or red data species that should be conserved and no developed allowed.
Medium-high: Land where sections are disturbed but which is in general ecologically sensitive to development/disturbances.

Medium: Land on which low impact development with limited impact on the vegetation / ecosystem could be considered for development. It is recommended that certain portions of the natural vegetation be maintained as open space.
Medium-low: Land of which small sections could be considered to conserve but where the area in general has little conservation value.
Low: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation.

The conservation value of the vegetation on Erf 349 Wapadrand Country Estates is **High** on the ridge and **Low to Medium-Low** on the plains. The Drainage Line has only **Medium-High** conservation value, due to its man-made features (see Wetland report).

5.3.5 Assessment of Screening Tool Results

5.3.5.1 Plant Species Sensitivity

The Result of the DEA Screening Tool analysis for Plant Species Sensitivity for Erf 349 Wapadrand Country Estates is given in Figure 5.10 (below). This Sensitivity is regarded as **Medium**.

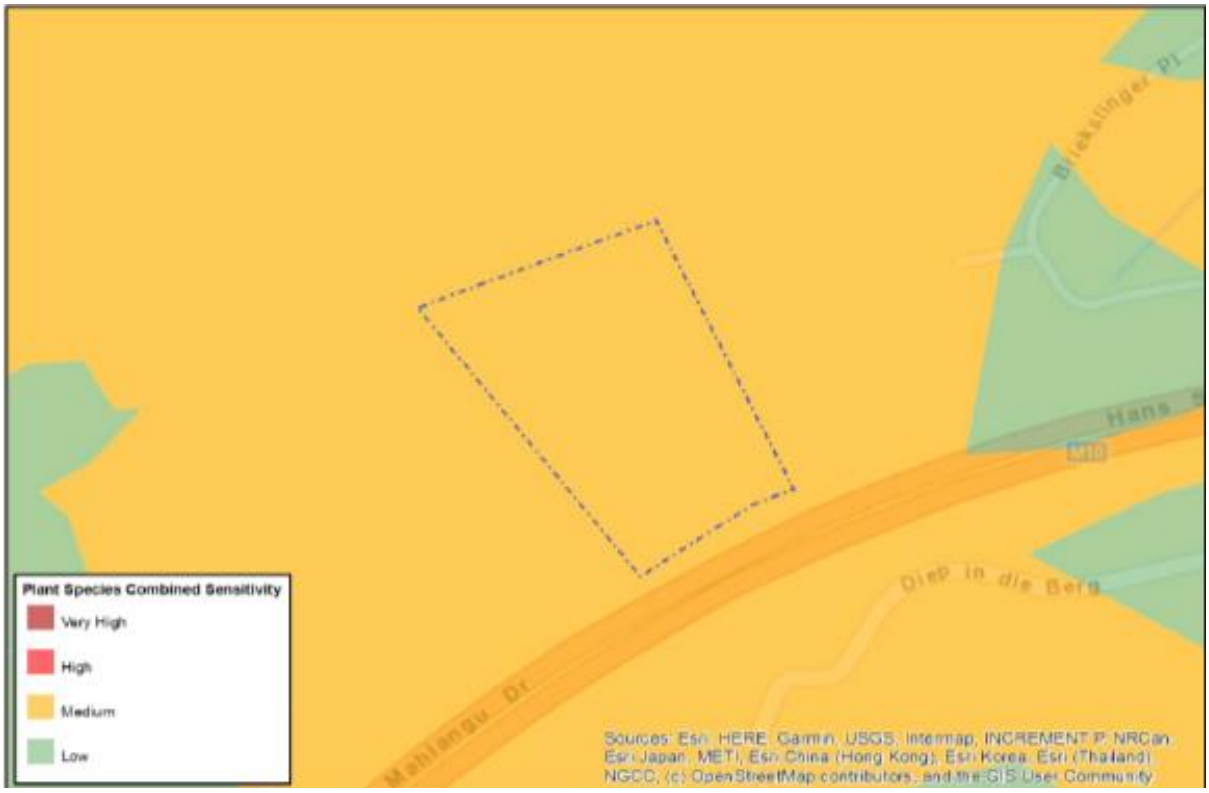

Figure 5.10: The Result of the DEA Screening Tool analysis for Plant Species Sensitivity on Erven 349 and 350.

The vegetation survey results indicate Low to Medium plant species richness in the various plant communities on Erf 349. Four protected and no red data species were found on the ridge, which is protected in the Bronberg Conservation area in the north of the site. No individuals of the red data listed *Ceropegia decidua* subsp *pretoriensis*

could be found. This is because the habitat is only marginally suitable. On the contrary the species richness on the plains is Low, with no protected or red data listed plant species present. In general, the DEA Screening Tool result of Medium Plant Species Sensitivity is confirmed.

5.3.5.2 Animal Species Sensitivity

The Result of the DEA Screening Tool analysis for Animal Species Sensitivity for Erf 349 Wapadrand Country Estates is given in Figure 5.11 (below). This Sensitivity is regarded as **Very High**.

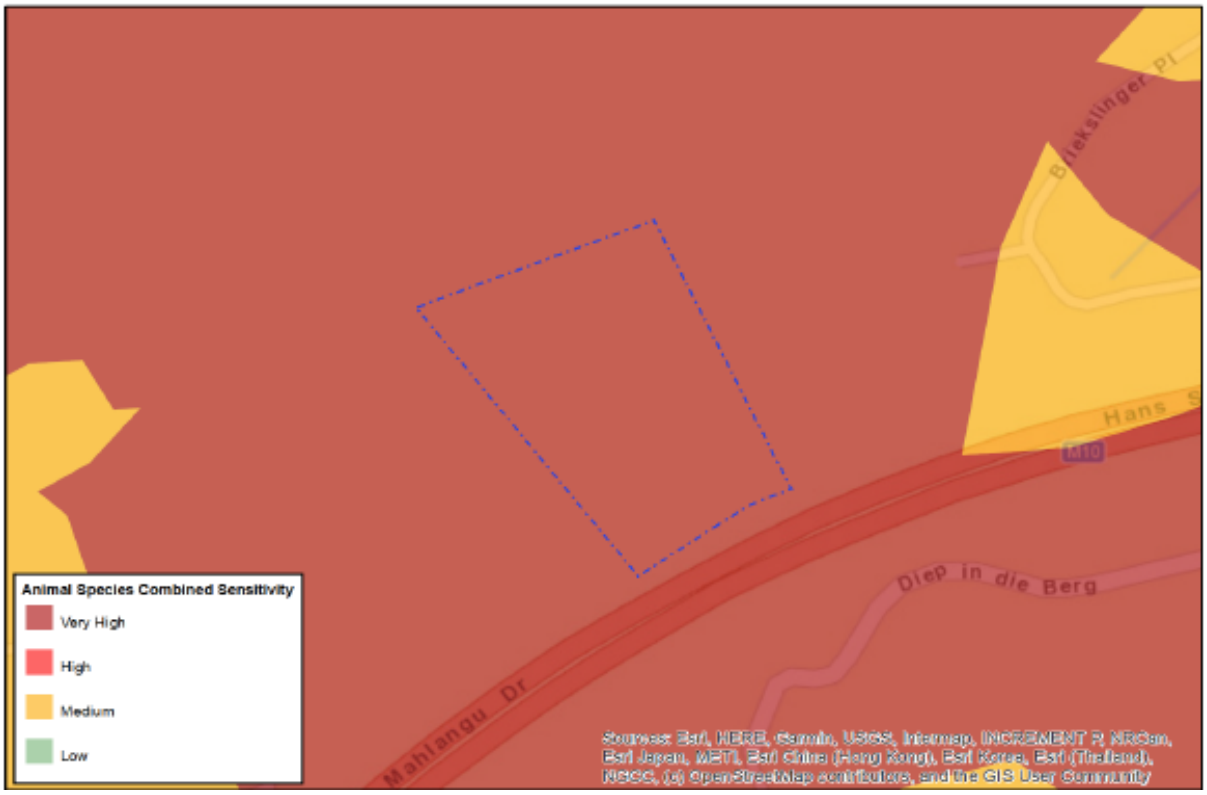

Figure 5:11 The Result of the DEA Screening Tool analysis for Animal Species Sensitivity on Erven 349 and 350.

Several animal species, may occur on the site (Table 5.14):.

Taxon	No species that could occur from time to time	No species observed
Mammals	62	12
Birds	301	115
Reptiles	67	3
Amphibia	12	7

However, the confirmed presence of Juliana's Golden Mole is the key factor causing the **Very High** Animal Sensitivity.

5.3.5.3 Terrestrial Biodiversity Sensitivity

The Result of the DEA Screening Tool analysis for Terrestrial Biodiversity Sensitivity for Erf 349 Wapadrand Country Estates is given in Figure 5.12 (below). This Sensitivity is regarded as **Very High**.

Figure 5.12: The Result of the DEA Screening Tool analysis for Terrestrial Biodiversity Sensitivity on Erven 349 and 350.

The Terrestrial Biodiversity Sensitivity is regarded to be **Very High**. This is caused by the presence of some protected plant species and marginal suitable habitat for red data plant species (on the ridge). The key factor causing the Very High Biodiversity Sensitivity is, however, the confirmed presence of Juliana's Golden Mole, both on the ridge and the plains. It should, nevertheless, be noted that the plant diversity on the plains area is regarded as Low.

5.3.5.4 Aquatic Biodiversity Sensitivity

The Result of the DEA Screening Tool analysis for Aquatic Biodiversity Sensitivity for Erf 349 Wapadrand Country Estates is given in Figure 5.13 (below). This Sensitivity is regarded as **Low**. This report does include wetlands, the presence/absence of wetland or drainage lines was noted. There is no permanent watercourse or wetland on the site, though a short, dry drainage line that was historically strongly influenced by man was noted (See Wetland Report Paragraph 7 below). Therefore this **Low** Aquatic Sensitivity is confirmed.

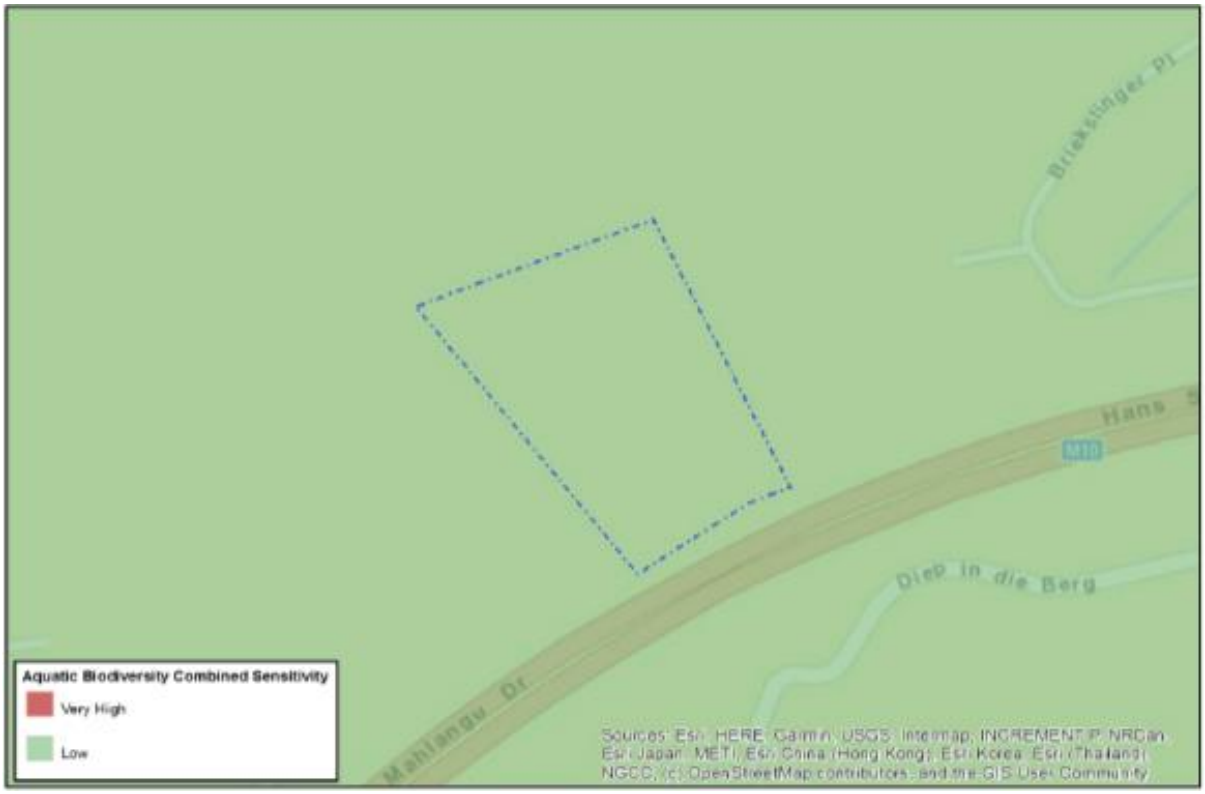

Figure 5.13: The Result of the DEA Screening Tool analysis for Aquatic Biodiversity Sensitivity on Erven 349 and 350.

6. RESULTS: FAUNA

6.1 MAMMALS

6.1.1 Mammal Habitat Assessment

Acocks (1988), Mucina and Rutherford (2006), Low and Rebelo (1996), Knobel and Bredenkamp (2006), SANBI & DEAT (2009) discuss the vegetation types of the study area in broad terms. It should be acknowledged that botanical geographers have made immense strides in defining plant associations (particularly assemblages denoted as vegetation units or veld types), whereas this cannot be said of zoologists. Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996), and latterly by Mucina and Rutherford (2006) as well Knobel and Bredenkamp (2006). Hence, although the former's work has been superseded by the work of the latter two, the definitions of biomes are similar and both remain valid for mammals and are therefore recognised as a reasonable determinant of mammal distribution.

The local occurrences of mammals are, on the other hand, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

Three of the four major habitat types are represented on the study site, i.e. terrestrial, rupicolous and arboreal. Small areas of wetland habitat occur near the site, but no open natural water occurs on the site.

The site visit was conducted during late summer/early autumn. The natural grasslands were first transformed for agricultural purposes and later by other anthropogenic influences such as wire and concrete fences, invasive plants, a brick road, ground clearing, water tanks and temporary construction buildings. The study site is thus ecologically disturbed in some parts. A few moribund termitaria were recorded on the study site. These structures are generally good indicators of the occurrence of small mammals. Accordingly, it is estimated that the mammal population density for the study site is fairly low. At the time of the site visit, the vegetation cover was locally good and would provide adequate nourishment and cover for small terrestrial mammals.

The ridge on the north-western part of the study site forms part of the Bronberg Conservation Area. This ridge provides natural rupicolous habitat on the study site, supporting populations of dassie, eastern rock elephant shrew and Namaqua rock mouse. Due to anthropogenic factors, larger rupicolous species such as klipspringer, mountain reedbuck, and grey rhebok were omitted from the species list in Table 6.1. Man-made rupicolous habitat exists in building material.

As a precautionary measure, ecologically robust mammals dependent on an arboreal habitat are included in the list in Table 6.1 of possible occurrences, because natural arboreal habitat occurs on and near the study site. This include species like South African galago, vervet monkey, woodland dormouse and acacia rat. Exotic trees occur on the site and their dead logs could provide shelter and food for some small mammals.

There is no aquatic habitat or vegetation on the actual study site. There is an important man-made dam on Erf 352 near the site and a drainage line on the south-eastern part of the site. However, African clawless otter and spotted-necked otter would be absent from the study site because of their narrow dependence on large permanent wetland habitat.

There are no caves suitable for cave-dwelling bats on the study site, although some of the nearby buildings may act as substitute daytime roosts. It is likely that common bats commute from roosting sites elsewhere to hawk for insects over the wetlands outside the study site.

6.1.2 Observed and Expected Mammal Species Richness

Large and medium-sized mammals (such as elephant, buffalo, blue wildebeest, red hartebeest, eland, plains zebra, white rhino, black rhino, lion, cheetah, spotted hyena, tsessebe, kudu, impala, sable and roan) have long since been extirpated for sport and later to favour grazing. Later other medium-sized animals like aardvark, warthog, brown hyena, and aardwolf were also exterminated. Although natural areas are shrinking, medium-sized species such as steenbok, grey duiker, vervet monkey, black-backed jackal, caracal, serval and African wild cat could still occur on or near the general area of the study site. A single old bush pig is known to roam in the nearby Faerie Glen Nature Reserve (Louise Ratzinger), but is omitted from the species list in Table 6.1.

It is estimated that 62 species of mammals may from time to time occur on or near the study site (Table 6.1). The occurrence of twelve species was confirmed (Table 6.2) on the site.

Most of the species of the resident diversity (Table 6.1) are common and widespread (viz. scrub hares, multimammate mice, pygmy mice, genets, mongooses and others). Many of the species listed in Table 6.1 are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses).

The listed Egyptian and flat-headed free-tailed bats as well as the vespertilionid bats show remarkable adaptability by expanding their distributional ranges and population numbers significantly by capitalising on the roosting opportunities offered by manmade structures in the vicinity. Vesper bats are more tolerant towards roost opportunities and it is more than likely that small colonies have found roosting opportunities in the roofs of buildings near the study site. Free-tailed bats are likewise partial to narrow-entranced roosts provided by buildings and in some instances roost occupation could reach epidemic proportions. The study site offers no caves or suitable structures answering to the exacting roosting requirements of cave-dwelling bats (Hipposideridae, Rhinolophidae, Nycteridae), but it is likely that

they have roosts elsewhere and during summer sunsets commute to the site to hawk for invertebrates.

The genet species and the mongooses all have wide habitat tolerances, and that, coupled with their catholic diets and reticent habits, render them persistent carnivores, even in or close to human settlements.

The present-day species richness is low to fair because of the small size of the site and the fact that many parts are disturbed and connectivity to adjacent suitable habitats is fair.

