

Terrestrial Biodiversity Assessment Associated with the Boschoek Filling Stations North West, South Africa



Address

Plot 424
Zwavelpoort
0036

Postal Address

P.O. Box 2365
Zwavelpoort
0036

Tel: (+27) 072 200 6244 **Fax:** 086 696 5003

email: lorain@iggdrasilscientific.com

Report Status

Report Title: **Biodiversity Assessment Associated with the Boschoek Filling Stations, North West, South Africa.**

Compiled by: **Lorainmari den Boogert (*Pr.Sci.Nat. Botanical and Ecological Science*), Barbara Kasl (*Pr.Sci.Nat Ecological and Environmental Science*), and Kimberley Anne Perry (*Cand. Sci. Nat. Zoology*)**

Reviewed by: **Lorainmari den Boogert**

Client: **HydroScience**

Client Representative: **Paulette Jacobs**

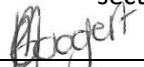
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Declaration

I, Lorainmari den Boogert, declare that -

- I act as the independent specialist;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.


Signature of specialist

Iggdrasil Scientific Services (Pty) Ltd.

Name of company

2018/12/11

Date

Executive Summary

Iggdrasil Scientific Services (ISS) was appointed by HydroScience to conduct the biodiversity assessment associated with two proposed Filling Stations on the Boschoek farm in the North West Province. The proposed development is situated on Portion 135 of the Boschoek farm, which totals approximately 1.4 hectares in size. The biodiversity field survey was conducted on the 8th November 2018.

This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

The following conclusions were reached based on the results of this biodiversity assessment:

- The project area is classified as a Critical Biodiversity Area 2 based on the North West Biodiversity Sector Plan due to natural Corridor Nodes;
- Due to the high level of disturbance of the site, no fatal flaws or special recommendations are relevant. In general, designating the site for development is not seen to impact significantly on floral or fauna biodiversity or Threatened or Protected Species (TOPS). The preferred site is already within a road servitude of a small town and very disturbed.
- The management and monitoring plan must be implemented to ensure overall impact significance stays low to moderate.
- Consideration should be given to considering Site 4 as a green area in the development plan (a picnic site for example) and improve the indigenous vegetation structure to attract local indigenous fauna back to the area.

Abbreviations

ADU	Animal Demography Unit
AI	Alien Invasive
AIS	Alien Invasive Species
BODATSA	Botanical Database of Southern Africa
CARA	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
CBAs	Critical Biodiversity Areas
CR	Critically Endangered
DD	Data Deficient
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act, 1989 (Act No. 73 of 1989)
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EMPr	Environmental Management Plan Report
EN	Endangered
EO	Environmental Officer
ESAs	Ecological Support Areas
GPS	Global Positioning System
ISS	Iggdrasil Scientific Services
IUCN	International Union for Conservation of Nature
LC	Least Concern
LT	Least Threatened
mamsl	Metres above mean sea level
MPNE	Magaliesberg Protected Natural Environment
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NT	Near Threatened
NWBSP	North West Biodiversity Sector Plan
PA	Protected Area
QDGS	Quarter Degree Grid Square
SABAP	South African Bird Atlas Project
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
UP	University of Pretoria
UNESCO	United Nations Educational, Scientific and Cultural Organization
VMUS	Virtual Museum
WMA	Water Management Area
VU	Vulnerable

Definitions

TERM	DEFINITION
Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Avifauna	The birds of a particular region, habitat, or geological period
Azonal	Water-logged and salt-laden habitats require specially adapted plants to survive in these habitats. Consequently, the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character (Mucina and Rutherford, 2006)
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern	Species of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see Threatened), Extinct in the wild, Data deficient, Near threatened, Critically rare, Rare and Declining. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining <u>extant</u> either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo <i>et al.</i> , 2009).

TERM	DEFINITION
Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible.
Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution.
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.
Endemic	Naturally only found in a particular and usually restricted geographic area or region.
Exotic species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity.
Fauna	The animals of a particular region, habitat, or geological period.
Forb	A herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live.
Herpetofauna	The reptiles and amphibians of a particular region, habitat, or geological period.
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa.
In Situ	“In the place” In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas.
Mammals	A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young, and (typically) the birth of live young.
Mitigation	The implementation of practical measures to reduce adverse impacts.
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable and is therefore likely to qualify for a threatened category in the near future (Raimondo <i>et al.</i> , 2009).
No Natural Remaining	Areas in poor ecological condition (severely or irreversibly modified) that are not required to meet biodiversity targets for ecosystem types, species or ecological processes.
Plant community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighboring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat <i>et al.</i> , 2004).

TERM	DEFINITION
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. <i>Now termed Plants of Conservation Concern.</i>
Reptile	A vertebrate animal of a class that includes snakes, lizards, crocodiles, turtles, and tortoises. They are distinguished by having a dry scaly skin and typically laying soft-shelled eggs on land
Species diversity	A measure of the number and relative abundance of species.
Species richness	The number of species in an area or habitat.
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo <i>et al.</i> , 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future (Raimondo <i>et al.</i> , 2009)

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1. Introduction

1.1. Orientation and Context

Igdrasil Scientific Services (ISS) was appointed by HydroScience to conduct the biodiversity assessment associated with two proposed Filling Stations on the Boschoek farm in the North West Province. The proposed development is situated on Portion 135 of the Boschoek farm, which totals Exact size is 1.3933 hectares in size.

The biodiversity field survey was conducted on the 8th November 2018. This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2. Project Brief

As per the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requirements, the following is relevant regarding the scope of work:

- Assess the significance of the terrestrial fauna and flora habitat components and current general conservation status of the property;
- Comment on ecologically sensitive areas in terms of ecologically significant [Endemic and Threatened or Protected Species (TOPS)] terrestrial fauna and flora;
- Comment on connectivity with natural vegetation and habitats on adjacent sites;
- Provide lists of ecologically significant terrestrial fauna and flora that occur or might occur on site and in the area.
- Highlight potential impacts on terrestrial fauna and flora, with specific focus on ecologically sensitive species, which may have occurred / will occur as a result of existing and future activities; and
- Provide management recommendations to mitigate negative and enhance positive impacts of the activities on terrestrial fauna and flora assemblages.

1.3. Terms of Reference

The aim of the study was to undertake and compile a biodiversity scoping assessment for the proposed Boschoek Filling Stations located in the North West Province.

The biodiversity assessment was informed by:



- Appendix 6 of GNR. 982 of the National Environmental Management Act, 1998: Environmental Impact Assessment Regulations, 2014; and
- National Environmental Management: Biodiversity Act 2004: Amendment of Protected Species List 2015.

2. Location and Surrounding Environment

The project area is situated in the Rustenburg Local Municipality of the Bojanala Platinum District Municipality, in the North West Province. The total footprint of the proposed development, within Portion 135 (approximately 1.4 hectares) of the farm Boschoek, is approximately 1.39 hectares in size (Figure 1). The project area is situated adjacent to the R565 from Rustenburg to Sun City, approximately 23 km north west of Rustenburg (Figure 1).

The site is situated in the Western Bankenveld ecoregion, the A22F sub-quatarnary reach, the Limpopo Water Management Area (WMA_01), and the Savanna biome. The site is situated within Quarter Degree Squares (QDS) 2527CA and 2527AC.

2.1. Project Area

The project area is situated adjacent to the R565 from Rustenburg to Sun City, approximately 23 km north west of Rustenburg. The project area slopes slightly from approximately 1171 mamsl in the south of the area to the north of the area which is approximately 1167 mamsl. During the field visit the project area and specifically the sites for the proposed developments were traversed on foot, and the presence of important biodiversity features identified (Figure 2). The following specific areas were identified on the site:

- Seriously modified ecosystem due to agricultural and residential activities; and
- Existing infrastructure.

Artificial Wetlands were present outside of the project area to the north east.

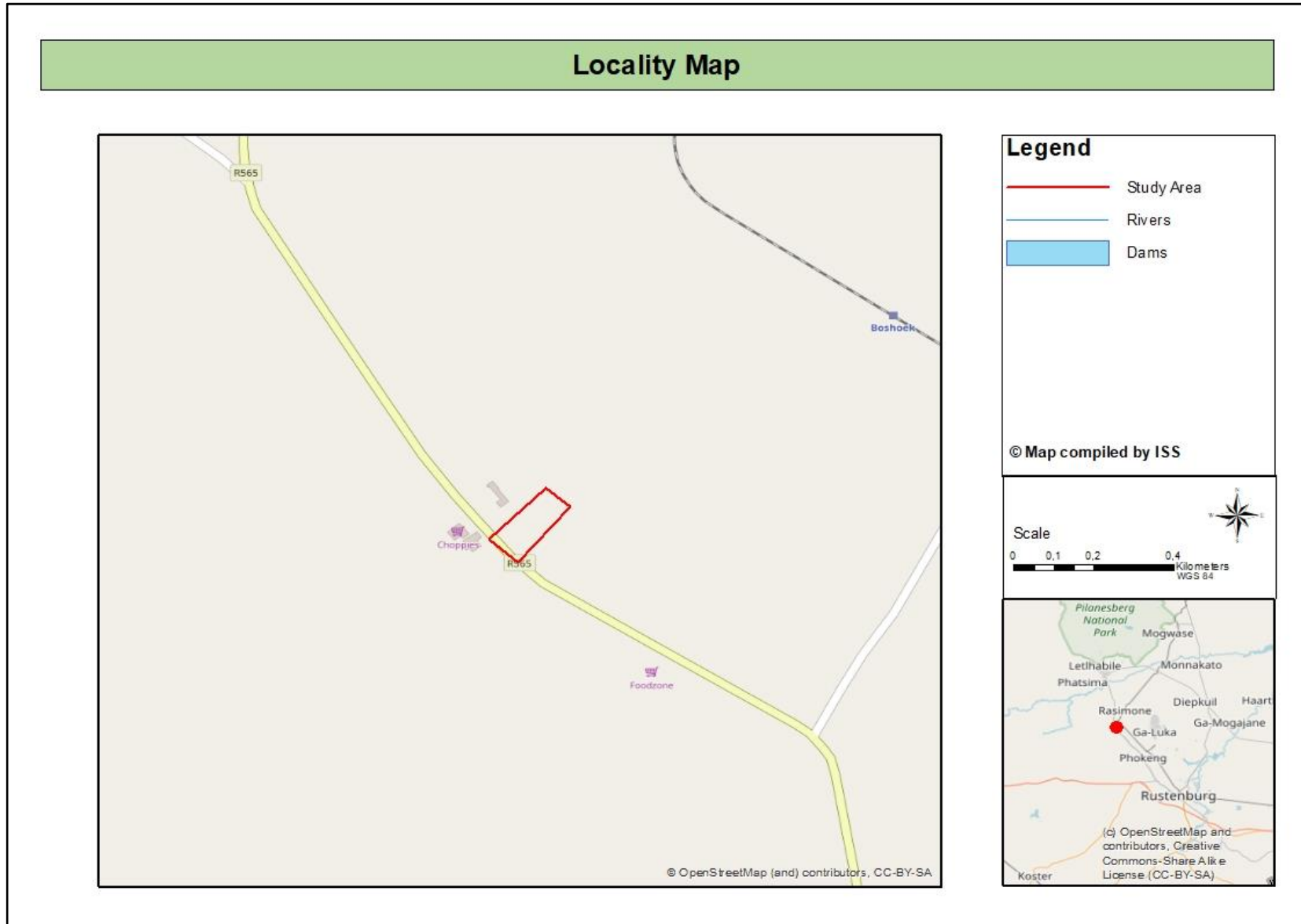


Figure 1: Proposed project area located in the North West Province

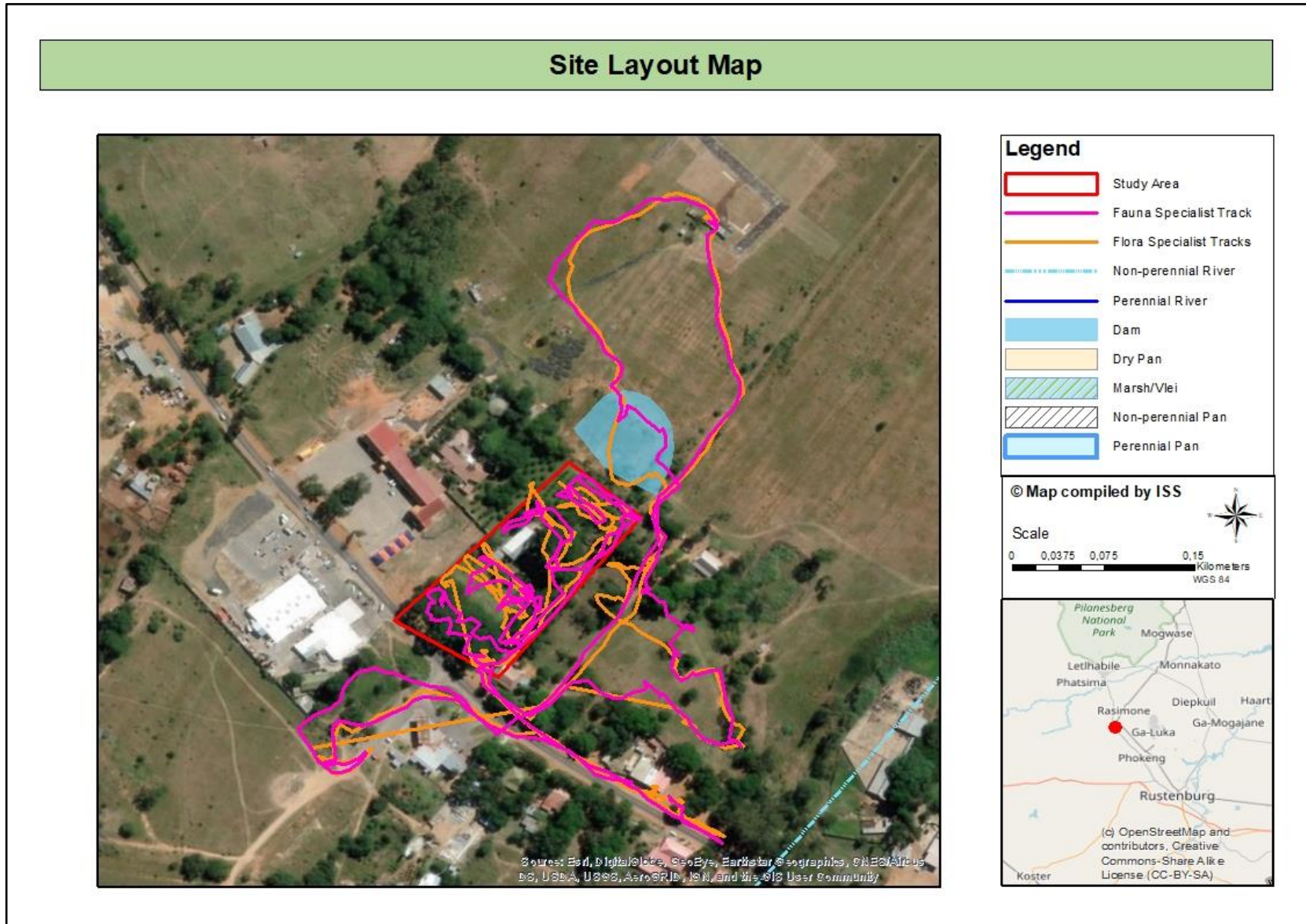


Figure 2: Site layout showing the location of proposed development as well as specialist track for the site visit conducting during November 2018

2.2. North West Biodiversity Sector Plan

In 2015, the Department of Agriculture, Conservation, Environment and Rural Development in the North West province developed the North West Biodiversity Sector Plan (NWBSPP). In essence, the NWBSPP is a map guiding areas of conservation concern for the North West Province. Two maps have been developed, namely one for terrestrial biodiversity, and the other for freshwater/aquatic biodiversity.

The NWBSPP maps the terrestrial ecosystems of the North West into the following categories:

- Critical Biodiversity Areas (CBAs) – areas of high biodiversity value, needed to meet biodiversity targets. These areas should be maintained in natural or near natural state;
- Ecological Support Areas – these areas support CBAs, but are not essential for meeting conservation targets;
- Other Natural Areas – these areas have natural characteristics but have not been earmarked as priority areas for conservation but perform a range of biological as well as ecological functions;
- Heavily Modified Areas – Areas which have been impacted and have had a significant or complete loss of natural habitat and ecological function.

According to the terrestrial NWBSPP, the study area crosses a terrestrial Critical Biodiversity Area 2 (Figure 3) (NWREAD, 2015). According to the metadata the CBA was assigned due to the presence of natural corridor nodes (NWREAD, 2015). The site CBA is part of an inter-connected system of CBAs, including a CBA corridor created by a non-perennial tributary located outside of the project area to the east. In terms of fauna, the CBA2 is listed as important habitat for vultures. Lastly there are ESA level 2 (ESA2) areas around site, all listed as important habitat for vultures (NWREAD, 2015).

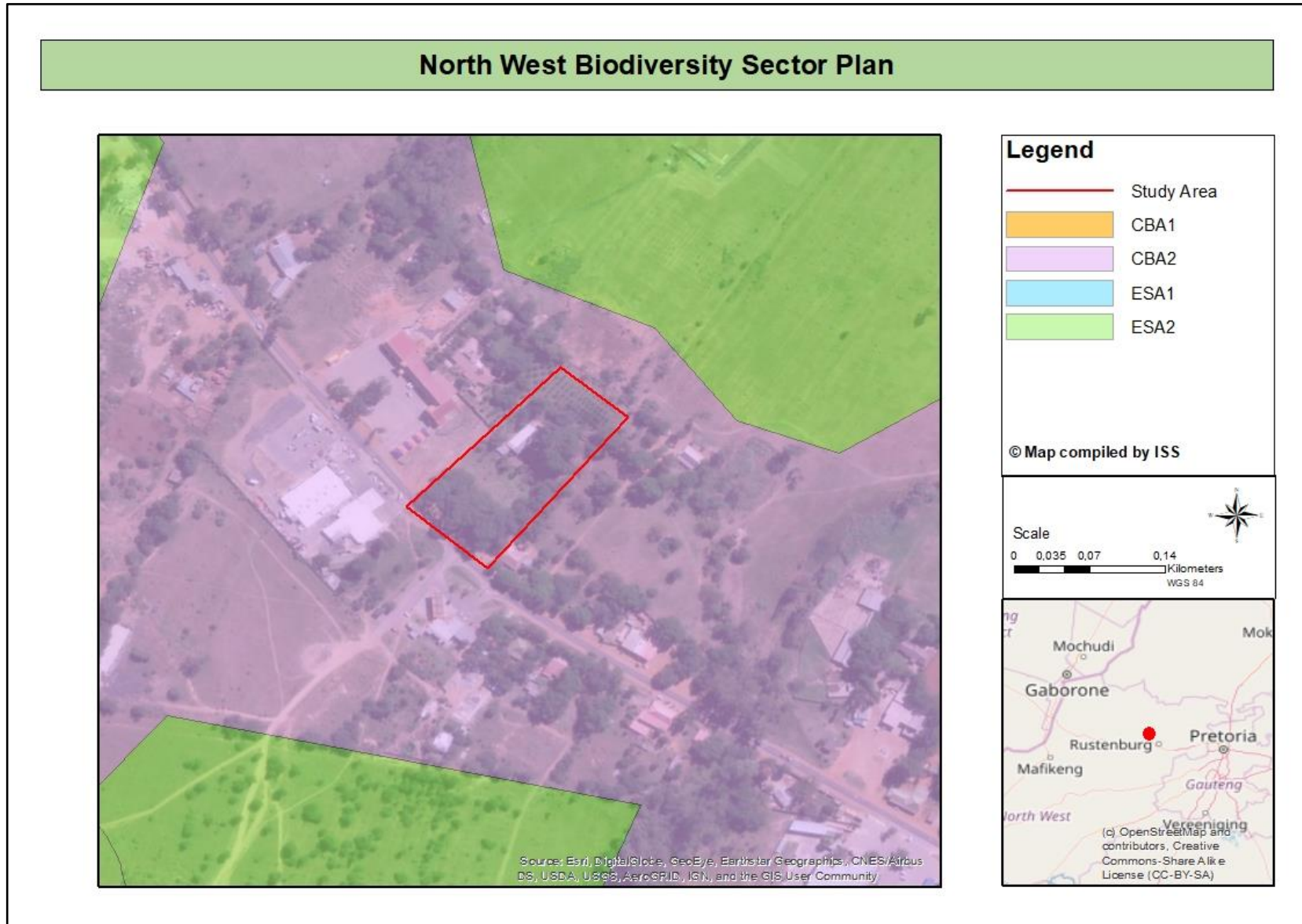


Figure 3: Proposed project area overlapped with the North West Biodiversity Sector Plan

2.3. National Biodiversity Assessment 2011

The National Biodiversity Assessment (NBA) was completed as a collaboration between the South African National Biodiversity Institute (SANBI), the Department of Environmental Affairs and stakeholders, scientists and biodiversity management experts throughout the country over a three-year period (Driver *et al.*, 2012).

The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors (Driver *et al.*, 2012).

The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level (Driver *et al.*, 2012). The proposed Boschoek development is situated in an ecosystem which is listed as Least Threatened (LT) and moderately protected (Figure 4, Figure 5).

2.4. Important Bird Areas and Protected Areas

The Magaliesberg IBA (363 890ha) is approximately 15km SSE of the site (Figure 6). Magaliesberg IBA (363 890ha) is partially protected as it overlaps with the MPNE. IBA trigger species include the globally threatened Cape Vulture and Secretarybird and regionally threatened Lanner Falcon, Half-collared Kingfisher, African Grass Owl, African Finfoot and Verreauxs' Eagle (Marnewick *et al.*, 2015). Biome-restricted species include White-bellied Sunbird, Kurrichane Thrush, White-throated Robin-Chat, Kalahari Scrub Robin and Barred Wren-warbler (Marnewick *et al.*, 2015).

Threats to the trigger species include the expansion of commercial, recreational and housing developments, decreasing area of land available for wild ungulates and domestic livestock (main food sources to vultures), the use of poisons by small-stock farmers (which poisons scavenger and predatory birds), recreational mountaineering, collisions with man-made structures such as power lines (Marnewick *et al.*, 2015).

Pilanesberg National Park IBA (49 580ha) is approximately 17km N of site and overlaps directly with the protected Pilanesberg National Park and is fully protected (Figure 6). IBA trigger species include the globally threatened Kori Bustard, Secretarybird (breeding in the park) and European Roller and regionally threatened Verreauxs' Eagle, (breeding in the park), Lanner Falcon, African Finfoot, African Grass Owl, Yellow-billed Stork, Yellow-throated Sandgrouse and Marabou Stork (Marnewick *et al.*, 2015). Biome-restricted species include the Kurrichane Thrush, White-throated Robin-Chat, White-bellied Sunbird, Kalahari Scrub Robin and Barred Wren-Warbler (Marnewick *et al.*, 2015).

Due to the relatively close proximity of large urban areas, threats include: road kills, fences and electrical supply infrastructure. In addition, the immediate proximity of low-income settlements just outside the Pilanesberg National Park, raises the risk of poaching and reduces the buffer zone areas.

There are no National Parks or Informal Protected Areas in the vicinity of the proposed site. The nearest Formal Protected Areas include the MPNE (Magaliesberg Protected Natural Environment) and adjacent Kgaswane Nature Reserve approximately 15km SSE of the site, the Pilanesberg National Park approximately 17km N of site, and the Vaalkop Dam Nature Reserve approximately 33km ESE of site. The nearest National Protected Areas Expansion Strategy area is 11km E of site.

