

Terrestrial Biodiversity Assessment Associated with Lenasia South Reservoir

Gauteng, South Africa



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Report Status

Report Title: **Biodiversity Assessment Associated with Lenasia South Reservoir, Gauteng, South Africa.**

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Report Status: **Draft Report**

Date of Report: **November 2018**

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;

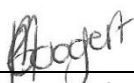
I will take into account, to the extent possible, the matters listed in Regulation 8;

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

2018/11/09

Date

Executive Summary

Iggdrasil Scientific Services (ISS) was appointed by Envirolution Consulting to conduct the biodiversity assessment associated with the proposed Lenasia South reservoir development in the Gauteng Province. The proposed development entails the proposed construction of a new concrete reservoir adjacent to an existing reservoir already located on the property. The proposed development is situated on Portions 302/60 of the farm Roodepoort, as well as on Portion 352 of the farm Lenasia. The footprint of the development totals approximately 1.0 hectares in size. The biodiversity field survey was conducted on the 26th September 2018. Additionally, a follow up botanical survey was conducted on the 5th of 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 assessment:

- The project area is classified as an Ecological Support Area, as well as a CBA - Important Area in the southern section, based on the Gauteng Conservation Plan;
- Faunal diversity on the site was found to be moderate. There was suitable habitat present at the study area, including rocky outcrops, termite mounds, and grassland for the occurrence of more species and potentially species of conservation concern such as *Mystromys albicaudatus* and *Otomys auratus*. The survey was short and with additional sampling methods, it is expected that more species may be found;
- Floral diversity was adversely affected by a fire event prior to the site survey. One provincially protected orchid species was identified approximately eight meters outside of the study area. The vegetation within the study area is considered primary and highly sensitive;
- The significance of loss of terrestrial habitat was rated as moderate. The faunal assessment indicated that the habitat found at the study area was largely intact;
- The significance of the loss of CBA - Important Area habitat was rated as low. However, the area which is classified as CBA – Important Area surrounding the proposed Lenasia South Reservoir has been increasingly developed, placing a high importance on conserving the remaining CBA and ESA areas in this location;
- The significance of the loss of Ecological Support Area habitat is rated as high. Although the development footprint (approximately 1 hectare) is small, the area is primarily an Ecological Support Area which links with Important Areas in the vicinity of the study area
- Despite being classified as occurring in the Savannah Biome on a desktop level, the site visit confirmed that the area is situated in a pristine grassland. Grasslands, particularly in the Gauteng

Province, are one of the most threatened habitat types with very little formally conserved in South Africa.

The following is recommended to mitigate negative impacts of the proposed development on the faunal diversity in the proposed study area: The Important Area located in the southern section of the proposed study area should be avoided during construction, and the use of existing infrastructure such as roads should be prioritized to avoid unnecessary loss of terrestrial habitat as well as the orchid *Eulophia hians* var. *hians* which is located outside of the proposed footprint area.

Abbreviations

ADU	Animal Demography Unit
BODATSA	Botanical Database of Southern Africa
CBAs	Critical Biodiversity Areas
CR	Critically Endangered
DD	Data Deficient
EAP	Environmental Assessment Practitioner
ESAs	Ecological Support Areas
EN	Endangered
GDARD	Gauteng Department of Agriculture and Rural Development
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
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NT	Near Threatened
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

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).
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).
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.

TERM	DEFINITION
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)