Table 6.2: **Mammal diversity of the study site.**

	SCIENTIFIC NAME	ENGLISH NAME
	Order: AFROSORICIDA	
	Family Chrysochloridae	**Golden moles**
CEN√	*Neamblysomus julianae*	Juliana's golden mole
	Order: MACROSCELIDEA	
	Family: Macroscelididae	**Elephant-shrews**
√	*Elephantulus myurus*	Eastern Rock Elephant-Shrew
	Order: HYRACOIDEA	
	Family: Procaviidae	**Hyraxes**
√	*Procavia capensis*	Rock hyrax
	Order: LAGOMORPHA	
	Family: Leporidae	**Hares, Rabbits and Rock Rabbits**
√	*Lepus saxatilis*	Scrub Hare
?	*Pronolagus randensis*	Jameson's red rock rabbit
	Order: RODENTIA	
	Family: Bathyergidae	**Mole-Rats**
√	*Cryptomys hottentotus*	African Mole-Rat
	Family: Hystricidae	**Porcupines**
√	*Hystrix africaeaustralis*	Cape Porcupine
	Family: Thryonomyidae	**Canerats**
√	*Thryonomys swinderianus*	Greater canerat
	Family: Myoxidae	**Dormice**
√	*Graphiurus murinus*	Woodland dormouse
	Family: Muridae	Rats and Mice
?	*Acomys spinosissimus*	Spiny Mouse
?	*Lemniscomy rosalia*	Single-Striped Grass Mouse
√	*Rhabdomys pumilio*	Four-Striped Grass Mouse
?	*Mus indutus*	Desert Pygmy Mouse
√	*Mastomys natalensis*	Natal Multimammate Mouse
√	*Mastomys coucha*	Southern Multimammate Mouse
?	*Thallomys paedulcus*	Acacia Rat
*	*Aethomys ineptus*	Tete Veld Rat
√	*Aethomys namaquensis*	Namaqua Rock Mouse
√	*Otomys angoniensis*	Angoni vlei rat

?	*Otomys irroratus*	Vlei rat
√	*Gerbilliscus (Tatera) leucogaster*	Bushveld Gerbil
√	*Gerbilliscus (Tatera) brantsii*	Highveld Gerbil
√	*Saccostomus campestris*	Pouched Mouse
√	*Dendromus melanotis*	Grey Pygmy Climbing Mouse
?	*Dendromus mystacalis*	Chestnut' Climbing Mouse
*	*Steatomys pratensis*	Fat Mouse
	Order: PRIMATES	
	Family: Galagidae	**Galagos**
√	*Galago moholi*	South African Galago
	Family: Cercopthecidae	Baboons and Monkeys
?	*Papio hamadryas*	Chacma Baboon
√	*Cercopitecus pygerythrus*	Vervet Monkey
	Order: EULIPOTYPHA	
	Family: Soricidae	**Shrews**
?	*Suncus varilla*	Lesser Dwarf Shrew
*	*Crocidura cyanea*	Reddish-grey Musk Shrew
?	*Crocidura silacea*	Lesser Grey-Brown Musk Shrew
*	*Crocidura hirta*	Lesser Red musk Shrew
	Family: Erinaceidae	**Hedgehog**
NT√	*Atelerix frontalis*	Southern African Hedgehog
	Order: CHIROPTERA	
	Family: Pteropodidae	**Fruit Bats**
?	*Epopophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat
?	*Eidolon helvum*	Straw-Coloured Fruit Bat
	Family: Embalonuridae	**Sheath-Tailed Bats**
?	*Taphozous mauritianus*	Mauritian Tomb Bat
	Family: Molossidae	**Free-Tailed Bats**
√	*Tadarida aegyptiaca*	Egyptian Free-Tailed Bat
	Family: Vespertilionidae	**Vesper Bats**
√	*Miniopterus natalensis*	Natal Long-Fingered Bat
√	*Neoromicia capensis*	Cape Serotine Bat
√	*Myotis tricolor*	Temminck's Hairy Bat
√	*Scotophilus dinganii*	African Yellow Bat
	Family: Nycteridae	**Slit-Faced Bats**
√	*Nycteris thebaica*	Egyptian Slit-Faced Bat
	Family: Rhinolophidae	**Horseshoe Bats**
√	*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat
√	*Rhinolophus darlingi*	Darling's horseshoe Bat
NT?	*Rhinolophus blasii*	Blasius's Horseshoe Bat
?	*Rhinolophus simulator*	Bushveld Horseshoe Bat
	Family: Hipposideridae	**Trident Bats and Leaf-nosed Bats**
	Hipposideros caffer	Sundevall's Roundleaf Bat
EN?	*Cloeotis percivali*	Short-Eared Trident Bat
	Order: CARNIVORA	
	Family: Felidae	**Cats**

√	*Caracal caracal*	Caracal
?	*Felix silvestris*	African Wild Cat
NT?	*Leptailurus serval*	Serval
	Family: Viverridae	**Civets and Genets**
√	*Genetta genetta*	Small-Spotted Genet
?	*Genetta tigrina*	South African Large-Spotted Genet
	Family: Herpestidae	**Suricates and Mongooses**
√	*Cynictis penicillata*	Yellow Mongoose
√	*Galerella sanguinea*	Slender Mongoose
*	*Atilax paludinosus*	Marsh Mongoose
	Family Canidae	Foxes, Wild Dogs and Jackals
?	*Canis mesomelas*	Black-Backed Jackal
	Family: Mustelidae	Otters, Honey Badger, Weasel and Polecat
NT?	*Poecilogale albinucha*	African striped weasel
*	*Ictonyx striatus*	Striped Polecat
	Family: Bovidae	**Antelopes and Buffalo**
√	*Syvicapra grimmia*	Common Duiker
*	*Raphicerus campestris*	Steenbok

The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Bronner et .al [2003], Skinner & Chimimba [2005], Apps [2012], Stuart & Stuart [2015] & Child et.al.[2016].

√ Definitely there or have a *high* probability to occur;
***** *Medium* probability to occur based on ecological and distributional parameters;
? *Low* probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 6.3: **Mammal species positively confirmed on the study site, observed indicators and habitat.**

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Neamblysomus julianae	Juliana's golden mole	Tunnels	Terrestrial
Procavia capensis	Rock hyrax	Sight record	Rupicolous
Thryonomys swinderianus	Greater canerat	Scat	Terrestrial
Aethomys namaquensis	Namaqua rock mouse	Scat	Rupicolous
Hystrix africaeaustralis	Cape Porcupine	Dr. M Carstens (pers.comm)	Terrestrial

Galago moholi	South African galago	Dr. M Carstens (pers.comm)	Arboreal
Cercopitecus pygerythrus	Vervet monkey	Dr. M Carstens (pers.comm)	Arboreal
Atelerix frontalis	Southern African hedgehog	Dr. M Carstens (pers.comm)	Terrestrial
Genetta genetta	Small-spotted genet	Dr. M Carstens (pers.comm)	Arboreal/terrestrial
Otomys angoniensis	Angoni vlei rat	Dr. M Carstens (pers.comm)	Terrestrial/aquatic
Caracal caracal	Caracal	Dr. M Carstens (pers.comm)	Terrestrial
Syvicapra grimmia	Common duiker	Dr. M Carstens (pers.comm)	Terrestrial

The rock hyrax, greater cane rat, Namaqua rock mouse, Cape porcupine, South African galago, vervet monkey, small-spotted genet, Angoni vlei rat, caracal and common duiker (Table 6.2) are common and widespread in Southern Africa.

The Southern African hedgehog is a Near Threatened species due to habitat destruction and the muti trade (Van Wyk, 1998).

The Juliana's golden mole is a Critically Endangered species and any development in their restricted area must be thoroughly investigated.

6.1.3. Red Listed Mammal Species Identified:

A total of six mammal species with Red Data status could possibly occur on the site (Table 6.1). All Red Data species listed in Table 6.1 as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as result of the deterioration of their preferred habitats. Of the six species, two definitely occur on the site - Juliana's golden mole (pers.obser) and Southern African hedgehog (Dr M Carstens pers.comm).

The study site falls outside the natural range of the Maquassie musk shrew, white-tailed mouse and black-footed cat. These species do not occur on the study site.

Due to the anthropogenic influences certain Red Data mammals should be absent from the rupicolous habitat of the site, which include mountain reedbuck and grey rhebok. Both the leopard and brown hyena have long since been extirpated for sport and agricultural reasons. Although they are sometimes encountered in the greater Pretoria area these two species should not occur on or near the study site due to the island effect of the site.

Due to their ability to fly and to cover large distances, the distribution information on some bat species is insufficient. This has resulted in Red Data species such as the

Blasius's (Peak-saddle) horseshoe bat and short-eared trident bat being included as a precautionary measure.

Due to the absence of especially wetland-associated vegetation cover on the actual study site, the possibility of Red listed mammal species occurring decreases dramatically. Protecting these habitat types would automatically protect many Red Data status species. The swamp musk shrew, African marsh rat, the Cape clawless and spotted-necked otter species should not occur on or near the site.

The Southern African hedgehog occurs in a wide variety of habitat types but must have suitable vegetation cover. The study site provides that and as already mentioned, their presence was confirmed by Dr Maryke Carstens, resident of Erf 352.

There is a small possibility that the serval and African striped weasel may occur on the site from time to time. The African striped weasel was recorded in the nearby Faerie Glen Nature Reserve (Louise Kritzinger, pers. comm.)

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

6.1.4. Juliana Golden Mole

6.1.4.1 Background

Golden moles (Chrysochloridae) constitute an ancient mammal family (50-57 million years since divergence) endemic to Sub-Saharan Africa, with a centre of distribution in Southern Africa. All species are insectivorous and fossorial, have a golden sheen on the dense fur, and all have a dependence on soft substrates.

Juliana's golden mole (*Neamblysomus julianae*) is one of the smallest members of this distinct family of fossorial and exclusively insectivorous mammals. In Gauteng it occurs only in The Willows and Shere areas along the slopes and foot of the Bronberg (Bronner *et al*., 2003; Meester *et al*., 1986; Skinner and Chimimba, 2005). It is also known from Nylsvlei in the Limpopo Province and in Pretoriuskop in the Kruger National Park in Mpumalanga Province (but there is some doubt whether these populations differ genetically at the species level from the Pretoria population).

N. julianae is categorized as "Critically Endangered" by Friedman and Daly (2004) and Maree, Bennett & Bronner (2016). Apart from being severely restricted in its distributional range, it is threatened in the Pretoria area by high-density urbanisation. Most records of occurrence are in sandy pockets amongst rocks along the Bronberg. It would, however, appear that these records do not necessary represent its preferred habitat and that destruction of preferred sandy habitat on the plains by intensive urban development is responsible for limiting its range to the Bronberg *per se* where urbanisation is curbed as per the GDARD "Ridges Policy". Sites with

suitable sandy substrate have been found on the plains south of the Bronberg foothills where this mole has re-populated a small fallow field. Jackson *et al.* (2007) correlates golden mole occurrence with soil particle size and comparatively low density.

Several criteria for ranking a species as endangered are applicable. In the case of Juliana's golden mole it is ranked as 'Critically Endangered' since it has an extremely limited distribution range. However, given the prerequisite soft and sandy substrate it is not uncommon along the Bronberg or in gardens and small-holdings in the Shere and The Willows areas.

When appraising the conservation status of an insectivore in an ecosystem (such as golden moles, hedgehogs or shrews), it should be borne in mind that insectivores function at the apex of a food chain, and in order to sustain its protein-rich food sources its population numbers must numerically be lower than that of herbivores (viz. rodents). It is thus contended that wherever Juliana's golden mole occur in natural or semi-natural environments, its population density approach natural levels.

Little is known of Juliana's golden mole, and field information is largely anecdotal. Like other golden moles, it 'swims' in soft sand just below the surface while foraging for invertebrate prey by loosening the substrate with the well-developed claws of the phalanges and then lifting the sand with the padded snout and shoulders to form an unstable tunnel. As result its wanderings are characterized by a trail of cracked soil visible on the surface. These trails are particularly noticeable after rains, both since wet sand have a firmer texture than dry sand and mole activity then appears to be higher. It would appear that this species is mostly solitary, and that during breeding it also constructs deeper tunnels and breeding chambers to maintain young (Jackson *et al.,* 2009). They then make small mounds. As a result of its random subsurface movements it is extremely difficult to trap and relocate individuals. This was never done successfully before.

It should be obvious that the trend to protect suburban properties by means of security walls and partitions, local populations of Juliana's Golden Mole are divided into small unviable units. However, in larger properties with well-maintained gardens in sandy and composted substrates, golden moles co-exist well with normal garden practices.

Burrowing abilities of golden moles are, compared to rodent moles, extremely limited. It must be emphasized that the preferred habitat for golden moles (in particular Juliana's golden mole) is loose sand with no or minimal clay content, precluding compaction. Compacted soil of any kind will preclude burrowing and dispersion. Records of occurrences along the Bronberg are mostly in loose light-coloured sand, with some exceptions in red sand.

Monthly observations during previous studies showed that burrowing activities of Juliana's golden mole are less during winter, and that this decline can be correlated with seasonal soil compaction, and according to Jackson *et al.* (2009) also ambient temperature. By composting and irrigating year-round activity levels can be retained

and a dispersal corridor created. Jackson *et al*. (2009) found that *N. julianae* uses thermoregulation to conserve energy, and that good vegetation cover is conducive to maintaining substrate moisture and optimum temperatures. However, there is no evidence that Juliana's golden mole enter torpor or hibernation during stress periods, such as winters.

Golden moles do, at times, venture above ground. They are sometimes found in barn owl pellets, swimming pools and are sometimes caught by pets. Golden mole eyes are rudimentary and overgrown by skin. At best they can thus only distinguish between light and dark, and cannot make a visual decision on dispersal directions when on the surface. Surface wanderings are therefore concluded to be random.

6.1.4.2 Observations during the site visits

Golden mole subsurface activities were found on and near the study site during the site visits. They were recorded in and around a diversity of habitat types at the study site and buffer areas:

1. Sandy areas between natural vegetation in the ridge area.
2. In disturbed areas, where vegetation had been cleared of vegetation.
3. In disturbed areas, which were levelled and were cleared of vegetation
4. In flower beds and to a lesser extent in lawns, which are regularly irrigated.
5. In a dry drainage line.
6. In sandy sidewalk with many dead leaves.
7. Between indigenous white stinkwood trees.
8. Between exotic *Eucalyptus* trees.
9. In soil where indigenous and invasive plants were cleared.
10. In soil on a natural rocky outcrop, which is surrounded by flat areas.

With the exception of the ridge and rocky outcrop (in the buffer) areas, which also contain invasive plants, most of the other occurrences of subsurface activities are in disturbed areas with disturbed soils.

Golden moles rarely venture above ground, but are known to do this (probably during local migrations). Connectivity of the site is good, especially to the north-east towards the Bronberg Conservation Area.

Table 6.3 Confirmed Golden Mole activities on Erf 349

ERF	HABITAT	COORDINATES	ALTUTUDE
Erf 349	Ridge area (Figure	25°46'51"S	1440m

	6.1)	28°20’02”E	
Erf 349	Drainage line	25°46’54”S 28°20’04”E	1430m

Figure 6.1: Golden Mole activity on the ridge area of Erf 349

6.1.4 3 Findings and Potential Implications

The golden mole occurs at several localities on all five Erven within the Wapadrand Country Estates. Their commensal (*sensu lato*) condition (where two species live together and the one benefits without harming the other) is most probably a near-historical condition, where golden moles thrive in well cared for gardens. The occurrence of golden moles in the garden of Erf 352 manifests the earlier claims that golden moles are adapted to co-exist in suburban settings on condition that the substrate consists of soft sand or sandy loam with no or little clay content. Unlike mole-rats, golden moles are a real asset in the garden since they control underground insects and grubs, their activities loosen the sub-soil resulting in better soil aeration. They do not eat plant material, are not destructive and are a pest species.

Neamblysomus julianae is a Critically Endangered mammal species. GDARD is unlikely to sanction the proposed development unless a reasonable conservation strategy is adopted, together with an Ecological Management Plan (EMP) (included in this report) and the appointment of an ECO for the construction period.

It is therefore suggested that a strategy is adopted to manage the entire study site and its buffer area (Wapadrand Country Estates, which includes five erven) to

become more golden mole attractive concomitantly compliant to the GDARD regulations. It is assumed that a colourful and well-manicured gardens will visually be part of the up-market ambience of the development.

A suggested EMP offers suggestions how the development can be adapted and upgraded and focuses on protecting the golden mole population.

6.1.4.4 Conclusions

Erf 349 lies inside the Juliana's golden mole' distribution range. Implementing the suggested Ecological Management Plan suggested in this report will stabilise the population at higher density and ensure year-round optimized ecological conditions in a structured manner. Connectivity with adjoining natural areas is regarded as being good and gene flow as good as can be expected within the relatively isolated area of the Wapadrand Country Estates.

6.1.5 Proposed Ecological Management Plan for Golden Moles

This proposed ecological management plan is relevant and applicable to **all five Erven** within the Wapadrand Country Estates area.

6.1.5.1 Pre construction and design phase

The study site of the Wapadrand Country Estates forms part of the restricted distribution range of the Juliana's golden mole. This species of golden mole occurs on the site, in natural veld, though with *Lantana camara*, in disturbed veld, previously cleared of bush, and in on Erf 352 in a well-cared for garden. The individuals in the disturbed areas probably persisted during the transition from a natural to a disturbed environment.

This EMP proposes to stabilise and enhance the occurrence of golden moles in a local residential setting. The northern part of the study site consists of the Bronberg Conservation Area with natural veld, where no development may occur and where signs of the Juliana's golden mole presence have been recorded. These golden mole individuals in the Bronberg Conservation Area will not be affected by the development since they occur outside the intended footprint of the proposed development.

Site selection and site preparation for the area of the planned development on the plains south of the Bronberg Conservation Area is critical. It is reiterated that scientific field data pertaining to Juliana's golden mole is limited. However, considering the mole's persistence in this setting, the chances of individuals surviving the construction phase are rated as high, given precautions suggested herein. In view of the connectivity of the site, the possibility of a second wave of immigration and gene exchange is likely.

The following steps are recommended before construction commences:

In order to maintain and increase the population numbers of Juliana's golden mole on the study site, it is suggested that:

- The footprint of the planned construction area be cleared of vegetation.
- The storage area for building material etc. be cleared of vegetation, bar large indigenous trees.
- No clearing of any vegetation outside the construction and storage area footprint.
- Building materials are to be delivered and stored on only one of the cleared hard-surface areas on the site.
- Random dumping of building waste cannot be tolerated. There must be a specified area for it and must be removed from the site as soon as possible.
- No or limited access for workers to areas outside the above-mentioned footprint.
- The areas where there will not be any development must be irrigated so that the soil remains moist, attracting more potential prey items to these areas. This will increase the probability that the Juliana's golden moles will migrate to these irrigated areas, away from the construction and storage areas.

Stabilising the Juliana's golden mole population is dealt with on a general and a specific level:

General actions:

It is suggested that:

- the garden area be developed shortly after the construction of the residences has been completed.
- A well-manicured and maintained, mainly indigenous garden to reflect the upmarket ambience of the entire facility be developed.
- It is therefore strongly advised that the flower beds are composted on a regular and ongoing basis, to enhance the occurrence of subterranean invertebrate instars serving as food source for the golden moles. Increasing the organic content of the soil to a depth of 15cm will furthermore serve to loosen its texture and hence enhance mole occupation.
- In addition it is also suggested that flower beds are seeded with earthworms from time to time.
- Indigenous grasses be used amply in the beds.
- Planting of members of the legume family (pea family, Fabaceae) to bind atmospheric nitrogen.
- Leave large areas with natural vegetation or re-establish natural vegetation.
- LM grass is preferred to Kikuyu grass for a lawn.
- It is not anticipated that moderate use of inorganic fertilisers will have any effect on golden moles.
- Irrigation is an important facet of maintaining the soft substrate. Regular irrigation is suggested throughout the year.
- Use steppingstones rather than fully paved walkways to allow for mole tunnelling and dispersal.

- Juliana's golden mole activity was also observed on the sidewalk area southeast of the service road and this area may not be used for a storage or dumping site.
- That an Ecological Control Officer (ECO) be appointed as soon as operations commence. During the construction phase he/she is to monthly supervise the development and maintenance of the golden mole habitat, to monitor golden mole activities and dispersal, where necessary to interact with the construction site managers, has the right to amend the EMP in consultation with the developer, to monthly provide feedback to the developers who will copy that to the authorities, and to report non-compliance to GDARD.

Specific actions:

- Near the white stinkwood trees, at the heritage site, golden mole activities occur at 25°46'51"S; 28°20'05"E. This area must be excluded from development.
- This areas of golden mole activity together with a buffer zone of ten meters are to be demarcated in concurrence with the ECO, and this should be a no-entry area for all the construction workers.
- As little as feasible paving must be laid and preferably no Kikuyu grass be planted.
- The soil in the garden must be carefully loosened, composted and seeded with earthworms, and Canada Green or LM grass planted.
- Irrigation to be installed and the site watered throughout the year.
- It is possible that resident golden moles may be unearthed during preparation of the substrate. In such cases the specimens can be released anywhere where there are no plans to construct houses.
- A temporary route to bypass the golden mole areas should be established to transport building material, avoid trampling and compaction of soil.
- Upon completion of construction, this temporary route is to be loosened, composted and developed to be amenable for golden moles.