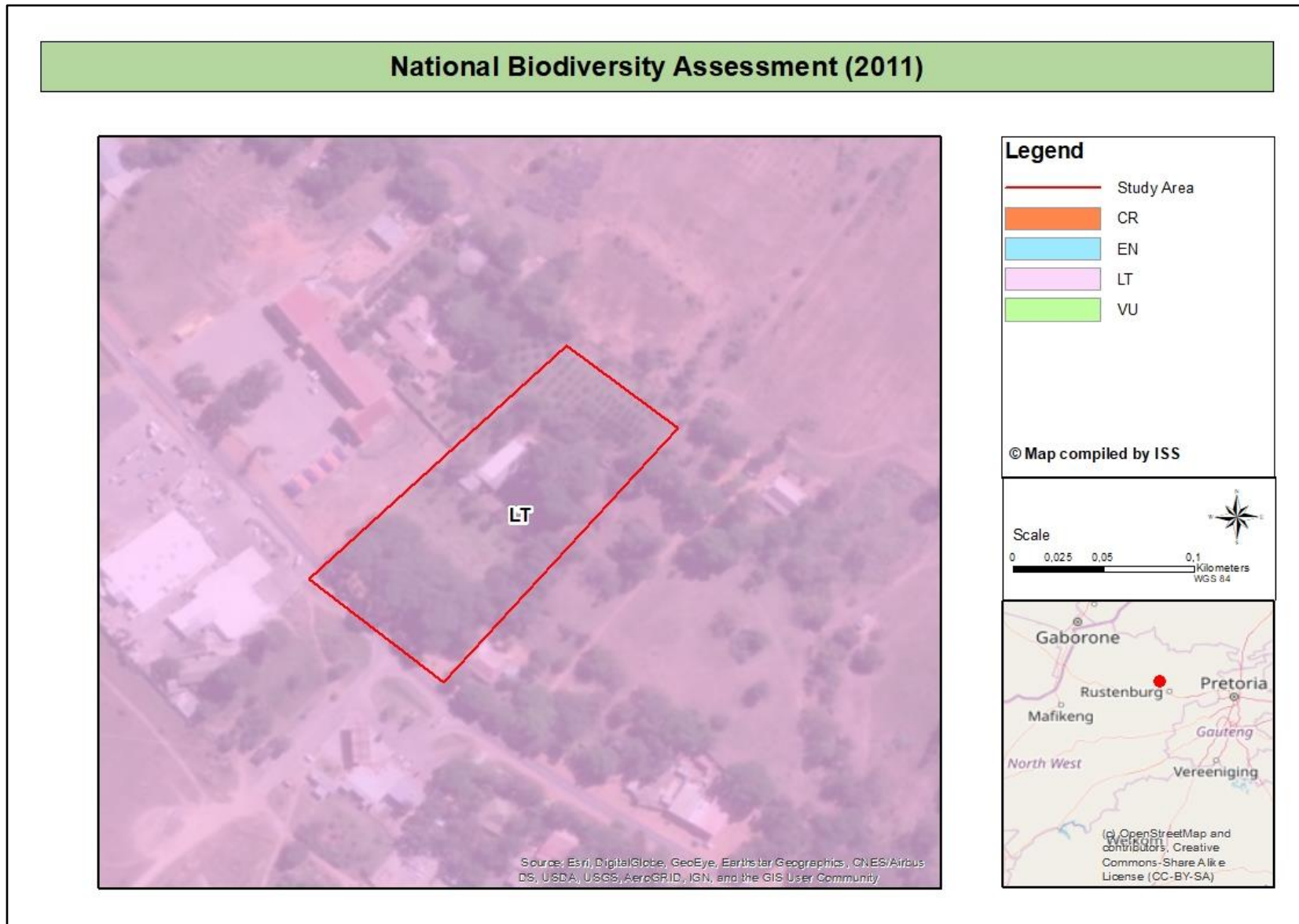


Figure 4: Threat status of terrestrial ecosystems associated with the proposed development based on the National Biodiversity Assessment (NBA, 2011)

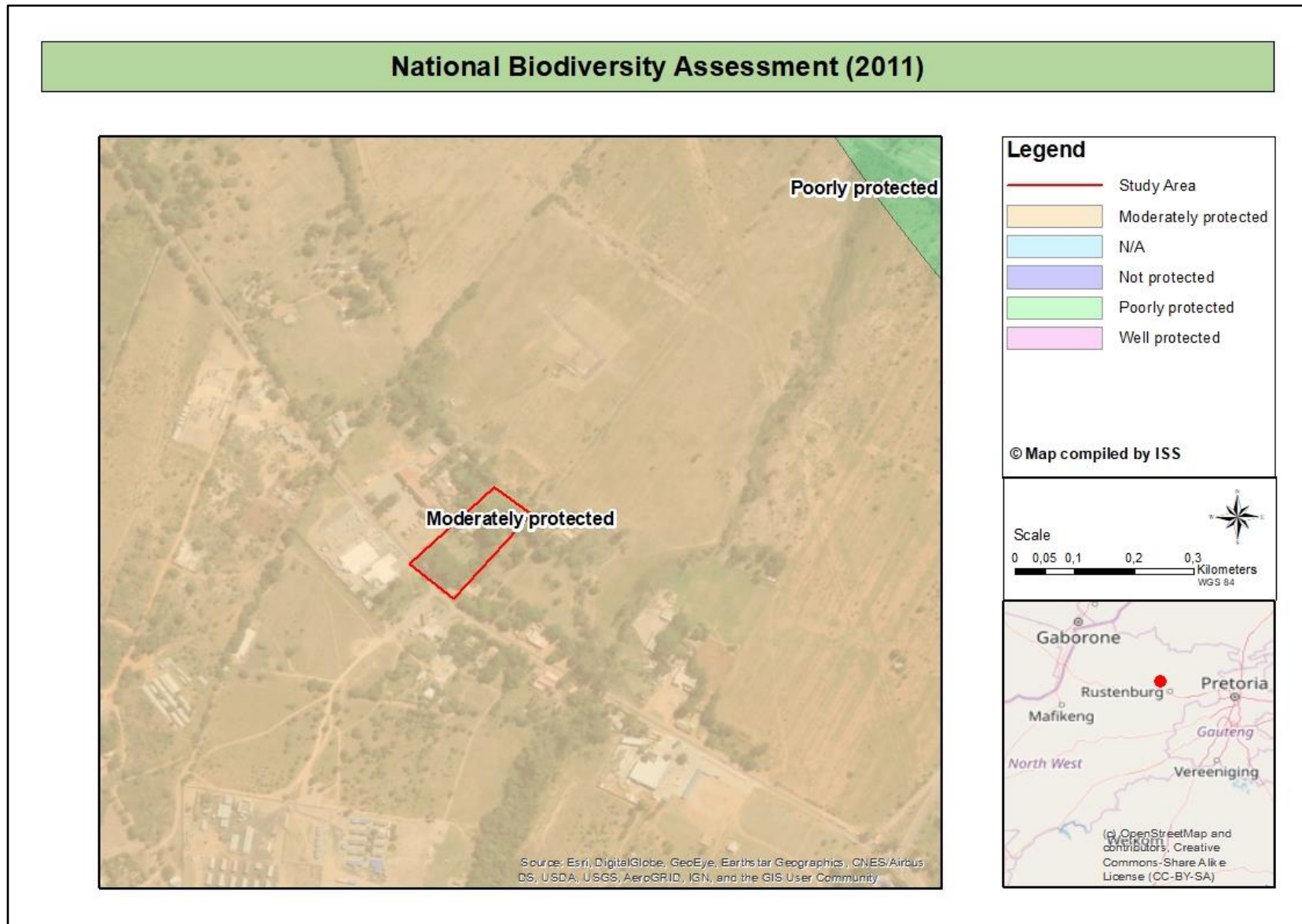


Figure 5: Protection level of terrestrial ecosystems associated with the proposed development based on the National Biodiversity Assessment (NBA, 2011)

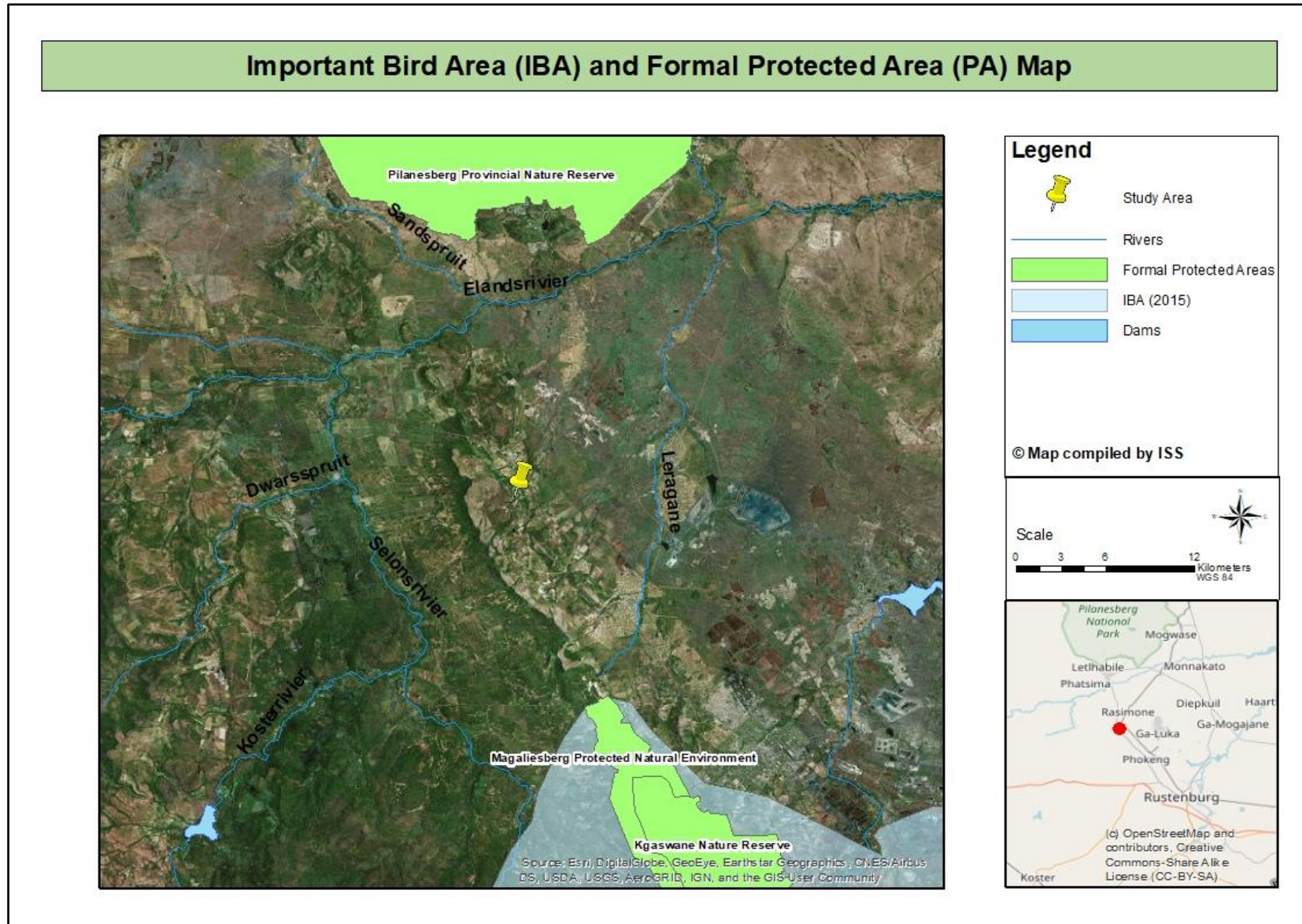


Figure 6: Important Bird Area's and Protected Areas associated with the study area

3. Methods

The methods were based on a desktop assessment as well as a site visit as described below. Additionally, a description of the impact assessment methodology is discussed in this section.

3.1. Desktop Assessment

The following datasets and sources were reviewed for the flora study:

- The Vegetation of South Africa, Lesotho & Swaziland (Mucina and Rutherford, 2006); and
- Botanical Database of Southern Africa (BODATSA) (SANBI, 2018).

Terrestrial fauna (mammal, bird, amphibian & reptile only) desktop lists for the QDGS were generated from Citizen Science sites (VMUS.ADU.org and SABAP2.org), referred to as ADU and SABAP2 Species. The desktop lists focussed on data for the last 10 years. South African Red Lists and Endemic Species lists were consulted and all TOPS and endemic species (ecologically significant species) with distributions overlapping the area were included within these desktop lists. Species are referred to as Desktop Species.

- Citizen Science sites do carry limitations (see section 2.1 below) which must be considered throughout this report.

All species identified under the above-mentioned references were not necessarily analysed in detail. The evaluation of species of concern was considered after the field study which served to identify their potential for occurrence. This considered species overall distribution, habitat, micro-habitat, roosting and feeding requirement / preferences. The probability assessment should be seen as a ranking system rather than an absolute and is designed to reduce subjectivity of assessments. Likelihood of occurrence was assessed as follows in terms of likelihood of occurrence:

- Confirmed: either through past or current surveys or through sightings, ecological indicators and local knowledge.
- Highly Likely: Distribution of the species occurs over the Study Area and the site and immediate surrounds provides habitat, roosting and food requirements of the specific species. There is nothing to prevent the species from residing on site for a length of time (season or year).
- Possible: Distribution of the species occurs over the Study Area, but the specific habitat, roosting or food requirements are absent from site and immediate surrounds but are present in the general area. Species are not likely to reside on site but may forage over or traverse the Survey Area.
- Unlikely: Distribution is on the edge of Study Area and habitat, roosting and food requirements are absent or sparse in the Study Area and surrounds.

Plants were identified using Van Oudtshoorn (2004) and Van Wyk and Van Wyk (1997).

The key to the rating of the species of conservation concern are as follows:

- CR = Critically Endangered;
- EN = Endangered;
- VU = Vulnerable;
- NT = Near Threatened; and
- LC = Least Concern.

The verification of the presence of species of conservation concern was one of the primary requirements of the faunal assessment.

3.1.1. Limitations

Specialist studies are conducted to certain levels of confidence, and in all instances known and accepted methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the report is accurate at high certainty levels, but there exists a low probability that some aspects have not been identified during the studies. Such situations cannot be avoided simply due to the nature of field work.

In situations where species sampling or sensitive site assessment is conducted, it must be understood that time limitation and conditions on site means that not all species can be identified / sites can be discovered during the surveys. Again, this is not deemed to be a fatal flaw, but must be considered.

There are inherent errors in GPS and mapping programmes which must be considered with all mapping information presented.

Impact assessment is a predictive tool to identify aspects of a development that need to be prevented, altered or controlled in a manner to reduce the impact to the receiving environment, or determine where remediation activities will need to be incorporated into the overall development/activity plan. This does not mean that the impact will occur at the predicted significance but provides guidance on the formulation and focus of the management and monitoring requirements which need to be incorporated to prevent/reduce/manage the impact.

Citizen Science projects were used for bird (SABAP2) and animal (ADU) desktop data. When utilising data from Citizen Science projects, the following must be kept in mind:

- Public interest in sites may be fickle, and may wane and increase, which could have a direct effect on the number of records available and therefore the number of species recorded.
- Populated areas or popular tourist destinations may have more participants and therefore higher biodiversity data than less populated areas.
- Misidentification of species by the public cannot be excluded but is not seen as a major problem as this is likely to be a consistent issue from year to year, and a degree of vetting does take place. In order to not manipulate the raw data, fauna species have been retained within the report but their likelihood of occurring on site has been listed as “Unlikely”.
- It must also be considered that animals observed in captivity may be recorded by citizens. Such animals should not be considered part of the natural biodiversity but as the data provided by citizen science sites do not make such distinctions, it cannot be separated from the biodiversity data presented in this report.

3.2. Site Survey

The survey included the following:

- Compilation of expected species lists;
- Overall assessment of broad fauna habitat types within the Survey Area and recording of:
 - Signs of fauna species, including direct sightings, tracks, calls and/or other ecological indicators (scat, dung, nests, egg shells, skeletal remains, etc.);
 - Any specific habitats or micro-habitats, such as substrate types, water resource types, rocky areas, wooded areas, man-made structures, cliffs, etc.;
- Visual scans for specialist habitat types within the study area;
- Compilation of identified species lists;
- Identification of any Red Data or listed species present or potentially occurring in the area;
- A proximity assessment to any protected or ecologically important areas; and
- Emphasis will be placed on the probability of occurrence of species of provincial, national and international conservation importance.

The faunal assessment focussed on the proposed site boundary (Plan 3 and Plan 4) where areas can be reasonably and safely accessed (Survey Area). Where natural or green areas extended beyond the development area (up to a 200m buffer area), a scan survey was completed for potential micro-habitats, where such sites could be reasonably and safely accessed (Scan Area).

The site visit was undertaken during summer on 8 November 2018, although it looked like the site had little to no rainfall. On the day of the survey, the weather was cloudy to partly cloudy with a chilly breeze, warming up towards the afternoon. The weather is deemed adequate for fauna surveying, although bird and reptile activity may have been low during the cooler morning. Plan 4 indicates the routes travelled (walking) over the site and buffer areas.

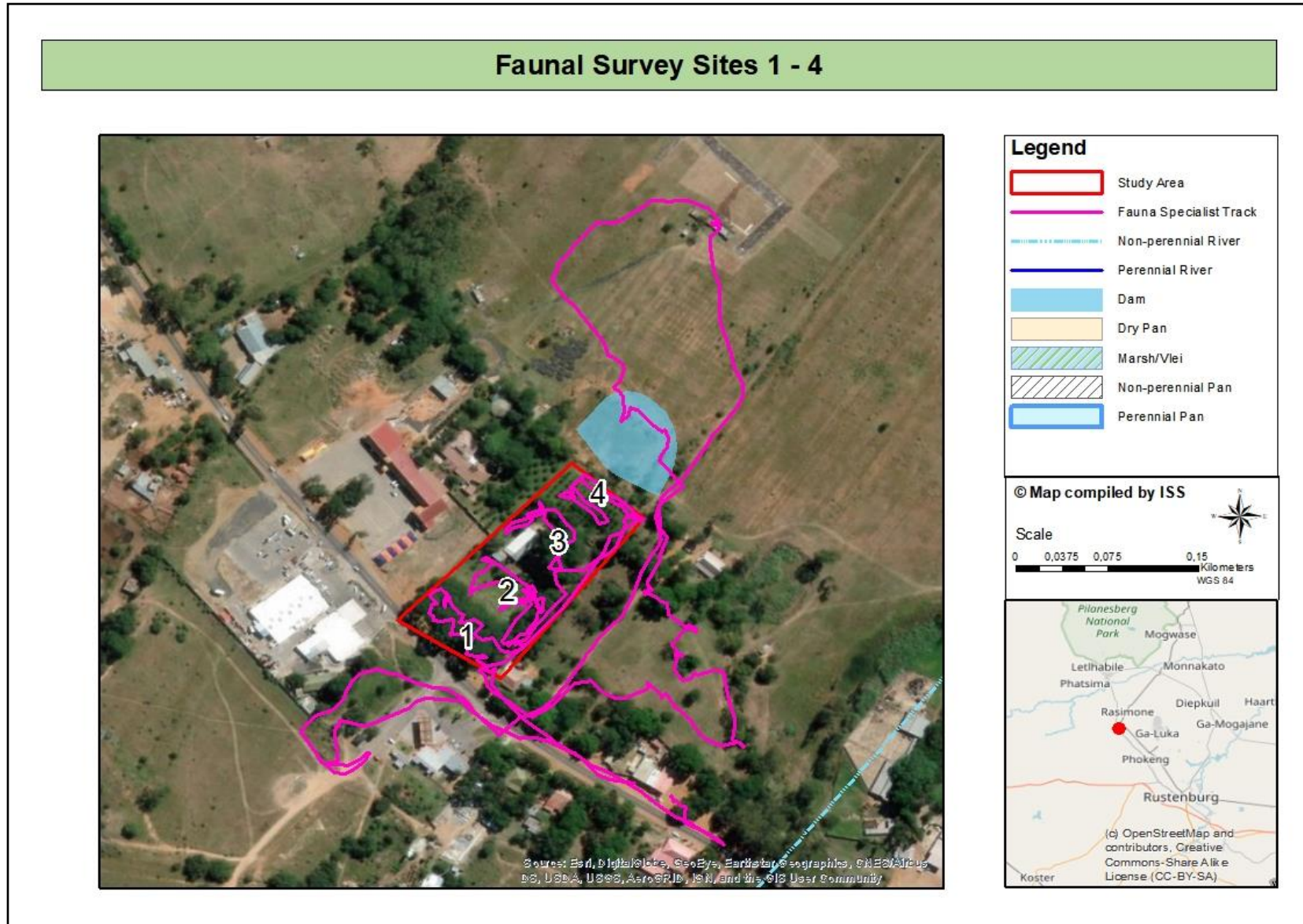


Figure 7: Faunal survey sites 1 – 4 in relation to the study area

3.3. Vegetation Sensitivity

The analysis methodology has been described and previously applied by Antoinette Eyssel Knox of Dimela Eco-Consulting and is currently unpublished.

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 and Coker, 1992). Vegetation is thus an important determination of the biodiversity of an area.

The vegetation sensitivity assessment aimed to identify whether the broad vegetation associations within the proposed development are of ecological importance and vulnerable to infrastructure development as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Protected by national or provincial legislation;
- Habitat or potential habitat to plant species of conservation concern, protected plants or protected trees as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats;
- Situated within ecologically sensitive features such as wetlands, riparian areas or rocky areas or ridges, that provides an important ecological function.
- This implies that in the sensitivity analysis not only aspects that currently prevail on the area should be taken into consideration, but also if there is a possibility of a full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed.

The following criteria and weighting were used to determine the vegetation sensitivity, function and conservation importance:

The status of the regional vegetation that is expected to occur on the study site, only where natural vegetation is remaining.

CONSERVATION STATUS*	SCORING
Critically Endangered	3
Endangered	2
Vulnerable	1
Least threatened	0

*This scoring is not applicable (N/A) for areas devoid of natural vegetation.

Whether the study area is situated within a Listed Ecosystem in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) or in a vegetation that is classified as Vulnerable or Endangered. The status of the vegetation within the listed ecosystem is assessed based on the level of current and or historic disturbance.

LISTED ECOSYSTEM*	SCORING
Primary state	3
Sub-climax state	2
Secondary state	1
No natural vegetation remaining	0

Whether the vegetation or ecological feature is protected by legislation:

LEVEL OF LEGISLATIVE PROTECTION	SCORING
National legislation	3
Provincial policies and guidelines	2
Municipal or other protection	1
No legislated protection	0

The presence of suitable habitat for plants of conservation concern as well as the actual occurrence thereof.

SUITABLE HABITAT / PRESENCE	SCORING
Confirmed presence of red listed species (Threatened)	3
Confirmed presence of Orange listed (Near threatened, Declining), or provincially protected species or suitable habitat and some likelihood of occurrence of Threatened species	2
Suitable habitat but unlikely to occur	1
No suitable habitat	0

Ecological Function: areas important to ecological processes such as ecological corridors, hydrological processes and important topographical features such as ridges.

ECOLOGICAL FUNCTION	SCORING
High: Sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.	3

ECOLOGICAL FUNCTION	SCORING
Medium to high: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with a high degree of connectivity with other ecological systems OR disturbed vegetation connected to an ecological and protected system e.g. ridge, wetland or river	2
Medium: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree or limited connectivity with other ecological systems	1
Low: Degraded and highly disturbed vegetation with little ecological function	0

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

ECOLOGICAL IMPORTANCE	SCORING
High: Ecosystems with high species diversity and usually provide suitable habitat for several threatened species. OR protected ecosystems e.g. wetlands, riparian vegetation etc. These areas should be protected	3
Medium to high: Ecosystems with intermediate levels of species with the possible occurrence of threatened species	2
Medium: Ecosystems with intermediate levels of species diversity without any threatened species.	1
Low: Areas with little or no conservation potential and usually species poor (most species are usually exotic).	0

To determine the sensitivity of the vegetation groups in the study area, weighting scores and criteria as above were applied. The results of the scoring places the vegetation in either of the sensitivity classifications. Vegetation with a low score is not considered to be sensitive. Vegetation with a score of 7 was considered as medium-low, while a score of 13 was regarded as medium-high.

SCORING	13-18	7-12	1-6
Sensitivity / ecological condition	High	Medium	Low

3.4. Impact Assessment Criteria

Potential impacts were evaluated against the data captured during the fieldwork to identify relevance to the study area. The relevant impacts were then subjected to a prescribed impact assessment methodology which is described below (Table 1). The significance of the impact is calculated as follows and rating significance is explained below (Table 2):

$$\text{Impact Significance (IS)} = [\text{Duration (D)} + \text{Extent (E)} + \text{Severity (S)}] \times \text{Probability (P)}$$

- I. The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.



- II. The duration, wherein it will be indicated whether
- the lifetime of the impact will be of a very short duration (less than 1 month) – assigned a score of 1;
 - the lifetime of the impact will be of a short duration (6 months) - assigned a score of 2;
 - medium-term or duration of the construction (36 months) – assigned a score of 3;
 - long term or life of project (operational phase of the project) - assigned a score of 4;
 - post-closure (time of rehabilitation and for reestablishment of natural systems - assigned a score of 5; or
 - residual/permanent impact (100 years or more) – assigned a score of 6.
- III. The extent, wherein it will be indicated whether the impact will be site specific (limited to the immediate area or site of development) or national (scale of the country), and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- IV. The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–6, where
- 1 is rare (<5% probability of occurrence – may occur in exceptional circumstances);
 - 2 is unlikely (6%-15% probability of occurrence – could occur at some time);
 - 3 is possible (45% - 16% chance of occurrence – might occur at some time);
 - 4 is likely (65% - 46% probability of occurrence – will probably occur in most circumstances);
 - 5 is almost certain (90% - 66% probability of occurrence – is expected to occur); and
 - 6 is definite (100% - will occur).
- V. The severity, quantified on a scale from 1-6, where
- 1 is insignificant and will have < 10 % change in the area of impact, no financial implications, localised impact, a small percentage of population;
 - 2 is minor and will have 10 – 19% change, short term impact that can be absorbed, on-site release, immediate containment, low financial implications;
 - 3 is moderate and will have 20 – 49% change, medium term loss in capabilities, rehabilitation / restoration / treatment required, on-site release with outside assistance, medium financial impact;
 - 4 is serious and will result in 50 – 70% long-term loss, extensive rehabilitation / restoration / treatment required, high financial impact, still restricted in extent;
 - 5 is significant/high will result in > 70% change in area of direct impact due to loss of significant aspect, extensive injuries, long term loss in capabilities, off-site release to high extent, major financial implications; and

- 6 is catastrophic/critical and results in total change in area of direct impact, relocation not an option, death, toxic release off-site with detrimental effects, irreversible loss, huge financial loss.

Table 1: Impact Assessment Table

DURATION (D)		
Immediate	Less than 1 month	1
Short-term	6 months	2
Construction	36 months	3
Life of project	Operational phase	4
Post-closure	Time of rehabilitation and for re-establishment of natural systems	5
Residual	A permanent impact (100 years or more)	6
EXTENT (E)		
Site Specific	Site of proposed development	1
Local	Farm/site and surrounding farms/site	2
Regional	Local Municipality	3
Provincial	Province (North West)	4
National	Republic of South Africa	5
PROBABILITY (P)		
Rare	<5% probability of occurrence – may occur in exceptional circumstances	1
Unlikely	15% - 6% probability of occurrence – could occur at some time	2
Possible	45% - 16% chance of occurrence – might occur at some time	3
Likely	65% - 46% probability of occurrence – will probably occur in most circumstances	4
Almost Certain	90% - 66% probability of occurrence – is expected to occur	5
Definite	100% - will occur	6
SEVERITY (S)		
Catastrophic (critical)	Total change in area of direct impact, relocation not an option, death, toxic release off-site with detrimental effects, irreversible loss, huge financial loss	6
Significant (high)	> 70% change in area of direct impact due to loss of significant aspect, extensive injuries, long term loss in capabilities, off-site release to high extent, major financial implications	5
Serious	50 – 70% long-term loss, extensive rehabilitation / restoration / treatment required, high financial impact, still restricted in extent	4
Moderate (medium)	20 – 49% change, medium term loss in capabilities, rehabilitation / restoration / treatment required, on-site release with outside assistance, medium financial impact	3
Minor	10 – 19% change, short term impact that can be absorbed, on-site release, immediate containment, low financial implications	2
Insignificant (low)	< 10 % change in the area of impact, no financial implications, localised impact, a small percentage of population	1

The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, moderate-low, moderate-high, or high.

The significance weightings for each potential impact are as follows:

- < 15 points: **Low** (i.e. The impact is minor or insubstantial; it is of little importance to any stakeholder and can easily be rectified),
- 16-45 points: **Moderate Low (ML)** (i.e. The impact is limited in extent, even if the intensity is major; the probability will only be likely, the impact will not have a significant impact considered in relation to the bigger picture; no major material effect on decisions and will require only small-scale management intervention bearing moderate costs),
- 46-70 points: **Moderate High (MH)** (i.e. The impact is significant to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required), and
- 71< points: **High** (i.e. The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in project decision-making).