Table of Contents

EXECUTIVE SUMMARY	I
ABBREVIATIONS	II
DEFINITIONS	III
1. INTRODUCTION.....	1
1.1. <i>Orientation and Context</i>	1
1.2. <i>Terms of Reference</i>	1
2. LOCATION AND SURROUNDING ENVIRONMENT.....	2
2.1. <i>Project Area</i>	2
2.2. <i>Gauteng Conservation Plan</i>	6
2.3. <i>National Biodiversity Assessment 2011</i>	6
3. METHODS	10
3.1. <i>Desktop Assessment</i>	10
3.2. <i>Site Survey</i>	10
3.3. <i>Vegetation Sensitivity</i>	11
3.4. <i>Impact Assessment Criteria</i>	13
4. DISCUSSION AND EVALUATION OF RESULTS.....	16
4.1. <i>Desktop Assessment</i>	16
4.1.1. <i>Vegetation</i>	16
4.1.1.1. <i>Vegetation Map</i>	16
4.1.1.2. <i>BODATSA</i>	17
4.1.2. <i>Avifauna</i>	19
4.1.3. <i>Mammals</i>	20
4.1.4. <i>Reptiles</i>	21
4.1.5. <i>Amphibians</i>	21
4.2. <i>Site Survey</i>	21
4.2.1. <i>Vegetation Assessment</i>	22
4.2.2. <i>Sensitivity Analysis</i>	27
4.2.2.1. <i>Alien Invasive Plant Species</i>	30
4.2.3. <i>Avifauna</i>	31
4.2.4. <i>Mammals</i>	31
4.2.5. <i>Herpetofauna</i>	33
5. IMPACT ASSESSMENT AND SUGGESTED MITIGATION MEASURES	34
5.1. <i>Impact Statement</i>	34
5.2. <i>Assessment of Significance</i>	34
5.2.1. <i>Loss of terrestrial habitat</i>	34
5.2.2. <i>Loss of Important Area Habitat</i>	35
5.2.3. <i>Loss of Ecological Support Area Habitat</i>	36
5.2.4. <i>Degradation of grasslands and subsequent loss of plant diversity including protected plant species</i>	36
5.2.5. <i>Increase in alien and invasive plant species</i>	38
6. CONCLUSIONS AND RECOMMENDATIONS.....	39
7. PROFESSIONAL OPINION.....	40
8. REFERENCES.....	41
ANNEXURE A: EXPECTED AVIFAUNAL SPECIES	44
ANNEXURE B: EXPECTED MAMMAL SPECIES	50
ANNEXURE C: EXPECTED HERPETOFAUNA	52
ANNEXURE D: SPECIALIST CURRICULUM VITAE	53

List of Tables

TABLE 1:	PLANT OF CONSERVATION CONCERN WHICH MAY OCCUR WITHIN THE PROJECT AREA	17
TABLE 2:	LIST OF BIRD SPECIES OF REGIONAL OR GLOBAL CONSERVATION IMPORTANCE THAT ARE EXPECTED TO OCCUR IN PENTAD 2620_2750 AS WELL AS LIKELIHOOD OF OCCURRENCE (SABAP2, 2018, BLSA, 2017; IUCN, 2018).....	19
TABLE 3:	LIST OF MAMMAL SPECIES OF CONSERVATION CONCERN THAT MAY OCCUR IN THE PROJECT AREA AS WELL AS THEIR GLOBAL AND REGIONAL CONSERVATION STATUSES AND LIKELIHOOD OF OCCURRENCES (IUCN, 2018; SANBI, 2016).....	21
TABLE 4:	PLANT SPECIES RECORDED DURING THE SEPTEMBER 2018 SURVEYS	24
TABLE 5:	PRELIMINARY SENSITIVITY SCORING OF VEGETATION COMMUNITIES WITHIN THE PROJECT AREA	27
TABLE 6:	BIRD SPECIES RECORDED IN THE PROJECT AREA DURING THE AUGUST 2018 FIELD SURVEYS	31
TABLE 7:	HERPETOFAUNA SPECIES OBSERVED DURING THE SEPTEMBER 2018 SURVEY.....	33
TABLE 8:	ASSESSMENT OF SIGNIFICANCE OF LOSS OF TERRESTRIAL HABITAT PRIOR TO AND POST MITIGATION	34
TABLE 9:	ASSESSMENT OF SIGNIFICANCE OF LOSS OF CBA – IMPORTANT AREA HABITAT PRIOR TO AND POST MITIGATION.....	35
TABLE 10:	ASSESSMENT OF SIGNIFICANCE OF LOSS OF ECOLOGICAL SUPPORT HABITAT PRIOR TO AND POST MITIGATION.....	36
TABLE 11:	DEGRADATION OF GRASSLANDS AND SUBSEQUENT LOSS OF PLANT DIVERSITY INCLUDING PROTECTED PLANT SPECIES	37
TABLE 12:	INTRODUCTION AND INCREASE IN ALIEN INVASIVE PLANTS.....	38