6.1.5.2 Construction phase

This is a critical phase. Since golden moles are completely blind, they rely on acute hearing and detection of tremors conveyed through the substrate to detect prey. Experience at other developments suggest that they respond neutrally to typical noise of construction processes. To ensure that conservation measures are maintained and amended as necessary, it is suggested that:

- An appropriate Management Authority should be identified (e.g. the owners) that is contractually bound to implement this Environmental Management Plan during the construction phase of the development. The Management Authority will keep a record of ECO monthly audits and upon request make these available to GDARD.
- That the ECO monitors the construction site on a regular basis (at least monthly) and keeps a written Record of Decision (ROD). Particular attention should be

paid to unforeseen artificial edge effects (e.g. water runoff from developed areas & application of chemicals).

- That a copy of this EMP should be provided to the neighbouring landowners.
- That the ECO interacts with the landscape architect / site manager in terms of enriching the substrate and the planting of vegetation on the site.
- The contractor and all the construction personnel receive environmental training on the importance of the Juliana golden moles.
- No dumping of construction materials, hazardous materials such as oil and diesel or domestic waste is to be allowed within the site.
- The landscape planting plan must ensure that the trees / shrubs used in the gardens are indigenous.
- The contractor is aware of the need for as little noise as possible on site.
- The footprint of paving or other concrete structures around the houses must be kept to a minimum.
- Wire fence (not concrete or brick wall) between the different erven is preferred to enable migration of golden moles between the properties.
- Swimming pools must have a barrier to prevent Juliana golden moles from accidentally falling into pools.

5.1.5.3 Operational phase

During this phase the homeowners should continuously be aware of the presence of the Juliana golden mole and take care to implement management action that will promote the golden moles existence. Monitoring of the study area for the continued existence of the golden mole would be important to determine the effect on the golden mole of the construction and later the occupation of the residences. The following is suggested:

- At the onset of the operational phase, the plains area of the site should be planned and developed as an indigenous garden to augment the atmosphere of the Wapadrand Country Estates and also enhance suitable habitat for Juliana's Golden Mole.
- The ECO to cooperate with the landscape planner to select plants amenable to golden mole habitat prerequisites.
- The remaining plains area should remain in a natural state, with measures to control all alien and invasive plant species.
- Employees should be familiarised with the conservation measures implemented and their responsibility in this regard.
- The ECO must interact with the gardener to ensure optimal development and maintenance of the study site. Suitable training in this regard is necessary.
- The garden beds must be kept well-composted and moist by irrigation.
- All garden areas must be inspected regularly to ensure that the soil is not compacted. Measures implemented to carefully loosen the soil ensuring that mole individuals are not killed accidentally.
- The swimming pools must be regularly inspected to ensure rescuing of golden moles that accidentally fell into the pool.

6.2 BIRDS

6.2.1. Bird Habitat Assessment

The habitats occupied by flighted birds differ from those of most terrestrial vertebrates in being explicitly three-dimensional, especially for aerial-feeding species and in the airspace above landscapes with low relief and short vegetation. In the two primarily terrestrial dimensions, most birds are dependent on vegetation structure, and substrate texture and colour. Some species have particular food requirements of foliage, flowers, fruit or seeds.

The aerial mobility of birds also demands paying attention to the principal habitats surrounding the study site and their conservation status, not just those along the immediate borders but also more distant habitats that might provide sources for species visiting the site and sinks for those breeding on site.

Birds are also a relatively visible and audible group of homeothermic vertebrates, active throughout the year, and with habitat preferences that can be evaluated from experience, by reference to the comprehensive literature available and by the subset of species that can be detected by a field survey during a particular season and time of day. Such information and experience also inform and enable searches for particular species of conservation concern.

The principal habitat types detected on the site that are most relevant to bird ecology and community structure are:

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1. Disturbed plains bushveld, ground clearing, a small brick road and road reserve.
2. Dense arboreal habitat on the ridge with mostly natural veld.

The habitats adjacent to the study site are similar and consist mostly of disturbed flat plains bushveld and the ridge with dense natural mountain bushveld.

6.2.2 Expected and Observed Bird Species Richness

Most of the expected species are typical generalists and garden birds that might occupy the fabricated habitats available, especially the various lands transformed and other man-induced alterations such as buildings, artificial wetlands and birdfeeders, while others are aerial feeders that mainly use the airspace above the habitats. Species typically inhabiting aquatic habitats would be unlikely to occur in significant numbers due to the limited extent of this habitat. There is a small artificial wetland on erf 532.

The natural plains bushveld is disturbed and in a poor to fair condition with invasive plant species.

The disturbed nature of part of the habitat, and the location which includes a busy tarred road (Solomon Mahlangu Drive) nearby, would normally collectively mean that avian diversity is lower than normal. However, due to the green area of the ridge and large urban gardens in the vicinity of the site, the diversity has increased. A total of 301 species are expected or were recorded on this Pentad/2545_2820 (Table 6.4). Dr Maryke Carstens, resident of erf 532, has documented 115 birds (38 % of the species of the SABAP 2 Pentad) on or over their property. This list of birds species she has observed are listed in Table6. 4 as *confirmed* species. The nearby Faerie Glen Nature Reserve bird list comprises of 176 bird species (Louise Kritzinger, pers.comm).

Table 6.4: Bird species diversity expected on and around the proposed site. Based on the national list and annotations of Birdlife South Africa (2011), sorted in the order of 'Roberts VII' (Hockey *et al*. 2005), with probability of occurrence and habitat preferences assessed and comparison with lists from SABAP 1&2 (Harrison *et al*., 1997; www.sabap2.org).

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
CoquiFrancolin	*Peliperdix coqui*						L
Crested Francolin	*Dendroperdix sephaena*				Confirmed	M	
Francolin							L
Red-winged Francolin	*Scleroptila lecailantii*						L
Natal Spurfowl	*Pternistis natalensis*						L
Swainson's Spurfowl	*Pternistis swainsonii*					M	
Helmeted Guineafowl	*Numida meleagris*				Confirmed		
Fulvous Duck	*Dendrocygna bicolor*						L
White-faced Duck	*Dendrocygna viduata*				Confirmed		L
White-backed Duck	*Thalassornis leuconotus*						L
Egyptian Goose	*Alopochen aegyptiaca*				Confirmed		L
South African Shelduck	*Tadorna cana*						L
Spur-winged Goose	*Plectopterus gambensis*						L
African Black Duck	*Anas sparsa*				Confirmed		
Mallard	*Anas platyrhynchos*			I			L
Yellow-billed Duck	*Anas undulata*				Confirmed		

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Cape Shovler	*Anas smithi*						L
Red-billed Teal	*Anas erythrorhyncha*					M	
Southern Pochard	*Netta erythrophthalma*						L
Kurrichane Buttonqual	*Turnix sylvaticus*						L
Greater Honeyguide	*Indicator indicator*				Confirmed		
Lesser Honeyguide	*Indicator minor*				Confirmed		
Red-throated Wryneck	*Jynx ruficollis*						L
Golden-tailed woodpecker	*Campethera abingoni*				Confirmed		
Cardinal Woodpecker	*Dendropicos fuscescens*				Confirmed		
Bearded Woodpecker	*Dendropicos namaquus*						L
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*					M	
Acacia Pied Barbet	*Tricholaema leucomelas*					M	
Black-collared Barbet	*Lybius torquatus*				Confirmed		
Crested Barbet	*Trachyphonus vaillantii*				Confirmed		
Southern Yellow-billed Hornbill	*Tockus leucomelas*						L
Red-billed Hornbill	*Tockus erythrorhynchus*						L
African Grey Hornbill	*Tockus nasutus*				Confirmed		
African Hoopoe	*Upupa africana*				Confirmed		
Green Wood-hoopoe	*Phoeniculus purpureus*				Confirmed		
Common Schimitarbill	*Rhinopomastus cyanomelas*						L
Lilac-Breasted Roller	*Coracias caudatus*						L
Purple Roller	*Coracias naevius*						L
Half-collared Kingfisher	*Alcedo semitorquata*			NT			L
Malachite Kingfisher	*Alcedo cristata*				Confirmed		
Woodland Kingfisher	*Halcyon senegalensis*				Confirmed		

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Brown-hooded Kingfisher	*Halcyon albiventris*				Confirmed		
Striped Kingfisher	*Halcyon chelicuti*						L
Giant Kingfisher	*Megaceryle maximus*				Confirmed		
Pied Kingfisher	*Ceryle rudis*				Confirmed		
White-fronted Bee-eater	*Merops bullockoides*					M	
European Bee-eater	*Merops apiaster*		**B/NBM**		Confirmed		
Little Bee-eater	*Merops pussillus*						L
Speckled Mousebird	*Colius striatus*				Confirmed		
Red-faced Mousebird	*Urocolius indicus*				Confirmed		
Levaillant's Cuckoo	*Clamator levaillantii*		**BM**		Confirmed		
Great Spotted Cuckoo	*Clamator glandarius*		**BM**				L
Red-chested Cuckoo	*Cuculus solitarius*		**BM**		Confirmed		
Diderick Cuckoo	*Chrysococcyx caprius*		**BM**		Confirmed		
Black Cuckoo	*Cuculus clamosus*		**BN**		Confirmed		
Klaas's Cuckoo	*Chrysococyx klaas*		**BN**		Confirmed		
Burchell's Coucal	*Centropus burchellii*				Confirmed		
Alpine Swift	*Tachymarptis melba*		**BM**				L
African Palm Swift	*Cypsiurus parvus*				**H**		
Alpine Swift	*Tachymarptis melba*						L
Common Swift	*Apus apus*		**NBM**				L
African Black Swift	*Apus barbatus*						L
Little Swift	*Apus affinis*				Confirmed		
White-rumped Swift	*Apus caffer*						L
White-rumped Swift	*Apus caffer*		**BM**		H		
Grey Go-away-bird	*Corythaixoides concolor*				Confirmed		
Barn Owl	*Tyto albo*						L

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		R D	S	E	High	Mediu m	Low
Spotted Eagle-Owl	*Bubo africanus*				H		
Marsh Owl	*Asio capensis*						L
Fiery-necked Nightjar	*Caprimulgus pectoralis*				Confirmed		
Freckled Nightjar	*Caprimulgus tristigma*				Confirmed		
Rufous-cheeked Nightjar	*Caprimulgus rufigena*						L
Rock Dove	*Columba livia*				Confirmed		
Speckled Pigeon	*Columba guinea*				Confirmed		
African Olive-Pigeon	*Columba arquatix*						L
Laughing Dove	*Streptopelia senegalensis*				Confirmed		
Cape Turtle-Dove	*Streptopelia capicola*				Confirmed		
Red-eyed Dove	*Streptopelia semitorquata*				Confirmed		
Namaqua Dove	*Oena capensis*						L
African Green Pigeon	*Treron calvus*				Confirmed		
Northern Black Korhaan	*Afrotis afraoides*						L
African Crake	*Crecopsis egregia*						L
Black Crake	*Amaurornis flavirostra*					M	
African Purple Swamphen	*Porphyrio madagascariensis*						L
Common Moorhen	*Gallinula chloropus*				Confirmed		
Red-knobbed Coot	*Fulica cristata*					M	
African Snipe	*Gallinago nigripennis*						L
Common Greenshank	*Tringa nebularia*						L
Wood Sandpiper	*Tringa glareola*						L
Common Sandpiper	*Actitis hypoleucos*						L
African Jacana	*Actophilornis africanus*						L
Spotted Thick-knee	*Burhinus capensis*				Confirmed		

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Pied Avocet	*Recdurvirostra avosetta*						L
Three-banded Plover	*Charadrius tricollaris*						L
Blacksmith Lapwing	*Vanellus armatus*				Confirmed		
African Wattled Lapwing	*Vanellus senegallus*				Confirmed		
Crowned Lapwing	*Vanellus coronatus*				Confirmed		
Bronze-winged Courser	*Rhinoptilus chalcopterus*						L
Grey-headed Gull	*Larus cirrocephalus*						L
Whiskered Tern	*Chlidonias hybrida*						L
Osprey	*Pandion haliaetus*						L
Black-shouldered Kite	*Elanus caeruleus*				Confirmed		
Yellow-billed Kite	*Milvus migrans*						L
African Fish-Eagle	*Haliaeetus vocifer*						L
Black-chested Snake Eagle	*Circaetus pectoralis*						L
Brown Snake Eagle	*Circaetus cinereus*						L
African Harrier-Hawk	*Polyboroides typus*				Confirmed		
Lizard Buzzard	*Knaupifalco monogrammicus*				Confirmed		
Gabor Goshawk	*Melierax gabar*						L
Shikra	*Accipiter badius*				Confirmed		
Little Sparrowhawk	*Accipiter minullus*						L
Ovambo Sparrowhawk	*Accipiter ovampensis*						L
Black Sparrowhawk	*Accipiter melanoleucus*				Confirmed		
Wahlberg's Eagle	*Aquila wahlbergi*				Confirmed		
Long-crested Eagle	*Lophaetus occipitalis*						L
Greater Kestrel	*Falco rupicoloides*						L
Amur Falcon	*Falco amurensis*		**NBM**			M	

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Lanner Falcon	*Falco biarmicus*	VU					L
Peregrine Falcon	*Falco peregrinus*						L
Little Grebe	*Tachybaptus ruficollis*					M	
Greater Crested Grebe	*Podiceps cristatus*						L
African Darter	*Anhinga rufa*				Confirmed		
Reed Cormorant	*Phalacrocrorax africanus*				Confirmed		
White-breasted Cormorant	*Phalacrocorax lucidus*				Confirmed		
Black Heron	*Egretta ardesiaca*						L
Little Egret	*Egretta garzettta*					M	
Yellow-billed Egret	*Egretta intermedia*						L
Grey Heron	*Ardea cinerea*				Confirmed		
Black-headed Heron	*Ardea melanocephala*				Confirmed		
Goliath Heron	*Ardea goliath*						L
Purple Heron	*Ardea purpurea*						L
Cattle Egret	*Bubulcus ibis*				Confirmed		
Squacco Heron	*Ardeola ralloides*						L
Green-backed Heron	*Butorides striata*				Confirmed		
Black-crowned Night Heron	*Nycticorax nycticorax*					M	
Little Bittern	*Ixobrychus minutus*						L
Hamerkop	*Scopus umbretta*				Confirmed		
Lesser Flamingo	*Phoenicopterus minor*	NT					L
Glossy Ibis							L
Hadeda Ibis	*Bostrychia hagedash*				Confirmed		
African Sacred Ibis	*Threskiornis aethiopicus*				Confirmed		
African Spoonbill	*Platalea alba*						L
Yellow-billed Stork	*Mycteria ibis*	EN					L

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Abdim's Stork	*Ciconia abdimii*	NT					L
White Stork	*Ciconia ciconia*		NBM				L
Black-headed Oriole	*Oriolus larvatus*				Confirmed		
Fork-tailed Drongo	*Dicrurus adsimilis*				Confirmed		
African Paradise-Flycatcher	*Terpsiphone viridis*				Confirmed		
Brubru	*Nilaus afer*						L
Black-backed Puffback	*Dryoscopus cubla*				Confirmed		
Black-crowned Tchagra	*Tchagra senegalus*				Confirmed		
Brown-crowned Tchagra	*Tchagra australis*				H		
Southern Boubou	*Laniarius ferrugineus*				Confirmed		
Crimson-breasted shrike	*Laniarius atrococcineus*						L
Bokmakierie	*Telophorus zeylonus*				H		
Orange-breasted Bush-Shrike	*Teleophorus sulfureopectus*						L
Grey-headed Bush-Shrike	*Malaconotus blanchoti*				Confirmed		
Chinspot Batis	*Batis molitor*				Confirmed		
Pied crow	*Corvus albus*				Confirmed		
Red-backed Shrike	*Lanius collurio*		NBM			M	
Lesser Grey Shrike	*Lanius minor*		NBM				L
Common Fiscal	*Lanius collaris*				H		
Magpie Shrike	*Corvineella melanoleuca*						L
Black Cuckooshrike	*Campephaga flava*				Confirmed		
Grey Penduline Tit	*Anthoscopus caroli*						L
Southern Black Tit	*Parus niger*						L
Ashy Tit	*Parus cinerascens*						L
Brown-throated Martin	*Riparia paludicola*						L

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Banded Martin	*Riparia cincta*						L
Barn Swallow	*Hirundo rustica*		NBM		H		
White-throated Swallow	*Hirundo albigularis*		BM		Confirmed		
Pearl-breasted Swallow	*Hirundo dimidiata*		BM			M	
Greater Striped Swallow	*Cecropis cucullata*		BM		H		
Lesser Striped Swallow	*Hirundo abyssinica*		BM		Confirmed		
Red-breasted Swallow	*Cecropis semirufa*		BM			M	L
Rock Martin	*Hirundo fuligula*				Confirmed		
Common House Martin	*Delichon urbucum*				Confirmed		
Dark-capped Bulbul	*Pycnonotus tricolor*				Confirmed		
Fairy Flycatcher	*Stenostira scita*				Confirmed		
Cape Grassbird	*Sphenoeacus afer*					M	
Long-billed Crombec	*Sylvietta rufescens*					M	
Yellow-bellied Eremomela	*Eremomela icteropygialis*						L
Burnt-necked Eremomela	*Eremomela usticollis*						L
Little Rush-Warbler	*Bradypterus baboecala*						L
Sedge Warbler	*Acrocephalus schoenobaenus*		NBM				L
African Reed-Warbler	*Acrocephalus baeticatus*		BN				L
Marsh Warbler	*Acrocephalus palustris*		NBM				L
Lesser Swamp-Wabler	*Acrocephalus gracilirostris*						L
Icterine Warbler	*Hippolaris icterina*		NBM				L
Willow Warbler	*Phylloscopus trochilus*		NBM		H		
Arrow-marked Babbler	*Turdoides jardineii*				Confirmed		
Chestnut-vented Tit-Babbler	*Parisoma subcaeruleum*					M	

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		R D	S	E	High	Mediu m	Low
Garden Warbler	*Sylvia borin*						L
Common Whitethroat	*Sylvia communis*						L
Cape White-eye	*Zosterops capensis*			**(*)**	Confirmed		
Lazy Cisticola	*Cisticola aberrens*					M	
Rattling Cisticola	*Cisticola chiniana*				Confirmed		L
Wailing Cisticola	*Cisticola lais*						L
Levaillant's Cisticola	*Cisticola tinniens*				Confirmed		
Neddicky	*Cisticola fulvicapilla*				H		
Zitting Cisticola	*Cisticola juncidis*				H		
Desert Citicola	*Cisticola aridulus*						L
Cloud Cisticola	*Cisticola tektrix*						L
Wing-snapping Cisticola	*Cisticola ayresii*						L
Tawny-flanked Prinia	*Prinia subflava*				Confirmed		
Black-chested Prinia	*Prinia flavicans*				**H**		
Bar-throated Apalis	*Apalis thoracica*				Confirmed		
Grey-backed Camaroptera	*Camaroptera brevicaudata*				Confirmed		
Melodious Lark	*Mirafra cheniana*						L
Rufous-naped Lark	*Mirafra africana*					M	
Dusky Lark	*Pinarocorys nigrucans*						L
Red-capped Lark	*Calandrella cinerea*						L
Cape Rock-Thrush	*Monticola rupestris*						L
Groundscraper Thrush	*Psophocichla litsitsirupa*				Confirmed		
Kurrichane Thrush	*Turdus libonyanus*				Confirmed		
Karoo Thrush	*Turdus smithi*			**(*)**	Confirmed		
Pale Flycatcher	*Bradornis pallidus*						L
Marico Flycatcher	*Bradornis mariquensis*				Confirmed		