Table 2: Impact significance ratings

IMPACT SIGNIFICANCE (IS)		
IMPACT SIGNIFICANCE	IS SCORE RANGE	DESCRIPTION
Low (L)	<15	The impact is minor or insubstantial; it is of little importance to any stakeholder and can easily be rectified.
Moderate Low (ML)	16 - 45	The impact is limited in extent, even if the intensity is major; the probability will only be likely, the impact will not have a significant impact considered in relation to the bigger picture; no major material effect on decisions and will require only small scale management intervention bearing moderate costs.
Moderate high (MH)	46 - 70	The impact is significant to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High (H)	71 <	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in project decision-making.

For impacts with a low sensitivity the impact is not reassessed post-mitigation.

4. Discussion and Evaluation of Results

In this section, the results of the desktop assessment as well as the site survey is firstly described, followed by a discussion of the **results** obtained.

4.1. Overall Faunal Site Assessment

Due to the fact that animals are mobile, they may only be transient through the Survey Area and may not reside on site. The results presented below focuses on fauna Confirmed and on ecologically significant fauna Highly Likely to occur on site.


Appendices A to C provide the Desktop Lists generated from the Citizen Science sites (SABAP2.org and VMUS.ADU.org). These species are generally considered to have a high likelihood of occurring on site, although the limitations of Citizen Science sites (Section 2.1) must be kept in mind. Where ecologically significant ADU and SABP2-species are considered unlikely to occur on site, this has been highlighted in the various species Tables presented in the results. It must be stressed that Threatened or Protected Species (TOPS) originally refers to species listed on GN151 of 2007, but within this report is extended to include threatened Red-listed species.




The results below present the following:

- Overall site assessment which provides an overview of the habitats and micro-habitats identified on site that are of relevance to ecologically significant Desktop Species.

Table 3 provides a brief summary of the sites assessed in terms of overall habitat type and, where relevant, micro-habitats and specialised food sources as relevant to fauna. The fauna sites 1-4 are localities are indicated in Figure 7.

Table 3: Sites assessed, and general characteristics as may be relevant to fauna

SITE NO.		GENERAL CHARACTER, MICRO-HABITATS & OVERALL SITE OBSERVATIONS
1		<ul style="list-style-type: none"> ▪ Site comprises of an area 0-40m from the road (Plan 4). ▪ The area is flat, with sparse cover and scattered large trees (indigenous and alien trees). Shrubs are largely absent. ▪ No water bodies/features occur on site. ▪ The site comprises of loamy soils and sandy soils were not observed on site. ▪ Fauna signs were limited and dominated by birds; burrowing species are expected to be minimal due to the proximity to the road, which would cause noise and vibration. ▪ Site can be considered as disturbed and part of the road servitude.

<p>2</p>		<ul style="list-style-type: none"> ▪ Site comprises of an area 40-85m from the road (Plan 4). ▪ The area is flat with no obvious gradient and is covered by dense dead grass layer, which made visibility of fauna indicators difficult, but provided good shelter for smaller mammals. ▪ Site has scattered small to large trees (indigenous, fruit and alien trees). Scattered shrubs are present. ▪ A disused, open reservoir occurs on site. ▪ The site comprises of loamy soils and sandy soils were not observed on site. ▪ Site is an old orchard and historically disturbed.
<p>3</p>		<ul style="list-style-type: none"> ▪ Site comprises of an area 85-150m from the road (Plan 4). ▪ The area is flat. ▪ The site is a neglected residential area and garden. ▪ The site has sparse to no cover with scattered large trees (exotic, garden and alien trees). ▪ The site comprises of loamy soils and sandy soils were not observed on site. ▪ No water bodies/features occur on site. ▪ The site can be considered disturbed.
<p>4</p>		<ul style="list-style-type: none"> ▪ Site comprises of an area 150-180m from the road (Plan 4). ▪ The area is flat and has sparse to no cover, largely limited to some new grass shoots along the NE border. ▪ Site is an old orchard with citrus trees. ▪ Site appears to have suffered an extremely hot fire recently and signs of fauna was minimal. ▪ Site was utilised as a dumping site for earth material and building rubble and also has some pits for waste. ▪ The site comprises of loamy soils and sandy soils were not observed on site.

4.1.1. Site Findings & Habitat Characteristics Specific to Ecologically Significant Fauna

The availability of overall habitat types and specific micro-habitats is necessary in determining the likelihood of fauna occurring on site.

From aerial and satellite imagery the site is typical of a small town, with some residential small holdings and business along the main road. Surrounding land uses and structures that occur within 1km of the site include: tarred roads with power-lines, limited urban developments (shops, accommodation, small holdings), industrial developments, streams and drainage lines, small airfield, wetlands and a patchwork of natural and agricultural lands.

The Wetland identified adjacent to the north-east border was dry with no water and has a soil berm constructed around it. Hilly areas with bushveld occur approximately 900m south-west of site and provide some hilly and

rocky habitats. Approximately 3km west of the site are cliffs, which extend from the Magaliesberg Range and form part of the greater Witwatersrand Mountain Range.

The only source of open water identified was an open reservoir, approximately 40m east of site outside of the project area.

In terms ecologically significant Desktop Species, the following is relevant:

- No caves, mine adits/shafts, caverns occur within the immediate area and species with preference for such sites, such as some bats, are unlikely to reside (occur on site for season or more) in the area.
- Savanna woodland and/or forest is largely absent from site but may occur in the region along the streams and rivers. The site has limited connectivity to such sites. Species with preference for indigenous woodlands and forests are unlikely to reside in or travel through the site.
- Rocky terrain, rocky outcrops, cliffs and crags are absent from site. Species with preferences for such habitats, like the vultures, are unlikely to reside on site. Although there is proximity to rocky hills, species occurring in such habitats are unlikely to travel through or forage around the site as the site is poorly connected to such habitats.
- Species with a preference for wetlands and associated rank vegetation or reeds are unlikely to reside on site.
- Species with preference for large rivers or large bodies of water, including saline or brackish waters are unlikely to reside on site.
- Species with a preference for sandy soils, such as many mole and rodent species are unlikely to reside on site.

4.2. Mammals

Sources utilised for mammal distribution and identification included:

- ADU MammalMAP was utilised to generate mammal desktop lists for the QDGS and various sources utilised to determine additional TOP mammals that could occur within the area.
- Other sources used for details on mammal habitats and food preferences included:
 - Stuarts' Field Guide to Mammals of Southern Africa including Angola, Zambia & Malawi. 5th Edition (Stuart & Stuart, 2015)
 - Bats of Southern and Central Africa: A biogeographic and Taxonomic Synthesis (Monadjem *et al.*, 2010a).
 - Rodents of Sub-Saharan Africa: A biogeographic and Taxonomic Synthesis (Monadjem *et al.*, 2010b).
- A Field Guide to the Tracks & Signs of Southern, Central & East African Wildlife (Stuart & Stuart, 2013) was utilised to assist in identification of animal signs.
- SANBI.org was consulted for the latest Red Data Mammal (Child *et al.*, 2016) for South Africa.

The mammal desktop list is provided in Appendix A. A summary of mammals noted on site during the survey and ecologically significant ADU species and species with distribution ranges overlapping or near to the Survey Area are included in Table 4.

Signs of rodents (pellets closely resembling Single-striped Mouse) and antelopes (pellets resembling Common Duiker) were noted on site (specifically Site 2), but the pellets were old. In addition, a few scattered burrows were observed that could be indicative of other rodent species on site.

4.2.1. Species of Conservation Concern

TOPS status of mammals was sourced from SANBI (Child, *et al.*, 2016) and GNR151 (2007). The likelihood of these species occurring on site is briefly discussed below and indicated in Table 4.

No TOP mammals were observed on site, nor were any indicators of such species noted during the survey.

The site provides no real habitat for TOP mammals and habitat in the surrounding areas is limited in terms of TOPS. Although rocky hills occur nearby, the site provides no connectivity to this habitat type, and species preferring such habitats are likely to stay within the hilly corridor and are unlikely to visit the site.

The site could support the Near Threatened and Protected South African Hedgehog and the Protected Honey Badger. Both species tolerate a variety of habitats and have suitable habitat in the surrounding areas, where there are fewer anthropogenic activities and the environment is less disturbed, and they are more likely to retreat to these areas.

4.2.2. Invasive Species

Table 4 indicates all species listed as alien invasive (AI) mammals under South African Legislation (GN864, 2016) and exotic species recorded from citizen science sites. No AI mammals were recorded from site, but the Domestic Cat and House Rat are highly likely to occur on site.

Table 4: Mammals of interest

COMMON NAME	TAXON NAME	SA STATUS	IUCN (2016)	SITE OCCURRENCE
SITE SPECIES				
Possible Single-striped Mouse	<i>Lemniscomys rosalia</i>			Highly Likely – unconfirmed pellets
Duiker, Common	<i>Sylvicapra grimmia</i>			Confirmed (pellets)
SPECIES OF CONSERVATION IMPORTANCE				
Rhino, Southern-central Black	<i>Diceros bicornis minor</i>	Critically Endangered (Endangered – GN151, 2007)	Critically Endangered	Unlikely (Edge of distribution & restricted)
Antelope, Roan	<i>Hippotragus equinus</i>	Endangered (Vulnerable – GN151, 2007)		Unlikely (Edge of distribution, habitat limited on site)
Bat, Percival's (Short-eared) Trident	<i>Cloeotis percivali</i>	Endangered		Possible (May forage in area)
Oribi	<i>Ourebia ourebia</i>	Endangered (Endangered – GN151, 2007)		Possible (ADU species – Habitat in neighbouring areas)
Reedbuck, Mountain	<i>Redunca fulvorufula</i>	Endangered	Endangered	Unlikely (ADU species – Edge of distribution, no habitat on site)
Wild Dog, African	<i>Lycaon Pictus</i>	Endangered (Endangered – GN151, 2007)	Endangered	Unlikely (ADU species – Restricted)
Antelope, Sable	<i>Hippotragus niger niger</i>	Vulnerable		Unlikely (ADU species – Edge of distribution, limited surface water)
Bat, Swinny's Horseshoe	<i>Rhinolophus swinnyi</i>	Vulnerable		Unlikely (Edge of distribution, no roosting sites nearby)
Cat, Small Spotted (Black-footed)	<i>Felis nigripes</i>	Vulnerable (Protected – GN151, 2007)	Vulnerable	Unlikely (Edge of distribution)
Cheetah	<i>Acinonyx jubatus</i>	Vulnerable (Vulnerable – GN151, 2007)	Vulnerable	Unlikely (ADU species – Restricted)
Duiker, Blue	<i>Philantomba monticola</i>	Vulnerable (Vulnerable – GN151, 2007)		Unlikely (ADU species – Edge of distribution, limited habitat and surface water)
Leopard	<i>Panthera pardus</i>	Vulnerable (Vulnerable – GN151, 2007)	Vulnerable	Possible (ADU species – May traverse the site)
Mouse (Rat), White-tailed	<i>Mystromys albicaudatus</i>	Vulnerable	Endangered	Possible (Limited habitat on site, but may traverse area)
Otter, Spotted-necked	<i>Hydriectis (Lutra) maculicollis</i>	Vulnerable (Protected – GN151, 2007)	Near Threatened	Unlikely (Edge of distribution, no habitat on site)
Pangolin	<i>Smutsia (Manis) temminckii</i>	Vulnerable (Vulnerable – GN151, 2007)	Vulnerable	Possible (ADU species – May traverse the site)
Shrew, Maquassie Musk	<i>Crociodura maquassiensis</i>	Vulnerable		Unlikely (Edge of distribution, no habitat on site)
Tsessebe	<i>Damaliscus lunatus lunatus</i>	Vulnerable (Endangered – GN151, 2007)		Unlikely (ADU species – Edge of distribution, limited surface water)

COMMON NAME	TAXON NAME	SA STATUS	IUCN (2016)	SITE OCCURRENCE
Bat, Blasius's Horseshoe	<i>Rhinolophus blasii</i>	Near Threatened		Possible (May forage in area)
Bat, Damara Woolly	<i>Kerivoula argentata</i>	Near Threatened		Unlikely (Edge of distribution, little known on specific habitat requirements)
Bat, Dent's Horseshoe	<i>Rhinolophus denti</i>	Near Threatened		Unlikely (Edge of distribution, no roost sites in area)
Hedgehog, Southern African	<i>Atelerix frontalis</i>	Near Threatened (Protected – GN151, 2007)		Highly Likely
Hyaena, Brown	<i>Hyaena brunnea</i>	Near Threatened (Protected – GN151, 2007)	Near Threatened	Possible (ADU species – May traverse through the area if population is present in the surrounding areas)
Hyaena, Spotted	<i>Crocuta crocuta</i>	Near Threatened (Protected – GN151, 2007)		Unlikely (ADU species – No habitat or surface water)
Otter, Cape Clawless	<i>Aonyx capensis</i>	Near Threatened	Near Threatened	Possible (ADU species – May forage in area)
Rat, African Marsh	<i>Dasymys incomtus</i>	Near Threatened		Possible (ADU species – May forage in area)
Rat, Southern African Vlei (grassland)	<i>Otomys auratus</i>	Near Threatened	Near Threatened	Possible (ADU species – May forage in area)
Rhebok, Grey	<i>Pelea capreolus</i>	Near Threatened	Near Threatened	Unlikely (ADU species – No habitat on site)
Serval	<i>Leptailurus serval</i>	Near Threatened (Protected – GN151, 2007)		Unlikely (ADU species – No habitat on site)
Shrew, Swamp Musk	<i>Crocidura mariquensis</i>	Near Threatened		Unlikely (No habitat on site)
Weasel, African Striped	<i>Poecilogale albinucha</i>	Near Threatened		Possible (Habitat in neighbouring areas)
Fox, Cape	<i>Vulpes chama</i>	Least Concern (Protected – GN151, 2007)		Possible (Habitat in neighbouring areas)
Honey Badger (Ratel)	<i>Mellivora capensis</i>	Least Concern (Protected – GN151, 2007)		Highly Likely
Reedbuck, Southern	<i>Redunca arundinum</i>	Least Concern (Protected – GN151, 2007)		Unlikely (No habitat on site)
ALIEN SPECIES				
Cat, Domestic	<i>Felis Catus</i>	Exotic		Highly Likely (ADU species)
Red River Hog	<i>Potamochoerus porcus</i>			Unlikely (ADU species)
House Rat	<i>Rattus rattus</i>			Highly Likely (ADU species)

4.3. Avifauna

SABAP2 generated desktop bird lists for the QDGS. Additional sources utilised for TOP bird distribution and identification included:

- The 2015 Eskom Red Data Book of Birds was consulted for TOP birds that may occur in the area based on distribution maps (Taylor *et al.*, 2015).
- BirdLife South Africa Checklist of Birds in South Africa 2017 was utilised for endemic species lists, supplemented by Chittenden *et al.* (2016).
- Roberts Bird Guide, 2nd Edition (Chittenden *et al.*, 2016) was used to compliment endemic species lists for the Survey Area and was consulted for identification, distribution, habitat, roosting and feeding requirements of ecologically sensitive species.
- Sasol Birds of Southern Africa, 4th Edition (Sinclair *et al.*, 2011) was also consulted for identification, distribution, habitat, roosting and feeding requirements of ecologically sensitive species.
- Roberts Nests & Eggs of Southern African Birds (Tarboton, 2014) to assist in field identification where needed.
- A Field Guide to the Tracks & Signs of Southern, Central & East African Wildlife (Stuart & Stuart, 2013) to assist in field identification where needed.

The avifauna desktop list is provided in Appendix B (SABAP2.org). A summary of birds noted on site during the survey and ecologically significant ADU species and TOP birds with distribution ranges overlapping or near to the Survey Area are included in Table 5 below.

In general bird life was abundant and more than represented within the report. Dense tree foliage made it difficult to spot arboreal species. It is expected that bird-life will be dominated by suburban species. The patchwork of habitats available around the site would provide for good avian biodiversity but would however have limited representation of water birds.

4.3.1. Species of Conservation Concern

Protected and endemic status of birds was obtained from Taylor *et al.* (2015) and GNR389 (2013). Endemic Species were also complimented by Chittenden *et al.* (2016). No endemic or TOPS were recorded on site. The site provides limited to no habitat for TOP birds and habitat in the surrounding areas is limited in terms of TOPS.

The Near Threatened European Roller and Marabou Stork are the most likely TOPS to frequent the site (both are also a North West protected species). The European Roller, which is a non-breeding migrant, is threatened within its palearctic breeding grounds and along its migration route, with no substantial threats in South Africa identified (Taylor *et al.*, 2015). The main reason for declines in the Marabou Stork is suspected to be the removal

of predators from large areas of South Africa, reducing the amount of carrion for the birds (Taylor, *et al.*, 2015). In addition, the birds are susceptible to poisoning through consuming litter / waste and deliberately poisoned animal carcasses (Taylor, *et al.*, 2015). Birds are also susceptible to collisions with power-lines (Taylor, *et al.*, 2015).

The site provides little value in terms of endemic species, with only 5 endemic species identified for the greater area (Table 5).

4.3.2. Invasive Species

In terms of birds, a single Category 3 invasive species (GN864, 2016) was confirmed on site: The Common Myna. SABAP2 also identified two Category 3 species for the QDGS: Rock Dove and House Sparrow. The Rose-ringed Parakeet (Category 2) was also identified for the QDGS (SABAP2.org). These species have extensive distributions in South Africa and all are closely related to human settlements and no proper control programmes have been implemented in South Africa for these species (Picker and Griffiths, 2011). Control efforts will need to be applied provincially and nationally if control of these species is to be successful.

Table 5: Birds of interest

COMMON NAME	TAXON NAME	ENDEMISM	SA STATUS	IUCN (2016)	SITE OCCURRENCE
SITE SPECIES					
Barbet, Crested	<i>Trachyphonus vaillantii</i>				Confirmed
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>				Confirmed
Dove, Laughing	<i>Streptopelia senegalensis</i>				Confirmed
Dove, Cape Turtle	<i>Streptopelia capicola</i>				Confirmed
Mousebird, Speckled	<i>Colius striatus</i>				Confirmed
Myna, Common	<i>Acridotheres tristis</i>				Confirmed
Starling, Red-winged	<i>Onychognathus morio</i>				Confirmed
Thrush, Karoo	<i>Turdus smithi</i>				Confirmed
Weaver, Southern-masked	<i>Ploceus velatus</i>				Confirmed
SPECIES OF ECOLOGICAL SIGNIFICANCE					
Flufftail, White-winged	<i>Sarothrura ayresi</i>		Critically Endangered	Critically Endangered	Unlikely (Last records in area from 1990s)
Vulture, White-backed	<i>Gyps africanus</i>		Critically Endangered (Endangered – GN151, 2007)	Critically Endangered	Unlikely (SABAP2 species – May forage over surrounds, but carrion on site unlikely)
Bateleur, Bateleur	<i>Terathopius ecaudatus</i>		Endangered (Vulnerable – GN151, 2007)	Near Threatened	Unlikely (SABAP2 species – Localised, avoids inhabited areas)
Eagle, Martial	<i>Polmaetus bellicosus</i>		Endangered (Vulnerable – GN151, 2007)	Vulnerable	Unlikely (SABAP2 species – May forage sporadically in the general area, but typically have large territories)
Eagle, Tawny	<i>Aquila rapax</i>		Endangered (Vulnerable – GN151, 2007)		Possible (SABAP2 species – May forage over area)
Harrier, African Marsh	<i>Circus ranivorus</i>		Endangered (Protected – GN151, 2007)		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Stork, Yellow-billed	<i>Mycteria ibis</i>		Endangered		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Vulture, Cape	<i>Gyps coprotheres</i>	Near Endemic	Endangered (Endangered – GN151, 2007)	Endangered	Unlikely (SABAP2 species – No suitable habitat in immediate area and presence of carrion on site unlikely)
Vulture, Lappet-faced	<i>Torgos tracheliotus</i>		Endangered (Endangered – GN151, 2007)	Endangered	Unlikely (SABAP2 species – May forage over surrounds, but carrion on site unlikely)
Eagle, Verreaux's	<i>Aquila verreauxii</i>		Vulnerable		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Falcon, Lanner	<i>Falco biarmicus</i>		Vulnerable		Unlikely (SABAP2 species – Uncommon, preferred habitats & roosting sites absent from site)
Finfoot, African	<i>Podica senegalensis</i>		Vulnerable		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Heron, White-backed Night	<i>Gorsachius leuconotus</i>		Vulnerable		Unlikely (Distribution edge, no suitable habitat in immediate area)

COMMON NAME	TAXON NAME	ENDEMISM	SA STATUS	IUCN (2016)	SITE OCCURRENCE
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>		Vulnerable		Unlikely (SABAP2 species – Outside distribution, limited suitable habitat in surrounds)
Pelican, Great White	<i>Pelecanus onocrotalus</i>		Vulnerable		Unlikely (Distribution edge, no suitable habitat in surrounds)
Pelican, Pink-backed	<i>Pelecanus rufescens</i>		Vulnerable (Endangered – GN151, 2007)		Unlikely (SABAP2 species – No suitable habitat and roosts in immediate area)
Owl, African Grass	<i>Tyto capensis</i>		Vulnerable (Vulnerable – GN151, 2007)		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Secretarybird, Secretarybird	<i>Sagittarius serpentarius</i>		Vulnerable	Vulnerable	Possible (SABAP2 species – Suitable habitat in surrounds)
Stork, Black	<i>Ciconia nigra</i>		Vulnerable (Vulnerable – GN151, 2007)		Unlikely (SABAP2 species – No suitable habitat and roosts in immediate area)
Tern, Caspian	<i>Sterna caspia</i>		Vulnerable		Unlikely (SABAP2 species – No suitable habitat and roosts in immediate area)
Bustard, Kori	<i>Ardeotis kori</i>		Near threatened (Vulnerable – GN151, 2007)	Near Threatened	Possible (Distribution edge, suitable habitat in surrounds)
Crane, Blue	<i>Anthropoides paradiseus</i>	Near Endemic	Near Threatened (Endangered – GN151, 2007)	Vulnerable	Possible (SABAP2 species – Suitable habitat in surrounds)
Curlew, Eurasian	<i>Numenius arquata</i>		Near threatened	Near Threatened	Unlikely (Distribution edge, no suitable habitat in surrounds)
Duck, Maccoa	<i>Oxyura maccoa</i>		Near threatened	Near Threatened	Possible (Distribution edge)
Falcon, Red-footed	<i>Falco vespertinus</i>		Near threatened	Near Threatened	Possible (SABAP2 species – Suitable habitat in surrounds)
Flamingo, Greater	<i>Phoenicopterus ruber</i>		Near threatened		Unlikely (SABAP2 species – No suitable habitat and roosts in immediate area)
Flamingo, Lesser	<i>Phoenicopterus minor</i>		Near threatened	Near Threatened	Unlikely (SABAP2 species – No suitable habitat and roosts in immediate area)
Harrier, Pallid	<i>Circus macrourus</i>		Near threatened	Near Threatened	Unlikely (Low density, no suitable habitat in surrounds)
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>		Near threatened		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Painted-snipe, Greater	<i>Rostratula benghalensis</i>		Near Threatened		Unlikely (SABAP2 species – No suitable habitat in immediate area)
Pratincole, Black-winged	<i>Glareola nordmanni</i>		Near Threatened	Near Threatened	Unlikely (SABAP2 species – No suitable habitat in immediate area)
Roller, European	<i>Coracias garrulus</i>		Near Threatened	Near Threatened	Highly likely (SABAP2 species)
Sandgrouse, Yellow-throated	<i>Pterocles gutturalis</i>		Near Threatened		Possible (SABAP2 species – Suitable habitat in surrounds)
Stork, Abdim's	<i>Ciconia abdimii</i>		Near Threatened		Possible (SABAP2 species – Suitable habitat in surrounds)
Stork, Marabou	<i>Leptoptilos crumeniferus</i>		Near Threatened		Highly likely (SABAP2 species)

COMMON NAME	TAXON NAME	ENDEMISM	SA STATUS	IUCN (2016)	SITE OCCURRENCE
Falcon, Peregrine	<i>Falco peregrinus</i>		Least Concern (Vulnerable – GN151, 2007)		Unlikely (SABAP2 species – Outside distribution, limited habitat and no roosting sites in immediate area)
Kestrel, Lesser	<i>Falco naumanni</i>		Least Concern (Vulnerable – GN151, 2007)		Possible (SABAP2 species – Suitable habitat in surrounds)
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>	Endemic			Unlikely (Distribution edge, limited habitat on site)
Rock-thrush, Cape	<i>Monticola rupestris</i>	Endemic			Unlikely (SABAP2 species – No suitable habitat in surrounds)
Starling, Pied	<i>Spreo bicolor</i>	Endemic			Possible (SABAP2 species – Distribution edge, suitable habitat in surrounds)
Sunbird, Greater Double-collared	<i>Cinnyris afer</i>	Endemic			Unlikely (SABAP2 species – Distribution edge, limited suitable habitat in surrounds)
Swallow, South African Cliff	<i>Petrochelidon spilodera</i>	Breeding Endemic			Possible (SABAP2 species – Distribution edge, suitable habitat in immediate surrounds)
ALIEN SPECIES					
Myna, Common	<i>Acridotheres tristis</i>		Category 3 Invasive (GN864, 2016)		Confirmed (SABAP2 species)
Dove, Rock	<i>Columba livia</i>		Category 3 Invasive (GN864, 2016)		Highly likely (SABAP2 species)
Sparrow, House	<i>Passer domesticus</i>		Category 3 Invasive (GN864, 2016)		Highly Likely (SABAP2 species)
Parakeet, Rose-ringed	<i>Psittacula krameri</i>		Category 2 Invasive (GN864, 2016)		Highly Likely (SABAP2 species)

4.4. Reptiles

ADU ReptileMAP was utilised to generate reptile desktop lists for the QDGS and various sources utilised to determine additional TOPS and endemic reptiles that could occur within the area. These included:

- Atlas and red list of the reptiles of South Africa, Lesotho and Swaziland (Bates, *et al.*, 2014).
- Chameleons of Southern Africa (Tolley & Burger, 2012) was utilised for additional information requirements and identification as needed.
- A Field Guide to the Tracks & Signs of Southern, Central & East African Wildlife (Stuart & Stuart, 2013) to assist in field identification where needed.