List of Figures

FIGURE 1:	PROPOSED PROJECT AREA LOCATED IN LENASIA SOUTH, GAUTENG PROVINCE.....	3
FIGURE 2:	SITE LAYOUT SHOWING THE LOCATION OF PROPOSED DEVELOPMENT AS WELL AS SPECIALIST TRACK FOR THE SITE VISIT CONDUCTING DURING SEPTEMBER 2018	4
FIGURE 3:	SITE LAYOUT SHOWING THE LOCATION OF PROPOSED DEVELOPMENT AS WELL AS SPECIALIST TRACK FOR THE SITE VISIT CONDUCTING DURING NOVEMBER 2018	5
FIGURE 4:	PROPOSED PROJECT AREA OVERLAPPED WITH THE GAUTENG CONSERVATION PLAN SHOWING THE PROJECT AREA OCCURRING WITHIN AN ECOLOGICAL SUPPORT AREA, AS WELL AS A CBA - IMPORTANT AREA IN THE SOUTHERN SECTION	7
FIGURE 5:	THREAT STATUS OF TERRESTRIAL ECOSYSTEMS ASSOCIATED WITH THE PROPOSED LENASIA SOUTH RESERVOIR DEVELOPMENT BASED ON THE NATIONAL BIODIVERSITY ASSESSMENT (NBA, 2011)	8
FIGURE 6:	PROTECTION LEVEL OF TERRESTRIAL ECOSYSTEMS ASSOCIATED WITH THE PROPOSED LENASIA SOUTH DEVELOPMENT BASED ON THE NATIONAL BIODIVERSITY ASSESSMENT (NBA, 2011)	9
FIGURE 7:	RECORDS INCLUDED IN THE SEARCH FOR PROTECTED SPECIES CLOSE TO THE SITE FROM THE BODATSA (SANBI, 2016)	17
FIGURE 8:	LENASIA SOUTH RESERVOIR PROJECT AREA SHOWING THE VEGETATION TYPE BASED ON THE VEGETATION OF SOUTH AFRICA, LESOTHO & SWAZILAND (SANBI, 2006-).....	18
FIGURE 9:	A) ROCKY GRASSLAND WITH SPARSE VEGETATIVE COVER IN NOVEMBER B) ROCKY GRASSLAND COMMUNITY AFTER FIRE EVENT OBSERVED IN SEPTEMBER C) EMERGENT GRASS LAYER B) LITTERING OBSERVED DURING THE SITE VISIT.....	22
FIGURE 10:	A,) ARTIFICIAL WETLAND AFFECTED BY THE FIRE EVENT B,C,D) THE ORCHID SPECIES <i>EULOPHIA HIANS</i> VAR. <i>HIANS</i> SITUATED AMONGST THE ROCKY OUTCROPS.....	23
FIGURE 11:	FINE-SCALE VEGETATION MAP OF THE PROPOSED LENASIA SOUTH RESERVOIR STUDY AREA.....	28

FIGURE 12: VEGETATION SENSITIVITY MAP29

FIGURE 13: MAMMAL DUNG RECORDED IN THE LENASIA SOUTH RESERVOIR PROJECT AREA DURING THE SEPTEMBER 2018 SURVEY INCLUDED: A: LAGOMORPH MOST LIKELY *LEPUS SAXATILIS* (SCRUB HARE) AND B: SMALL CARNIVORE SCAT MOST LIKELY *CYNICTIS PENICILLATE* (YELLOW MONGOOSE)32

FIGURE 14: MOUNDS OF *CRYPTOMYS HOTTENTOTUS* (COMMON MOLE-RAT) RECORDED WITHIN THE LENASIA SOUTH RESERVOIR PROJECT AREA32

FIGURE 15: IMAGES OF THE HERPETOFAUNAL SPECIES RECORDED DURING THE SEPTEMBER 2018 SURVEY33

1. Introduction

1.1. Orientation and Context

Iggdrasil Scientific Services (ISS) was appointed by Envirolution Consulting to conduct the biodiversity assessment associated with the proposed development of a new reservoir located in Lenasia South, Gauteng Province. The proposed development entails the proposed construction of a new concrete reservoir adjacent to an existing reservoir. The development is situated on Portions 302/60 of the farm Roodepoort, as well as on Portion 352 of the farm Lenasia. The footprint of the development totals approximately 1.0 hectares in size.

The biodiversity field survey was conducted on the 26th September 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. Terms of Reference

The aim of the study was to undertake and compile a biodiversity scoping assessment for the proposed Lenasia South Reservoir.

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 south of Johannesburg in the Gauteng Province. The total footprint of the proposed development, within the farm Portions 302/60 of the farm Roodepoort, as well as on Portion 352 of the farm Lenasia, is approximately 1.0 hectares in size (Figure 1). The project area is situated approximately 35 km south west of the Johannesburg Central Business district, located between the R558 and the R553 (Figure 1).