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Southern Black Flycatcher	*Melaenornis pammelaina*						L
Fiscal Flycatcher	*Sigelus silens*			(*)	Confirmed		
Spotted flycatcher	*Muscicapa striata*		NBM			M	
Cape Robin-Chat	*Cossypha caffra*				Confirmed		
White-throated Robin-Chat	*Cossypha humeralis*				H		
White-browed Scrub-Robin	*Cercotrichas leucophrys*					M	
Kalahari Scrub-Robin	*Cercotrichas paena*						L
African Stonechat	*Saxicola torquatus*				H		
Mountain Wheatear	*Oenanthe monticola*					M	
Familiar Chat	*Cercomela familiaris*						L
Ant-eating Chat	*Myrmecocichla formicivora*						L
Mocking Cliff-Chat	*Thamnolaea cinnamomeiventris*				Confirmed		
Red-winged Starling	*Onychognathus morio*				Confirmed		
Cape Glossy Starling	*Lamprotornis nitens*				Confirmed		
Violet-backed Starling	*Cinnyricinclus leucogaster*				Confirmed		
Pied Starling	*Lamprotornis bicolor*						L
Wattled Starling	*Creatophora cinerea*						L
Common Myna	*Acridotheres tristis*		I		Confirmed		
Amethyst Sunbird	*Chalcomitra amethystina*				Confirmed		
Malachite Sunbird	*Nectarinia famosa*						L
White-bellied Sunbird	*Cinnyris talatala*				Confirmed		
Scaly-feathered Finch	*Sporopipes squamifrons*						L
White-browed Sparrow-Weaver	*Plocepasser mahali*					M	
Lesser Masked Weaver	*Ploceus intermedius*						L

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Cape Weaver	*Ploceus capensis*				Confirmed		
Southern Masked-Weaver	*Ploceus velatus*				Confirmed		
Village Weaver	*Ploceus cucullatus*				Confirmed		
Red-Headed Weaver	*Anaplectes melanotis*						L
Red-billed Quelea	*Quelea quelea*				Confirmed		
Yellow-crowned Bishop	*Euplectes afer*					M	
Southern Red Bishop	*Euplectes orix*				Confirmed		
Fan-tailed Widowbird	*Euplectes axillaris*						L
White-winged Widowbird	*Euplectes albonotatus*				Confirmed		
Red-collared Widowbird	*Euplectes ardens*						L
Long-tailed Widowbird	*Euplectes progne*						L
Thick-billed Weaver	*Amblyospiza albifrons*				Confirmed		
Orange-breasted Waxbill	*Amandava subflava*						L
African Quailfinch	*Ortygospiza fuscocrissa*						L
Red-headed Finch	*Amadina erythrocephala*				Confirmed		
Cut-throat Finch	*Amadina fasciata*				Confirmed		
Black-faced Waxbill	*Estrilda erythrinotos*						L
Common Waxbill	*Estrilda astrild*				Confirmed		
Blue waxbill	*Uraeginthus angolensis*					M	
Green-winged Pytilia	*Pytilia melba*					M	
Red-billed Firefinch	*Laginosticta senegala*						L
African Firefinch	*Lagonosticta rubricata*				Confirmed		
Jameson's Firefinch	*Lagonosticta rhodopareia*						L
Bronze Mannikin	*Spermestes cucullatus*				Confirmed		
Pin-tailed Whydah	*Vidua macroura*				Confirmed		

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 4.2 above)		
		RD	S	E	High	Medium	Low
Long-tailed paradise-Whydah	*Vidua paradisaea*						L
Shaft-tailed Whydah	*Vidua regia*						L
Village Indigobird	*Vidua chalybeate*						L
Dusky Indigobird	*Vidua funerea*						L
Purple Indigobird	*Vidua purpurascens*						L
House Sparrow	*Passer domesticus*		I		Confirmed		
Greater Sparrow	*Passer motitensis*						L
Cape Sparrow	*Passer melanurus*				Confirmed		
Southern Grey-headed Sparrow	*Passer diffuses*				Confirmed		
Yellow-throated Petronia	*Petronia superciliaris*						L
African Pied Wagtail	*Motacilla aguimp*						L
Cape Wagtail	*Motacilla capensis*				Confirmed		
Cape Longclaw	*Macronyx capensis*					M	
Striped Pipit	*Anthus lineiventriis*				Confirmed		
African Pipit	*Anthus cinnamomeus*				H		
Bushveld Pipit	*Anthus caffer*						
Nicholson's	*Anthus nicholsoni*						L
Cape Canary	*Serinus canicollis*						L
Yellow-fronted Canary	*Crithagra mozambicus*				Confirmed		
Black-throated Canary	*Crithagra atrogularis*				H		
Yellow Canary	*Chrithagra flaviventris*						L
Streaky-headed Seedeater	*Crithagra gularis*				H		
Cape Bunting	*Emberiza capensis*						L
Cinnamon-breasted Bunting	*Emberiza tahapisi*					M	
Golden-breasted Bunting	*Emberiza flaviventris*						L

Red Status	Status in south Africa (S)	Endemism in South Africa (E)
NA = Not Assessed	BM = breeding migrant	Endemism in South Africa (E) (not southern Africa as in field guides)
LC = Least Concern	NBM = non-breeding migrant	
NT = Near-Threatened	V = vagrant	* = endemic
VU = Vulnerable	I = introduced	
EN = Endangered	R = rare	(*) = near endemic (i.e. ~70% or more of population in RSA)
CR = Critically Endangered	PRB = probable rare breeder	B* = breeding endemic
EX = Extinct Regionally	RB = rare breeder	B(*) = breeding near endemic
NR = Not Recognised	RV = rare visitor	W* = winter endemic
Red Status is from *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland,* Taylor (2015).		

Table 6.5: Red-listed species whose possible presence at the site of the proposed development was evaluated during the assessment process.

Species	Scientific name	Red Data[1]	Assessment of likelihood of presence at site
Stork, Marabou	*Leptoptilos crumeniferus*	NT	Very unlikely. No suitable habitat – occurs in open, semi-arid areas, wetlands. Rarely found outside of game reserves / ranching areas. Not recorded in this Pentad (SABAP 2).
Stork, Yellow-billed	*Mycteria ibis*	EN	Habitat not suitable - generally inhabits open, shallow water. Recorded in this Pentad (SABAP 2)
Stork, Black	*Ciconia nigra*	VU	Unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Stork, Abdim's	*Ciconia abdimii*	NT	Possible, but unlikely. Occurs in grasslands, woodlands and cultivated fields in rural areas. Recorded in this Pentad (SABAP 2).
Flamingo, Greater	*Phoenicopterus ruber*	NT	Extremely unlikely – no suitable habitat on site. Not recorded in this Pentad (SABAP 2).
Flamingo, Lesser	*Phoenicopterus minor*	NT	Extremely unlikely – no suitable habitat on site. Recorded in this Pentad (SABAP 2).
Duck, Maccoa	*Oxyura maccoa*	NT	Extremely unlikely – occurs in permanent standing water bodies. Not recorded in this Pentad (SABAP 2).
Secretarybird	*Sagittarius serpentarius*	VU	Unlikely. Site is too small and disturbed to host this species. Not recorded in this Pentad (SABAP 2).
Vulture, White-Backed	*Gyps africanus*	CE	Unlikely. Site is too small and disturbed to host this species. Not recorded in this Pentad (SABAP 2).
Vulture, Cape	*Gyps coprotheres*	EN	Unlikely. Ranges widely, but unlikely to venture into a small transformed landscape. However, occurs within 50 km of site, and therefore possible that birds traverse the area from time to time. Not recorded in this Pentad (SABAP 2).

Falcon, Lanner	*Falco biarmicus*	VU	Occurrence possible, but the area is unlikely to be important hunting habitat. Recorded in this Pentad (SABAP 2).
Falcon, Red-footed	*Falco vespertinus*	NT	Unlikely. Occurs in open savannas, but the site is too small and too disturbed. Not recorded in this Pentad (SABAP 2).
Eagle, Verreaux's	*Aquila verreauxii*	VU	Unlikely. Largely confined to mountainous areas. However, occurs within 20 km of site, and therefore possible that birds traverse the area from time to time. Not recorded in this Pentad (SABAP 2).
Eagle, Martial	*Polemaetus bellicosus*	EN	Unlikely - requires huge areas of suitable habitat and avoids disturbed landscapes. Not recorded in this Pentad (SABAP 2).
Eagle Tawny	*Aquila rapax*	EN	Unlikely - requires huge areas of suitable habitat and avoids disturbed landscapes. Not recorded in this Pentad (SABAP 2).
Marsh-harrier, African	*Circus ranivorus*	EN	Unlikely. Site too small and disturbed. Not recorded in this Pentad (SABAP 2).
Harrier Pallied	*Circus macrourus*	NT	Unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Finfoot, African	*Podica senegalensis*	VU	Extremely unlikely – requires slow-flowing water in large river systems. The waterbodies are much too small and disturbed to hold this species. Not recorded in this Pentad (SABAP 2).
Night Heron, White-backed	*Gorsachius leuconotus*	VU	Very unlikely. Require clear, swift-or slow-flowing perennial rivers. Not recorded in this Pentad (SABAP 2).
Crane, Blue	*Anthropoides paradiseus*	NT	Very unlikely. Site too small and surroundings too disturbed to host this species. Not recorded in this Pentad (SABAP 2).
Korhaan, White-bellied	*Eupodotis senegalensis*	VU	Unlikely. Site too small and surroundings too disturbed host this species. Not recorded in this Pentad (SABAP 2).
Painted-snipe, Greater	*Rostratula benghalensis*	NT	Unlikely. Habitat not suitable, prefer freshwater wetlands, where they prefer secluded muddy areas adjacent to concealing vegetation. Not recorded in this Pentad (SABAP 2).
Pratincole, Black-winged	*Glareola nordmanni*	NT	Unlikely. Site too small and disturbed. Not recorded in this Pentad (SABAP 2).

Curlew, Eurasian	*Numenius arquata*	NT	Unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Grass-owl, African	*Tyto capensis*	VU	Extremely unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Pelican, Great White	*Pelecanus onocrotalus*	VU	Extremely unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Pelican, Pink-backed	*Pelecanus rufescens*	VU	Extremely unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).
Kingfisher, Half-collared	*Alcedo semitorquata*	NT	Extremely unlikely. Habitat not suitable. The waterbodies are too shallow and/or slow-flowing with no riverine habitat. Recorded in this Pentad (SABAP 2).
Roller, European	*Coracias garrulus*	NT	Unlikely. Habitat not suitable. Not recorded in this Pentad (SABAP 2).

[1]Current (2015) IUCN Red List Status for South Africa, Lesotho and Swaziland (Taylor et al. 2015). NT = *Near Threatened*; VU = *Vulnerable*; EN = *Endangered*; CR = *Critically Endangered*

6.2.3 Threatened and Red Listed Bird Species

A total of 29 threatened or near-threatened species (Taylor, Peacock & Wanless, 2015) were recorded in the general area (Table 6.5). However, of these species, only five were actually recorded in the Pentad of the study site (SAPAB 2), namely the yellow-billed stork, Abdim's stork, lesser flamingo, half-collared kingfisher and lanner falcon. There are many full protocols for the Pentad, which imply that the data for the site is fairly accurate. However, for most Red Data species the nature of the site is such that their occurrence is extremely unlikely (Table 6.5). Due to the limited extent and quality of the habitats, half the species are expected to be at best erratic visitors and the other half are only expected as infrequent vagrants, their inclusion being primarily due to the Precautionary Principle. As can be seen from the estimates of the habitats as support for the basic requirements of the species, they are considered at best as only mediocre for all the threatened species. The odd yellow-billed stork, Abdim's stork or lanner falcon may fly over the site, but the area is unlikely to be an important hunting or scavenging habitat.

6.3 HERPETOFAUNA

6.3.1 Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological habitat perspective, it was established that three of the four major habitat types are represented on the study site, i.e. terrestrial, rupicolous and arboreal. Small areas of wetland habitat occur near the site.

The site visit was conducted during late summer and early autumn and generally, the grass cover was fair to good. The natural plains bushveld were first transformed for agricultural purposes and later by other anthropogenic influences such as wire and concrete fences, ground clearing, a brick road, invasive plants, water tanks and construction buildings. The study site is thus ecologically disturbed in part, but the ridge is in fair to good condition and offers connectivity with other natural areas on neighbouring properties. A few moribund termitaria were recorded on the study site. These structures are generally good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the herpetofauna population density for the study site is somewhat higher. At the time of the site visit, the basal cover was good in some places and would provide adequate cover for terrestrial herpetofauna.

There are good natural rupicolous habitats on the ridge of the study site and good man-made rupicolous habitat exists in the form of concrete fences. Due to the presence of large natural rupicolous habitat, some species like southern rock agama and common girdled lizard were added to the species list in Table 6.6.

Natural arboreal habitat occurs on the study site. Due to the presence of natural arboreal habitat, some species like flap-neck chameleon and tree agama were added to the species

list in Table 6.6. Exotic trees occur on the site and their dead logs could provide shelter and food for some herpetofauna.

There is no aquatic habitat or vegetation on the actual study site. There is an important man-made dam on erf 352 near the site. These water sources would provide habitat for a few water-dependent herpetofauna. The Nile monitor and some other herpetofauna species would be absent from the study site because of their narrow dependence on wetland habitat.

6.3.2 Expected and Observed Herpetofauna Species Richness

Of the 67 reptile species that may occur on the study site (Table 6.6), three were confirmed during the site visits (Table 6.7), and of the 12 amphibian species that may possibly occur on the study site (Table 6.6), none were confirmed during the site visits (Table 6.7). Seven other herpetofauna species were confirmed by Dr. Maryke Carstens from erf 352 (Table6. 7)

the reptiles & amphibians which were observed on or deduced to occupy the site are listed in Table 6.6.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 6.6) are fairly common and widespread (viz. the common house snake, Cape skink, speckled rock skink, variable skink, yellow-throated plated lizard, common dwarf gecko, guttural toad and red toad).

The species richness is fair due to the fact that all four habitat types occur on or near the study site.

Table 6.6: The Reptile and Amphibian species observed on or deduced to occupy the site

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	**REPTILES**
	Order: TESTUDINES	**TORTOISES & TERRAPINS**
	Family: Pelomedusidae	**Side-necked Terrapins**
√	*Pelomedusa subrufa*	Marsh Terrapin
	Family: Testudinidae	Tortoises
Vu*?*	*Kinixys lobatsiana*	Lobatse Hinged-Back Tortoise
?	*Kinixys spekii*	Speke's Hinged-Back Tortoise
√	*Stigmochelys pardalis*	Leopard Tortoise
	Order: SQUAMATA	**SCALE-BEARING REPTILES**
	Suborder:LACERTILIA	**LIZARDS**
	Family: Gekkonidae	**Geckos**

	SCIENTIFIC NAME	ENGLISH NAME
?	*Chondrodactylus turneri*	Turners's Gecko
√	*Hemidactylus mabouia*	Common Tropical House Gecko
√	*Lygodactylus capensis*	Common Dwarf Gecko
√	*Pachydactylus affinis*	Transvaal Gecko
*	*Pachydactylus capensis*	Cape Gecko
	Family: Lacertidae	**Old World Lizards or Lacertids**
?	*Ichnotropis capensis*	Ornate Rough-Scaled Lizard
√	*Meroles squamulosus*	Savanna Lizard
*	*Nucras holubi*	Holub's Sandveld Lizard
√	*Nucras intertexta*	Spotted Sandveld Lizard
√	*Nucras ornata*	Ornate Sandveld Lizard
√	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard
	Family: Cordylidae	
?	*Cordylus jonesii*	Jones' Girdled Lizard
√	*Cordylus vittifer*	Common Girdled Lizard
	Family: Gerrhosauridae	**Plated Lizards**
√	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
	Family: Scincidae	**Skinks**
?	*Acontias gracilicauda*	Thin-tailed Legless Skink
?	*Acontias occidentalis*	Savanna Legless Skink
√	*Afroablepharus wahlbergii*	Wahlberg's Snake-Eyed Skink
√	*Mochlus sundevallii sundevallii*	Sundevall's Writhing Skink
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis punctatissima*	Speckled Rock Skink
√	*Trachylepis varia*	Variable Skink
	Family: Varanidae	**Monitors**
√	*Varanus albigularis albigularis*	Southern Rock Monitor
	Family: Chamaeleonidae	**Chameleons**
√	*Chamaeleo dilepis dilepis*	Common Flap-Neck Chameleon
	Family: Agamidae	**Agamas**
√	*Agama aculeate distanti*	Ground Agama
√	*Agama atra*	Southern Rock Agama
?	*Acanthocercus atricollos atricollis*	Southern Tree Agama
	Suborder: SERPENTES	**SNAKES**
	Family: Typhlopidae	**Blind Snakes**
√	*Afrotyphlops bibronii*	Bibron's Blind Snake
?	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake
	Family: Leptotyphlopidae	**Thread Snakes**
?	*Leptotyphlops distanti*	Distant's Thread Snake
?	*Leptotyphlops incognitus*	IncognitoThread Snake
√	*Leptotyphlops scutifrons*	Peter's Thread Snake
	Family: Pythonidae	**Pythons**
?	*Python natalensis*	Southern African Python

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Viperidae	**Adders**
√	*Bitis arietans arietans*	Puff Adder
?	*Bitis caudalis*	Horned Adder
√	*Causus rhombeatus*	Rhombic Night Adder
	Family: Lamprophiidae	
√	*Aparallactus capensis*	Black-headed Centipede Eater
*	*Atractapis bibronii*	Bibron's Stiletto Snake
√	*Boaedon capensis*	Common House Snake
?	*Lamprophis aurora*	Aurora House Snake
√	*Lycodonomorphus rufulus*	Brown Water Snake
√	*Lycophidion capense*	Cape Wolf Snake
?	*Psammophis angolensis*	Dwarf Sand Snake
√	*Psammophis brevirostris*	Short-snouted Grass Snake
?	*Psammophis crucifer*	Cross-Marked Grass Snake
?	*Psammophis subtaeniatus*	Western Yellow-bellied Sand Snake
?	*Psammophis trinasalis*	Kalahari Sand Snake
*	*Psammophylax rhombeatus*	Spotted Grass Snake
√	*Psammophylax tritaeniatus*	Striped Grass Snake
*	*Duberria lutrix*	Common Slug Eater
?	*Prosymna bivittata*	Two-Striped Shovel-Snout
*	*Prosymna sundevallii*	Sundevall's Shovel-snout
√	*Pseudaspis cana*	Mole Snake
	Family: Elapidae	**Cobras, Mambas and Others**
?	*Elapsoidea sunderwallii*	Sundevall's Garter Snake
√	*Hemachatus haemachatus*	Rinkhals
√	*Naja annulifera*	Snouted Cobra
√	*Naja mossambica*	Mozambique Spitting Cobra
	Family: Colubridae	
√	*Crotaphopeltis hotamboeia*	Red-Lipped Snake
√	*Dasypeltis scabra*	Rhombic Egg Eater
√	*Dispholidus typus*	Boomslang
?	*Philothamnus hoplogaster*	Southeastern Green Snake
?	*Philothamnus natalensis occidentalis*	Western Natal Green Snake
√	*Philothamnus semivariegatus*	Spotted Bush Snake
?	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake
	CLASS: AMPHIBIA	**AMPHIBIANS**
	Order: ANURA	**FROGS**
	Family: Pipidae	**Clawed Frogs**
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	**Toads**
√	*Sclerophrys gutturalis*	Guttural Toad
?	*Sclerophrys capensis*	Raucous Toad

	SCIENTIFIC NAME	ENGLISH NAME
?	*Sclerophrys poweri*	Western Olive Toad
√	*Schismaderma carens*	Red Toad
	Family: Hyperoliidae	**Reed Frogs**
*	*Kassina senegalesis*	Bubbling Kassina
	Family: Microhylidae	**Rubber Frogs**
?	*Phrynomantis bifasciatus*	Banded Rubber frog
	Family: Phrynobatrachidae	**Puddle Frog**
?	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family: Pyxicephalidae	
√	*Amietia delalandii*	Common River Frog
√	*Cocosternum boettgeri*	Boettger's Caco
*	*Tomopterna cryptotis*	Tremolo Sand Frog
?	*Tomopterna natalensis*	Natal Sand Frog

Systematic arrangement and nomenclature according to Branch (1998), Alexander & Marais (2007), Minter, *et.al* (2004), Bates, *et.al* 2014 and Du Preez & Carruthers (2017).