The reptile desktop list is provided in Appendix C (VMUS.ADU.org). A summary of reptiles noted on site during the survey and ecologically significant species with distribution ranges overlapping the Survey Area are included in Table 6 below.

No reptile species were observed on site. It must be stressed that very few burrows were noted on site that may be indicative of reptile species.

4.4.1. Species of Conservation Concern

The main sources utilised for the protected status of reptiles was the Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, *et al.*, 2014) and GNR389 (2013).

Only one threatened species (the Vulnerable Nile Crocodile) and one protected species (the Protected Natal Python) were identified for the site. Neither is likely to occur on site for any extended period as primary preferred habitat is not available on site.

The site provides little value in terms of endemic species, with only 4 endemic species identified for the greater area (Table 6), of which only the Eastern Ground Agama and Transvaal Thick-toed Gecko (also a North West protected species) are likely to occur on site.

4.4.2. Invasive Species

Bates, *et al.* (2014) provide lists of exotic snakes that have been collected around South Africa. None were noted on site, but cannot be excluded from the area, especially considering the urban nature of the area.



Table 6: Reptiles of interest

COMMON NAME	TAXON NAME	ENDEMISM	SA STATUS	IUCN (2016)	SITE OCCURRENCE
SITE SPECIES					
No species or indicators/tracks of species observed during site assessments.					
SPECIES OF ECOLOGICAL SIGNIFICANCE					
Crocodile, Nile	<i>Crocodylus niloticus</i>		Vulnerable	Near Threatened	Unlikely (ADU species – Distribution edge, no suitable habitat in surrounds)
Python, Southern African	<i>Python natalensis</i>	Endemic	Least Concern (Protected – GN151, 2007)		Possible (Limited habitat in surrounds)
Agama, Eastern Ground	<i>Agama aculeata distanti</i>	Endemic			Highly Likely (ADU species)
Snake, Western Natal Green	<i>Philothamnus natalensis occidentalis</i>	Endemic			Unlikely (Edge of distribution, limited habitat in surrounds)
Gecko, Transvaal Thick-toed	<i>Pachydactylus affinis</i>	Endemic			Highly Likely (ADU species – Primary habitat in surrounds, secondary habitat on site)
ALIEN SPECIES					
None recorded from the area					

4.5. Amphibians

ADU FrogMAP was utilised to generate frog desktop lists for the QDGS and additional sources utilised to determine additional TOP frogs that could occur within the area. Sources utilised for amphibian distribution and identification included:

- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009).
- A Field Guide to the Tracks & Signs of Southern, Central & East African Wildlife (Stuart & Stuart, 2013) to assist in field identification where needed.

The amphibian desktop list is provided in Appendix C (VMUS.ADU.org). A summary of frogs noted on site during the survey and ecologically significant species with distribution ranges overlapping the Survey Area are included in Table 7.

No frogs were observed during site visits.

4.5.1. *Species of Conservation Concern*

No species of conservation concern are likely to occur on site. The only species that may occur in the surrounding areas is the Near Threatened Giant Bull Frog (also a North West protected species). As these species are only mobile during the breeding season (November to December), activities that may impact on the surrounds (potentially transport-related activities) must be ceased if the frogs become active in the area during this period.

4.5.2. *Invasive Species*

No categorised alien invasive frogs are likely to occur on site.

Table 7: Amphibians of interest

COMMON NAME	TAXON NAME	ENDEMISM	SA STATUS	IUCN (2016)	SITE OCCURRENCE
SITE SPECIES					
No species or indicators/tracks of species observed during site assessments.					
SPECIES OF ECOLOGICAL SIGNIFICANCE					
Bullfrog, Giant	<i>Pyxicephalus adspersus</i>		Near Threatened (Protected – GN151, 2007)		Possible (Habitat available in surrounds)
Bullfrog, African	<i>Pyxicephalus edulis</i>		Least Concern (Protected – GN151, 2007)		Unlikely (Edge of distribution, limited habitat in surrounds)
Toad, Raucous	<i>Amietophrynus rangeri</i>	Endemic			Unlikely (Habitat largely absent from surrounds, would remain within specific habitat type)
ALIEN SPECIES					
None recorded from the area					

4.6. Invertebrates

Additional sources utilised for invertebrate supporting information included:

- Field Guide to Insects of South Africa (Picker and Weaving, 2012).
- Field guide to butterflies of South Africa (Woodhall, 2005).
- Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas (Mecenero *et al.*, 2013).
- Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index (Samways & Simaika, 2016).

A summary of TOPS with distribution ranges (where distribution ranges are available) overlapping or near the Survey Area are included in Table 8. It must be stressed that the distribution of many species listed in GN151 of 2007 are unknown and it is very possible that these species do not occur in the area at all. In terms of this, no likelihood of occurrence has been completed for invertebrates.

A single Vulnerable dragonfly, the Makabusi Sprite (*Pseudagrion makabusiense*), was recorded from the QDGS according to OdonataMap (VMUS.ADU.org). However, the species distribution is limited to the Limpopo Province and it is Unlikely to occur on site.

Opisthophthalmus pugnax was recorded for the QDGS (ScorpionMAP). All burrowing scorpions in this genus are protected under GN151 of 2007.

Although a specific invertebrate assessment did not form part of the scope of work, two butterflies were recorded from site, an *Acraea* species and a *Mylothris* species. Neither is a TOPS.

Table 8: Invertebrates of interest (ADU species in bold)

COMMON NAME	TAXON NAME	SA RED-LIST STATUS	TOPS STATUS (GN151, 2007)
Roodepoort Copper Butterfly	<i>Aloeides dentatis dentatis</i>	Endangered	
Horned Baboon Spiders (All)	<i>Ceratogyrus sp. (All)</i>		Protected
Stag Beetles (All)	<i>Colophon sp. (All)</i>		Endangered
Tiger Beetles (All)	<i>Dromica sp. (All)</i>		Protected
Velvet Ground Beetle	<i>Graphipterus assimilis</i>		Protected
Fruit Chafer Beetles (All)	<i>Ichnestoma sp. (All)</i>		Protected
Highveld Blue Butterfly	<i>Lepidochrysops praeterita</i>	Endangered	
Monster Tiger Beetles (All)	<i>Manticora sp. (All)</i>		Protected
Tiger Beetles	<i>Megacephala asperata</i>		Protected
Tiger Beetles	<i>Megacephala regalis</i>		Protected
Stag Beetles	<i>Nigidius auriculatus</i>		Protected
Stag Beetles	<i>Oonotus adpersus</i>		Protected
Stag Beetles	<i>Oonotus interioris</i>		Protected
Stag Beetles	<i>Oonotus rex</i>		Protected
Stag Beetles	<i>Oonotus sericeus</i>		Protected
Creeping Scorpions (All)	<i>Opisthacanthus sp. (All)</i>		Protected
Burrowing Scorpions (All)	<i>Opisthophthalmus sp. (All)</i>		Protected
Tiger Beetles	<i>Platychila pallida</i>		Protected
Stag Beetles	<i>Prosopocoilus petitclerci</i>		Protected
Tiger Beetles	<i>Prothyma guttipennis</i>		Protected
Makabusi Sprite	<i>Pseudagrion makabusiense</i>	Vulnerable	
Golden Baboon Spiders (All)	<i>Pterinochilus sp. (All)</i>		Protected
Flat Rock Scorpions (All)	<i>Xadogenes sp. (All)</i>		Protected
Common Baboon Spiders (All)	<i>Xarpactira sp. (All)</i>		Protected

4.7. Vegetation

The desktop assessment of vegetation included the Vegetation Map of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006), as well as a search for protected species which may occur in within or within the proximity of the project area on BODATSA website (SANBI, 2016).

4.7.1. Vegetation Map

The proposed Boschoek Filling Stations are situated in the savanna Biome. The savanna vegetation of South Africa represents the southernmost extension of the most widespread biome in Africa (Mucina and Rutherford, 2006). Most savanna vegetation communities are characterised by an herbaceous layer dominated by grasses and a discontinuous to sometimes very open tree layer (Mucina and Rutherford, 2006). Major macroclimatic traits that characterise the Savanna biome include:

- Seasonal precipitation; and
- (Sub) tropical thermal regime with no or usually low incidence of frost (Mucina and Rutherford, 2006).

The savanna biome is the largest biome in South Africa, extending throughout the east and north-eastern areas of the country. Savannas are characterised by a dominant grass layers, over-topped by a discontinuous, but distinct woody plant layer. At a structural level, Africa's savannas can be broadly categorised as either fine-leaved (microphyllous) savannas or broad-leaved savannas. Fine-leaved savannas typically occur on nutrient rich soils and are dominated by microphyllous woody plants of the Mimosaceae family (Common genera include *Acacia* and *Albizia*) and a generally dense herbaceous layer (Scholes and Walker, 1993).

The study area occurs within the Gold Reef Mountain Bushveld (SVcb 9) (Mucina and Rutherford, 2006) (Figure 9). The Gold Reef Mountain Bushveld is characterized by rocky hills and ridges are often west-east trending with denser woody vegetation on the south facing slopes associated with distinct floristic differences. Tree cover elsewhere is variable and often the tree and shrub layer are continuous. Important taxa found in the Gold Reef Mountain Bushveld include small trees such as *Senegalia caffra*, *Combretum molle* and *Protea caffra*. Tall shrubs include *Canthium gilfillanii* and *Ehretia rigida* subsp. *rigida*. Low shrubs include *Athrixia elata* and woody climbers include *Ancylobotrys capensis*. Graminoids include *Loudetia simplex* and many more, whilst herbs include *Helichrysum nudifolium* and *Pentanisia angustifolia* amongst others. Geophytic herbs occurring in the Gold Reef Mountain Bushveld include *Hypoxis hemerocallidea* amongst others. Endemic taxa include *Aloe peglerae* and *Frithia pulchra*. This vegetation unit is considered to be least threatened (Mucina and Rutherford 2006). This vegetation unit is not a listed threatened terrestrial ecosystem as per GN 1002 (GG 34809 of 9 December 2011) published under the NEM:BA.

4.7.2. BODATSA

The polygon used to obtain the plant species data from BODATSA is illustrated in Figure 8 below:

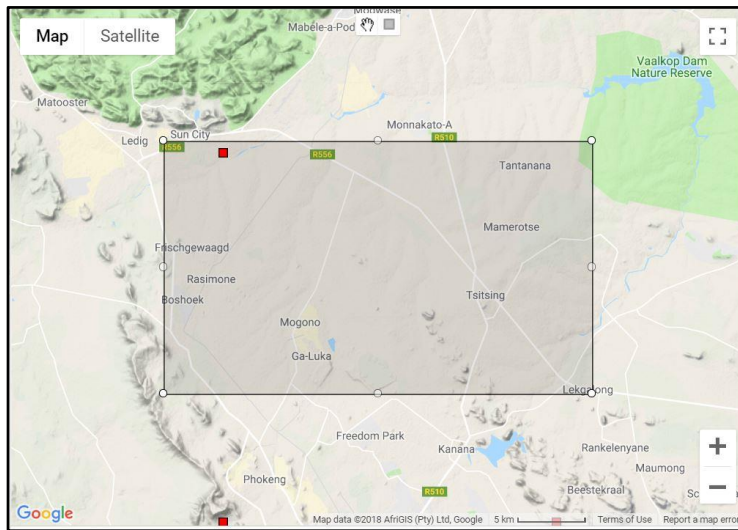


Figure 8: Records included in the search for protected species close to the site from the BODATSA (SANBI, 2018)

A total of 421 plant species are expected within the rectangle on the BODATSA database, this data is available on request. Based on the results obtained from the BODATSA database the expected plant species of conservation concern (SCC) include one (1) Data Deficient (DD) species (Table 9). Data Deficient species are species that are poorly known, with insufficient information on their habitat, population status or distribution in order to make an assessment. If a Data Deficient species is likely to be impacted upon by a proposed activity, the subpopulation should be well surveyed, and the data sent to the Threatened Species Programme. The species will be reassessed and the new status of the species, with a recommendation, will be provided within a short timeframe (Raimondo *et al.*, 2009).

Table 9: Plant species of conservation concern which may occur within the project area

SPECIES	IUCN (2017)	ECOLOGY	HABITAT
<i>Myrothamnus flabellifolius</i>	DD	Indigenous	Geophyte which possesses an extensive root system which extends into the crevices of the rocky slopes on which it grows. It usually forms large stands in shallow soil on sunny rocky hills or along cracks and crevices in rocks.

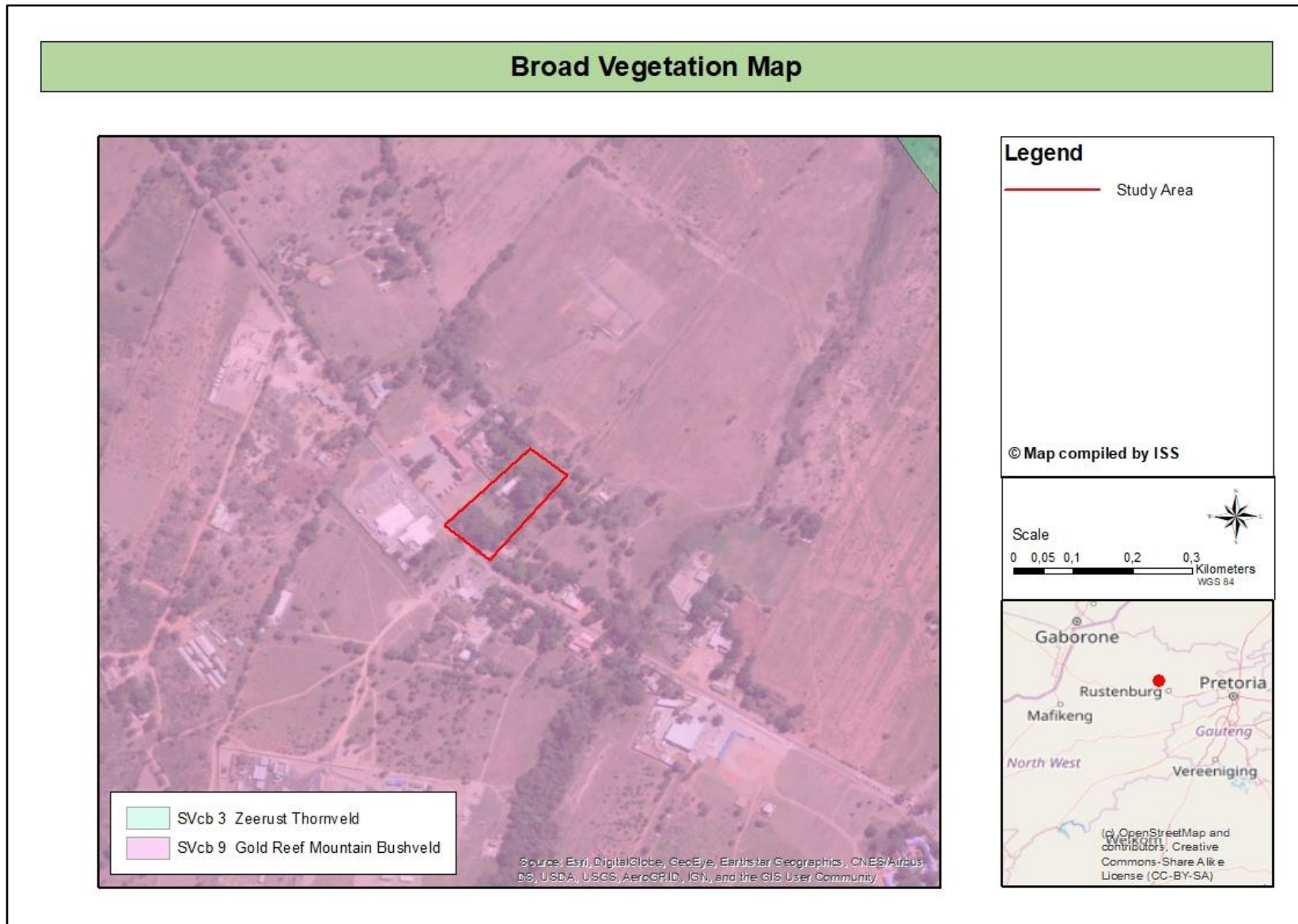


Figure 9: Boschoek Filling Stations study area showing the vegetation type based on the Vegetation of South Africa, Lesotho & Swaziland (SANBI, 2006-)

4.8. Vegetation Assessment

One vegetation community was identified within the study area namely:

- Transformed (Figure 14).

The following vegetation communities were identified outside of the study area namely:

- Wetland,
- Secondary grasslands, and
- Savanna (Figure 14).

Rainfall prior to the site visit was limited. The grass herb layer was particularly affected by the lack of rain. A fire event also removed a significant amount of vegetation in the north eastern portion of the transformed community. The fire was hot, and plants had not recovered after the fire event.

Prior to the disturbance events the study area most likely resembled an open savanna system. However, due to agricultural as well as residential activities the site was degraded. Subsequently floral composition as well as ecosystem structure was altered significantly. In terms of agriculture, fruit orchards were observed as well as a bee hive. The site contained a house as well as garden including garden plants (Figure 10).

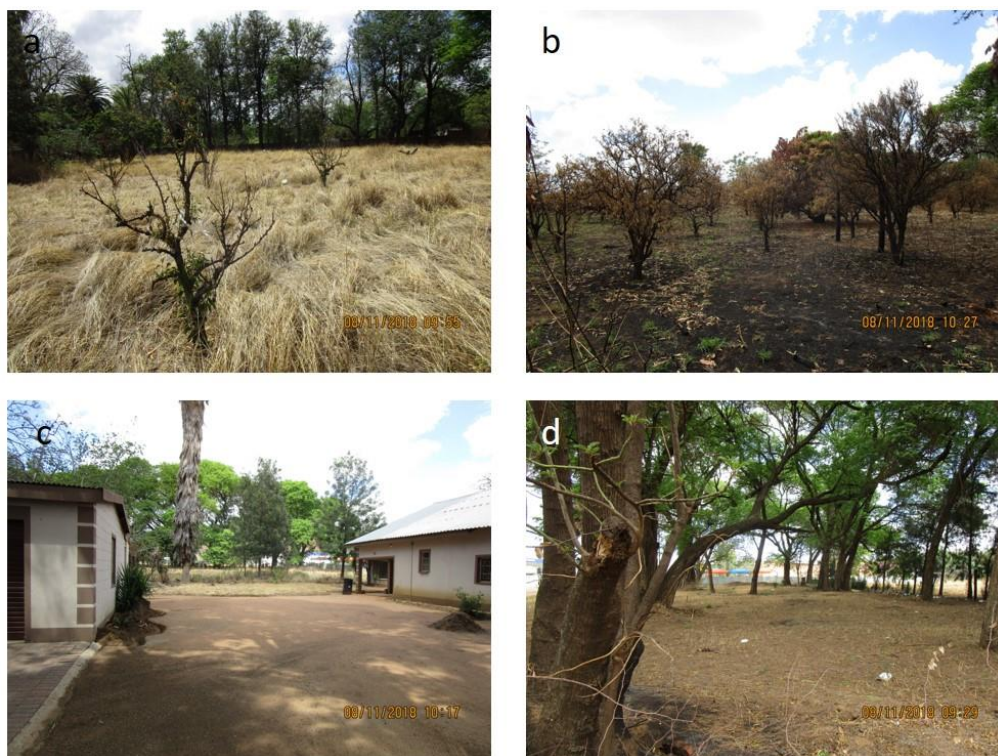


Figure 10: a) Grass layer still largely dormant in a fruit orchard to the south west of the residential buildings b) Burnt orchards in the north eastern corner of the study area, c) Residential buildings and garden, d) Sparse vegetative cover underneath the tree canopy bordering the R565.

In terms of floristic composition, the site was seriously modified from what would be expected under natural conditions. No plants of conservation concern were observed during the site visit and no habitat was observed which would support any plants of conservation concern. A total of four species were recorded within the transformed community, however, not all garden and ornamental species were identified. Nineteen of the species were invasive or weedy in nature Table 10.

The wetland vegetation community contained two different wetland types namely:

- Artificial wetlands and
- Riparian area.

No wetlands are present within the project area.

The artificial wetland is situated to the north east of the study area and the riparian area to the east both are located outside of the proposed project area. The artificial wetland had contained bamboo species as well as some *Phragmites australis* (Common Reed). The vegetation of especially the grass-herb layer was still dormant during the site visit and a complete floristic diversity of the vegetation community was therefore not recorded. Some invasive *Eucalyptus camaldulensis* were observed on the edges of the artificial wetland, it was evident that these trees were cut down as part of alien plant management. Sedges were not observed during the site visit, but this could be attributed to the lack of sufficient rain. Both of the wetland types were significantly altered from natural conditions (Figure 11).

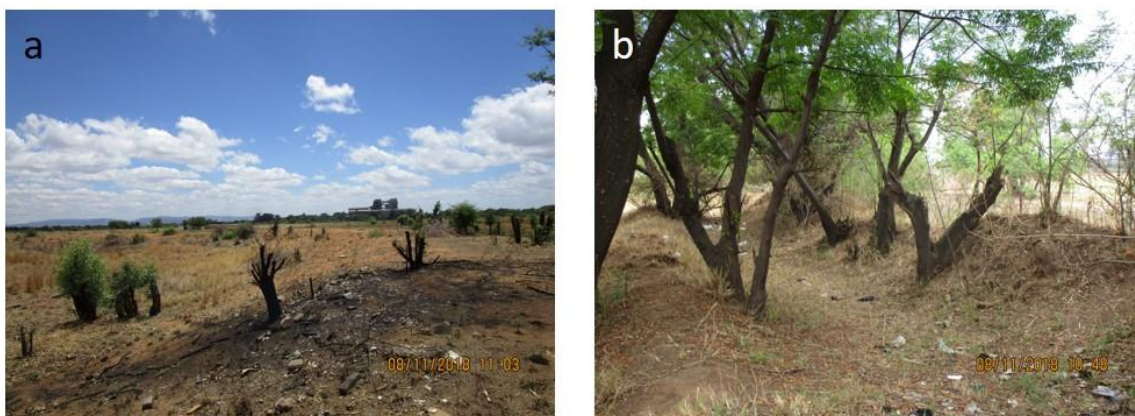


Figure 11: a) Artificial wetland with *Eucalyptus camaldulensis* and a burnt area b) Riparian area with *Melia azedarach* and limited vegetation cover

The secondary grassland was present to the north and east of the study area and had varying levels of disturbances. The grass herb layer was largely dormant during the site visit and numerous plant species could not be identified. Due to the high level of disturbance within the community it is not expected that any plant species of conservation concern would occur, even after sufficient rains. Patches of the secondary grassland was burnt (Figure 12).

Secondary grasslands develop where the original, primary (undisturbed) grassland vegetation was removed (e.g. by cultivation, vegetation clearing, dumping, infilling etc.). After such disturbances cease, pioneer grassland species, as well as weedy plants, colonise the disturbed areas leading to a secondary grassland state with lower species diversity as opposed to the primary (climax) state prior to any disturbances. Where grasslands were historically disturbed although no cultivation took place (e.g. compaction of the soils), the result could also resemble a secondary grassland state with limited species diversity. An indicator of secondary grasslands is the presence of *Hyparrhenia hirta*. Primary grasslands are species rich ecosystems, which once disturbed, are difficult, if not impossible to restore.

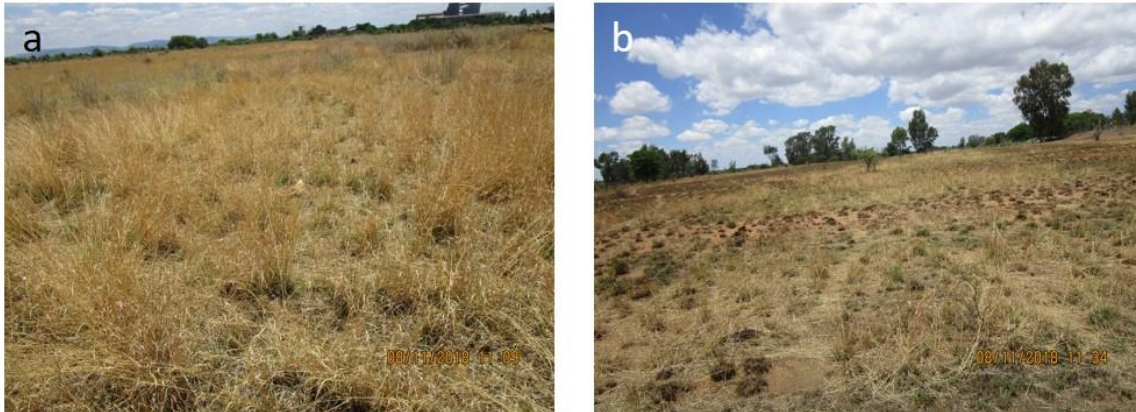


Figure 12: a) Secondary grassland with *Hyparrhenia hirta* b) Burnt patches of secondary grassland

The savanna system also had a dormant grass- herb layer and hence total floristic composition was not recorded during the site visit. High levels of disturbance were recorded around the existing petrol station to the south west of the project area opposite the R565. A total of 26 species were recorded within the plant community, 6 of which were invasive or weedy species. It is not expected that any plants of conservation concern would be present in the plant community due to the lack of rocky habitat. Littering was quite significant within the plant community (Figure 13). A small trench was observed to the south west of the nursery located to the south west of the project area area. The trench included a the *Typha capensis* (Bulrush), which is indicative of wetland conditions.