The site is situated in the Highveld ecoregion, the C22A sub-quaternary reach, the Vaal Water Management Area (WMA_05), and the Savannah biome. The site is situated within Quarter Degree Square (QDS) 2627BD.

2.1. Project Area

The project area is situated adjacent to the north western boundary of an existing reservoir. The project area slopes slightly from approximately 1741 mamsl. in the north west of the area to the south of the area which is approximately 1732 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. The following specific areas were identified on the site:

- Proposed development site;
- Existing infrastructure;
- Artificial Wetlands; and
- Rocky Grasslands (Figure 2).

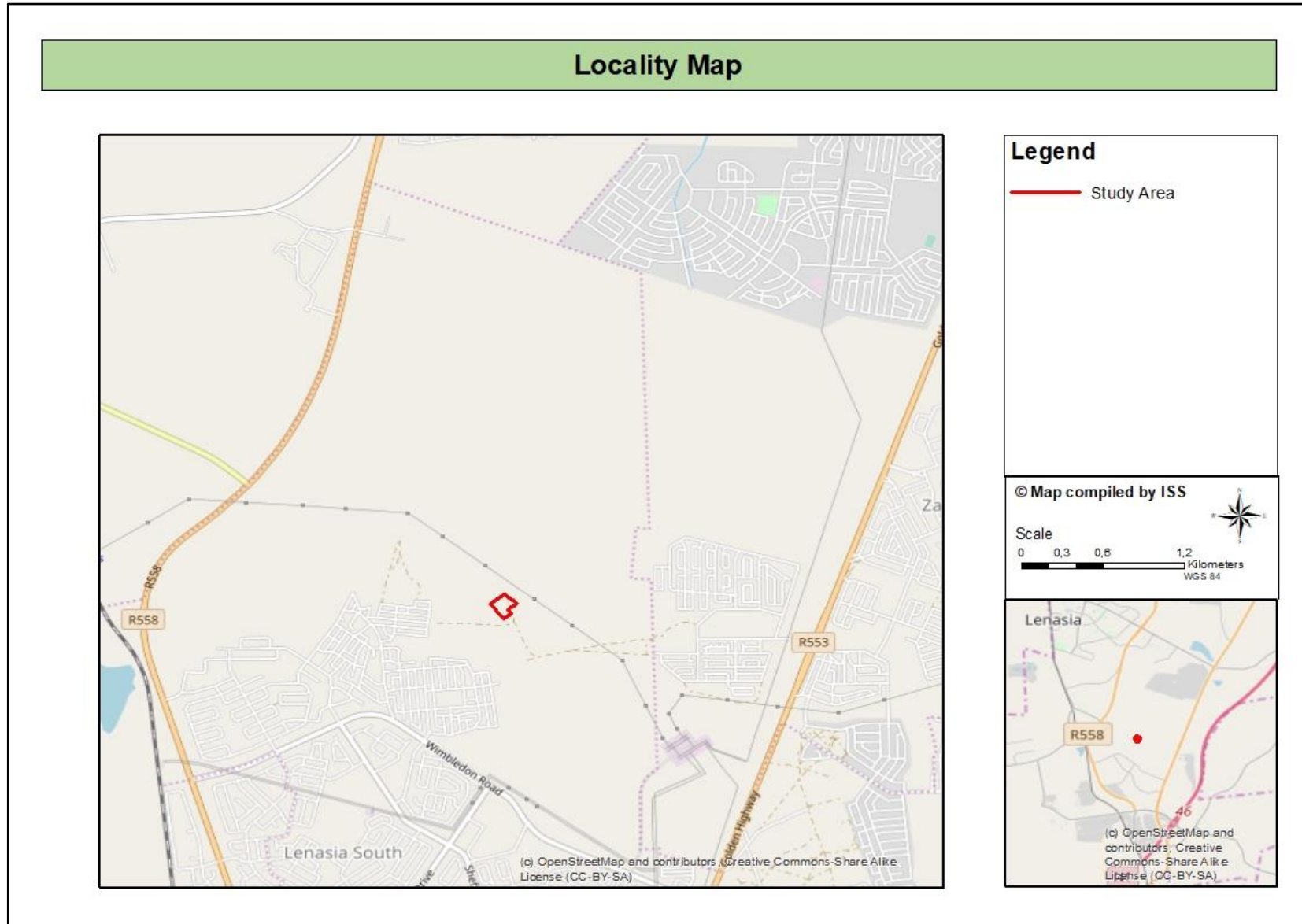


Figure 1: Proposed project area located in Lenasia South, Gauteng Province

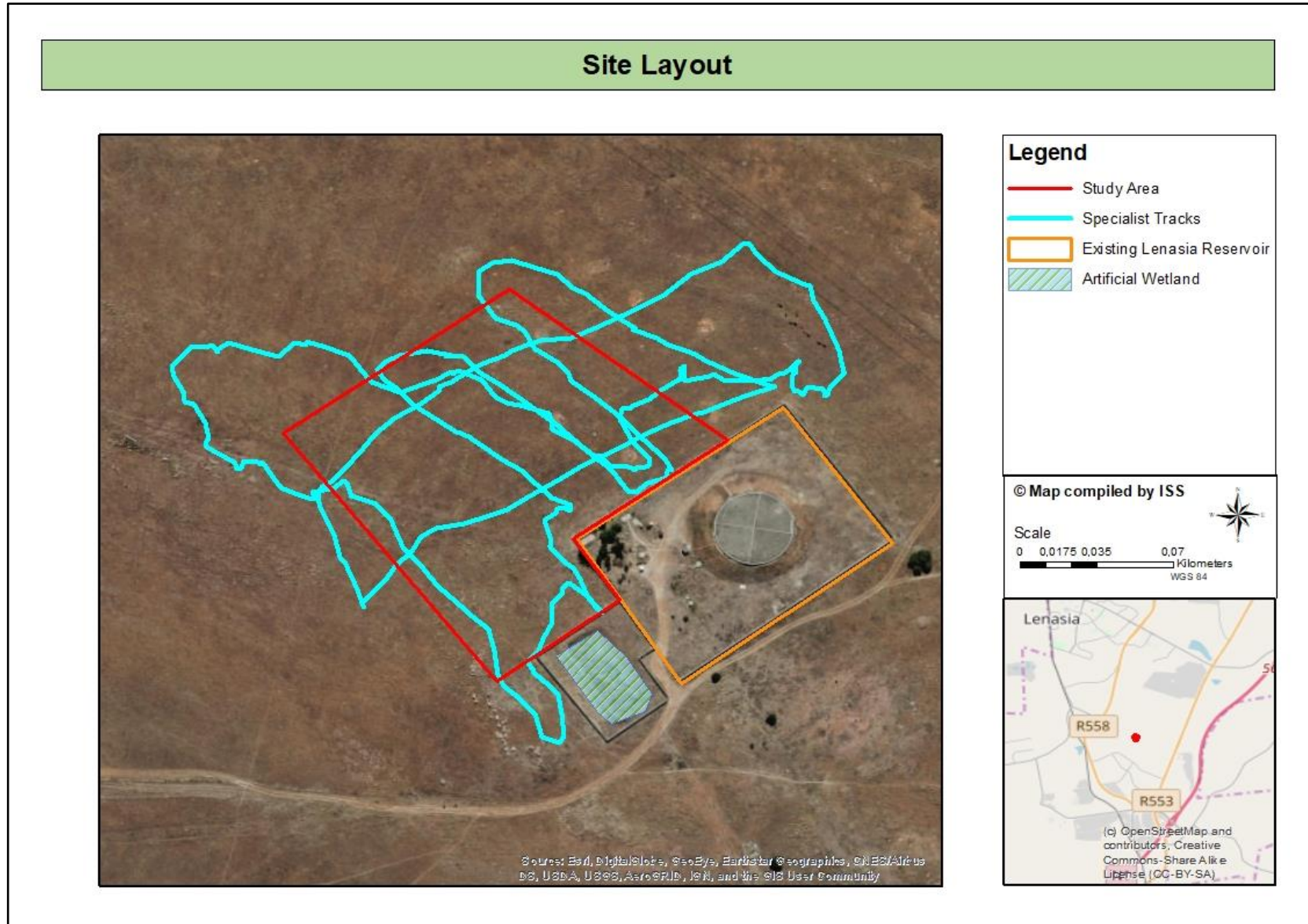


Figure 2: Site layout showing the location of proposed development as well as specialist track for the site visit conducting during September 2018