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103..In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 6.7: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Lygodactylus capensis	Common Dwarf Gecko	Sight record	Arboreal & Rupicolous
Trachylepis punctatissima	Speckled Rock Skink	Sight record	Rupicolous
Trachylepis varia	Variable Skink	Sight record	Rupicolous
Pelomedusa subrufa	Marsh Terrapin	Dr. M Carstens (pers.comm)	Aquatic
Stigmochelys pardalis	Leopard Tortoise	Dr. M Carstens (pers.comm)	Terrestrial
Boaedon capensis	Common House Snake	Dr. M Carstens (pers.comm)	Terrestrial
Sclerophrys gutturalis	Guttural Toad	Dr. M Carstens (pers.comm)	Aquatic
Schismaderma carens	Red Toad	Dr. M Carstens (pers.comm)	Aquatic
Xenopus laevis	Common Platanna	Dr. M Carstens (pers.comm)	Aquatic
Amietia delalandii	Common River Frog	Dr. M Carstens	Aquatic

		(pers.comm)	

The common dwarf gecko, speckled rock skink, variable skink, marsh terrapin, leopard tortoise, common house snake, guttural toad, red toad common, platanna & common river frog listed in Table 6.7 should be common on or near the study site and elsewhere in its range.

6.3.3 Threatened and Red listed Reptile and Amphibian Species

The study site falls outside the natural range of Nile crocodile. This species should not occur on the site.

The study site falls just inside the natural range of the Southern African python (Alexander, 2014). According to Bradley (1990), Southern African pythons favour moist, rocky, well-wooded valleys, plantations or bush country, but seldom if ever stray far from permanent water. The study site is too small to support even a small population of the Southern African python. It is often estimated that a single python needs at least a 100 ha area to forage. However, one or two Southern African python individuals may migrate to and from the study site from time to time.

The Southern African python's national status has changed from Vulnerable (Branch, 1988) to regional Least Concern (Alexander, 2014), although it is currently still a ToPS-listed species (Threatened or Protected Species).

The striped harlequin snake has not been recorded on this quarter degree square [2528CD] (TVL Museum Records or Ditsong Museum of Natural History), and only a few moribund termitaria, where this species is most likely to be found, are present on the study site. It is very difficult to confirm whether this cryptic snake is present on any study site, but this species should not occur on the study site.

The coppery grass lizard has been recorded on this quarter degree square (TVL Museum Records or Ditsong Museum of Natural History) but the study site is too disturbed and this species should not occur on the site.

There are no temporary water bodies on or near the study site. Giant bullfrogs need temporary dams in order to avoid predation from fish. This species should not occur on or near the study site.

The Lobatse hinged-back tortoise occurs in this quarter degree square [2528CD] (pers.observation).

The Lobatse hinged-back tortoise is not mentioned in the South African Red Data Book–Reptiles and Amphibians (Branch, 1988) and has the status of Least Concern in the Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates et.al. 2014). However, Hofmeyr & Boycott (2018) assess that this species has the Red Data Status of *Vulnerable*.

This species prefers rocky hillsides and rocky outcrops (Boycott & Bourquin, 2000). There is such habitat available on the site and rupicolous habitat on nearby properties. It is still possible that the odd individual may migrate to the study site. This development would not affect this species negatively, especially if the education of the construction staff about the value of wildlife and environmental sensitivity is properly done. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.

7. RESULTS: WETLAND

7.1 Watercourse databases and maps

On the 1:50 000 cadastral map (Figure 3.2 above) a drainage line is indicated as a canal. The hydrology map from GDARD shows the drainage line that transects the southern portion of the site (Figure 7.1 below). The flood lines are also indicated in Figure 7.1.

The only indication of a (former) canal is a small and shallow drainage line present in the extreme south-western corner of the site, coming from the neighbouring Erf 348 and flowing in an easterly direction but soon leaves the site through the southern boundary of Erf 349, towards Solomon Mahlangu Drive. (See paragraph 5.2.5). The canals are mainly manmade systems.

Figure 7.1: Left: A drainage line according to the GDARD website.
Right: The flood lines of the drainage line (Supplied by Environment and Agriculture Management Department, City of Tshwane)

No watercourses are indicated on site in the NFEPA wetlands of NFEPA rivers databases, the SAIIAE database, National Wetland Map 5 (NWM5) or Gauteng C-Plan. A small dam is indicated approximately 650 m (Google Earth image July 2001) to the north-east of the site in the NFEPA wetlands database and a portion of the stream to the north-east is included in the C-Plan database, approximately in the same area where the NFEPA database indicate a wetland (dam) area.

7.2 Watercourses on site

A canal is present on Portions 348 and 349. This canal conveys water from these properties to the south-west, to the stormwater channel in the Solomon Mahlangu Drive reserve, outside the boundary of the site. This canal is certainly man-made.

As indicated in Table 7.1 below the species observed in the canal on site is mainly widespread species and species that are indicators of disturbance. The few individuals that are associated with wetness is also associated with disturbance and present in very low densities. The water flowing through the canal during a rainfall event increases the suitability of the habitat for these species. The vegetation is however not an indication of wetland or riparian conditions but is rather an indication of disturbance.

Figure 7.1: Images of the canal located on site.

Table 7.1: List of species recorded within the channel on Erven 348 and 349, with their status.

Species	Growth form	Alien / invasive class	Indicator of

Species	Growth form	Alien / invasive class	Indicator of
Alternanthera pungens	Forb	Alien	Disturbance
Bidens pilosa	Forb	Alien	Disturbance
Bromus catharticus	Grass	Alien	Disturbance / Wetness
Celtis africana	Tree		Widespread
Dietes species	Shrub		Garden escape
Diospyros lycioides	Shrub		Rocky areas
Eucalyptus camaldulensis	Tree	Class 2 invader	Disturbance
Galinsoga parviflora	Forb	Alien	Disturbance
Ipomoea purpurea	Forb	Class 1b invader	Disturbance
Melia azedarach	Tree	Class 3 invader	Disturbance
Oenothera rosea	Forb	Alien	Disturbance / Wetness
Oxalis species	Forb		Disturbance / Wetness
Panicum maximum	Grass		Disturbance
Paspalum dilatatum	Grass	Alien	Disturbance
Pennisetum clandestinum	Grass	Not listed in this case	Disturbance
Plectanthus comosus	Forb	Alien	Disturbance
Ricinus communis	Shrub	Class 1b invader	Disturbance
Rumex crispus	Forb	Alien	Wetness
Searsia pyroides	Tree		Widespread
Senegalia caffra	Tree		Widespread
Sida dredgei	Forb		Widespread
Solanum lycopersicum	Forb	Alien	Garden escape
Solanum mauritianum	Shrub	Class 1b invader	Disturbance
Solanum panduriforme	Forb		Disturbance
Verbena bonariensis	Forb	Class 1b invader	Disturbance / Wetness

The soil in the canal is a red-brown loam with occasional manganese mottles. Rare grey flecks are present in the soil as well as signs of disturbance. The soil does not indicate prolonged wetness.

Figure 7.2: Images of the soil on site.

No canal, wetland unit or riparian area is visible on site on the historical aerial photograph from 1964, but a vegetated channel or riparian system is located adjacent to the area to the north-east in the same approximate area where the current vegetated canal is located. Although various aerial photographs are available for the 1970s and 1980s, these aerial photographs are of poor quality and very little is visible of the site.

7.3 Risk assessment

Table 7.2: Risk assessment table for the construction of the proposed houses.

Phase	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
				Flow Regime	Physico & Chemical	Habitat	Biota											
Construction	Site clearing	Clearing of riparian vegetation	Loss of wetland habitat and functions	1	1	1	1	1	1	2	4	1	1	5	1	**8**	**32**	**L**
		Erosion		1	1	1	1	1	1	2	4	2	2	5	1	**10**	**40**	**L**
		Sedimentation		1	1	1	1	1	1	2	4	2	2	5	1	**10**	**40**	**L**
		Soil compaction		1	1	1	1	1	1	2	4	2	1	5	1	**9**	**36**	**L**
		Encroachment of invasive species		1	1	1	2	1.3	1	2	4.3	2	2	5	1	**10**	**43**	**L**
Construction	Construction camp	Littering	Pollution of the wetland units	1	1	1	1	1	2	2	5	2	2	5	1	**10**	**50**	**L**
		Biological waste		1	1	1	1	1	2	2	5	2	1	5	2	**10**	**50**	**L**
		Spillage of hydrocarbons		1	1	1	1	1	2	2	5	2	1	5	1	**9**	**45**	**L**
Operational	Gardening	Infestation by alien and invasive species	Loss of wetland habitat and functions	1	1	1	1	1	2	2	5	2	1	5	1	**9**	**45**	**L**
		Alteration in species composition		1	1	1	1	1	2	2	5	2	1	5	1	**9**	**45**	**L**

Figure 7.3: Canal indicated on the topographical map 2528CD.

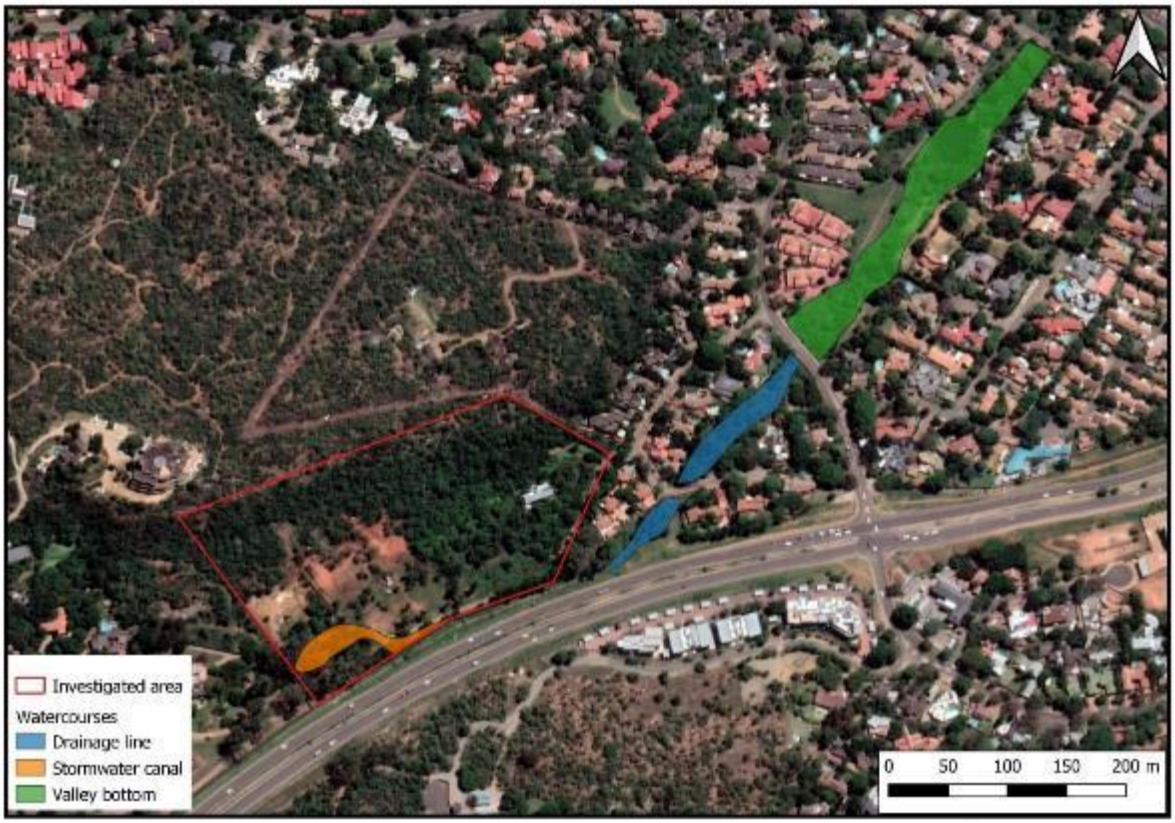

Figure 7.4: The watercourses and stormwater canal on site and adjacent to the site.

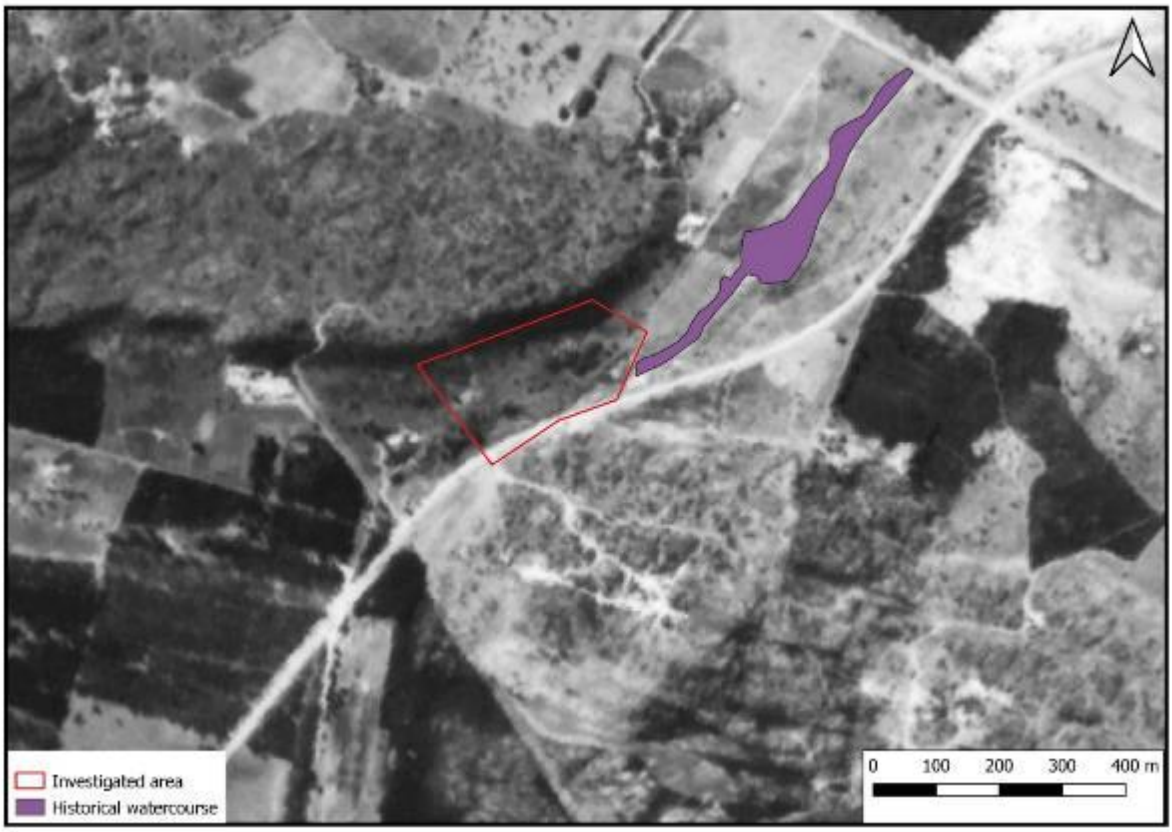

Figure 7.5: Historical watercourse area to the north-east of the area

Conclusion

A canal is present on Erven 348 and 349. The vegetation on site is indicative of disturbed conditions and **not wetland conditions** and the **soil is not hydromorphic**. **No watercourse is visible on site on the historical aerial photographs from 1964**. It is therefore highly likely that the canal indicated on the site is **man-made and artificial**. The man-made, artificial canal system on Erven 348 and 349 is weedy and modified by the surrounding land uses. The proposed houses will not have any impact on this man-made, artificial channel, due to the distances of from the channel. No permanent structures may occur within the flood lines of the drainage line. Although the indicated canal is not a wetland or riparian area the development activities must remain outside the channel and the determined flood lines. The risk assessment (Table 7.2 above) indicates that the proposed development of two houses on the Erf has a **Low risk** for any wetland.

The canal located to the north-east outside the site runs through densely developed residential area and it resembles a highly modified riparian area. Further east north of Disselboom Avenue the stormwater drainage canal eventually runs into a small, more natural valley bottom seasonal drainage line. This area is situated about 450 m from Erf 349 and is located within densely developed residential area. Considering the above, it is suggested that **no water licence is needed** for the suggested development on Erf 349.

8. IMPACT ASSESSMENT

As indicated in Paragraph 1 above, the development of two residential dwellings is proposed for Erf 349. Preferred and Alternative lay-out plans were proposed. The Preferred lay-out is based on suggestions made by the ecological consultants. The following results include the envisaged Impacts of both the Preferred and Alternative on vegetation, flora and fauna and the derived ecological sensitivity.

The Impact Assessment is based on the following **criteria** (also given under Methods, paragraph 4.4, but repeated here for convenience).

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **probability (P)** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **duration (D)**, wherein it will be indicated whether:
    - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
    - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
    - medium-term (5–15 years) – assigned a score of 3;
    - long term (> 15 years) - assigned a score of 4; or
    - permanent - assigned a score of 5;
- The **extent (E)**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **magnitude (M)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **significance (S)**, which shall be determined through a synthesis of the characteristics described above.

  The significance rating is calculated by the following formula:

  S (significance) = (D + E + M) x (P)

- The **status**, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The *degree* to which the impact can be *mitigated.*

The numerical value of the calculation is assigned to a significance category.

Table 8.1: Significance ranking of impacts

SIGNIFICANCE	**Very High**	**High**	**Moderate**	**Low**	**Minor**
	81-100	**61-80**	**41-60**	**21-40**	**1-20**

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

8.1 Results of the Impact Assessment: Vegetation and Flora

The plant communities with **High** ecological sensitivity (Figure 8.1 below), namely those that occur on the Bronberg Ridge and therefore within the Bronberg Conservation area, located on the northern part of Erf 349, should be **excluded** from any development. However, it is still suggested that the alien invasive *Lantana camara* (and other alien invasive plant species), which are abundantly present in these plant communities, be removed and controlled. This would imply a **positive** outcome of the proposed development for this highly sensitive ridge vegetation.