Figure 13: a) Savanna with *Vachellia karoo* and littering b) Littering present within the savanna community

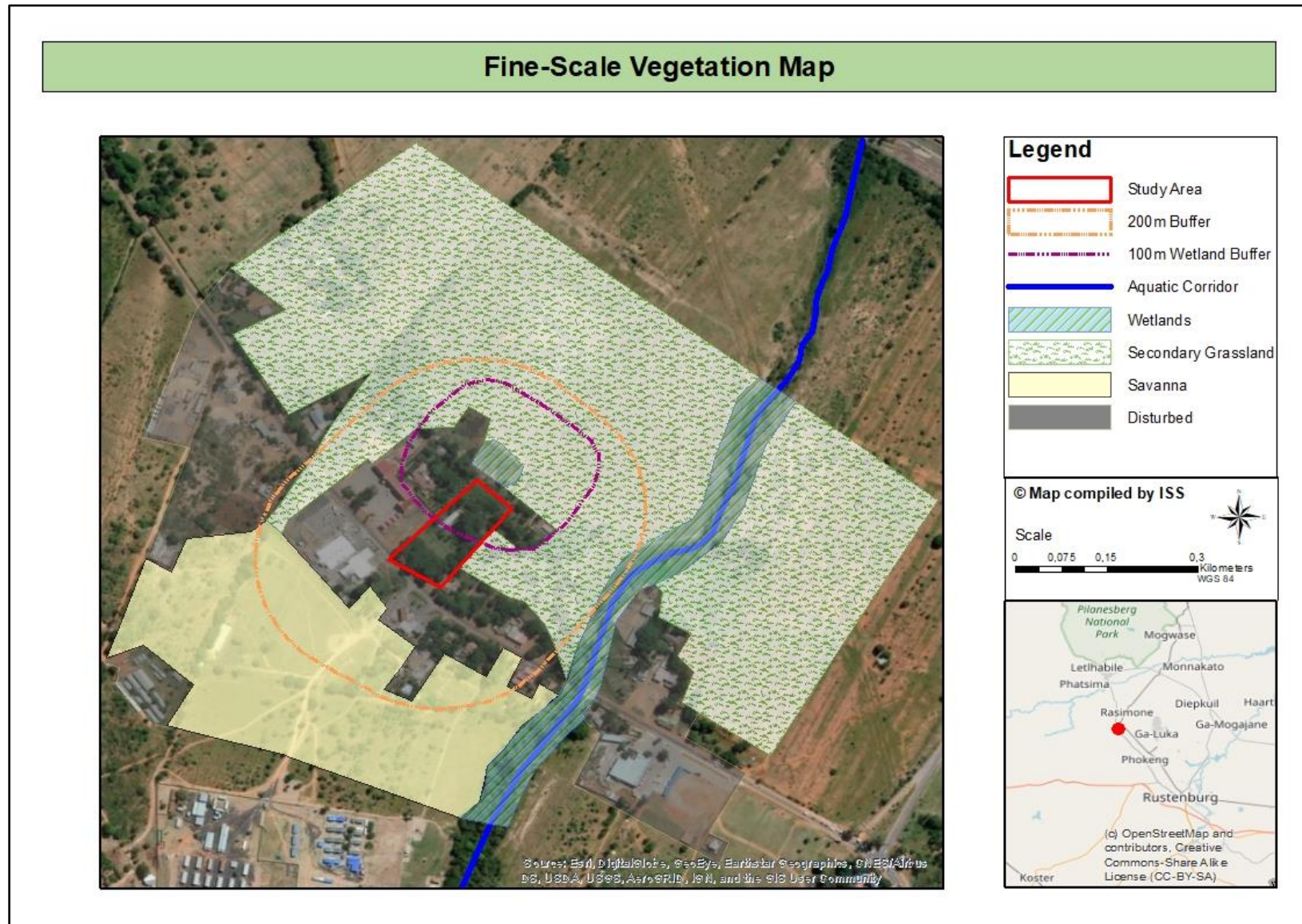


Figure 14: Fine-Scale vegetation map of the study areas as well as 200m buffer area

Table 10: Plant species recorded during the November 2018 survey

SPECIES	COMMON NAME	HABITAT NOTES	TRANSFORMED	WETLAND	SAVANNA	SECONDARY GRASSLAND
Grasses						
<i>Brachiaria brizantha</i>	Common Signal grass	Sandy soil, next to roads or undisturbed areas	1		1	
<i>Chloris pycnothrix</i>	Spiderweb grass	Fallow lands, disturbed areas	1			1
<i>Cynodon dactylon</i>	Couch grass	Most soils, usually in disturbed areas. Increaser II grass, palatable	1	1	1	1
<i>Cynodon nlemfuensis</i>	Star Grass	Well adapted to any soils, grows mostly on disturbed land such as road reserves and old fields. Propagate by runners	1		1	1
<i>Eustachys paspaloides</i>	Brown Rhodes grass	Undisturbed, open grassland	1			1
<i>Hyparrhenia hirta</i>	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass	1	1	1	1
<i>Panicum maximum</i>	Guinea Grass	Grow in shade under trees, also in sun, moist to dry areas.	1		1	
<i>Phragmites australis</i>	Common Reed	Grows close to water sources such as rivers and wetlands.		1		
<i>Pogonarthria squarrosa</i>	Herringbone Grass	Disturbed places, sparsely distributed in natural, open grassland. Sub climax grass that colonise disturbed sandy soils. Not palatable, Increaser II	1			1
<i>Sporobulus africanus</i>	Ratstail Dropseed	Disturbed places close to water or in road verges. Increaser III grass	1			1
<i>Urochloa mosambicensis</i>	Bushveld Signal Grass	Disturbed areas such as farmland, also in compacted soils. Good grazing grass. Increaser II	1		1	
Total number of grass species =10			10	4	6	7
Forbs/ shrubs						
<i>Aloe davyana</i>	Spotted aloe; Highveld grass aloe	Grassland and bushveld. Often forming dense stands in overgrazed areas.	1		1	
<i>Asclepia fruticosa</i>	Milkweed	Grassland			1	
<i>Asparagus cooperi</i>	Haakdoring	Climbing into trees or fences	1		1	
<i>Asparagus laricinus</i>	Cluster-leaved Asparagus	Thicket or disturbed areas, waste places. Difficult to eradicate if encroaching into grassland	1		1	
<i>Justica flava</i>	Yellow Justicia	Bushveld, along roadsides and disturbed areas.	1			1
<i>Lactuca inermis</i>	Wild lettuce	Grassland and disturbed areas.	1			1
<i>Leonotis microphylla</i>	Klipdagga	Grassland and Bushveld, often in disturbed areas.	1		1	1
<i>Portulacaria afra</i>	Porkbush / Spekboom	Popular succulent garden plant			1	
Total number of forb and shrub species =			6	0	6	3
Trees						
<i>Senegalia burkei</i>	Black Monkey Thorn	Bushveld and sandy soil.	1		1	
<i>Vachellia erubescens</i>	Blue Thorn	Bushveld, grassland and coastal scrub	1		1	
<i>Vachellia karroo (M)</i>	Sweet Thorn	Widespread, often proliferate in overgrazed areas	1		1	

SPECIES	COMMON NAME	HABITAT NOTES	TRANSFORMED	WETLAND	SAVANNA	SECONDARY GRASSLAND
<i>Vachellia nilotica</i> (M)	Scented Thorn	Bushveld on sandy soils around pans and near riverbanks. Often colonising disturbed areas			1	
<i>Celtis africana</i>	Stinkwood	Wooded areas or bush clumps, usually on dolomite	1			
<i>Euclea crispa</i> subsp <i>crispa</i>	Blue Guarri	Rocky slopes, kloofs, along rivers and forest margins	1			
<i>Gymnosporia buxifolia</i>	Common Spike Thorn	Widespread, often as pioneer in disturbed places	1			
<i>Searsia lancea</i>	Sour Karee	Grassland and bushveld	1		1	
<i>Searsia pyroides</i>	Common Wild Currant	Mountain grassland, bushveld, grassland - wide range of habitats	1			
<i>Ziziphus mucronata</i>	Buffalo-thorn	Widespread, in various habitats	1	1	1	
Total number of trees species =		10	9	1	6	0
Sedges						
<i>Typha capensis</i> *	Bulrush	Grows in marshy areas and along watercourses.		1	1	
Total number of sedge species =		1	0	1	1	0
Climbers						
<i>Pentarrhinum insipidum</i>	Donkieperske	Grassland and clumps of bush, often twining in fences. It is an aggressive grower and in slightly disturbed areas exhibits invasive tendencies.	1		1	1
Total number of climbers =	1	1	1	0	1	1
Alien and invasive species						
<i>Achyranthes aspera</i> (M)	Burrweed	Grassland, savanna, forest margins - usually in shaded moist sites. Category 1 invader in CARA	1		1	1
<i>Bidens bipinnata</i>	Blackjack	Widespread, naturalised weed.	1		1	1
<i>Cereus jamacaru</i>	Queen of the night	Category 1b (NEM:BA)	1			
<i>Citrus limon</i>	Lemon tree	Cultivated species	1			
<i>Citrus reticulata</i>	Naartjie	Cultivated species	1			
<i>Citrus sinensis</i>	Orange	Cultivated species	1			
<i>Conyza albida</i>	Tall Fleabane	Weed	1		1	1
<i>Eucalyptus camaldulensis</i>	Red River Gum	Category 1b (NEM:BA)	1			1
<i>Grevillea robusta</i>	Australian Silky Oak	Category 3 (CARA)	1			1
<i>Jacaranda mimosifolia</i>	Jacaranda	Category 1b (NEM:BA) in Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga and North West	1			
<i>Lantana camara</i>	Lantana	Form dense impenetrable thickets, replacing indigenous vegetation. Declared Category 1b (NEM:BA)	1		1	
<i>Melia azedarach</i>	Syringa	Category 1b (3 in urban areas) (NEM:BA)	1			1
<i>Morus alba</i>	Mulberry	Invader, Category 3 (CARA)	1			
<i>Nicotiana glauca</i>	Wild Tabaco	Category 1b (NEM:BA)	1			

SPECIES	COMMON NAME	HABITAT NOTES	TRANSFORMED	WETLAND	SAVANNA	SECONDARY GRASSLAND
<i>Opuntia spinulifera</i>	Saucepan cactus	Category 1 (CARA)	1			
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Category 1b (NEM:BA) in wetlands and protected areas	1		1	
<i>Populus cf deltoides</i>	Poplar	Exotic	1			
<i>Schkuhria pinnata</i>	Dwarf Marigold	Weedy annual herb from S America	1			1
<i>Tagetes minuta</i>	Khaki Weed	Weed in disturbed places. Has become naturalised and due to the vast amount of seed set, difficult to control	1	1	1	1
Total number of alien and invasive species=		19	19	1	6	8
Total number of species per plant community			45	6	26	19

Key to the table:

1 – recorded in the vegetation grouping

NT - Near Threatened

M- Medicinal

D – Declining

P - Provincially protected



4.8.1. *Alien Invasive Plant 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 these systems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations were published in the Government Gazette No. 37886, 1 August 2014. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control program. Remove and destroy. 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: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing
- Take steps to manage the listed invasive species in compliance with:
 - Section 75 of the Act;
 - The relevant invasive species management program developed in terms of regulation 4; and
 - Any directive issued in terms of section 73(3) of the Act.

Four (4) category 1b and one (1) category 3 NEM:BA species were recorded at the site and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act as stated above. The identified category 1b and 2 species are listed in Table 10.

4.9. Habitat Sensitivity in Terms of Fauna

The site has been categorised as an Important Critical Biodiversity Area in the NW Biodiversity Sector Plan and as important habitat for vultures. In terms of the Rustenburg Local Municipality's EMF, the site is within Agricultural Holdings Management Zone, where agriculturally-related developments should be prioritised.

In terms of the findings of the study, the site offers little in terms of supporting unique or special fauna and contributing significantly to fauna biodiversity. In terms of being important habitat for vultures, it is unlikely that the vultures would reside in the immediate area due to the general anthropogenic town activities and the general lack of preferred roosting areas. They are likely to fly over and possibly forage over the greater area, but not specifically at the site, where no carrion would be expected for the vultures. In terms of the EMF, the site has already been subdivided, was a private residence with small orchard, and has developed areas adjacent to it, giving it limited value for any large agricultural development or practices.

Plan 5 depicts the sensitive areas in terms of fauna. It must be stressed that areas beyond site are extrapolated based on visual scans and Google Earth Imagery. Also, due to the canopy of the trees the extent of disturbed areas and location of the storm water drainage channel may not be accurately presented beyond the site borders.

The road servitude area (within Site 1) and the uninhabited residential area (site 3) have no natural habitat of relevance remaining and are classed as disturbed.

Site 2 is an unmanaged orchard with scattered fruit trees, alien plants and a dense overgrown, mat of dead grass and is disconnected from any other natural vegetation units. The site could be classed as low sensitivity but due to the fact that the site is disconnected it has been designated as disturbed.

Site 4, although connected to a more natural corridor, is also an unmanaged orchard with old waste pits and dumped building rubble and provides little for fauna and has low sensitivity. This site could be slightly improved, by way of planting indigenous trees and connecting the site to the smaller tree-corridor (Plan 5) related to the storm water drainage channel (earth channel with no lining). The existing corridor is narrow and would only continue to support existing species in the area.

The north-eastern area appears to be old pastures and fields and supports largely grassy vegetation. It does provide a substantial terrestrial ecological corridor and thus is designated as moderate sensitivity. The area to the south west is linked to the buffer areas of the rocky hills which link to the Magaliesberg range further south-west of site. The site offers some connectivity between the grassy area to the NE and the rocky hills further SW and thus this area was categorised as moderately sensitive in terms of fauna.

The only areas designated as sensitive are the areas associated with the wetland on the north-eastern border and buffer areas associated with the south-eastern tributary. The latter also provides an ecological corridor. The wetland is a seep, which was dry at the time of surveying. An earth berm has been constructed around the seep and the site is disturbed. Nonetheless, wetlands and buffers are classified as sensitive, and in terms of fauna they provide unique habitats within the greater landscape, support many TOPS and are often associated with ecological corridors critical for fauna movement and prevention of isolation of fauna populations (Figure 15).

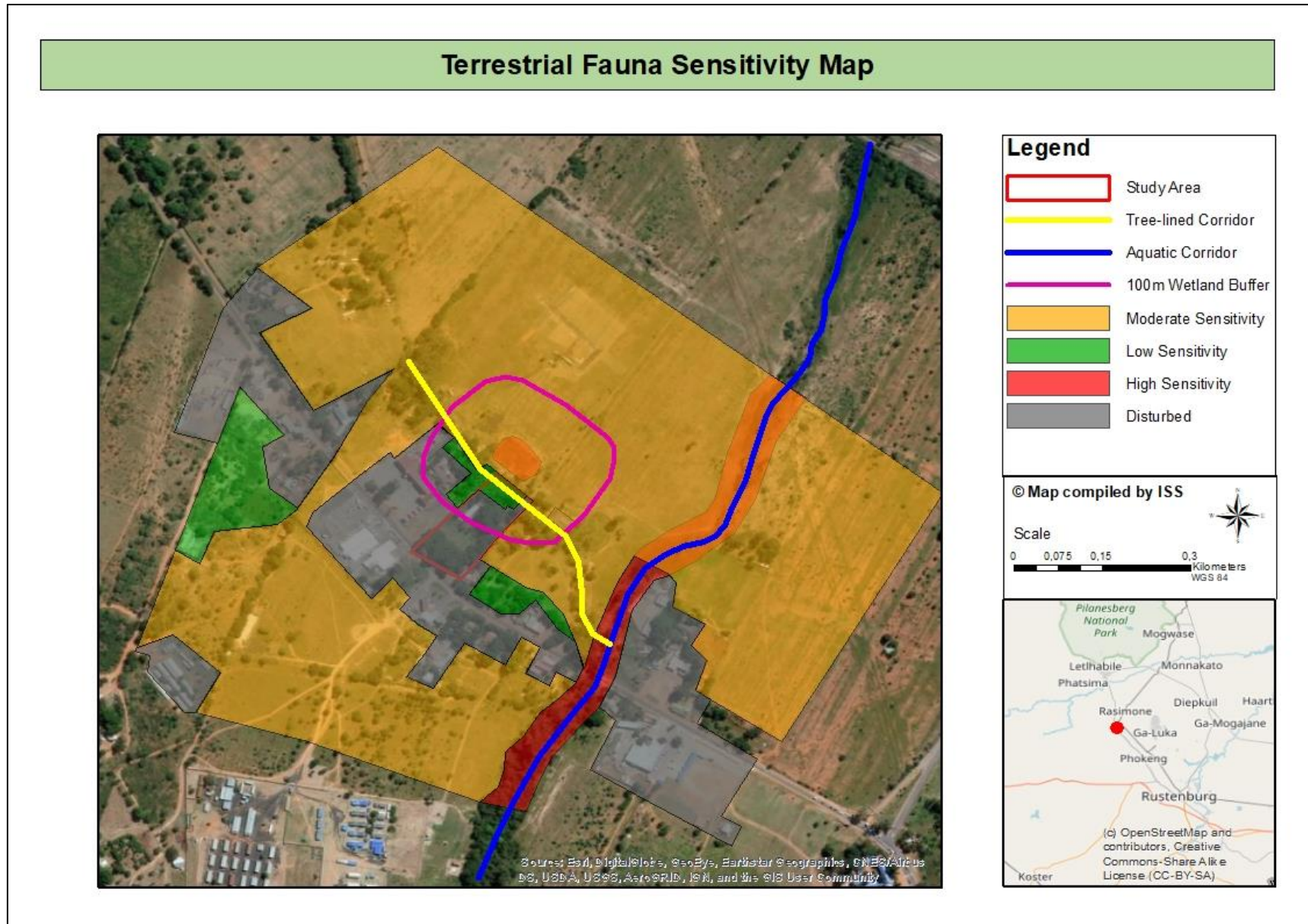


Figure 15: Terrestrial fauna sensitivity map

4.10. Habitat Sensitivity in Terms of Flora

As per Table 11 below, the result of the sensitivity assessment indicated that the artificial wetland community had a moderate sensitivity. This is primarily attributed to the fact that wetlands are protected by national legislation. The artificial wetland community also was mapped with a 100m buffer as per best practice. The secondary grassland, savanna and transformed areas were all assigned a low sensitivity. The study area contained only transformed vegetation and therefore a low sensitivity (Figure 16).

Table 11: Preliminary sensitivity scoring of vegetation communities within the project area

SITE	CONSERVATION STATUS OF REGIONAL VEGETATION UNIT	LISTED ECOSYSTEM OR STATE OF VEGETATION	LEVEL OF LEGISLATIVE PROTECTION	SUITABLE HABITAT FOR PLANTS OF CONSERVATION	ECOLOGICAL FUNCTION	ECOLOGICAL IMPORTANCE	TOTAL SCORE OUT OF MAX OF 18
Artificial wetland	0*	0	3	1	1	2	7 Medium
Secondary grassland	0*	0	2	0	1	1	4 Low
Savanna	0	0	2	1	1	1	5 Low
Transformed	0*	0	0	0	0	0	0 Low

*Vegetation is secondary

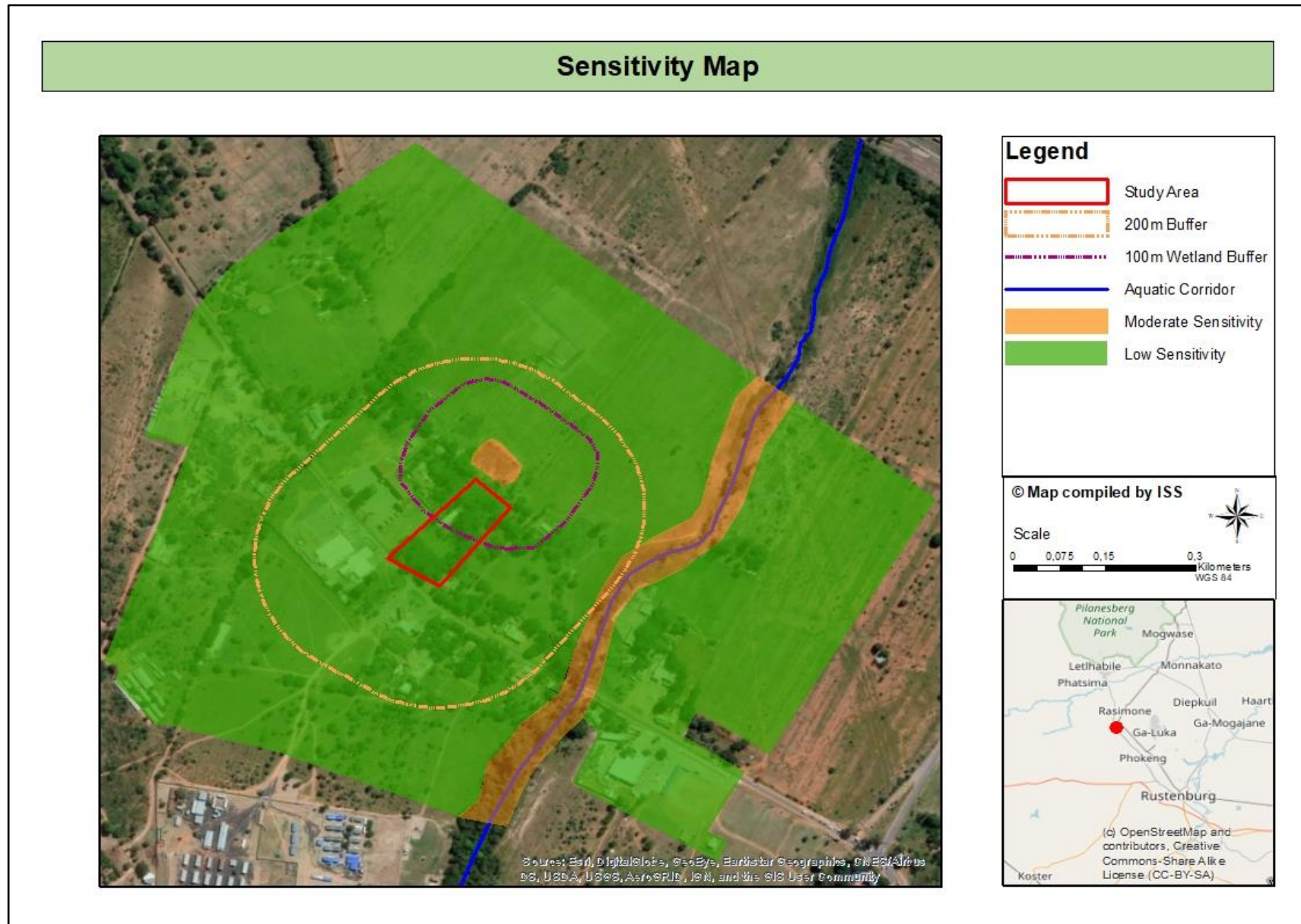


Figure 16: Vegetation sensitivity map

5. Impact Assessment and suggested mitigation measures

5.1. Impact Statement

In terms of the impact assessment the following is assumed:

- The 100m / 1: 100-year flood-line of the wetland will be respected as per legislation (NWA) and will remain intact otherwise the necessary water use license (WUL) will be obtained.

No detailed plan or list of activities were available at the time of this report. No decommissioning or closure is applicable to the activity. The following activities are assumed:

- Site preparation and construction of fuel station:
 - Removing trees and vegetation.
 - Stripping and stockpiling soil.
 - Excavation for fuel storage tanks.
 - Cement mixing and construction of foundations, storm water drainage and oil traps.
 - Construction of fuel station and supporting buildings (toilet facilities, shop, parking area).
 - Generation and handling of waste.
- Operation of the fuel station:
 - Delivery and dispensing of fuel and oil (hydrocarbon handling) and general goods.
 - Additional servicing (tyre pumping, windscreen washing) of vehicles.
 - Utilisation of toilets and sewage and grey water handling.
 - Generation of domestic and hazardous (hydrocarbon and chemical) waste.

Potential impacts associated with the proposed development include the following:

- Destruction and loss of sensitive fauna habitat and loss of habitat connectivity;
- Destruction of burrowing / fossorial fauna through excavation;
- Destruction of TOPS fauna;
- Disturbance to fauna (noise, vibration, dust, human activity) and emigration of fauna from site, resulting influx of fauna to neighbouring areas;
- Attraction of pests and exotic / alien species;
- Hindrance, trapping, killing / poisoning of fauna;
- Contamination of fauna environment through littering and dumping of waste or sewage leaks;
- Contamination of fauna environment due to hydrocarbon (new and used) handling on site;
- Cement spills will impact on soil and surrounding habitats, indirectly impacting fauna reliant on these habitats;

- Loss of floral species or floral habitat;
- Increase in alien invasive plant species.

5.2. Assessment of Significance

5.2.1. Destruction and loss of sensitive fauna habitat and loss of habitat connectivity

Nature: Destruction and loss of sensitive fauna habitat and loss of habitat connectivity		
CONSTRUCTION PHASE - REMOVAL OF TREES & VEGETATION, STRIPPING AND STOCKPILING OF SOIL	WITHOUT MITIGATION	WITH MITIGATION
Duration	Short-Medium Term (2)	Immediate (1)
Extent	Local (2)	Site specific (1)
Probability	Unlikely (2)	Rare (1)
Severity	Moderate (3)	Minor (2)
Significance	Low (14)	Low (4)
Status (+ or -)	-	-
OPERATIONAL PHASE - ONLY IF HYDROCARBON-CONTAMINATED RUN-OFF IS NOT APPROPRIATELY CONTAINED ON SITE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Immediate (1)
Extent	Local (2)	Site Specific (1)
Probability	Possible (3)	Unlikely (2)
Severity	Significant (5)	Minor (2)
Significance	Moderate low (30)	Low (8)
Status (+ or -)	-	-
Reversibility	Low: No rehabilitation required	
Irreplaceable loss of resources?	Low likelihood	
Can impacts be mitigated?	Yes	
<p>Mitigation: STOP: No activities are to commence within wetland area and wetland buffer (approximate 100m buffer indicated in Plan 5) until the necessary authorisations are obtained under the NWA.</p> <p>MODIFY: Areas designated as disturbed must be targeted for physical development, areas of low and moderate fauna sensitivity for gardens, green spaces and corridors. Avoid areas of high sensitivity.</p> <p>Plan and implement a proper storm-water management plan with appropriate hydrocarbon containment system (oil traps).</p> <p>CONTROL: When removing trees, maintain indigenous trees that will not hamper development. Peg out and demarcate areas for development before commencing with any activities to prevent disturbance to areas not targeted for development and maintain these in their existing state. Plan for material stockpiles (topsoil and subsoil and excavated rock) within the disturbed areas as far as possible. If the area designated as low sensitivity is required for stockpiling then soils should be prioritised for the area. Maintain areas of physical disturbance as small as possible to limit the area of disturbance. All conditions in the Water Use License and Environmental Authorisations must be complied with and audited as required.</p> <p>REMEDY: Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible.</p> <p>Cumulative impacts: No significant impacts are foreseen as the site is disturbed, neighboured by developments and within a road servitude. Site also provides little in terms of ecological connectivity. Future developmental planning for the greater area must ensure ecological corridors are not blocked or pinched off through development.</p>		



Residual risks: Any hydrocarbon contamination will cause residual impact, especially if not attended to immediately. With the implementation of the above measures, any disturbed areas should be rehabilitated, and hydrocarbons effectively contained on site, and no residual impact is expected.