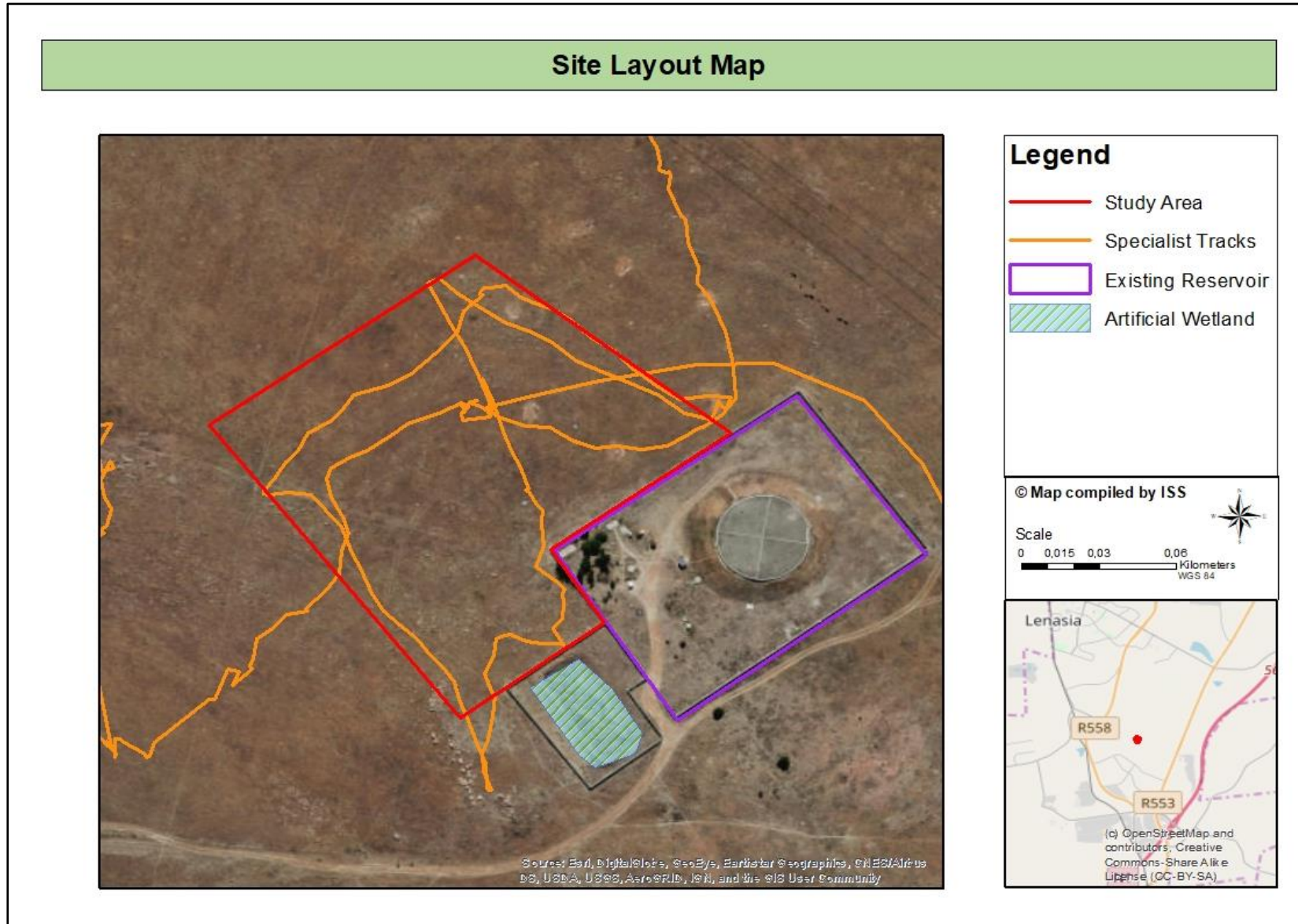


Figure 3: Site layout showing the location of proposed development as well as specialist track for the site visit conducting during November 2018

2.2. Gauteng Conservation Plan

The Gauteng Conservation Plan (Version 3.3) (GDARD, 2011) classified areas within the province on the basis of their contribution to reach the conservation targets within the province. These areas are classified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESA). The CBA are further subdivided into Important or Irreplaceable areas. Irreplaceable areas must be conserved whereas Important areas are of secondary importance but need to be conserved in order to reach conservation targets.

Ecological Support Areas (ESAs) were also set aside to ensure sustainability in the long term. ESAs can include buffered wetlands, open natural, semi-natural vegetation and even cultivated areas. ESAs provide vital connections between areas of high or critical biodiversity importance and are therefore not necessarily always in good condition or primary vegetation. In addition, areas formally protected are also indicated.