8.1.a: Impact on plant communities with Medium-Low or Low ecological sensitivity – Preferred Lay-Out

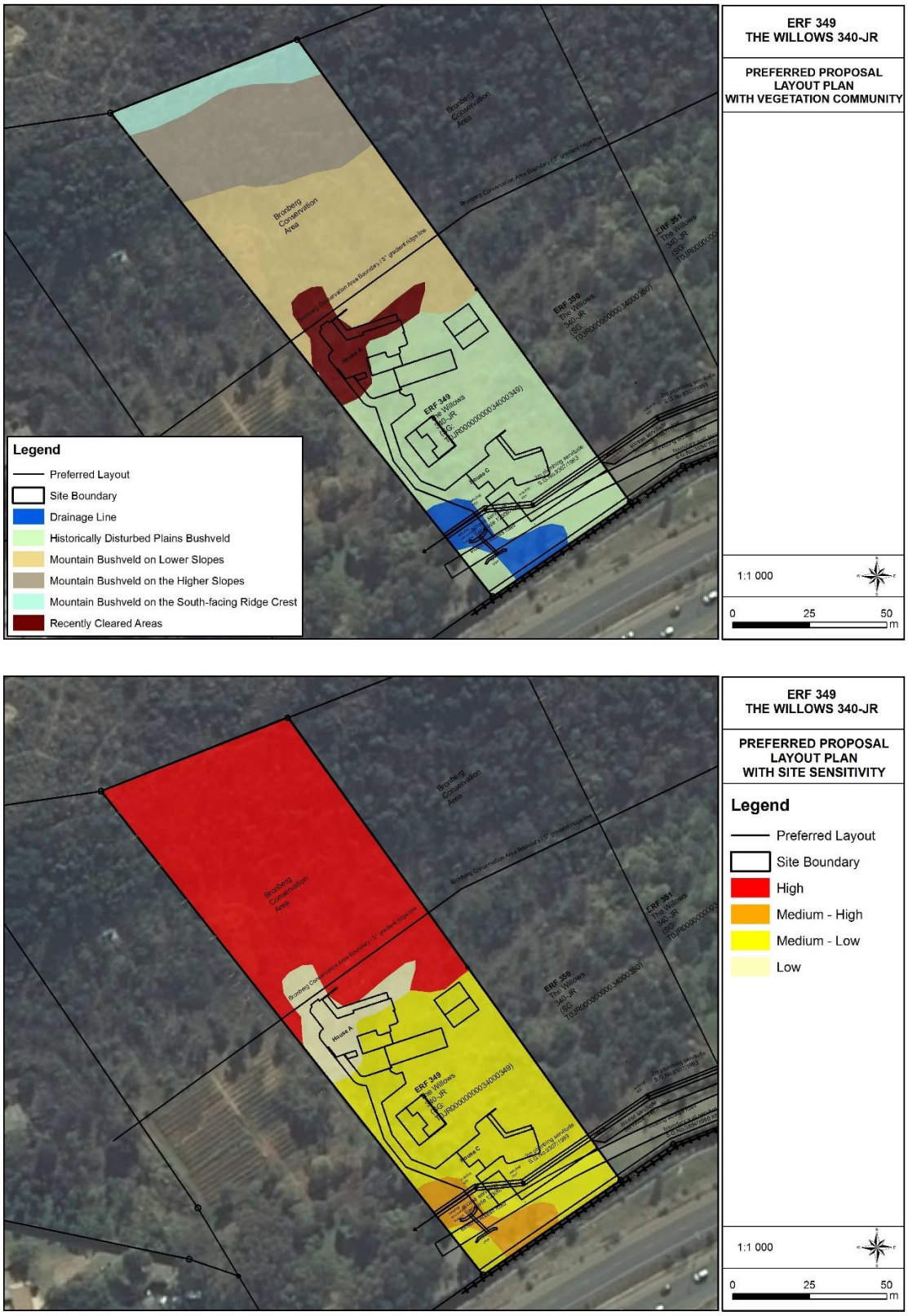

Figure 8.1: The Preferred Lay-Out over the plant communities (top) and the ecological sensitivity (bottom) on Erf 349.

Table 8.2: Impact of the Preferred Lay-Out development on plant communities with Medium-Low or Low ecological sensitivity - loss of indigenous vegetation due to clearing for construction of two residences.

Nature: The relevant area is 0,6 ha in size. Only the footprint area for the development of two residences will be cleared of vegetation. The rest of the area will remain as natural as possible, with the development of an indigenous garden with special measures to enhance habitat for Juliana's Golden Mole. The Due to the small area to be cleared, minimal loss of indigenous plant species is expected, while low disturbance of plant populations and the limited fragmentation of the already disturbed plant community will occur. The removal of vegetation will expose soil, with minimal risk of erosion during construction period.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short duration	1	Short duration	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Minor	2	Small	1
Significance	**Minor**	**20**	**Minor**	**15**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Major	5	Minor	2
Significance	**Moderate**	**55**	**Moderate**	**40**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- The clearing of vegetation must be kept to a minimum and remain within the footprint development – leave the rest of the area with natural vegetation in tact
- Leave all trees but remove alien invasive species wherever possible
- Construction must be completed as quickly as possible
- Disturbed open areas must be rehabilitated immediately after construction has been completed in that area by developing an indigenous garden by planting appropriate indigenous tree, grass and forb species
- During the construction phase workers must be limited to areas under construction and access to the planned open areas must be strictly controlled
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.
- Plant only indigenous trees – no alien species
- Adhere to the proposed management plan for Juliana's Golden Mole

Cumulative impacts: **Not** Expected to reduce the functional ecosystems in the area.

Residual Risks: Little anticipated as it is expected that the mitigation measures will be implemented correctly.

Table 8.3: Impact of the Preferred Lay-Out development on plant communities with Medium-Low or Low ecological sensitivity - Increase of alien invasive plant species on cleared sites.

Nature: Alien invasive plant species and weeds may encroach into any disturbed areas particularly areas cleared for the proposed development. Large parts of the proposed site already have various woody alien and invasive plant species present. These must be removed and an indigenous garden developed.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Short-term	1	Short-term	1
Extent	Limited to site	1	Limited to Site	1
Magnitude	Moderate	5	Minor	2
Significance	**Minor**	**14**	**Minor**	**4**
Status (positive or negative)	Negative		Positive	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to site	1	Limited to Site	1
Magnitude	Low	2	Low	1
Significance	**Minor**	**16**	**Minor**	**7**
Status (positive or negative)	Negative		Positive	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- An alien invasive management programme must be incorporated into the Environmental Management Programme;
- Ongoing alien plant control must be undertaken;
- Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan must be implemented for the clearing/eradication of alien species.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.
- Avoid planting of exotic plant species, use indigenous species.
- Develop an indigenous garden.
- Adhere to the proposed management plan for Juliana's Golden Mole

Cumulative impacts: Minor, should mitigation measure not be implemented. Alien invader plant species pose an ecological threat as they alter habitat structure; lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs.

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly, and rehabilitation of the site is undertaken.

The Impact Assessment is restricted to the plant communities with Medium-Low or Low ecological sensitivity.

The ecological sensitivity of the Historically Disturbed Plains Bushveld and the Recently Cleared Areas is **Medium-Low** or **Low**. This is mainly due to the transformed, degraded and

disturbed nature of these plant communities, they have medium species richness and do not contain any protected plant species. The proposed development is restricted to these two plant communities with Medium-Low or Low ecological sensitivity (Figure 8.1 above).

As the natural vegetation had already long ago been transformed the **significance of the impact** of the proposed development on this vegetation, with mitigation, is therefore considered to be **Minor** during construction and **Low** during operational phases. Removal and control of alien invasive plant species is very important. There is adequate space left for conservation of plains bushveld, albeit historically disturbed, and the development of an indigenous garden and implementation of the management plan for Juliana's Golden Mole are important measures to maintain biodiversity on the site.

From vegetation and flora point of view, the proposed development on this area can be supported (Table 8.2 and 8.3 above).

8.1.b: Impact of the Alternative Lay-Out development on plant communities with High, Medium-Low or Low ecological sensitivity

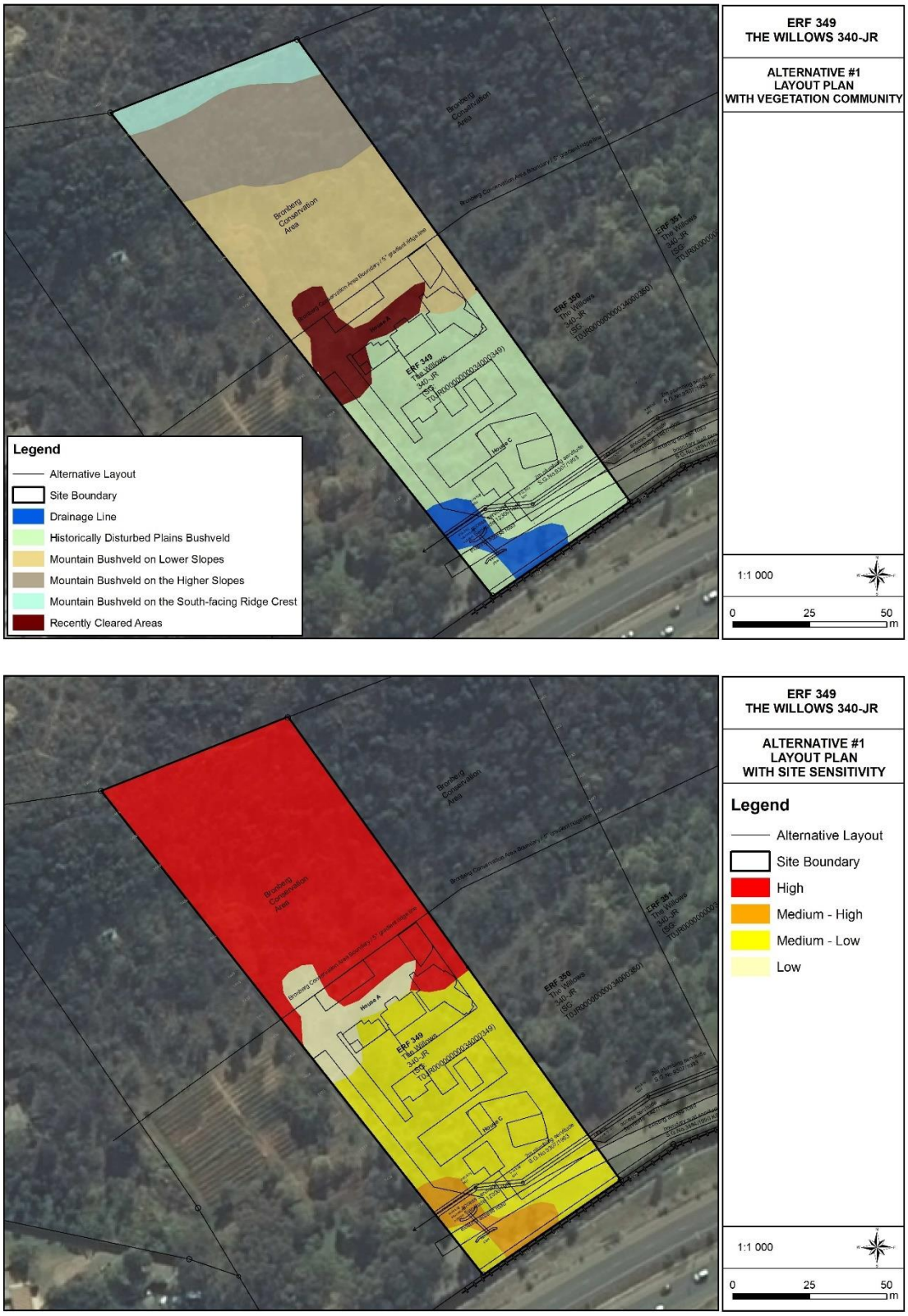

Figure 8.2: The Alternative Lay-Out over the plant communities (top) and the ecological sensitivity (bottom) on Erf 349.

Table 8.4: Impact of the Alternative Lay-Out development on plant communities with High, Medium-Low or Low ecological sensitivity - loss of indigenous vegetation due to clearing for construction of two residences.

Nature: The relevant area is 0,6 ha in size. The footprint area for the development of two residences is widely spread over the plains area and partially on the lower slopes of the Bronberg (but restricted to the area below the conservation line). This area will be cleared of vegetation. Little area will remain natural, with little area left for the development of an indigenous garden with special measures to enhance habitat for Juliana's Golden Mole. Due to the relatively large area to be cleared, loss of indigenous plant species is expected, while disturbance of plant populations and the fragmentation of the already disturbed plant community will occur. The removal of vegetation will expose soil, with minimal risk of erosion during construction period.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short duration	1	Short duration	1
Extent	Over entire site	3	Over entire site	3
Magnitude	High	8	Moderate	6
Significance	**High**	**60**	**Moderate**	**50**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Over entire site	3	Over entire site	3
Magnitude	High	8	Moderate	6
Significance	**Very High**	**80**	**High**	**70**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes to a limited extent			

Mitigation:

- The clearing of vegetation must be kept to a minimum and remain within the footprint development, which is over the entire site, – leave the limited rest of the area with natural vegetation intact,
- Leave all trees but remove alien invasive species wherever possible
- Construction must be completed as quickly as possible
- Disturbed open areas must be rehabilitated immediately after construction has been completed in that area by developing an indigenous garden by planting appropriate indigenous tree, grass and forb species
- During the construction phase workers must be limited to areas under construction and access to the planned open areas must be strictly controlled
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.
- Plant only indigenous trees – no alien species
- Adhere to the proposed management plan for Juliana's Golden Mole

Cumulative impacts: **Not** Expected to reduce the functional ecosystems in the area.

Residual Risks: Little anticipated as it is expected that the mitigation measures will be implemented correctly.

Table 8.5: Impact of the Alternative Lay-Out on plant communities with High, Medium-Low or Low ecological sensitivity - Increase of alien invasive plant species on cleared sites.

Nature: Alien invasive plant species and weeds may encroach into any disturbed areas particularly areas cleared for the proposed development. Large parts of the proposed site already have various woody alien and invasive plant species present. These must be removed and an indigenous garden developed.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Short-term	1	Short-term	1
Extent	Limited to site	1	Limited to Site	1
Magnitude	Moderate	5	Minor	2
Significance	**Minor**	**14**	**Minor**	**4**
Status (positive or negative)	Negative		Positive	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to site	1	Limited to Site	1
Magnitude	Low	2	Low	1
Significance	**Minor**	**16**	**Minor**	**7**
Status (positive or negative)	Negative		Positive	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation: • An alien invasive management programme must be incorporated into the Environmental Management Programme; • Ongoing alien plant control must be undertaken; • Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan must be implemented for the clearing/eradication of alien species. • Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. • Avoid planting of exotic plant species, use indigenous species. • Develop an indigenous garden. • Adhere to the proposed management plan for Juliana's Golden Mole				
Cumulative impacts: Minor, should mitigation measure not be implemented. Alien invader plant species pose an ecological threat as they alter habitat structure; lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs.				
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly, and rehabilitation of the site is undertaken.				

The Impact Assessment includes the plant communities with High, Medium-Low or Low ecological sensitivity.

The ecological sensitivity of the Historically Disturbed Plains Bushveld and the Recently Cleared Areas is **Medium-Low** or **Low,** but the Mountain Bushveld of Lower Slopes has

High ecological sensitivity (Figures 8.4 and 8.5 above). The Alternative Lay-Out development is widely spread over the entire Historically Disturbed Plains Bushveld, leaving limited area to conserve part of this bushveld. There is not adequate space left for conservation of plains bushveld, albeit historically disturbed, and also not adequate space the development of an indigenous garden and implementation of the management plan for Juliana's Golden Mole are important measures to maintain biodiversity on the site.

Due to the extent of the development as proposed by the Alternative Lay-Out development the **significance of the impact** of the proposed development on this vegetation, with mitigation, is therefore considered to be **High** during construction and **Very High** during operational phases. Removal and control of alien invasive plant species is still very important.

From vegetation and flora point of view, the proposed Alternative Lay-Out development is not supported.

8.2 Results of the Impact Assessment: Mammals

The conservation rating of the site for mammals must be regarded as being **High** due to the confirmed presence of Juliana's Golden Mole. No development at all may occur on the Bronberg Ridge. The proposed project involves development of two residences based on a Preferred Lay-Out plan and an Alternative Layout plan (Figures 8.1 and 8.2 above).

The development impacts on mammals will be during the construction phase and the operational phase, when people will occupy their new homes and they undertook to implement a conservation management plan. The impacts will mainly be habitat loss due to vegetation clearing and disturbance related to construction activities. Since the construction activities will be limited to the two residences only, the spatial extent of the impacts will also be limited. Should the proposed management plan for the maintained conservation of Juliana's Golden Mole be implemented during the operational phase, the habitat for small mammals will generally be maintained or even improved.

8.2.a: Impact on mammals – Preferred Lay-Out

The development according to the **Preferred Lay-Out** plan will be located on the Recently Disturbed Area with Low ecological sensitivity and the Historically Disturbed Plains Bushveld area with Medium-Low ecological sensitivity. An area with the current natural (disturbed) plains bushveld vegetation will remain as natural veld and an indigenous garden is planned for the immediate surroundings of the residences.

Table 8.6: Direct Impacts of the Preferred Lay-Out development on mammal communities and loss of mammal habitat.

Nature: The relevant area is 0,6 ha in size. Only the footprint area for the development of two residences will be cleared of vegetation. The rest of the area will remain as natural as possible, with the development of an indigenous garden with special measures to enhance habitat for Juliana's Golden Mole. The Due to the small area to be cleared, minimal loss of indigenous plant species is expected, while low disturbance of plant populations and the limited fragmentation of the already disturbed plant community will occur. The footprint for the proposed residential development will result in clearing most of the vegetation area. After clearing the vegetation, construction will commence. Construction activities may result in disturbance of mammal individuals or populations.

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	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Minor	4	Minor	1
Significance	**Low**	**30**	**Minor**	**15**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Site	1	Site	1
Magnitude	Moderate	5	Moderate	3
Significance	**Moderate**	**55**	**Moderate**	**45**
Status (positive or negative)	**Negative**		**Negative/Positive**	
Reversibility	No		No.	
Irreplaceable loss of resources?	No too small areas and natural mammal habitats are already disturbed for biodiversity or conservation.		No too small areas and natural mammal habitats are already disturbed for biodiversity or conservation.	
Can impacts be mitigated?	Yes,			

Mitigation:

- Should any South African Hedgehog or other mammal species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. The contractor must ensure that no indigenous mammal 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.
- During the construction phase there may be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate this environmental impact.
- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive plant species growing on the site.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred.
- Planting indigenous species in the gardens and development of an indigenous garden will enhance habitats for mammals.
- Implementation of the management plan for Juliana's Golden Mole will improve mammal habitats in general and contribute to the conservation of these species.

Cumulative impacts: Limited, the adjacent areas are already used as residential areas.

***Residual Risks*:** No.

8.2.b: Impact on mammals – Alternative Lay-Out

According to the **Alternative Lay-Out** plan, the development will occur widely spread over the Historically Disturbed Plains Bushveld area and the Recently Disturbed Area but will include part of the Mountain Bushveld on the Lower Slopes, which has a High ecological sensitivity. No development should occur on these lower slopes of the Bronberg Ridge.

Table 8.7: Direct Impacts of the Alternative Lay-Out development on mammal communities and loss of mammal habitat.

Nature: The relevant area is 0,6 ha in size. Although only the footprint area for the development of two residences will be cleared of vegetation this area is widely spread over the Historically Disturbed Plains Bushveld, Recently Disturbed Area and on part of the Bushveld on the Lower Slopes. The area will remain as natural as possible is therefore limited. Due to the larger area to be cleared, loss of mammal habitat is more. After clearing the vegetation, construction will commence. Construction activities may result in disturbance of mammal individuals or populations.