5.2.2. Destruction of burrowing/fossorial fauna through excavation

Nature: Destruction of burrowing / fossorial fauna through excavation		
CONSTRUCTION PHASE - SOIL STRIPPING, STOCKPILING AND EXCAVATIONS	WITHOUT MITIGATION	WITH MITIGATION
Duration	Short Term (2)	Short Term (2)
Extent	Site specific (1)	Site specific (1)
Probability	Possible (3)	Possible (3)
Severity	Serious (4)	Serious (4)
Significance	Moderate low (21)	Moderate low (21)
Status (+ or -)	-	-
OPERATIONAL PHASE - ONLY IF HYDROCARBON-CONTAMINATED RUN-OFF IS NOT APPROPRIATELY CONTAINED ON SITE (SEE ABOVE) OR POOR WASTE MANAGEMENT ON SITE (SEE BELOW)	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Construction (3)
Extent	Local (2)	Local (2)
Probability	Possible (3)	Possible (3)
Severity	Significant (5)	Significant (5)
Significance	Moderate low (30)	Moderate low (30)
Status (+ or -)	-	-
Reversibility	Low: No rehabilitation required	
Irreplaceable loss of resources?	Low likelihood	
Can impacts be mitigated?	Partially	
<p>Mitigation: GENERAL NOTE: Specific impact cannot be mitigated, but area can be developed in a way to minimise impact by maintaining source populations in neighbouring areas not targeted for development. STOP: See above. MODIFY: See above. CONTROL: See above. Maintain the substrate in surrounding areas in tact to provide source populations which can then repopulate rehabilitated areas. Where needed, stockpile excavated soil as per the soil utilisation guide. Keep topsoil stockpiles loose and keep surface of stockpiles moist. Utilise soils over the site as soon as possible. REMEDY: See above</p>		
<p>Cumulative impacts: No significant impacts are foreseen as the site is disturbed, neighboured by developments and within a road servitude. Site also provides little in terms of ecological connectivity. Future developmental planning for the greater area must ensure ecological corridors are not blocked or pinched off through development.</p>		
<p>Residual risks: Any hydrocarbon contamination will cause residual impact, especially if not attended to immediately. With the implementation of the above measures, any disturbed areas should be rehabilitated and hydrocarbons effectively contained on site, and no residual impact is expected.</p>		



5.2.3. Destruction of TOPS fauna

Nature: Destruction of TOPS fauna		
CONSTRUCTION PHASE - POTENTIAL ONLY EXISTS DURING THE BREEDING SEASON OF THE GIANT BULLFROG DUE TO CONSTRUCTION VEHICLES IN THE GENERAL AREA	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Short Term (2)
Extent	Regional (3)	Local (2)
Probability	Possible (3)	Unlikely (2)
Severity	Significant (5)	Moderate (3)
Significance	Moderate low (33)	Low (14)
Status (+ or -)	-	-
OPERATIONAL PHASE - ONLY IF HYDROCARBON-CONTAMINATED RUN-OFF IS NOT APPROPRIATELY CONTAINED ON SITE (SEE ABOVE) OR POOR WASTE MANAGEMENT ON SITE (SEE BELOW)	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Immediate (1)
Extent	Local (2)	Site specific (1)
Probability	Possible (3)	Unlikely (2)
Severity	Significant (5)	Minor (2)
Significance	Moderate low (30)	Low (8)
Status (+ or -)	-	-
Reversibility	High: irreversible only if impact occurs	
Irreplaceable loss of resources?	High: only if impact occurs	
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <p>GENERAL NOTE: Identified TOPS will leave the area upon disturbance and are unlikely to be impacted (see section 3). The Giant Bullfrog, unlikely to reside on site, but may be a visitor to site, is the only potential TOPS that may be directly impacted.</p> <p>STOP: Should the November – December breeding season indicate the presence of the Giant Bullfrog on or near site, then activity will cease.</p> <p>MODIFY: Plan activities outside the breeding season.</p> <p>CONTROL: Ensure all drivers on site and staff in general are informed of the importance of these species through environmental awareness training. Trucks must drive carefully during the breeding season and staff must not harm, hinder or kill these species.</p> <p>Cumulative impacts: No significant impacts are foreseen as the site is disturbed, neighboured by developments and within a road servitude. Site also provides little in terms of ecological connectivity. Future developmental planning for the greater area must ensure ecological corridors are not blocked or pinched off through development and ensure that any Giant Bullfrog habitat identified in the greater area is conserved as Critical or Important CBAs.</p> <p>Residual risks: Should activities proceed without any caution to these species should they occur on site, then the species could experience a regional and national decline in numbers.</p>		

5.2.4. Disturbance to fauna and emigration of fauna from site

Nature: Disturbance to fauna (noise, vibration, dust, human activity) and emigration of fauna from site, resulting influx of fauna to neighbouring areas		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Short Term (2)	Short Term (2)
Extent	Local (2)	Local (2)
Probability	Possible (3)	Unlikely (2)
Severity	Low (1)	Low (1)
Significance	Low (15)	Low (10)
Status (+ or -)	-	-
OPERATIONAL PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Short Term (2)	Short Term (2)
Extent	Local (2)	Local (2)
Probability	Possible (3)	Possible (3)
Severity	Low (1)	Low (1)
Significance	Low (15)	Low (15)
Status (+ or -)	-	-
Reversibility	Low: Species composition not expected to change dramatically	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Not required. Mitigation measures are proposed for consideration.	
<p>Mitigation:</p> <p>GENERAL NOTE: Site already supports generalist and suburban species that are not TOPS. Therefore, not all species will leave and those that do should be allowed to without hindrance. The mitigation proposed below should be considered.</p> <p>MODIFY: Utilise quieter equipment where feasible.</p> <p>If fences are to be erected ensure open fences, such as palisades are used, particularly within ecological corridors or important ecological areas (the northern half of the property) to allow fauna to leave the site to surrounding areas. Consider planting indigenous trees and plants in the northern part of the property (Site 4, Figure 7) with bird boxes and establishing the area as a green rest area or picnic site to attract local species back to the site.</p> <p>CONTROL: Ensure dust suppression, through water sprinkling, is applied at time of high dust generation.</p> <p>Any noisy point-sources utilised on site should be enclosed, and all equipment / machinery fitted with silencers where applicable. All equipment / machinery will be serviced and maintained within operating specifications to prevent excessive noise.</p>		
<p>Cumulative impacts: No significant impacts are foreseen as the site is disturbed, neighboured by developments and within a road servitude.</p>		
<p>Residual risks: No residual impact is expected. Neighbouring area provides ample habitat and most of the species already utilise areas beyond the site boundary.</p>		

5.2.5. Attraction of pests and exotic/alien faunal species

Nature: Attraction of pests and exotic / alien species		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Short Term (2)
Extent	Local (2)	Local (2)
Probability	Definite (6)	Possible (3)
Severity	Moderate (3)	Minor (2)
Significance	Moderate high (48)	Moderate low (18)
Status (+ or -)	-	-
OPERATIONAL PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Short Term (2)
Extent	Local (2)	Local (2)
Probability	Definite (6)	Possible (3)
Severity	Moderate (3)	Minor (2)
Significance	Moderate high (48)	Moderate low (18)
Status (+ or -)	-	-
Reversibility	Moderate: Minor rehab required	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <p>GENERAL NOTE: Alien species are already present on site and include wide-spread, urbanised alien avifauna which cannot be controlled on a site-specific basis and need to be tackled nationally.</p> <p>MODIFY: Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition. Consider planting indigenous trees and plants in the northern part of the property (Site 4) with bird boxes and establishing the area as a green rest area or picnic site to attract local species back to the site.</p> <p>CONTROL: Compile and implement an alien invasive management plan in line with the municipal management plan, which must include measures to prevent attracting additional AI avifauna and AI mammals to site. This should include not feeding wild life and ensuring that all food and food waste and domestic waste is placed in sealed containers and not exposed on site. Ensure that the outside areas are kept clean and tidy and provide adequate waste removal services to prevent the attraction of rats and other alien scavenging species to the site.</p> <p>REMEDY: Clear all domestic and food waste from site.</p>		
<p>Cumulative impacts: Not attempting to control or preventing the worsening of alien invasive infestation will cause a decline in indigenous species. Altered population dynamics such as displacement of natural indigenous species by AIS can cause significant impact on overall fauna community structure, impacting further on ecological interactions and natural food-chains.</p>		
<p>Residual risks: If not properly managed, AIS will out-compete indigenous flora and reduce overall indigenous biodiversity in the area.</p>		

5.2.6. Hindrance, trapping, killing/poisoning of fauna

Nature: Hindrance, trapping, killing / poisoning of fauna		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Construction (3)
Extent	Local (2)	Site specific (1)
Probability	Likely (4)	Unlikely (2)
Severity	Moderate (3)	Moderate (3)
Significance	Moderate low (32)	Low (14)
Status (+ or -)	-	-
OPERATIONAL PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Construction (3)
Extent	Local (2)	Site Specific (1)
Probability	Likely (4)	Unlikely (2)
Severity	Moderate (3)	Moderate (3)
Significance	Moderate low (32)	Low (14)
Status (+ or -)	-	-
Reversibility	Moderate: Time will be required for population numbers to recover	
Irreplaceable loss of resources?	Moderate	
Can impacts be mitigated?	Yes	
<p>Mitigation: GENERAL NOTE: Wastes and hydrocarbons can be poisonous to fauna and should be managed (see below). STOP: Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site. No poisons against fauna are to be brought on site and any substances that could be harmful to fauna will be stored and handled in a manner that will prevent exposure to fauna. No deliberate killing or trapping of fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area. CONTROL: All contractors on site must undergo environmental awareness training which must include the prohibition of any harm or hindrance to any fauna species. REMEDY: Contracts with contractors must specify actions that will be taken against contractors who do not conduct activities in line with the EMP. Should any fauna be trapped within the development area, activities will cease, and specialists brought in to safely remove the animals from site. Ensure safe speed limits and working conditions on site.</p>		
<p>Cumulative impacts: With unrestricted and continued development in the area, where several projects are active with significant increase in subcontractors in the area, along with poor environmental awareness training, fauna biodiversity in the area could decrease significantly through subsistence hunting and poaching.</p>		
<p>Residual risks: No residual impact is expected as mass killing of fauna is unlikely to occur and species typical of the area are likely to recover their numbers.</p>		



5.2.7. Contamination of fauna environment through littering and dumping of waste or sewage leaks

Nature: Contamination of fauna environment through littering and dumping of waste or sewage leaks		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Immediate (1)	Immediate (1)
Extent	Local (2)	Site specific (1)
Probability	Likely (4)	Unlikely (2)
Severity	Moderate (3)	Minor (2)
Significance	Moderate low (24)	Low (8)
Status (+ or -)	-	-
OPERATIONAL PHASE – ONLY IF MAINTENANCE OR REPAIR WORK NEEDS TO BE UNDERTAKEN	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Immediate (1)
Extent	Local (2)	Site Specific (1)
Probability	Likely (4)	Possible (3)
Severity	Moderate (3)	Minor (2)
Significance	Moderate low (32)	Low (12)
Status (+ or -)	-	-
Reversibility	Moderate: Monitoring and clean-up required	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <p>STOP: Ensure a waste management plan has been compiled in line with the NEM:WA highlighting handling and storage of various wastes on site, in line with prescribed standards before any activities commence on site.</p> <p>MODIFY: Provide for adequate portable toilets for the number of staff on site and provide for male and female staff.</p> <p>CONTROL: Keep portable toilets and public toilets clean and hygienic and keep all facilities outside the wetland buffer zone. Portable toilets will properly managed and emptied regularly to prevent overflow and leaks. All waste (domestic, hydrocarbon, hazardous) must be managed in line with the prescribed waste management plan. Refuse bins with properly secured lids will be placed around site to collect waste for separation, recycling and disposal. Waste (domestic, construction, hazardous) should be recycled as far as possible and sold/given to interested contractors. Recyclable waste should not be stored for excessive periods. Waste will be stored according to the Norms and Standards for Storage of Waste.</p> <p>REMEDY: Inspect and clear all litter and waste from the site and surrounds. Public toilets will be regularly checked for leaks which will be attended to immediately. Repair any sewage leaks immediately.</p>		
<p>Cumulative impacts: No major cumulative impact foreseen in terms of this development, but town planning must ensure capacity in terms of water supply and water and sewage reticulation for all current and future developments to specifically prevent sewage flows into the environment.</p>		
<p>Residual risks: In terms of town planning, poor sewage and waste services for current and future developments could cause the site to degrade substantially and alter the surrounding ecosystems permanently.</p>		

5.2.8. Contamination of environment due to hydrocarbon handling on site

Nature: Contamination of environment due to hydrocarbon (new and used) handling on site		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Construction (3)	Immediate (1)
Extent	Local (2)	Site specific (1)
Probability	Possible (3)	Unlikely (2)
Severity	Serious (4)	Moderate (3)
Significance	Moderate low (27)	Low (10)
Status (+ or -)	-	-
OPERATIONAL PHASE – ONLY IF MAINTENANCE OR REPAIR WORK NEEDS TO BE UNDERTAKEN	WITHOUT MITIGATION	WITH MITIGATION
Duration	Life of project (4)	Immediate (1)
Extent	Local (2)	Site Specific (1)
Probability	Definite (6)	Unlikely (2)
Severity	Critical (6)	Moderate (3)
Significance	High (72)	Low (10)
Status (+ or -)	-	-
Reversibility	Moderate: Monitoring and clean-up required	
Irreplaceable loss of resources?	Moderate	
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <p>STOP: Discontinue use of all faulty machinery / equipment on site until properly repaired. Plan and implement a proper storm-water management plan with appropriate hydrocarbon containment system (oil traps).</p> <p>MODIFY: Due to proximity of petrol stations, hydrocarbon storage on site during construction should be limited. Repairs to vehicles will be conducted off-site and where this is not possible the underlying ground will be covered with impermeable sheet and pans.</p> <p>CONTROL: All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. Hydrocarbons must in no way be exposed to the environmental elements. New hydrocarbons must be properly stored and handled according to prescribed manner to prevent spills onto bare ground. Used hydrocarbons must be stored and handled as per the waste management plan. Any machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks.</p> <p>REMEDY: All hydrocarbons spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bio-remediation or disposal to a hazardous waste facility.</p>		
<p>Cumulative impacts: With the presence of other fuel stations in the area, cumulative large spills or continuous cumulative leaks that are not cleaned up will enter the environment through run-off and contaminate the environment and poison the fauna.</p>		
<p>Residual risks: Any hydrocarbon contamination will cause residual impact, especially if not attended to immediately. With the implementation of the above measures, any disturbed areas should be rehabilitated, and hydrocarbons effectively contained on site, and no residual impact is expected.</p>		

5.2.9. Cement spills

Nature: Cement spills will impact on soil and surrounding habitats, indirectly impacting fauna reliant on these habitats.		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Immediate (1)	Immediate (1)
Extent	Local (2)	Site specific (1)
Probability	Possible (3)	Unlikely (2)
Severity	Moderate (3)	Moderate (3)
Significance	Moderate low (18)	Low (10)
Status (+ or -)	-	-
OPERATIONAL PHASE – NO FURTHER CEMENT HANDLING ANTICIPATED DURING OPERATION PHASE		
Duration	NA	NA
Extent	NA	NA
Probability	NA	NA
Severity	NA	NA
Significance	NA	NA
Status (+ or -)	Neutral	Neutral
Reversibility	Moderate: Monitoring and clean-up required	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <p>MODIFY: Before any cement mixing takes place on site, a designated and banded area will be created on site outside the wetland buffer zone for cement mixing.</p> <p>CONTROL: Cement bags will be stored under a tarpaulin and on an impervious sheet. Cement mixing will take place within the designated area only.</p> <p>REMEDY: All dry and wet cement spills on bare ground will be cleared immediately.</p>		
<p>Cumulative impacts: No significant impacts are foreseen as the site is disturbed, neighboured by developments and within a road servitude. Site also provides little in terms of ecological connectivity.</p>		
<p>Residual risks: No residual impact is expected. With the implementation of the above measures, cement should be effectively contained on site.</p>		

5.2.10. Loss of floral species or floral habitat

The likelihood of the presence of plant species of conservation concern within the footprint area for the proposed filling station is low. This is attributed to the fact that the study area was transformed and contained no natural remaining patches of vegetation.

The significance of this impact was rated pre- and post- mitigation for the construction and operational phases of the development (Table 12). During the construction phase the significance of the loss of flora habitat was rated as moderate low prior to mitigation and low post-mitigation (Table 12). The significance of flora habitat

loss during the operational phase was rated as moderate low prior to mitigation and low post-mitigation (Table 12).

Table 12: Assessment of significance of loss of flora habitat prior to and post mitigation

<p>Nature: Construction of the proposed filling station will require clearing of vegetation and modification of the habitat with the project footprint. During the survey it was found that the habitat within the project footprint had already been extensively modified due to residential as well as agricultural activities. No floral species of conservation concern were observed during the site visit nor were any expected to occur within the are based on BODATSA data as the SCC only occurs on rocky hill sides.</p>		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Permanent (5)	Permanent (5)
Extent	Local (1)	Local (1)
Probability	Unlikely (2)	Unlikely (2)
Severity	Minor (2)	Insignificant (1)
Significance	Moderate low (16)	Low (14)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	No, project footprint already transformed and situated in heavily utilised farmyard	
Can impacts be mitigated?	Yes, to a certain extent	
<p>Mitigation: Clearing of vegetation should be limited to the filling station footprint area. Any additional clearing should be limited. Access roads should be planned in areas which have been transformed to limited additional fragmentation within the landscape and additional loss of vegetative cover.</p>		
<p>Cumulative impacts: As the footprint of the proposed development is small and the site has been extensively utilised and transformed the contribution of the development to cumulative habitat loss in the region is considered to be insignificant</p>		
<p>Residual risks: None</p>		
OPERATIONAL PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Permanent (5)	Permanent (5)
Extent	Regional (2)	Local (1)
Probability	Possible (3)	Unlikely (2)
Severity	Minor (2)	Insignificant (1)
Significance	Moderate low (27)	Low (14)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	Low likelihood	
Can impacts be mitigated?	Yes	
<p>Mitigation: Although the project footprint itself is small in size the proposed development once operational has the potential to impact on the buffer area related to the wetland vegetation. As mitigation to this, any impacts associated with the operation of the filling station should be limited to the project footprint itself and should not be allowed to impact on the surrounding buffer area or beyond.</p>		
<p>Cumulative impacts: Potential cumulative impacts would include impacts from the filling station impacting on the surrounding primary vegetation. This impact can be avoided by limiting the transformation of habitat to the proposed footprint only and not allowing impacts to degrade the surrounding buffer area.</p>		



Residual risks: None

5.2.11. Increase in invasive plant species

During the construction phase of the project vegetation clearing will occur. This will alter the natural competition present within the ecosystem currently and allow a window of opportunity for invasive species to colonise the disturbed areas. During the operational phase as long as invasive species are removed from the project area in the construction phase and no invasive plant species are used within the landscaping, it is unlikely that the impact will be as significant as in the construction phase.

The significance of this impact was rated pre- and post- mitigation for the construction and operational phases of the development (Table 13). During the construction phase the significance of the increase of invasive species was rated as moderate low prior to mitigation and low post-mitigation (Table 13). The significance of the increase of invasive species during the operational phase was rated as moderate low prior to mitigation and low post-mitigation (Table 13).

Table 13: Assessment of significance of loss of increase in alien invasive plant species prior to and post mitigation

<p>Nature: The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can outcompete natural vegetation, decreasing the species abundance and diversity. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on vegetation communities on a regional level.</p>		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Permanent (5)	Immediate (1)
Extent	Region (2)	Local (1)
Probability	Likely (4)	Unlikely (2)
Severity	Moderate (3)	Minor (2)
Significance	Moderate low (40)	Low (8)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	Yes, loss of primary vegetation due to invasion	
Can impacts be mitigated?	Yes, to a certain extent	
<p>Mitigation: Clearing of vegetation should be limited to the footprint area. Any additional clearing should be limited. Access roads should be planned in areas which have been transformed to limited additional fragmentation within the landscape and additional loss of vegetative cover. Alien invasive species, in particular category 1b species that were identified within the study area should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. All alien seedlings and saplings must be removed as they become evident for the duration of construction. All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO</p>		



Cumulative impacts: As the footprint of the proposed development is small and the site has been extensively utilised and transformed the contribution of the development to cumulative habitat loss in the region is considered to be insignificant		
Residual risks: None		
OPERATIONAL PHASE	WITHOUT MITIGATION	WITH MITIGATION
Duration	Permanent (5)	Permanent (5)
Extent	Regional (2)	Local (1)
Probability	Possible (3)	Unlikely (2)
Severity	Minor (2)	Insignificant (1)
Significance	Moderate low (27)	Low (14)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	Low likelihood	
Can impacts be mitigated?	Yes	
Mitigation: Alien invasive species, in particular category 1b species, that were identified within the study site should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. All alien seedlings and saplings must be removed as they become evident for the duration of the operational phase.		
Cumulative impacts: If not mitigated the invasive species will spread into the surrounding area and lead to species loss on a larger scale.		
Residual risks: None		

5.3. Fauna Management and Monitoring Planning

The objectives of the management plan are as follows:

- To prevent the unnecessary destruction of natural habitat and animal life within the development area and to maintain ecological connectivity to neighbouring sites and, where possible, to regional ecological corridors.
- Not to unnecessarily or deliberately alienate or hinder the movement of fauna in the area or to harm any animal life found on the property.
- To maintain or improve existing fauna biodiversity and prevent the skewing of fauna communities as far as possible.

The mitigation measures stipulated in the various impact tables above form the fauna management plan. The following mitigation actions have been considered for each impact:

- **STOP:** These are activities that cannot continue on site until the necessary additional authorisations / legal requirements are obtained / met or necessary operating procedures are compiled. Also includes activities that are considered fatal flaws that must be stopped.



- **MODIFY:** These are developmental aspects that must be considered and changed as needed in order to reduce the impact significance and probability.
- **CONTROL:** These are mitigation measures that must be implemented to reduce the overall impact significance.
- **REMEDY:** These are mitigation measures that focus on remedying impacts that have occurred on site.

A monitoring plan must be implemented in order to ensure mitigation measures are effective. With monitoring, an adaptive management approach must be applied. The benefits of monitoring and adaptive management include:

- Saving costs by discontinuation of non-effective measures.
- Higher success in environmental impact management through application of more effective management measures targeting specific identified impacts.

The monitoring plan is highlighted in Table 8. It must be kept in mind that activities related to fauna may be further restricted under Provincial legislation and these should be carefully consulted to ensure that necessary provincial permits are obtained to undertake necessary activities (trapping, catching, releasing fauna that may get trapped in the development area for example) where needed.

Most of the site is disturbed. In addition, alien invasive avifauna typical of South African urban areas is present in the area so the site has already experienced much impact. An Environmental Officer (EO) must be appointed to ensure activities are in line with EMP requirements, including the mitigation and management measures stipulated within this report. Inspection, records of issues and corrective measures and sign-off will form part of the EO's responsibilities.

5.3.1. Invasive species

Alien species are already present on site and include wide-spread, urbanised alien avifauna which cannot be controlled on a site-specific basis and need to be tackled nationally. The Alien and Invasive Species Regulations published under GNR598 (2014) list aliens under various categories, including:

- Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of NEM:BA as species which must be eradicated.
- Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of NEM:BA as species which must be controlled.
- Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of NEM:BA 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, as the case may be. If there is no permit for these species then they are to be treated as Category 1 species.

- Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of NEM:BA, as species which are subject to exemptions (regarding possession of such species) in terms of section 71(3) and prohibitions (importing, transporting, handling, breeding, releasing) in terms of section 71A of Act, as specified in the Notice.

In terms of the findings of this study, only Category 3 alien invasive fauna species were identified on site (the common myna) and confirmed for the QDGS (the rock dove, house sparrow). In addition, the Rose-ringed Parakeet (Category 2) is likely to occur in the area.

These specific bird species have extensive distributions in South Africa and all are closely related to human settlements and no proper control programmes have been implemented in South Africa for these species (Picker & Griffiths, 2011). Extensive populations of these birds were not observed on site, but populations must be monitored and controlled in line with the Municipal Control Plan.

Table 14: Monitoring plan

MONITORING ACTION	RESPONSIBLE PERSON	FREQUENCY
Ensure all proposed mitigation measures detailing proposed activity modifications have been incorporated into the final design plan and operational procedures and sign off on final plan.	Environmental officer (EO)	Once-off
Inspect servicing, maintenance and calibration (where needed) records of all vehicles, machinery and equipment on site.	Environmental officer (EO)	Before brought to site and then every 3 months.
Inspect and sign-off on placement of demarcation pegs marking out activity areas and no-go areas.	Environmental officer (EO)	Once-off
Monitor construction activities to ensure they are within the designated areas.	Environmental officer (EO)	Weekly
The only Red-Listed species at potential risk is the Giant Bullfrog which is highly mobile during the breeding season (November to December) and must be protected. The area should be visually monitored for the presence and extent of the species during the breeding season and activities adapted or stopped to reduce negative impact on these species.	Environmental officer (EO)	Weekly during November-January
Noise & dust should be maintained within national standards.	Environmental officer (EO)	As stipulated in authorisations
EO must ensure the following is managed in accordance to the EMP and operational procedures: 1) Litter, waste, hydrocarbon spills, cement spills, sewage leaks. 2) Food and food-waste handling. 3) Damage or disturbance to neighbouring areas not targeted for development. 4) State of portable toilets. 5) Hydrocarbon storage area.	EO to appoint on-site person	Daily, at close of day.