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	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Over entire site	1	Over entire site site	1
Magnitude	Minor	8	Minor	1
Significance	**Moderate**	**50**	**Minor**	**15**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Site	1	Site	1
Magnitude	Moderate	5	Moderate	2
Significance	**Moderate**	**55**	**Moderate**	**40**
Status (positive or negative)	**Negative**		**Negative/Positive**	
Reversibility	No		No.	
Irreplaceable loss of resources?	No too small areas and natural mammal habitats are already disturbed for biodiversity or conservation.		No too small areas and natural mammal habitats are already disturbed for biodiversity or conservation.	
Can impacts be mitigated?	Yes,			

Mitigation:

- Should any South African Hedgehog or other mammal species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. The contractor must ensure that no indigenous mammal 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.
- During the construction phase there may be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate this environmental impact.
- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive plant species growing on the site.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred.
- Planting indigenous species in the gardens and development of an indigenous garden will enhance habitats for mammals.
- Implementation of the management plan for Juliana's Golden Mole will improve mammal habitats in general and contribute to the conservation of these species.

Cumulative impacts: Limited, the adjacent areas are already used as residential areas.

***Residual Risks*:** No.

The Preferred Lay-Out development plan implies that a much larger area of natural vegetation will remain intact and a much larger area can be developed into a indigenous garden to the benefit of Juliana's Golden Mole. It is therefore envisaged that the impact of the Preferred Lay-Out development will be far less significant on the mammals, particularly the Juliana's Golden Mole, than the Alternative Lay-Out development, particularly should the conservation management plan be implemented.

8.3 Impacts on Avifauna

8.3.1 General comments

The impacts on avifauna will occur during both the construction and operational phases, though due to the very limited extent of the development of only two houses, the impacts will also be limited. The two broad categories of impacts will be habitat loss and disturbance related to construction activities and finally the increased presence of residents during the operational phase.

Avian habitat loss will be very limited, in fact new habitat will be created for certain species. The movement and activities of personnel and residents on site and the associated noise, pollution and litter all having a negative effect on birds. In addition, the presence of people will increase the probability of activities such as illegal killing of birds. Pollution associated with construction activities (e.g., fuel spills, use of cleaning chemicals) could have negative impacts on avifauna, particularly if such chemicals were to make their way into drainage lines and wetlands, even off-site. Electrical infrastructure such as distribution lines, as well as electric fences, pose a potential collision risk to flying birds, and a potential electrocution risk to perching birds.

The impacts of the Preferred and Alternative Lay-Out development plans will be very similar and therefore not tabled separately.

8.3.2 Specific impacts

Table 8.8: Avian habitat loss.

Nature: Construction of two residential houses and other buildings is likely to take place and may potentially incur the loss of habitat, but also potential creation of new habitats for certain species.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Probable	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	2	Limited to construction site	2
Magnitude	Minor	2	Small	1
Significance	**Low**	**25**	**Minor**	**20**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	No, area too small		No, area too small	
Can impacts be mitigated?	Yes, to some extent			

Mitigation:

- The spatial extent of construction activities must be minimized,
- The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.
- Disturbance by residents of birds breeding and foraging in the area should be minimized and controlled.
- Provide adequate briefing for site personnel and residents prior to construction.
- Any bird nests that are found during the construction period must be reported to the Environmental Control Officer (ECO).

Cumulative Impacts: Expected to be minimal on habitat with low avifaunal sensitivity. The habitat of low avifaunal sensitivity is already transformed and fragmented due to historic activities and the site is not a unique habitat within the landscape.

Residual Risks: Low, if mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

Table 8.9: Impact on birds due to disturbance associated with construction activities and with increased human presence in the area.

Nature: The presence of vehicles and construction workers will cause disturbance to avifauna, with the movement and activities of personnel on site and the associated noise, pollution and litter all having a negative effect on birds. In addition, the presence of construction workers will increase the probability of activities such as illegal hunting of birds. The permanent presence of a much larger number of people than presently occur at the site will result in greater disturbance of birds that use the area for foraging and breeding.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction area	2	Limited to construction area	2
Magnitude	Low	4	Minor	2
Significance	**Moderate**	**35**	**Low**	**25**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to Local Area	2	Limited to Local Area	2
Magnitude	Low	4	Minor	2
Significance	**Moderate**	**55**	**Moderate**	**45**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	No, area too small		No area too small	
Can impacts be mitigated?	Yes			

Mitigation:

- Movement of construction vehicles and workers beyond the boundary of the site must be minimized. In addition, workers must be instructed to minimize disturbance of birds at all times, and steps must be taken to ensure that no illegal hunting occurs.
- The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.
- Disturbance by residents of birds breeding and foraging in the area should be minimized.
- Provide adequate briefing for site personnel and residents.
- Any bird nests that are found during the construction period must be reported to the Environmental Control Officer (ECO) and residents should always be aware of the importance of birds in their built environment.

- Cumulative impacts: Expected to be minimal. The habitat is however already largely transformed and fragmented due to residential activities in the vicinity of the site. The site is is not a unique habitat within the landscape. It is not envisaged that any Red Data species will be displaced by the habitat transformation that will take place as a result of the construction and operation of the proposed development. Birds are very mobile and may migrate to adjacent suitable habitat. It should be noticed that the newly created houses and indigenous garden forms habitat for specific bird species.

Residual Risks:

- None anticipated provided that the mitigation measures are implemented correctly, and rehabilitation

of the site is undertaken.

Table 8.10: Pollution associated with construction or residential activities

Nature: Pollution associated with construction activities and residents (e.g., fuel spills, use of cleaning chemicals) could have negative impacts on avifauna.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Low	4	Minor	2
Significance	**Minor**	**12**	**Minor**	**4**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to Site	2	Limited to Site	2
Magnitude	Low	4	Minor	2
Significance	**Low**	**22**	**Minor**	**6**
Status (positive or negative)	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- Great care must be taken that no pollutants or other waste pollute the area or enter local water systems during the construction or operational phases. Measures to rapidly deal with spills of fuel, cleaning chemicals or any other potential pollutants must be put in place before construction commences.
- Construction workers must be suitably trained to deal with any such spills.
- Facilities to handle pollution and waste must be provided to residents.

Cumulative impacts: Expected to be minimal. The habitat is already transformed and fragmented due to the residential activities and the site is not a unique habitat within the landscape. It is not envisaged that any Red Data species will be displaced. Birds are very mobile and may migrate to adjacent suitable habitat. It should be noticed that the newly created town forms habitat for specific bird species.

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

Table 8.11: Electrocution and collision hazards

Nature: Electrical infrastructure such as distribution lines, as well as electric fences, pose a potential collision risk to flying birds, and a potential electrocution risk to perching birds. The magnitudes of these risks are much lower than the corresponding risks associated with large overhead transmission lines. Assuming that the electrical infrastructure comprising part of the proposed development is typical of housing developments, no specific mitigation measures are required.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Very Improbable	1	Very Improbable	1
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Low	4	Minor	2
Significance	**Minor**	**6**	**Minor**	**4**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Low	4	Minor	2
Significance	**Minor**	**20**	**Minor**	**8**
Status (positive or negative)	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation: • Normal safety measures for electrical installations as used by Eskom				
Cumulative impacts: Expected to be minimal. The habitat is already largely transformed and fragmented due to the adjacent residential activities and the site is not a unique habitat within the landscape. It is not envisaged that any Red Data species will be displaced. Birds are very mobile and may migrate to adjacent suitable habitat. It should be noticed that the newly created town forms habitat for specific bird species.				
Residual Risks: None.				

Conclusion

From a general avifaunal point of view, most of the terrestrial habitat types containing unspecialised and generalist bird species with widespread distribution ranges. The proposed development of the Preferred Lay-Out development plan can be supported.

8.4 Results of the Impact Assessment: Herpetofauna

The conservation rating of the site for reptiles can be regarded as **Medium** due to the specific good habitat on the Bronberg Ridge. No development at all may occur on the Bronberg Ridge. On the plains good habitat for amphibia is limited. The proposed project involves development of only two residences on the Historically Disturbed Plains Bushveld area, with large areas remaining with the current natural (disturbed) vegetation. An indigenous garden is planned for the immediate surroundings of the residences. The development impacts on herpetofauna will largely be restricted to the construction phase, the operational phase is when people occupy their new homes. The two broad categories of impacts will be habitat loss due to vegetation clearing and disturbance related to construction activities. Since the construction activities will be limited to the two residences only, the spatial extent of the impacts will also be limited. Should the proposed management plan for the maintained conservation of Juliana's Golden Mole be implemented, the habitat for herpetofauna in general will be improved.

The impacts of the Preferred and Alternative Lay-Out development plans will be very similar and therefore not tabled separately.

Table 8.12: Direct impact on herpetofauna communities and loss of herpetofauna habitat.

Nature: The current habitat is mostly disturbed terrestrial habitat The footprint for the proposed residential development will result in clearing most of the vegetation area. This will result in some loss of mammal habitat. After clearing the vegetation, construction will commence. .				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Minor	2	Small	1
Significance	**Low**	**20**	**Minor**	**15**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Site	1	Site	1
Magnitude	Moderate	5	Moderate	3
Significance	**Moderate**	**55**	**Moderate**	**45**
Status (positive or negative)	**Negative**		**Negative/Positive**	

Reversibility	No	No.
Irreplaceable loss of resources?	No too small areas and natural herpetofauna habitats are already disturbed for biodiversity or conservation.	No too small areas and natural herpetofauna habitats are already disturbed for biodiversity or conservation.
Can impacts be mitigated?	Yes, planting indigenous species in the gardens will enhance habitats for herpetofauna and implementation of the management plan for Juliana's Golden Mole will improve herpetofauna habitats in general	
Mitigation: Should any reptile or amphibia species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. The contractor must ensure that no indigenous herpetofauna 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. • During the construction phase there may be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate the environmental impact. • The appropriate agency should implement an ongoing monitoring and eradication program for all invasive plant species growing on the site. • Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred.		
Cumulative impacts: Limited, the adjacent areas are already used as residential areas.		
Residual Risks**:** No.		

The development according to the Preferred Lay-Out plan can be supported.

8.5.a: Impact on wetland – Preferred Lay-Out

The development according to the **Preferred Lay-Out** plan will be located on the edge of the wetland buffer. This wetland is a small man-made canal (drainage line) no hydromorphic soil and weedy vegetation, located in the south-western corner of the site. the Risk Assessment (Paragraph 7 above) indicates a **Low** Risk for any impacts on the Preferred development. An area with the current natural (disturbed) plains bushveld vegetation, including the wetland (canal) area will remain as natural veld. Only a small part of the entrance paving will edge on the buffer are the canal.

The impacts of the Preferred and Alternative Lay-Out development plans will be very similar and therefore not tabled separately.

Table 8.13: Direct Impacts of the Preferred Lay-Out development on Wetland:

Nature: This wetland is a small man-made canal no hydromorphic soil and weedy vegetation, located in the south-western corner of the site. the Risk Assessment (Paragraph 7 above) indicates a **Low** Risk for any impacts on the Preferred development. An area with the current natural (disturbed) plains bushveld vegetation, including the wetland (canal) area will remain as natural veld. Only a small part of the entrance paving will edge on the buffer are the canal.

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	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short term 1 year	1	Short term 1 year	1
Extent	Limited to construction site	1	Limited to construction site	1
Magnitude	Minor	1	Minor	0
Significance	**Low**	**15**	**Minor**	**10**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Site	1	Site	1
Magnitude	Moderate	1	Moderate	1
Significance	**Low**	**35**	**Moderate**	**35**
Status (positive or negative)	**Negative**		**Negative/Positive**	
Reversibility	No		No.	
Irreplaceable loss of resources?	No too small areas		No too small area	
Can impacts be mitigated?	Yes,			

Mitigation:

- Remain clear from the wetland edge with paving of entrance.
- Ensure that no erosion can occur during heavy rains.
- Ensure good vegetation cover be maintained in the vicinity of the canal.
- Control all alien and invasive plant species.

Cumulative impacts: Limited, the adjacent areas are already used as residential areas.

***Residual Risks*:** No.

The Preferred Lay-Out development plan implies that a large area of natural vegetation in the vicinity of the canal will remain intact. It is envisaged that the impact of the Preferred Lay-Out development will have no negative effect on the canal (wetland).

9. DISCUSSION AND CONCLUSION

9.1 Vegetation

SANBI and DEAT (2009) and NEMBA, Government Notice 1002 (2011) indicate that the Bronberg Mountain Bushveld is **Critically Endangered**. This Bushveld therefore enjoys legal protection.

Wapadrand Country Estates is furthermore located within a Critical Biodiversity Area, namely an “Irreplaceable” area. Within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan (GDARD C-Plan 3.3, 2014), the clearance of an area of 300 m^2 or more of indigenous vegetation, except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in

accordance with a maintenance management plan, is a listed activity (Environmental Impact Assessment Regulations Listing Notice No. 3 of 2014).

The vegetation study of Erf 349 Wapadrand Country Estates resulted in the identification of six different plant communities (= ecosystems on the plant community level of organisation) that could be mapped. Three plant communities were identified in northern part of the Erf namely the Mountain Bushveld on South-facing Ridge Crests, Mountain Bushveld on Higher Slopes and the Mountain Bushveld on Lower Slopes. These three plant communities occur on the Bronberg ridge within the Bronberg Conservation Area. The rich plant species composition, including four protected species, are protected in this area. Both these two plant communities have **High** ecological sensitivity and **High** conservation value. The density of the alien invasive *Lantana camara* is a concern. **This area is excluded from any development**.

Another ecosystem with legal protection (NWA Act 36 of 1998 and NEMA Act 107 of 1998), with **Medium**-**High** ecological sensitivity and consequently **High** conservation value, is the canal (Drainage Line). This small and disturbed drainage line comes through an opening in the boundry wall to Erf 348, and leaves the site (Erf 349) about 30 m further towards Solomon Mahlangu Drive (however see paragraph 8.3 below). The Preferred Lay-Out development plan implies that a large area of natural vegetation in the vicinity of the canal will remain intact. It is envisaged that the impact of the Preferred Lay-Out development will have no negative effect on the canal (wetland).

The results of an ecological sensitivity analysis indicate **Medium-Low** to **Low** sensitivity respectively for the **Historically Disturbed Plains Bushveld and Cleared Areas** on the plains. The vegetation ecology survey and analysis indicate that the plains bushveld **had been already been disturbed by 2004**. Considerable disturbance was evident over the southern part of the Erf during 2007 up to about 2014. From the images of May 2015 to August 2016 a (slight) recovery of woody vegetation on the plains can be seen, most probably dominated by **pioneer species** such as *Vachellia karroo* and **alien invasive** species such as *Melia azedarach* and *Lantana camara*, currently still prominent in the area.

More recently from September 2019 to November 2020 the southern disturbed areas have been covered densely by lush weedy species, particularly *Bidens pilosa*, as observed during the current survey.

A limited part (700m^2) of this **previously disturbed** area on Erf 349, have been cleared for the proposed development, as can be seen on November 2020 Google Earth image. It is suggested that this clearing of vegetation within the **previously disturbed area not be regarded as a violation of a listed activity** as per Environmental Impact Assessment Regulations Listing Notice No. 3 of 2014.

Vegetation and ecological sensitivity maps (Figures 9.1 and 9.2 below) relate the vegetation and sensitivity of Erf 349 to that of the other Erven within the Wapadrand Country Estates.

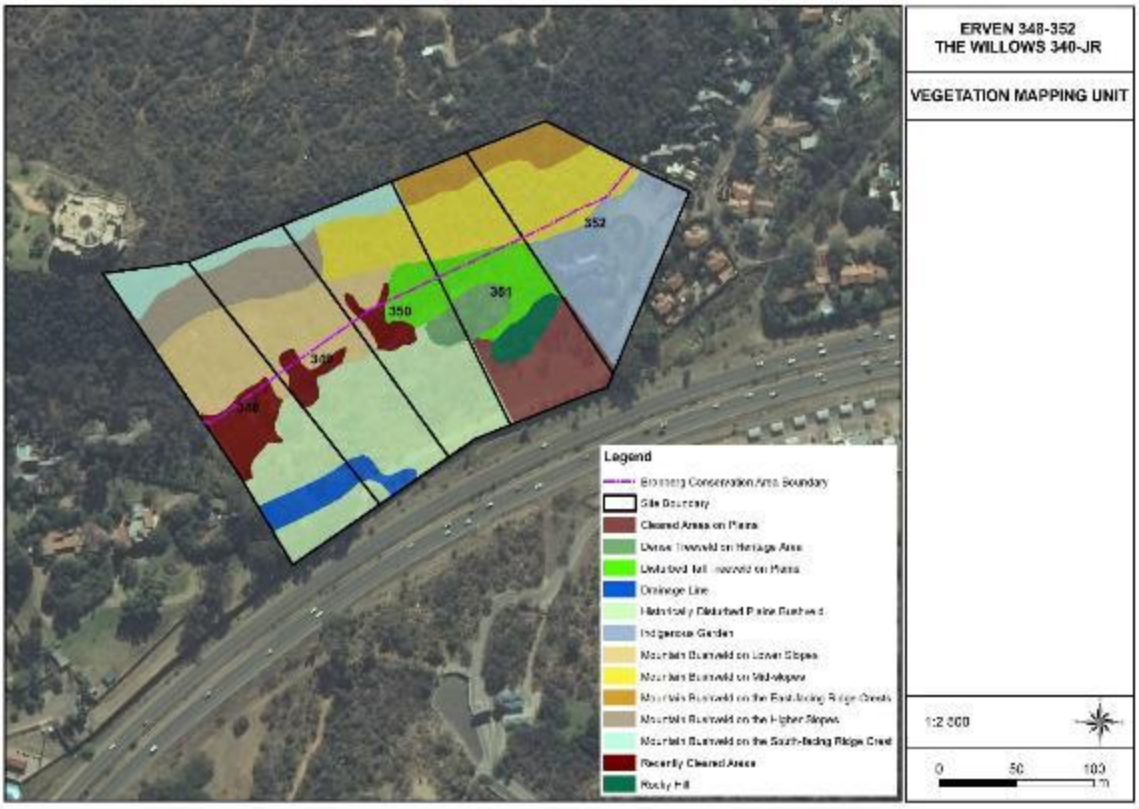

Figure 9.1: The vegetation of the Wapadrand Country Estates.