MONITORING ACTION	RESPONSIBLE PERSON	FREQUENCY
6) Cement storage and handling practices on site. 7) Refuse bins and waste storage area.		
Apply monitoring and auditing requirements stipulated in NWA & NEMA authorisations as relevant.	Environmental officer (EO)	As stipulated in the authorisations

6. Conclusion

The following conclusions were reached based on the results of this biodiversity assessment:

- The project area is classified as a Critical Biodiversity Area 2 based on the North West Biodiversity Sector Plan due to natural Corridor Nodes;
- Due to the high level of disturbance of the site, no fatal flaws or special recommendations are relevant. In general, designating the site for development is not seen to impact significantly on floral or fauna biodiversity or Threatened or Protected Species (TOPS). The preferred site is already within a road servitude of a small town and very disturbed.
- The management and monitoring plan must be implemented to ensure overall impact significance stays low to moderate.
- Consideration should be given to considering Site 4 as a green area in the development plan (a picnic site for example) and improve the indigenous vegetation structure to attract local indigenous fauna back to the area.

7. Professional opinion

A professional opinion is required as per the NEMA regulations with regards to the proposed development. Although the study area is situated within a CBA on a provincial level the moderate to high levels of disturbance has already led to the degradation of the area. The proposed footprint of the filling stations is limited in extent and not expected to negatively impact on the surrounding environment if the mitigation measures are applied. Therefore, it is recommended that the proposed filling stations are favourably considered for approval.

8. Limitations

Specific limitations relevant to this study in terms of fauna are as follows:

- The project budget was limited and only a 1-day scan survey was completed and focussed on indicators of ecologically significant Desktop Species.



- No trapping was completed. The nature of the site and duration of the survey deemed this unnecessary. Trapping would increase costs significantly and can cause severe stress to animals trapped, without necessarily providing additional insight to the overall fauna assessment.
- Areas of dense grassy vegetation (Site 2) reduced visibility of fauna indicators.
- Site 4 appears to have been recently exposed to a very hot fire and it does not appear that the fauna has moved back to the site.

It is acknowledged that the knowledge of the faunal specialists could be limited and there could be gaps in the information provided in this report.

The following limitations should be noted associated with flora for the study:

- This assessment comprised of one site visit conducted in November 2018. Therefore, seasonal variation was not taken into consideration.
- The low amount of rainfall as well as a fire event prior to the site visit affected the vegetation present within the study area.
- No design information was available to the specialist at the time of compiling the report.

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. The methods used for fauna assessments often require the author to make a predicted estimation based on prior knowledge and learning.

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably during November and February. However, this report relied on a single site visit undertaken in early November 2018. Due to the disturbed nature of the project area the risk associated with the timing of the site visit is low.

Plant species resprouting from storage tubers (geophytes) will take advantage of the first rains, stored reserves and low grass cover after the dry season to grow and flower during summer (December to March) and then die back. Herbs, forbs, and grasses first need adequate rainfall before being able to fully grow and flower between February and April. Most of the geophytes, forbs, succulents, and grasses can only be fully identified if they are actively growing and have either flowers or fruit.

The wetland boundaries were done solely on vegetation groupings as well as topographic maps and contours. For accurate wetland boundaries, the wetland report should be consulted.

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. To obtain a comprehensive understanding of the dynamics of an ecosystem in an area, ecological assessments should always consider investigations at different time scales (across seasons/years) and through replication, as ecosystems are in constant change.

9. References

9.1. Literature

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Assumptions

- All information provided to ISS was accurate and up to date.
- The position of study site was accurate.

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Annexure A: Expected Mammal Species

SPECIES NAME	COMMON NAME	IUCN (2017)	SANBI (2016)	TOPS (2007)
<i>Aepyceros melampus</i>	Impala	LC	LC	None
<i>Aethomys ineptus</i>	Tete Veld Rat	LC	LC	None
<i>Alcelaphus buselaphus</i>	Red Hartebeest	LC	LC	None
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT	Protected
<i>Atelerix frontalis</i>	South African Hedgehog	LC	NT	Protected
<i>Atilax paludinosus</i>	Water Mongoose	LC	LC	None
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	None
<i>Caracal caracal</i>	Caracal	LC	LC	None
<i>Ceratotherium simum</i>	Southern White Rhinoceros	NT	NT	Protected
<i>Chlorocebus pygerythrus</i>	Vervet Monkey	LC	LC	None
<i>Civettictis civetta</i>	African Civet	LC	LC	None
<i>Cloeotis percivali</i>	Short-eared Trident Bat	LC	EN	None
<i>Connochaetes taurinus</i>	Blue Wildebeest	LC	LC	None
<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	LC	LC	None
<i>Crocidura fuscomurina</i>	Tiny Musk Shrew	LC	LC	None
<i>Crocidura hirta</i>	Lesser Red Musk Shrew	LC	LC	None
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	LC	NT	None
<i>Crocidura silacea</i>	Lesser Grey-brown Musk Shrew	LC	LC	None
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	None
<i>Damaliscus lunatus</i>	Tsessebe	LC	VU	EN
<i>Damaliscus pygargus</i>	Blesbok	LC	LC	None
<i>Dendromus melanotis</i>	Grey Climbing Mouse	LC	LC	None
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	LC	LC	None
<i>Diceros bicornis</i>	Southwestern Black Rhinoceros	CR	EN	EN
<i>Elephantulus brachyrhynchus</i>	Short-snouted Sengi	LC	LC	None
<i>Elephantulus myurus</i>	Eastern Rock Sengi	LC	LC	None
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	LC	LC	None
<i>Equus quagga</i>	Plains Zebra	NT	LC	None
<i>Felis nigripes</i>	Black-footed Cat	VU	VU	Protected
<i>Felis silvestris</i>	African Wildcat	LC	LC	None
<i>Galago moholi</i>	Southern Lesser Galago	LC	LC	None
<i>Genetta genetta</i>	Small-spotted Genet	LC	LC	None
<i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC	None
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	LC	None
<i>Giraffa camelopardalis</i>	South African Giraffe	VU	LC	None
<i>Graphiurus microtis</i>	Large Savanna African Dormouse	LC	LC	None
<i>Helogale parvula</i>	Dwarf Mongoose	LC	LC	None
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC	None
<i>Hippopotamus amphibius</i>	Hippopotamus	VU	LC	None
<i>Hipposideros caffer</i>	Sundevall's Leaf-nosed Bat	LC	LC	None
<i>Hippotragus niger</i>	Sable Antelope	LC	VU	None
<i>Hydrictis maculicollis</i>	Spotted-necked Otter	NT	VU	Protected

SPECIES NAME	COMMON NAME	IUCN (2017)	SANBI (2016)	TOPS (2007)
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC	None
<i>Ichneumia albicauda</i>	White-tailed Mongoose	LC	LC	None
<i>Ictonyx striatus</i>	Striped Polecat	LC	LC	None
<i>Kerivoula lanosa</i>	Lesser Woolly Bat	LC	LC	None
<i>Kobus ellipsiprymnus</i>	Common Waterbuck	LC	LC	None
<i>Lemniscomys rosalia</i>	Single-striped Mouse	LC	LC	None
<i>Leptailurus serval</i>	Serval	LC	NT	Protected
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC	None
<i>Lepus victoriae</i>	African Savanna Hare	LC	LC	None
<i>Mastomys coucha</i>	Multimammate Mouse	LC	LC	None
<i>Mellivora capensis</i>	Honey Badger	LC	LC	Protected
<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	LC	LC	None
<i>Mungos mungo</i>	Banded Mongoose	LC	LC	None
<i>Mus indutus</i>	Desert Pygmy Mouse	LC	LC	None
<i>Myotis tricolor</i>	Temminck's Hairy Bat	LC	LC	None
<i>Mystromys albicaudatus</i>	White-tailed Rat	EN	VU	None
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	LC	None
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC	LC	None
<i>Oreotragus oreotragus</i>	Klipspringer	LC	LC	None
<i>Orycteropus afer</i>	Aardvark	LC	LC	None
<i>Oryx gazella</i>	Gemsbok	LC	LC	None
<i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC	None
<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC	LC	None
<i>Panthera pardus</i>	Leopard	VU	VU	Vulnerable
<i>Papio ursinus</i>	Chacma Baboon	LC	LC	None
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT	Protected
<i>Paraxerus cepapi</i>	Tree Squirrel	LC	LC	None
<i>Pedetes capensis</i>	Springhare	LC	LC	None
<i>Pelea capreolus</i>	Grey Rhebok	NT	NT	None
<i>Phacochoerus africanus</i>	Common Warthog	LC	LC	None
<i>Poecilogale albinucha</i>	African Striped Weasel	LC	NT	None
<i>Procavia capensis</i>	Rock Hyrax	LC	LC	None
<i>Proteles cristata</i>	Aardwolf	LC	LC	None
<i>Raphicerus campestris</i>	Steenbok	LC	LC	None
<i>Rattus rattus</i>	Black rat	LC	Invasive	Unlisted
<i>Redunca arundinum</i>	Southern Reedbuck	LC	LC	Protected
<i>Redunca fulvorufula</i>	Mountain Reedbuck	EN	EN	None
<i>Rhodomys pumilio</i>	Xeric Four-striped Mouse	LC	LC	None
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	LC	None
<i>Rhinolophus simulator</i>	Bushveld Horseshoe Bat	LC	LC	None
<i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	None
<i>Sauromys petrophilus</i>	Flat-headed Free-tail Bat	LC	LC	None
<i>Scotophilus dinganii</i>	Yellow House Bat	LC	LC	None
<i>Smutsia temminckii</i>	Temminck's Ground Pangolin	VU	VU	VU
<i>Steatomys pratensis</i>	Fat Mouse	LC	LC	None
<i>Suncus lixus</i>	Greater Dwarf Shrew	LC	LC	None

SPECIES NAME	COMMON NAME	IUCN (2017)	SANBI (2016)	TOPS (2007)
<i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	LC	None
<i>Suricata suricatta</i>	Suricate	LC	LC	None
<i>Sylvicapra grimmia</i>	Common Duiker	LC	LC	None
<i>Syncerus caffer</i>	Southern Savannah Buffalo	LC	LC	None
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	None
<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	LC	LC	None
<i>Thallomys paedulus</i>	Tree Rat	LC	LC	None
<i>Tragelaphus oryx</i>	Eland	LC	LC	None
<i>Tragelaphus scriptus</i>	Bushbuck	LC	Unlisted	None
<i>Tragelaphus strepsiceros</i>	Greater Kudu	LC	LC	None
<i>Vulpes chama</i>	Cape Fox	LC	LC	Protected
<i>Xerus inauris</i>	Cape Ground Squirrel	LC	LC	None