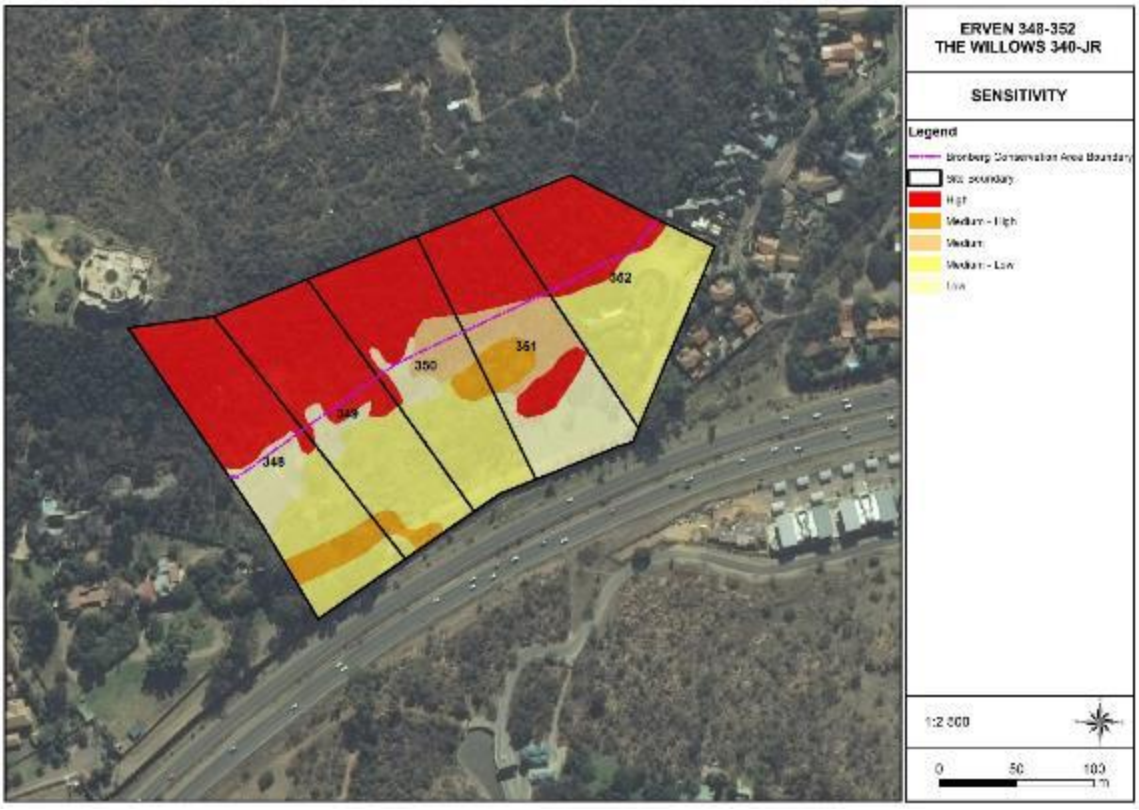

Figure 9.2: The ecological sensitivity of the Wapadrand Country Estates.

9.2 Fauna

Part of the Wapadrand Country Estates (study site) forms part of the Bronberg Conservation Area.

The Endangered Species treat the site as part of their home ranges / territories. There is a possibility that two bat species may fly over the site from time to time, therefore the Blasius's (Peak-saddle) horseshoe bat and short-eared trident bat are included as a precautionary measure. The Southern African hedgehog occurs in a wide variety of habitat types, but must have suitable vegetation cover. The study site provides that and as already mentioned, their presence was confirmed by Dr Maryke Carstens, resident of Erf 352.

Five Red Data birds species were recorded in the Pentad of the study site (SAPAB 2), namely the yellow-billed stork, Abdim's stork, lesser flamingo, half-collared kingfisher and lanner falcon. However, for all these Red Data bird species the nature of the site is such that their occurrence is extremely unlikely due to the limited extent and quality of the habitats and they are only expected as infrequent vagrants. Their inclusion being primarily due to the Precautionary Principle. No Red Data herpetofauna species occur on the site.

Neamblysomus julianae, the Juliana's golden mole, is a Critically Endangered mammal species and the Wapadrand Country Estate (study site) forms part of the restricted distribution range of the Juliana's golden mole. GDARD is unlikely to sanction the development unless a reasonable conservation strategy is adopted, together with an Ecological Management Plant (EMP) and the appointment of an ECO.

Juliana's golden mole subsurface activities were recorded in a few localities on site. The golden mole subsurface activities were found around a diversity of habitat types on the study site and buffer areas. The golden mole occurs on the site is in both natural and in unnatural urban settings. Part of the study site includes the Bronberg Conservation Area where no development may occur and signs of the Juliana's golden mole activity have been recorded. These golden mole individuals in the Bronberg Conservation Area would not be affected by the development since they occur outside the intended footprint of the development.

The area where the intended development will take place has been severely altered by invasive plant species and except for a small area, no Juliana's golden mole subsurface activities were recorded. Near the white stinkwood trees at Erf 350, which is also a potential cultural site, golden mole activities were observed at 25°46'51"S; 28°20'05"E. This area must be excluded from development.

Golden moles are very well adapted to co-exist with human beings in rural settings on condition that the substrate consists of soft sand with no clay content and the soils kept permanently moist by regular irrigation.

Implemented the suggested Ecological Management Plan (included in this report) will stabilize the population at higher numbers, and ensure year-round optimized ecological conditions in a structured manner. Connectivity with adjoining properties is good.

From a vertebrate perspective, there is no objection against the development as long as the development strictly adheres to the mitigation measures for the Juliana's Golden mole.

9.3 Wetland

A canal is present on Erven 348 and 349. The vegetation on site is indicative of disturbed conditions and **not wetland conditions** and the **soil is not hydromorphic**. **No watercourse is visible on site on the historical aerial photographs from 1964**. It is therefore highly likely that the canal indicated on the site is **man-made and artificial**. The man-made, artificial canal system on Erven 348 and 349 is weedy and modified by the surrounding land uses. The proposed houses will not have any impact on this man-made, artificial channel, due to the distances of from the channel. No permanent structures may occur within the flood lines of the drainage line. Although the indicated canal is not a wetland or riparian area the development activities must remain outside the channel and the determined flood lines.

The canal located to the north-east outside the site runs through densely developed residential area and it resembles a highly modified riparian area. Further east north of Disselboom Avenue the stormwater drainage canal eventually runs into a small, more natural valley bottom seasonal drainage line. This area is situated about 450 m from Erf 349 and is located within densely developed residential area. Considering the above, it is suggested that **no water licence is needed** for the suggested development on Erf 349.

9.4 Impact Assessment

The Impact Assessments provided in Paragraph 8 above indicate that the Preferred Layout development plan will have smaller impacts on vegetation, flora and mammals than the Alternative Lay-out Plan. This is mainly because less vegetation will be cleared, implying more natural vegetation will remain intact. This also provides adequate space for the development of an indigenous garden and also implementing a management plan for Juliana's Golden Mole.

9.5 Conclusion

It is suggested that the planned Preferred Lay-Out development plan for Erf 349, accompanied by the development of an indigenous garden that can enhance suitable habitat for Juliana's Golden Mole, be supported. The remaining Plains should remain in a natural state, with measures to control al alien and invasive plant species. Any permanent structures must be outside the flood lines of the canal drainage line.

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11. CURRICULA

11.1 Abridged Curriculum Vitae: Prof George Johannes Bredenkamp

Born: 10 February 1946 in Johannesburg, South Africa.
Citizenship: South African
Marital status: Married, 1 son, 2 daughters

Present work address
EcoAgent CC
Ecological, botanical and biodiversity consultants
PO Box 25533, Monument Park, 0105, South Africa
Tel: (27)(12) 460 2525
Cell 082 5767046
E-Mail: ecoagent@mweb.co.za

Previous work address:
Extra-ordinary Professor
Department of Plant Sciences, University of Pretoria, Pretoria, 0002, South Africa

Qualifications:
1963 Matriculation Certificate, Kempton Park High School
1967 B.Sc. University of Pretoria, Botany and Zoology as majors,
1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.
1969 H.E.D. (cum laude) Pretoria Teachers Training College.
1975 M.Sc. University of Pretoria, Plant Ecology .
1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:

MSAIE&ES South African Institute of Ecologists and Environmental Scientists
- 1989-1990 Council member

MGSSA Grassland Society of Southern Africa
- 1986 Elected as Sub-editor for the Journal
- 1986-1989 Serve on the Editorial Board of the Journal
1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
- 1993 Elected as professional member

Pr.Sci.Nat. South African Council for Natural Scientific Professions **Reg No 400086/83**
1993-1997 **Chairman** of the Professional Advisory Committee:Botanical Sciences
- 1993-1997: **Council** Member
- 1992-1994: Publicity Committee
- 1994-1997: Professional Registration Committee

2017-2020: Council Member

Professional career:

• Teacher in Biology 1970-1973 in Secondary Transvaal Schools
• Lecturer and senior lecturer in Botany 1974-1983 at University of the North
• Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
• Professor in Plant Ecology 1988-2008 at University of Pretoria.
• Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

Academic career:

• Students:
- Completed post graduate students: M.Sc. 57; Ph.D. 16.

• Author of:
- about 200 scientific papers in refereed journals
- >150 papers at national and international congresses
- >1000 scientific (unpublished) reports on environment and natural resources
- 17 popular scientific papers.
- about 45 contributions in books

• Editorial Committees of
South African Journal of Botany,
Journal Grassland Society of Southern Africa,
Bulletin of the South African Institute of Ecologists.
Journal of Applied Vegetation Science.(Sweden)
Phytocoenologia (Germany)
• Highest FRD evaluation category: C1 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

Membership:

• International Association of Vegetation Science.
• International Society for Ecology (Intecol)
• Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).
• South African Association of Botanists (SAAB)
1988-1993 Elected to the **Council** of SAAB.
1989-1990 Elected as **Chairman** of the Northern Transvaal Branch
1990 Elected to the Executive Council as **Vice-President**
1990 Sub-editor Editorial Board of the Journal
1991-1992 Elected as **President** (2-year period)
1993 **Vice-President** and Outgoing President
• Wildlife Management Society of Southern Africa
• Suid-Afrikaanse Akademie vir Wetenskap en Kuns
(=South African Academy for Science and Art).
• Wildlife Society of Southern Africa
1975 - 1988: Member
1975 - 1983: Committee member, Pietersburg Centre
1981 - 1982: **Chairman**, Pietersburg Centre

• Dendrological Society of Southern Africa
1984 - present: Member
1984 - 1988: Committee member, Western Transvaal Branch
1986 - 1988: **Chairman**, Western Transvaal Branch
1987 - 1989: Member, Central Committee (National level)
1990 - 2000: Examination Committee
• Succulent Society of South Africa
1987 - present: Member
• Botanical Society of South Africa
2000 – present: Member
2001- 2008: Chairman, Pretoria Branch
2009-present Committee member Pretoria Branch
2002 – 2015: Chairman, Northern Region Conservation Committee
2002- 2007: Member of Council
2017-2017 President of Council

Special committees:
• Member or past member of 10 special committees re ecology, botany, rangeland science in South Africa.
• Member of the International Code for Syntaxonomical Nomenclature 1993-1996.

Merit awards and research grants:
1968 Post graduate merit bursary, CSIR, Pretoria.
1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.
1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.
1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.
1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.
1991-present Research Grant, National Research Foundation , Pretoria.
Research Grant, Water Research Commission.
1999-2003 Research Grant, Water Research Commission.
2006 South African Association of Botanists Silwer Medal for outstanding contributions to South African Botany

Abroad:
1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom
Visits to Israel, Italy, Germany, United Kingdom, Portugal.
1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.
Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.
1990 Travel Grant, FRD.
Visit to Japan, Taiwan, Hong-Kong.
1991 Travel Grant, FRD.
Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.
1993 Travel Grant, University of Pretoria.
Visits to the USA, Costa Rica, Czech Republic, Austria.
1994 Travel Grant FRD.
Visits to Switzerland, The Netherlands, Germany, Czech Republic.

1995 Travel Grant FRD, University of Pretoria
Visits to the USA
Travel Grant, University of Pretoria, Visit to the UK.
Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria
Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden
Travel Grant, University of Pretoria, Visit Hungary, Spain, USA
Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.
Travel Grant, NRF, Visit Brazil
2006 German Grant Invited lecturer in Rinteln, Germany

Consultant

Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC
Since 1988 **>1000** reports as consultant on environmental matters, including:
Game Farm and Nature Reserve planning,
Environmental Impact Assessments,
Environmental Management Programme Reports,
Vegetation Surveys,
Wildlife Management,
Veld Condition and Grazing Capacity Assessments,
Red data analysis (plants and animals).

11.2. Abridged Curriculum Vitae: Jacobus Casparus Petrus (Jaco) Van Wyk

Identity number	680804 5041 08 4
Gender	Male
Date of birth	4 August 1968
Nationality	South African
Home languages	Afrikaans, fluent in English
Postal address	P.O. Box 25085, Monument Park, Pretoria, 0105.
	Tel no +27 12 347 6502, Cell +27 82 410 8871
	E-mail **jcpvanwyk@absamail.co.za**
Present position	Co-Department Head, Environmental Education & Life Sciences, Hoërskool Waterkloof
Consultant	Specialist Environmental Assessments, EIAs, writing, photo-recording
Qualifications	**B.Sc**. (U.F.S.) **B.Sc. (Hon.)** (U.F.S.), **H.E.D** (U.F.S.), **M.Sc.** (U.F.S.)
Honours	Foundation of Research Development bursary holder
	Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400062/09
Notable Research Contribution	In-depth field study of the giant bullfrog

Formal Courses Attended Outcomes Based Education, University of the South Africa (2002)

Introductory Evolution, University of the Witwatersrand (2008)

OBE, GET & FET training, 2002-2008, Education Department

Employment history

2009 – Present Vertebrate surveys for different Environmental Companies.

2000 – 2018 Co-Department Head for Environmental Education & Life Sciences, Hoërskool Waterkloof, Pretoria.

1995 - 1999 Teaching Biology (Grades 8 – 12) and Physics / Chemistry (Grades 8 – 9) at the Wilgerivier High School, Free State. Duties included teaching, mid-level management and administration.

July 1994 – Dec 1994 Teaching Botany practical tutorials to 1st year students at the Botany & Zoology Department of the Qwa-Qwa campus of the University of Free State, plant collecting, amphibian research

1993 - 1994 Mammal Research Institute (University of Pretoria) research associate on the Prince Edward Islands: topics field biology and population dynamics of invasive alien rodents, three indigenous seals, invertebrate assemblages, censussing king penguin chicks and lesser sheathbills, and marine pollution

1991 - 1993 Laboratory demonstrator for Zoological and Entomological practical tutorials, and caring for live research material, University of the Free State

1986 - 1990 Wildlife management and eco-guiding, Mt. Everest Game Farm, Harrismith

Professional Achievement

Research: Author and co-author of 52 scientific publications in peer-reviewed and popular subject journals, and >350 contractual EIA research reports. Extensive field work and laboratory experience in Africa

Public Recognition: Public speaking *inter alia* radio talks, TV appearances

Hobbies: Popular writing, travel, marathon running, climbing (viz Kilimanjaro), photography, biological observations, public speaking.

11.3 Abridged Curriculum Vitae: Catharina E Venter

Name:	Catharina Elizabeth Venter trading as Kyllinga Consulting
Position:	Senior Ecologist and Wetland Scientist
Date of Birth:	29 December 1979
Nationality:	South African
Languages:	Afrikaans, English

EDUCATIONAL QUALIFICATIONS

- M.Sc (Botany), University of Pretoria (2003)
- B.Sc Hons (Botany), University of Pretoria (2001)
- B.Sc (Environmental Sciences), University of Pretoria (2000). Majored in Geography and Botany
- Matriculated, Sasolburg High School (1997)

Additional

- Introduction to ArcGIS 1 (2006)
- Bringing your data into ArcGIS (2006)
- Introduction to ArcView 3.x (2003).

FIELDS OF EXPERTISE

- **Ecological Assessment:**
  Ecological Assessments as part of the Environmental Impact Assessment Process
- **Wetland Assessment:**
  Wetland Assessments as part of the Environmental Impact Assessment Process and Water Use Applications, as well as rehabilitation plans for wetlands, including planning or the Working for Wetlands programme. Large scale wetland assessments (catchment scale).
- **GIS:**
  Compilation of maps for submission as part of Environmental Impact Assessment Process. Creating spatial databases and large scale wetland maps (catchment scale). Projection conversions and matching/overlaying different format GIS maps.
- **Environmental Impact Assessment**
  Undertaken numerous Environmental Scoping Reports, as required by the Environment Conservation Act, 1989 (Act 73 of 1989), the National Environmental Management Act, 1998 (Act 107 of 1998), as amended and the Development Facilitation Act, 1995 (Act 67 of 1995). Project experience includes the establishment of various housing typologies, golf courses, commercial and industrial projects, infrastructure development (roads), resorts and/or game lodges as well as filling stations.
- **Public Participation:**
  Undertaken numerous public participation processes, ranging from basic to extensive, as required by relevant environmental legislation.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

- Professional Natural Scientist (Pr.Sci.Nat) in the field of Botanical Science (Reg no. 400048/08)
- Member of the Botanical Society of South Africa

EMPLOYMENT HISTORY EXPERIENCE

Kyllinga Consulting (July 2015 - present)
Senior Ecologist responsible for wetland and ecological specialist assessments.

Spatial Ecological Consulting (February 2010 – June 2015)
Senior Ecologist responsible for wetland and ecological specialist assessments.

- Wetland Related Assessments

More than 40 wetland assessments conducted between 2010 and 2015.

- Vegetation Assessments

Approximately 16 vegetation assessments between 2010 and 2015.

- Management Plans

Completed two ecological management plans.

MSA Group Services (previously Exigent Environmental CC) (August 2004 – January 2010)
Environmental Scientist responsible for ecological and wetland assessments and the compilation of maps. Also conducted various scoping and EIA applications and EMPRs.

- Ecological Assessments

In excess of 50 ecological assessments conducted between 2004 and 2010, including managing the inclusion of the fauna specialist assessments.

- Wetland Assessments

More than 60 wetland verification projects, wetland delineations and wetland assessments, completed between 2004 and 2010.

- As well as:

Rehabilitation Projects; Fatal Flaw / Screening Assessments; National Department of Agriculture Authorisations; Mining Related Assessments; Private, Public Partnership Projects; Resource Management Plans (RMP); Environmental Management Plans; Environmental Management Programme; Environmental Exemption Processes; Basic Assessments; Environmental Impact Assessments

Part-time employment (2002-2004)
Tutor for botany practicals; Assisting Wildlife management students with Braun-Blanquette analysis; Researcher for a project on the vegetation communities and ecology of the Kruger National Park; Research assistant for the analysis of street trees in Tshwane urban forest; Various part time projects related to vegetation and wetlands

COUNTRIES OF WORK EXPERIENCE

- South Africa
- Lesotho
- Botswana
- Mozambique

PAPERS AND PUBLICATIONS

Co-author and data contributor to: SIEBEN, E. *et al*. The vegetation of inland wetlands with salt-tolerant vegetation in South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Feb 2015.

Co-author and data contributor to: SIEBEN, E. *et al*. The herbaceous vegetation of subtropical freshwater wetlands in South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Feb 2015.

Co-author and data contributor to: SIEBEN, E. *et al*. The vegetation of grass lawn wetlands of floodplains and pans in semi-arid regions of South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Jan 2015.

Co-author of several vegetation descriptions in: MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

VENTER, C.E. & BREDENKAMP, G.J. In prep. Major plant communities on the Mfabeni swamp, St Lucia. *Bothalia.*

VENTER, C.E.; BREDENKAMP, G.J. & GRUNDLING, P-L. 2003. Plant community types, and their association with habitat factors as ecosystem driving forces, of Mfabeni swamp. Proceedings of the congress: *Environment of the St Lucia Wetland: Processes of Change*, Cape Vidal, September 4th-7th, 2003.

VENTER, C.E.; BREDENKAMP, G.J.; GRUNDLING P-L. 2002. Vegetation change on rehabilitated peatland on Rietvlei Nature Reserve. *Kudu* 46(1):53-63.

PRESENTATIONS

Venter, C.E.; Bredenkamp, G.J. & Grundling, P-L. 2003. Plant community types, and their association with habitat factors as ecosystem driving forces, of Mfabeni Swamp. *Environment of the St Lucia Wetland: Processes of Change*, Cape Vidal, September 4th- 7th, 2003.

Poster Presentations

Venter, C.E.; Bredenkamp, G.J.; Grundling P-L. 2002. Baseline vegetation surveys of rehabilitated peatland on Rietvlei Nature Reserve. SAAB Converence. Grahamstown.

Venter, C.E.; Bredenkamp, G.J.; Grundling P-L. 2003. Vegetation change on rehabilitated peatland on Rietvlei Nature Reserve. SAAB Converence. Pretoria.