Annexure B: Expected Avifaunal Species

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Accipiter badius</i>	Shikra, Shikra	Unlisted	LC
<i>Accipiter melanoleucus</i>	Sparrowhawk, Black	Unlisted	LC
<i>Accipiter minullus</i>	Sparrowhawk, Little	Unlisted	LC
<i>Accipiter ovampensis</i>	Sparrowhawk, Ovambo	Unlisted	LC
<i>Acridotheres tristis</i>	Myna, Common	Unlisted	LC
<i>Acrocephalus baeticatus</i>	Reed-warbler, African	Unlisted	Unlisted
<i>Acrocephalus gracilirostris</i>	Swamp-warbler, Lesser	Unlisted	LC
<i>Acrocephalus palustris</i>	Warbler, Marsh	Unlisted	LC
<i>Acrocephalus schoenobaenus</i>	Warbler, Sedge	Unlisted	LC
<i>Actitis hypoleucos</i>	Sandpiper, Common	Unlisted	LC
<i>Actophilornis africanus</i>	Jacana, African	Unlisted	LC
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC
<i>Alcedo cristata</i>	Kingfisher, Malachite	Unlisted	Unlisted
<i>Alcedo semitorquata</i>	Kingfisher, Half-collared	NT	LC
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	Unlisted	LC
<i>Amadina erythrocephala</i>	Finch, Red-headed	Unlisted	LC
<i>Amadina fasciata</i>	Finch, Cut-throat	Unlisted	LC
<i>Amandava subflava</i>	Waxbill, Orange-breasted	Unlisted	LC
<i>Amaurornis flavirostris</i>	Crake, Black	Unlisted	LC
<i>Amblyospiza albifrons</i>	Weaver, Thick-billed	Unlisted	LC
<i>Anaplectes rubriceps</i>	Weaver, Red-headed	Unlisted	LC
<i>Anas capensis</i>	Teal, Cape	Unlisted	LC
<i>Anas erythrorhyncha</i>	Teal, Red-billed	Unlisted	LC
<i>Anas hottentota</i>	Teal, Hottentot	Unlisted	LC
<i>Anas smithii</i>	Shoveler, Cape	Unlisted	LC
<i>Anas sparsa</i>	Duck, African Black	Unlisted	LC
<i>Anas undulata</i>	Duck, Yellow-billed	Unlisted	LC
<i>Anhinga rufa</i>	Darter, African	Unlisted	LC
<i>Anomalospiza imberbis</i>	Finch, Cuckoo	Unlisted	LC
<i>Anthoscopus caroli</i>	Penduline-tit, Grey	Unlisted	LC
<i>Anthoscopus minutus</i>	Penduline-tit, Cape	Unlisted	LC
<i>Anthropoides paradiseus</i>	Crane, Blue	NT	VU
<i>Anthus caffer</i>	Pipit, Bushveld	Unlisted	LC
<i>Anthus cinnamomeus</i>	Pipit, African	Unlisted	LC
<i>Anthus leucophrys</i>	Pipit, Plain-backed	Unlisted	LC
<i>Anthus lineiventris</i>	Pipit, Striped	Unlisted	LC
<i>Anthus similis</i>	Pipit, Long-billed	Unlisted	LC
<i>Anthus trivialis</i>	Pipit, Tree	Unlisted	LC
<i>Anthus vaalensis</i>	Pipit, Buffy	Unlisted	LC
<i>Apalis thoracica</i>	Apalis, Bar-throated	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Apus affinis</i>	Swift, Little	Unlisted	LC
<i>Apus apus</i>	Swift, Common	Unlisted	LC
<i>Apus barbatus</i>	Swift, African Black	Unlisted	LC
<i>Apus caffer</i>	Swift, White-rumped	Unlisted	LC
<i>Apus horus</i>	Swift, Horus	Unlisted	LC
<i>Aquila nipalensis</i>	Eagle, Steppe	Unlisted	EN
<i>Aquila pennatus</i>	Eagle, Booted	Unlisted	Unlisted
<i>Aquila rapax</i>	Eagle, Tawny	EN	LC
<i>Aquila spilogaster</i>	Hawk-eagle, African	Unlisted	LC
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC
<i>Aquila wahlbergi</i>	Eagle, Wahlberg's	Unlisted	LC
<i>Ardea cinerea</i>	Heron, Grey	Unlisted	LC
<i>Ardea goliath</i>	Heron, Goliath	Unlisted	LC
<i>Ardea melanocephala</i>	Heron, Black-headed	Unlisted	LC
<i>Ardea purpurea</i>	Heron, Purple	Unlisted	LC
<i>Ardeola ralloides</i>	Heron, Squacco	Unlisted	LC
<i>Asio capensis</i>	Owl, Marsh	Unlisted	LC
<i>Batis molitor</i>	Batis, Chinspot	Unlisted	LC
<i>Bostrychia hagedash</i>	Ibis, Hadeda	Unlisted	LC
<i>Bradornis mariquensis</i>	Flycatcher, Marico	Unlisted	LC
<i>Bradornis pallidus</i>	Flycatcher, Pale	Unlisted	LC
<i>Bradypterus baboecala</i>	Rush-warbler, Little	Unlisted	LC
<i>Bubalornis niger</i>	Buffalo-weaver, Red-billed	Unlisted	LC
<i>Bubo africanus</i>	Eagle-owl, Spotted	Unlisted	LC
<i>Bubo capensis</i>	Eagle-owl, Cape	Unlisted	LC
<i>Bubo lacteus</i>	Eagle-owl, Verreaux's	Unlisted	LC
<i>Bubulcus ibis</i>	Egret, Cattle	Unlisted	LC
<i>Buphagus erythrorhynchus</i>	Oxpecker, Red-billed	Unlisted	Unlisted
<i>Burhinus capensis</i>	Thick-knee, Spotted	Unlisted	LC
<i>Buteo rufofuscus</i>	Buzzard, Jackal	Unlisted	LC
<i>Buteo vulpinus</i>	Buzzard, Steppe	Unlisted	Unlisted
<i>Butorides striata</i>	Heron, Green-backed	Unlisted	LC
<i>Calamonastes fasciolatus</i>	Wren-warbler, Barred	Unlisted	LC
<i>Calandrella cinerea</i>	Lark, Red-capped	Unlisted	LC
<i>Calendulauda africanoides</i>	Lark, Fawn-coloured	Unlisted	LC
<i>Calendulauda sabota</i>	Lark, Sabota	Unlisted	LC
<i>Calidris ferruginea</i>	Sandpiper, Curlew	Unlisted	NT
<i>Calidris minuta</i>	Stint, Little	Unlisted	LC
<i>Camaroptera brachyura</i>	Camaroptera, Green-backed	Unlisted	LC
<i>Camaroptera brevicaudata</i>	Camaroptera, Grey-backed	Unlisted	Unlisted
<i>Campephaga flava</i>	Cuckoo-shrike, Black	Unlisted	LC
<i>Campethera abingoni</i>	Woodpecker, Golden-tailed	Unlisted	LC
<i>Campethera bennettii</i>	Woodpecker, Bennett's	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Caprimulgus pectoralis</i>	Nightjar, Fiery-necked	Unlisted	LC
<i>Caprimulgus rufigena</i>	Nightjar, Rufous-cheeked	Unlisted	LC
<i>Caprimulgus tristigma</i>	Nightjar, Freckled	Unlisted	LC
<i>Centropus burchellii</i>	Coucal, Burchell's	Unlisted	Unlisted
<i>Centropus superciliosus</i>	Coucal, White-browed	Unlisted	LC
<i>Cercomela familiaris</i>	Chat, Familiar	Unlisted	LC
<i>Cercotrichas leucophrys</i>	Scrub-robin, White-browed	Unlisted	LC
<i>Cercotrichas paena</i>	Scrub-robin, Kalahari	Unlisted	LC
<i>Certhilauda benguelensis</i>	Lark, Benguela Long-billed	Unlisted	Unlisted
<i>Certhilauda brevirostris</i>	Lark, Agulhas Long-billed	NT	Unlisted
<i>Certhilauda curvirostris</i>	Lark, Cape Long-billed	Unlisted	LC
<i>Certhilauda semitorquata</i>	Lark, Eastern Long-billed	Unlisted	LC
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	Unlisted	LC
<i>Ceryle rudis</i>	Kingfisher, Pied	Unlisted	LC
<i>Chalcomitra amethystina</i>	Sunbird, Amethyst	Unlisted	LC
<i>Charadrius hiaticula</i>	Plover, Common Ringed	Unlisted	LC
<i>Charadrius pecuarius</i>	Plover, Kittlitz's	Unlisted	LC
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC
<i>Chlidonias leucopterus</i>	Tern, White-winged	Unlisted	LC
<i>Chrysococcyx caprius</i>	Cuckoo, Diderick	Unlisted	LC
<i>Chrysococcyx klaas</i>	Cuckoo, Klaas's	Unlisted	LC
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC
<i>Ciconia ciconia</i>	Stork, White	Unlisted	LC
<i>Ciconia nigra</i>	Stork, Black	VU	LC
<i>Cinnyricinclus leucogaster</i>	Starling, Violet-backed	Unlisted	LC
<i>Cinnyris afer</i>	Sunbird, Greater Double-collared	Unlisted	LC
<i>Cinnyris mariquensis</i>	Sunbird, Marico	Unlisted	LC
<i>Cinnyris talatala</i>	Sunbird, White-bellied	Unlisted	LC
<i>Circaetus cinereus</i>	Snake-eagle, Brown	Unlisted	LC
<i>Circaetus pectoralis</i>	Snake-eagle, Black-chested	Unlisted	LC
<i>Circus ranivorus</i>	Marsh-harrier, African	EN	LC
<i>Cisticola aberrans</i>	Cisticola, Lazy	Unlisted	LC
<i>Cisticola aridulus</i>	Cisticola, Desert	Unlisted	LC
<i>Cisticola ayresii</i>	Cisticola, Wing-snapping	Unlisted	LC
<i>Cisticola chiniana</i>	Cisticola, Rattling	Unlisted	LC
<i>Cisticola fulvicapilla</i>	Neddicky, Neddicky	Unlisted	LC
<i>Cisticola juncidis</i>	Cisticola, Zitting	Unlisted	LC
<i>Cisticola lais</i>	Cisticola, Wailing	Unlisted	LC
<i>Cisticola textrix</i>	Cisticola, Cloud	Unlisted	LC
<i>Cisticola tinniens</i>	Cisticola, Levaillant's	Unlisted	LC
<i>Clamator jacobinus</i>	Cuckoo, Jacobin	Unlisted	LC
<i>Clamator levaillantii</i>	Cuckoo, Levaillant's	Unlisted	LC
<i>Coccygia melanotis</i>	Waxbill, Swee	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Colius colius</i>	Mousebird, White-backed	Unlisted	LC
<i>Colius striatus</i>	Mousebird, Speckled	Unlisted	LC
<i>Columba arquatrix</i>	Olive-pigeon, African	Unlisted	LC
<i>Columba guinea</i>	Pigeon, Speckled	Unlisted	LC
<i>Columba livia</i>	Dove, Rock	Unlisted	LC
<i>Coracias caudatus</i>	Roller, Lilac-breasted	Unlisted	LC
<i>Coracias garrulus</i>	Roller, European	NT	LC
<i>Coracias naevius</i>	Roller, Purple	Unlisted	LC
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC
<i>Corvus capensis</i>	Crow, Cape	Unlisted	LC
<i>Corythaixoides concolor</i>	Go-away-bird, Grey	Unlisted	LC
<i>Cossypha caffra</i>	Robin-chat, Cape	Unlisted	LC
<i>Cossypha humeralis</i>	Robin-chat, White-throated	Unlisted	LC
<i>Coturnix coturnix</i>	Quail, Common	Unlisted	LC
<i>Coturnix delegorguei</i>	Quail, Harlequin	Unlisted	LC
<i>Creatophora cinerea</i>	Starling, Wattled	Unlisted	LC
<i>Crithagra atrogularis</i>	Canary, Black-throated	Unlisted	LC
<i>Crithagra flaviventris</i>	Canary, Yellow	Unlisted	LC
<i>Crithagra gularis</i>	Seedeater, Streaky-headed	Unlisted	LC
<i>Crithagra mozambicus</i>	Canary, Yellow-fronted	Unlisted	Unlisted
<i>Cuculus clamosus</i>	Cuckoo, Black	Unlisted	LC
<i>Cuculus gularis</i>	Cuckoo, African	Unlisted	LC
<i>Cuculus solitarius</i>	Cuckoo, Red-chested	Unlisted	LC
<i>Cursorius temminckii</i>	Courser, Temminck's	Unlisted	LC
<i>Cypsiurus parvus</i>	Palm-swift, African	Unlisted	LC
<i>Delichon urbicum</i>	House-martin, Common	Unlisted	LC
<i>Dendrocygna bicolor</i>	Duck, Fulvous	Unlisted	LC
<i>Dendrocygna viduata</i>	Duck, White-faced	Unlisted	LC
<i>Dendroperdix sephaena</i>	Francolin, Crested	Unlisted	LC
<i>Dendropicops fuscescens</i>	Woodpecker, Cardinal	Unlisted	LC
<i>Dendropicops namaquus</i>	Woodpecker, Bearded	Unlisted	LC
<i>Dicrurus adsimilis</i>	Drongo, Fork-tailed	Unlisted	LC
<i>Dryoscopus cubla</i>	Puffback, Black-backed	Unlisted	LC
<i>Egretta alba</i>	Egret, Great	Unlisted	LC
<i>Egretta ardesiaca</i>	Heron, Black	Unlisted	LC
<i>Egretta garzetta</i>	Egret, Little	Unlisted	LC
<i>Egretta intermedia</i>	Egret, Yellow-billed	Unlisted	Unlisted
<i>Elanus caeruleus</i>	Kite, Black-shouldered	Unlisted	LC
<i>Emberiza capensis</i>	Bunting, Cape	Unlisted	LC
<i>Emberiza flaviventris</i>	Bunting, Golden-breasted	Unlisted	LC
<i>Emberiza impetuani</i>	Bunting, Lark-like	Unlisted	LC
<i>Emberiza tahapisi</i>	Bunting, Cinnamon-breasted	Unlisted	LC
<i>Eremomela icteropygialis</i>	Eremomela, Yellow-bellied	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Eremomela usticollis</i>	Eremomela, Burnt-necked	Unlisted	LC
<i>Eremopterix leucotis</i>	Sparrowlark, Chestnut-backed	Unlisted	LC
<i>Eremopterix verticalis</i>	Sparrowlark, Grey-backed	Unlisted	LC
<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC
<i>Estrilda erythronotos</i>	Waxbill, Black-faced	Unlisted	LC
<i>Euplectes afer</i>	Bishop, Yellow-crowned	Unlisted	LC
<i>Euplectes albonotatus</i>	Widowbird, White-winged	Unlisted	LC
<i>Euplectes ardens</i>	Widowbird, Red-collared	Unlisted	LC
<i>Euplectes orix</i>	Bishop, Southern Red	Unlisted	LC
<i>Euplectes progne</i>	Widowbird, Long-tailed	Unlisted	LC
<i>Eupodotis senegalensis</i>	Korhaan, White-bellied	VU	LC
<i>Eurocephalus anguitemens</i>	Shrike, Southern White-crowned	Unlisted	LC
<i>Falco amurensis</i>	Falcon, Amur	Unlisted	LC
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC
<i>Falco naumanni</i>	Kestrel, Lesser	Unlisted	LC
<i>Falco rupicoloides</i>	Kestrel, Greater	Unlisted	LC
<i>Falco rupicolus</i>	Kestrel, Rock	Unlisted	Unlisted
<i>Falco subbuteo</i>	Hobby, Eurasian	Unlisted	LC
<i>Fulica cristata</i>	Coot, Red-knobbed	Unlisted	LC
<i>Gallinago nigripennis</i>	Snipe, African	Unlisted	LC
<i>Gallinula chloropus</i>	Moorhen, Common	Unlisted	LC
<i>Glaucidium perlatum</i>	Owlet, Pearl-spotted	Unlisted	LC
<i>Gorsachius leuconotus</i>	Night-Heron, White-backed	VU	LC
<i>Granatina granatina</i>	Waxbill, Violet-eared	Unlisted	LC
<i>Gyps africanus</i>	Vulture, White-backed	EN	CR
<i>Gyps coprotheres</i>	Vulture, Cape	EN	EN
<i>Halcyon albiventris</i>	Kingfisher, Brown-hooded	Unlisted	LC
<i>Halcyon chelicuti</i>	Kingfisher, Striped	Unlisted	LC
<i>Halcyon leucocephala</i>	Kingfisher, Grey-headed	Unlisted	LC
<i>Halcyon senegalensis</i>	Kingfisher, Woodland	Unlisted	LC
<i>Haliaeetus vocifer</i>	Fish-eagle, African	Unlisted	LC
<i>Himantopus himantopus</i>	Stilt, Black-winged	Unlisted	LC
<i>Hippolais icterina</i>	Warbler, Icterine	Unlisted	LC
<i>Hirundo abyssinica</i>	Swallow, Lesser Striped	Unlisted	LC
<i>Hirundo albigularis</i>	Swallow, White-throated	Unlisted	LC
<i>Hirundo cucullata</i>	Swallow, Greater Striped	Unlisted	LC
<i>Hirundo dimidiata</i>	Swallow, Pearl-breasted	Unlisted	LC
<i>Hirundo fuligula</i>	Martin, Rock	Unlisted	Unlisted
<i>Hirundo rustica</i>	Swallow, Barn	Unlisted	LC
<i>Hirundo semirufa</i>	Swallow, Red-breasted	Unlisted	LC
<i>Hirundo spilodera</i>	Cliff-swallow, South African	Unlisted	LC
<i>Indicator indicator</i>	Honeyguide, Greater	Unlisted	LC
<i>Indicator minor</i>	Honeyguide, Lesser	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Ixobrychus minutus</i>	Bittern, Little	Unlisted	LC
<i>Ixobrychus sturmii</i>	Bittern, Dwarf	Unlisted	LC
<i>Jynx ruficollis</i>	Wryneck, Red-throated	Unlisted	LC
<i>Kaupifalco monogrammicus</i>	Buzzard, Lizard	Unlisted	LC
<i>Lagonosticta rhodopareia</i>	Firefinch, Jameson's	Unlisted	LC
<i>Lagonosticta rubricata</i>	Firefinch, African	Unlisted	LC
<i>Lagonosticta senegala</i>	Firefinch, Red-billed	Unlisted	LC
<i>Lamprotornis australis</i>	Starling, Burchell's	Unlisted	LC
<i>Lamprotornis nitens</i>	Starling, Cape Glossy	Unlisted	LC
<i>Laniarius atrococcineus</i>	Shrike, Crimson-breasted	Unlisted	LC
<i>Laniarius ferrugineus</i>	Boubou, Southern	Unlisted	LC
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC
<i>Lanius collurio</i>	Shrike, Red-backed	Unlisted	LC
<i>Lanius minor</i>	Shrike, Lesser Grey	Unlisted	LC
<i>Larus cirrocephalus</i>	Gull, Grey-headed	Unlisted	LC
<i>Leptoptilos crumeniferus</i>	Stork, Marabou	NT	LC
<i>Lybius torquatus</i>	Barbet, Black-collared	Unlisted	LC
<i>Macronyx capensis</i>	Longclaw, Cape	Unlisted	LC
<i>Malaconotus blanchoti</i>	Bush-shrike, Grey-headed	Unlisted	LC
<i>Megaceryle maximus</i>	Kingfisher, Giant	Unlisted	Unlisted
<i>Melaenornis pammelaina</i>	Flycatcher, Southern Black	Unlisted	LC
<i>Melierax canorus</i>	Goshawk, Southern Pale Chanting	Unlisted	LC
<i>Melierax gabar</i>	Goshawk, Gabar	Unlisted	LC
<i>Merops apiaster</i>	Bee-eater, European	Unlisted	LC
<i>Merops bullockoides</i>	Bee-eater, White-fronted	Unlisted	LC
<i>Merops hirundineus</i>	Bee-eater, Swallow-tailed	Unlisted	LC
<i>Merops persicus</i>	Bee-eater, Blue-cheeked	Unlisted	LC
<i>Merops pusillus</i>	Bee-eater, Little	Unlisted	LC
<i>Milvus aegyptius</i>	Kite, Yellow-billed	Unlisted	Unlisted
<i>Milvus migrans</i>	Kite, Black	Unlisted	LC
<i>Mirafra africana</i>	Lark, Rufous-naped	Unlisted	LC
<i>Mirafra apiata</i>	Lark, Cape Clapper	Unlisted	LC
<i>Mirafra cheniana</i>	Lark, Melodious	LC	NT
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	Unlisted	LC
<i>Mirafra marjoriae</i>	Lark, Agulhas Clapper	Unlisted	Unlisted
<i>Mirafra passerina</i>	Lark, Monotonous	Unlisted	LC
<i>Mirafra rufocinnamomea</i>	Lark, Flappet	Unlisted	LC
<i>Monticola brevipes</i>	Rock-thrush, Short-toed	Unlisted	LC
<i>Monticola rupestris</i>	Rock-thrush, Cape	Unlisted	LC
<i>Motacilla aguimp</i>	Wagtail, African Pied	Unlisted	LC
<i>Motacilla capensis</i>	Wagtail, Cape	Unlisted	LC
<i>Muscicapa striata</i>	Flycatcher, Spotted	Unlisted	LC
<i>Mycteria ibis</i>	Stork, Yellow-billed	EN	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Myioparus plumbeus</i>	Tit-flycatcher, Grey	Unlisted	LC
<i>Myrmecocichla formicivora</i>	Chat, Anteating	Unlisted	LC
<i>Nectarinia famosa</i>	Sunbird, Malachite	Unlisted	LC
<i>Netta erythrophthalma</i>	Pochard, Southern	Unlisted	LC
<i>Nilaus afer</i>	Brubru, Brubru	Unlisted	LC
<i>Numida meleagris</i>	Guinea fowl, Helmeted	Unlisted	LC
<i>Nycticorax nycticorax</i>	Night-Heron, Black-crowned	Unlisted	LC
<i>Oena capensis</i>	Dove, Namaqua	Unlisted	LC
<i>Oenanthe monticola</i>	Wheatear, Mountain	Unlisted	LC
<i>Oenanthe pileata</i>	Wheatear, Capped	Unlisted	LC
<i>Onychognathus morio</i>	Starling, Red-winged	Unlisted	LC
<i>Oriolus larvatus</i>	Oriole, Black-headed	Unlisted	LC
<i>Oriolus oriolus</i>	Oriole, Eurasian Golden	Unlisted	LC
<i>Ortygospiza atricollis</i>	Quailfinch, African	Unlisted	LC
<i>Otus senegalensis</i>	Scops-owl, African	Unlisted	LC
<i>Oxyura maccoa</i>	Duck, Maccoa	Unlisted	NT
<i>Pandion haliaetus</i>	Osprey, Osprey	Unlisted	LC
<i>Parisoma subcaeruleum</i>	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
<i>Parus cinerascens</i>	Tit, Ashy	Unlisted	LC
<i>Parus niger</i>	Tit, Southern Black	Unlisted	Unlisted
<i>Passer diffusus</i>	Sparrow, Southern Grey-headed	Unlisted	LC
<i>Passer domesticus</i>	Sparrow, House	Unlisted	LC
<i>Passer griseus</i>	Sparrow, Northern Grey-headed	Unlisted	LC
<i>Passer melanurus</i>	Sparrow, Cape	Unlisted	LC
<i>Passer motitensis</i>	Sparrow, Great	Unlisted	LC
<i>Pelecanus rufescens</i>	Pelican, Pink-backed	VU	LC
<i>Peliperdix coqui</i>	Francolin, Coqui	Unlisted	LC
<i>Petronia superciliaris</i>	Petronia, Yellow-throated	Unlisted	LC
<i>Phalacrocorax africanus</i>	Cormorant, Reed	Unlisted	LC
<i>Phalacrocorax carbo</i>	Cormorant, White-breasted	Unlisted	LC
<i>Philomachus pugnax</i>	Ruff, Ruff	Unlisted	LC
<i>Phoenicopterus minor</i>	Flamingo, Lesser	Unlisted	NT
<i>Phoenicopterus ruber</i>	Flamingo, Greater	Unlisted	LC
<i>Phoeniculus purpureus</i>	Wood-hoopoe, Green	Unlisted	LC
<i>Phylloscopus trochilus</i>	Warbler, Willow	Unlisted	LC
<i>Platalea alba</i>	Spoonbill, African	Unlisted	LC
<i>Plectropterus gambensis</i>	Goose, Spur-winged	Unlisted	LC
<i>Plegadis falcinellus</i>	Ibis, Glossy	Unlisted	LC
<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC
<i>Ploceus capensis</i>	Weaver, Cape	Unlisted	LC
<i>Ploceus cucullatus</i>	Weaver, Village	Unlisted	LC
<i>Ploceus intermedius</i>	Masked-weaver, Lesser	Unlisted	LC
<i>Ploceus velatus</i>	Masked-weaver, Southern	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Podiceps cristatus</i>	Grebe, Great Crested	Unlisted	LC
<i>Pogoniulus chrysoconus</i>	Tinkerbird, Yellow-fronted	Unlisted	LC
<i>Polemaetus bellicosus</i>	Eagle, Martial	EN	VU
<i>Polyboroides typus</i>	Harrier-Hawk, African	Unlisted	LC
<i>Porphyrio madagascariensis</i>	Swamphen, African Purple	Unlisted	Unlisted
<i>Prinia flavicans</i>	Prinia, Black-chested	Unlisted	LC
<i>Prinia subflava</i>	Prinia, Tawny-flanked	Unlisted	LC
<i>Prionops plumatus</i>	Helmet-shrike, White-crested	Unlisted	LC
<i>Prodotiscus regulus</i>	Honeybird, Brown-backed	Unlisted	LC
<i>Psophocichla litsipsirupa</i>	Thrush, Groundscraper	Unlisted	Unlisted
<i>Pternistis natalensis</i>	Spurfowl, Natal	Unlisted	LC
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	Unlisted	Unlisted
<i>Pterocles bicinctus</i>	Sandgrouse, Double-banded	Unlisted	LC
<i>Pterocles gutturalis</i>	Sandgrouse, Yellow-throated	NT	LC
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	Unlisted	LC
<i>Pycnonotus tricolor</i>	Bulbul, Dark-capped	Unlisted	Unlisted
<i>Pytilia melba</i>	Pytilia, Green-winged	Unlisted	LC
<i>Quelea quelea</i>	Quelea, Red-billed	Unlisted	LC
<i>Recurvirostra avosetta</i>	Avocet, Pied	Unlisted	LC
<i>Rhinopomastus cyanomelas</i>	Scimitarbill, Common	Unlisted	LC
<i>Riparia cincta</i>	Martin, Banded	Unlisted	LC
<i>Riparia paludicola</i>	Martin, Brown-throated	Unlisted	LC
<i>Riparia riparia</i>	Martin, Sand	Unlisted	LC
<i>Sagittarius serpentarius</i>	Secretarybird, Secretarybird	VU	VU
<i>Sarkidiornis melanotos</i>	Duck, Comb	Unlisted	LC
<i>Saxicola torquatus</i>	Stonechat, African	Unlisted	LC
<i>Scleroptila leuallantii</i>	Francolin, Red-winged	Unlisted	LC
<i>Scleroptila leuallantoides</i>	Francolin, Orange River	Unlisted	Unlisted
<i>Scleroptila shelleyi</i>	Francolin, Shelley's	Unlisted	LC
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	Unlisted	LC
<i>Sigelus silens</i>	Flycatcher, Fiscal	Unlisted	LC
<i>Spermestes cucullatus</i>	Mannikin, Bronze	Unlisted	Unlisted
<i>Sphenoeacus afer</i>	Grassbird, Cape	Unlisted	LC
<i>Spizocorys conirostris</i>	Lark, Pink-billed	Unlisted	LC
<i>Sporopipes squamifrons</i>	Finch, Scaly-feathered	Unlisted	LC
<i>Spreo bicolor</i>	Starling, Pied	Unlisted	LC
<i>Stenostira scita</i>	Flycatcher, Fairy	Unlisted	LC
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	Unlisted	LC
<i>Streptopelia senegalensis</i>	Dove, Laughing	Unlisted	LC
<i>Struthio camelus</i>	Ostrich, Common	Unlisted	LC
<i>Sylvia borin</i>	Warbler, Garden	Unlisted	LC
<i>Sylvia communis</i>	Whitethroat, Common	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Sylvietta rufescens</i>	Crombec, Long-billed	Unlisted	LC
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC
<i>Tachymarpis melba</i>	Swift, Alpine	Unlisted	LC
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC
<i>Tchagra australis</i>	Tchagra, Brown-crowned	Unlisted	LC
<i>Tchagra senegalus</i>	Tchagra, Black-crowned	Unlisted	LC
<i>Telophorus sulfureopectus</i>	Bush-shrike, Orange-breasted	Unlisted	LC
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	Unlisted	LC
<i>Terpsiphone viridis</i>	Paradise-flycatcher, African	Unlisted	LC
<i>Thalassornis leuconotus</i>	Duck, White-backed	Unlisted	LC
<i>Thamnolaea cinnamomeiventris</i>	Cliff-chat, Mocking	Unlisted	LC
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	Unlisted	LC
<i>Tockus damarensis</i>	Hornbill, Damara	Unlisted	LC
<i>Tockus damarensis/erythrorhynchus</i>	Hornbill, Hybrid Damara/Red-billed	Unlisted	Unlisted
<i>Tockus erythrorhynchus</i>	Hornbill, Red-billed	Unlisted	LC
<i>Tockus leucomelas</i>	Hornbill, Southern Yellow-billed	Unlisted	LC
<i>Tockus nasutus</i>	Hornbill, African Grey	Unlisted	LC
<i>Torgos tracheliotus</i>	Vulture, Lappet-faced	Unlisted	EN
<i>Trachyphonus vaillantii</i>	Barbet, Crested	Unlisted	LC
<i>Treron calvus</i>	Green-pigeon, African	Unlisted	LC
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	Unlisted	LC
<i>Tringa glareola</i>	Sandpiper, Wood	Unlisted	LC
<i>Tringa nebularia</i>	Greenshank, Common	Unlisted	LC
<i>Tringa ochropus</i>	Sandpiper, Green	Unlisted	LC
<i>Tringa stagnatilis</i>	Sandpiper, Marsh	Unlisted	LC
<i>Turdoides bicolor</i>	Babbler, Southern Pied	Unlisted	LC
<i>Turdoides jardineii</i>	Babbler, Arrow-marked	Unlisted	LC
<i>Turdus libonyanus</i>	Thrush, Kurrichane	Unlisted	Unlisted
<i>Turdus olivaceus</i>	Thrush, Olive	Unlisted	LC
<i>Turdus smithi</i>	Thrush, Karoo	Unlisted	LC
<i>Turnix sylvaticus</i>	Buttonquail, Kurrichane	Unlisted	LC
<i>Turtur chalcospilos</i>	Wood-dove, Emerald-spotted	Unlisted	LC
<i>Tyto alba</i>	Owl, Barn	Unlisted	LC
<i>Tyto capensis</i>	Grass-owl, African	VU	LC
<i>Upupa africana</i>	Hoopoe, African	Unlisted	Unlisted
<i>Uraeginthus angolensis</i>	Waxbill, Blue	Unlisted	LC
<i>Urocolius indicus</i>	Mousebird, Red-faced	Unlisted	LC
<i>Urolestes melanoleucus</i>	Shrike, Magpie	Unlisted	LC
<i>Vanellus armatus</i>	Lapwing, Blacksmith	Unlisted	LC
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC
<i>Vanellus senegallus</i>	Lapwing, African Wattled	Unlisted	LC
<i>Vidua chalybeata</i>	Indigobird, Village	Unlisted	LC
<i>Vidua funerea</i>	Indigobird, Dusky	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (ESKOM, 2016)	GLOBAL (IUCN, 2017)
<i>Vidua macroura</i>	Whydah, Pin-tailed	Unlisted	LC
<i>Vidua paradisaea</i>	Paradise-whydah, Long-tailed	Unlisted	LC
<i>Vidua purpurascens</i>	Indigobird, Purple	Unlisted	LC
<i>Vidua regia</i>	Whydah, Shaft-tailed	Unlisted	LC
<i>Zosterops pallidus</i>	White-eye, Orange River	Unlisted	LC
<i>Zosterops virens</i>	White-eye, Cape	Unlisted	LC

Annexure C: Expected Herpetofauna

SPECIES	SPECIES NAME	IUCN (2017)	SANBI (2014)
Reptiles			
<i>Trachylepis punctatissima</i>	Speckled Sand Skink	LC	LC
<i>Gonionotophis capensis</i>	Common File Snake	LC	LC
<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	LC	LC
<i>Aparallactus capensis</i>	Black-headed Centipede Eater	LC	LC
<i>Chamaeleo dilepis</i>	Common Flap-Neck Chameleon	LC	LC
<i>Dasypeltis scabra</i>	Rhombic Egg-Eater	LC	LC
<i>Prosymna ambigua/Prosymna stuhlmannii</i>	East African Shovel-Snout	LC	LC
<i>Psammophis subtaeniatus</i>	Western Yellow-bellied Sand Snake	LC	LC
<i>Thelotornis capensis</i>	Southern Twig Snake	LC	LC
Amphibians			
<i>Ptychadena mossambica</i>	Broad-banded Grass Frog	LC	LC
<i>Pyxicephalus adspersus</i>	Giant bull frog	LC	NT
<i>Amietia delalandii</i>	Delalande's River Frog	LC	LC
<i>Amietia poyntoni</i>	Poynton's River Frog	LC	LC
<i>Tomopterna natalensis</i>	Natal Sand Frog	LC	LC
<i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC	LC
<i>Poyntonophrynus fenoulheti</i>	Northern pygmy toad	LC	LC
<i>Sclerophrys/Bufo garmani</i>	Eastern Olive Toad	LC	LC
<i>Sclerophrys/Bufo gutturalis</i>	Guttural Toad	LC	LC
<i>Sclerophrys/Bufo poweri</i>	Western Olive Toad	LC	LC
<i>Sclerophrys/Bufo capensis</i>	Raucous Toad	LC	LC
<i>Schismaderma carens</i>	Red Toad	LC	LC
<i>Xenopus laevis</i>	Common Platanna	LC	LC
<i>Kassina senegalensis</i>	Bubbling Kassina	LC	LC
<i>Breviceps adspersus</i>	Bushveld Rain Frog	LC	LC
<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	LC	LC
<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC	LC
<i>Cacosternum boettgeri</i>	Boettger's Caco	LC	LC
<i>Ptychadena anchietae</i>	Plain Grass Frog	LC	LC
<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	LC
<i>Chiromantis xerampelina</i>	Southern Foam Nest Frog	LC	LC
<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	LC	LC
<i>Pyxicephalus edulis</i>	Edible bullfrog	LC	LC

Annexure D: Specialist Curriculum Vitae

Lorainmari den Boogert

Resume Summary

Contact: +27 722 006244
Email: lorain@iggdrasilscientific.com
Languages: English, Afrikaans, Dutch

Career Highlights

DIRECTOR, ECOLOGIST

Iggdrasil Scientific Services

Jan 2012 – Present

A medium sized enterprise specialising in ecological assessments, covering fauna, flora, wetland and aquatic ecosystems.

PLANT ECOLOGIST

GEM – Science, South Africa

Oct 2010 – Jan 2012

A medium sized enterprise providing comprehensive geological and environmental consulting service for the mining industry.

JUNIOR ENVIRONMENTAL CONSULTANT

Bokamoso Environmental Consultants, SA

Jan 2010 – Oct 2010

PROJECT RESEARCH ASSISTANT

Abiotic Research Group, Alterra, Wageningen, The Netherlands

Jan 2009 – Jun 2009

BOTANY DEMONSTRATOR

University of Pretoria, Plant Sciences, SA

Jul 2008 – Nov 2008

FIELD ASSISTANT

University of Pretoria, Zoology, SA

Nov 2007 – Feb 2007

PROJECT RESEARCH ASSISTANT

University of Pretoria, Zoology, SA

Jan 2006 – Aug 2006

Education and Training

Degrees

- **Master of Science in Geohydrology, in progress: expected completion** **December 2018**
University of the Free State, Bloemfontein, SA
- **Master of Science Plant Science** **2010**
Wageningen University, The Netherlands and University of Pretoria, SA
- **Bachelor of Science (Honours) Plant Science (Cum Laude)** **2008**
University of Pretoria, SA
- **Bachelor of Science Ecology** **2007**
University of Pretoria, SA



Certificates and Accreditations

- **SASS5 Accreditation (freshwater Aquatic Zoology)** 2017, 2014, 2011
Department of Water Affairs, SA
- **Dutch as a professional language** 2011
CNaTV, Belgium

Additional Courses

- Asteraceae ID course, by Paul Herman from SANBI's National Herbarium at the University of Pretoria, Department of Plant and Soil Sciences. 2018
- MIRAI (Macro invertebrate Response Assessment Index), Department of Water and Sanitation 2016
- Invasive Species and Herbicide Training, South African Green Industries Council (SAGIC) 2016
- A rapid method for water quality assessment, Nepid Consultants, Sabie 2011
- EIA water use authorisation and waste management activity licences, CBSS, Pretoria 2011
- Tools for wetland assessment, Rhodes University, Grahamstown 2011
- Inventory and survey methods for invasive plants, Online Course, Department of land resource of environmental Sciences, Montana State University, Bozeman, Montana. 2009

Conference Presentations

- **Course Presenter: Riparian Vegetation Assessment Methods for DWS** 2017
Department of Water and Sanitation, DWS, Roodeplaat
- **Conservation Planning in Urban Open Spaces** 2016
Botanical Society, Pretoria
- **The Vegetation ecology of Seringveld Conservancy, Cullinan South Africa** 2010
South African Association of Botanist's Annual Conference, Potchefstroom
- **A comparison between Ellenberg and Wamelink Biological indicator values** 2009
Wageninen Abiotic Research Group, Alterra Annual Conference, Wageningen, The Netherlands
- **The effect of the higher energy flow in the Ash River System, Bethlehem, SA** 2003
Stockholm International Youth Science Seminar, Sweden
- **The youth of South Africa would like to see underground water pollution addresses in light of the international summit for sustainable development** 2003
Water institute of South Africa, Annual Conference, Durban

Achievements

- Board member of the South African Botanical Society Pretoria Branch
- Selected for an exchange program to the University of Wageningen as part of my MSc studies.
- Overall Winner and gold medalist of the Eskom Expo for Young Scientist, representing south Africa in the Stockholm Sweden at the Stockholm international youth seminar
- Winner of the South Africa youth water prize of the department of water affairs and represented South Africa at the international youth water prize during world water week in Stockholm Sweden.

Membership & Associations

- South African Council of Natural Scientific Professions - Registered Professional Scientist (Pr.Sci.Nat: 400003/13),
- South African Association for Botanists,
- South African Botanical Society,
- South African Society for Aquatic Scientist,
- Department of Water and Sanitation SASS5 practitioners.



Dr Barbara Kasl

Resume Summary

Contact: +27 71 988 6773

Email: bk.zoology@gmail.com

Qualifications: PhD (Animal, Plant and Environmental Sciences)

Career Highlights

FAUNA SPECIALIST & ENVIRONMENTAL CONSULTANT

Feb 2017 – Present

Work involving fauna impact assessments and management and monitoring plans for various developments requiring NEMA authorisation, as well as terrestrial alien invasive fauna management plans. Working closely with ecologists on a variety of projects requiring specialist's terrestrial fauna input - Gauteng & North West Provincial Biodiversity Outlook Reports – Terrestrial Fauna input. Generic environmental management plans for the Working for Ecosystems and Land care projects (ongoing). Consulting on projects requiring Environmental Authorisation, including Mineral Authorisations, as well as the review of various environmental documentation.

ENVIRONMENTAL SCIENTIST/PRINCIPAL CONSULTANT

Cabanga Concepts, South Africa

Jan 2008 – Feb 2017

Cabanga works on a strategic level advising, consulting and overseeing environmental projects for construction, industry, mining and related businesses. Requested to join the company as an environmental consultant specialising in all environmental authorisation processes and related documents. I am one of three principal members/shareholders of Cabanga Concepts.

UNIT MANAGER / ACTING DEPARTMENT HEAD: BIOPHYSICAL DEPARTMENT

Digby Wells & Associates (now Digby Wells Environmental), SA

Sept 2004 – Nov 2007

Digby Wells Environmental's multidisciplinary team of integrated in-house specialists provides comprehensive environmental and social solutions for the Mineral Resources, Oil and Gas, Energy and Infrastructure sectors in Africa.

VARIOUS UNIVERSITY AND TEMP RESEARCH JOBS IN ENTOMOLOGY

University of Witwatersrand

2001 – 2003

PRIVATE TUTOR

University of Witwatersrand

2001



Education and Training

Degrees

- PhD in Animal, Plant and Environmental Sciences**
2004
University of Witwatersrand, Johannesburg, SA
2002 -
- Master of Science in Animal, Plant and Environmental Sciences (upgraded to PhD)**
2001
University of Witwatersrand, Johannesburg, SA
1999 -
- Bachelor of Science (Honours) Zoology and Entomology**
1998
University of Witwatersrand, Johannesburg, SA
- Bachelor of Science Zoology and Botany**
1998
University of Pretoria, SA
1995 -

Professional Memberships and Affiliations

- **2011 – current:** Registered Professional Environmental And Ecological Scientist
- **2015 – 2017:** EAPSA Certified Environmental Assessment Practitioner
- **1999, 2001 & 2008 – current:** Entomological Society of South Africa
- **2008-2011:** International Association for Impact Assessment
- **1998:** Zoological Society of Southern Africa

Additional Courses

- Alien invasive species identification and management course in KZN organised through Kay Montgomery 2017
- NEM: Air Quality Act course through IMBEWU Sustainability Legal Specialists (Pty) Ltd 2010
- NEMA and NEMWA course through ECOLAW 2009
- Environmental Impact Assessment Training 2007
- Project Management for Non-Project Managers Course through Astro Tech 2007
- Unilever Introduction to Managing Environmental Water Quality - Practical, Theoretical and Policy; through Institute for Water Research – RHODES University 2006
- Non-credited course in River health and SASS5 rapid methodology of water quality assessment presented by NEPID Consultants 2005
- Snake Identification and Snakebite Treatment Course 2005

*Project list and references available on request