The study site occurs within an ESA, with a small section located in the southern corner being an Important Area (Figure 4).

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 Lenasia South reservoir development is situated in an ecosystem which is listed as Least Threatened (LT) and poorly protected (Figure 5, Figure 6).

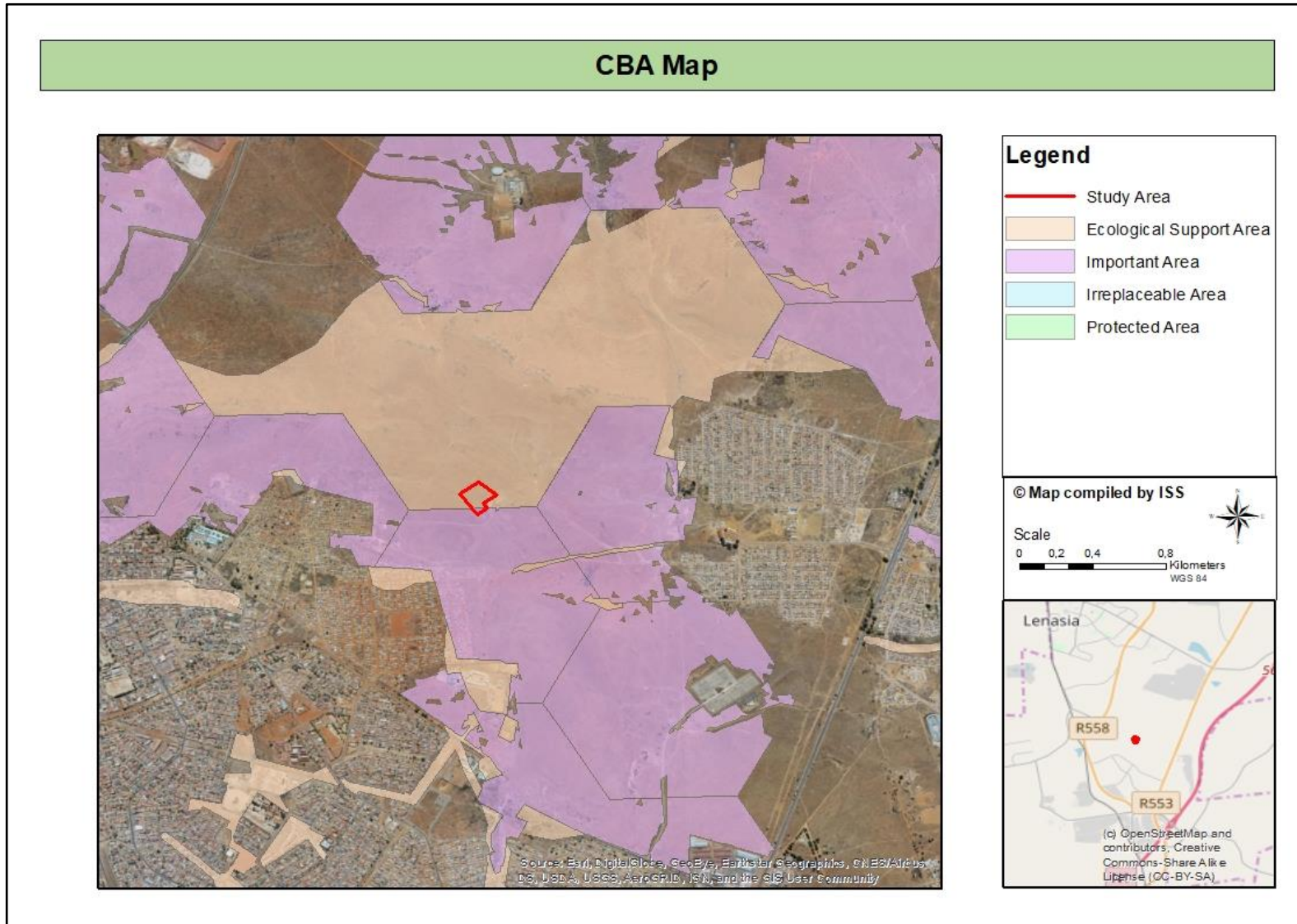


Figure 4: Proposed project area overlapped with the Gauteng Conservation Plan showing the project area occurring within an Ecological Support Area, as well as a CBA - Important Area in the southern section

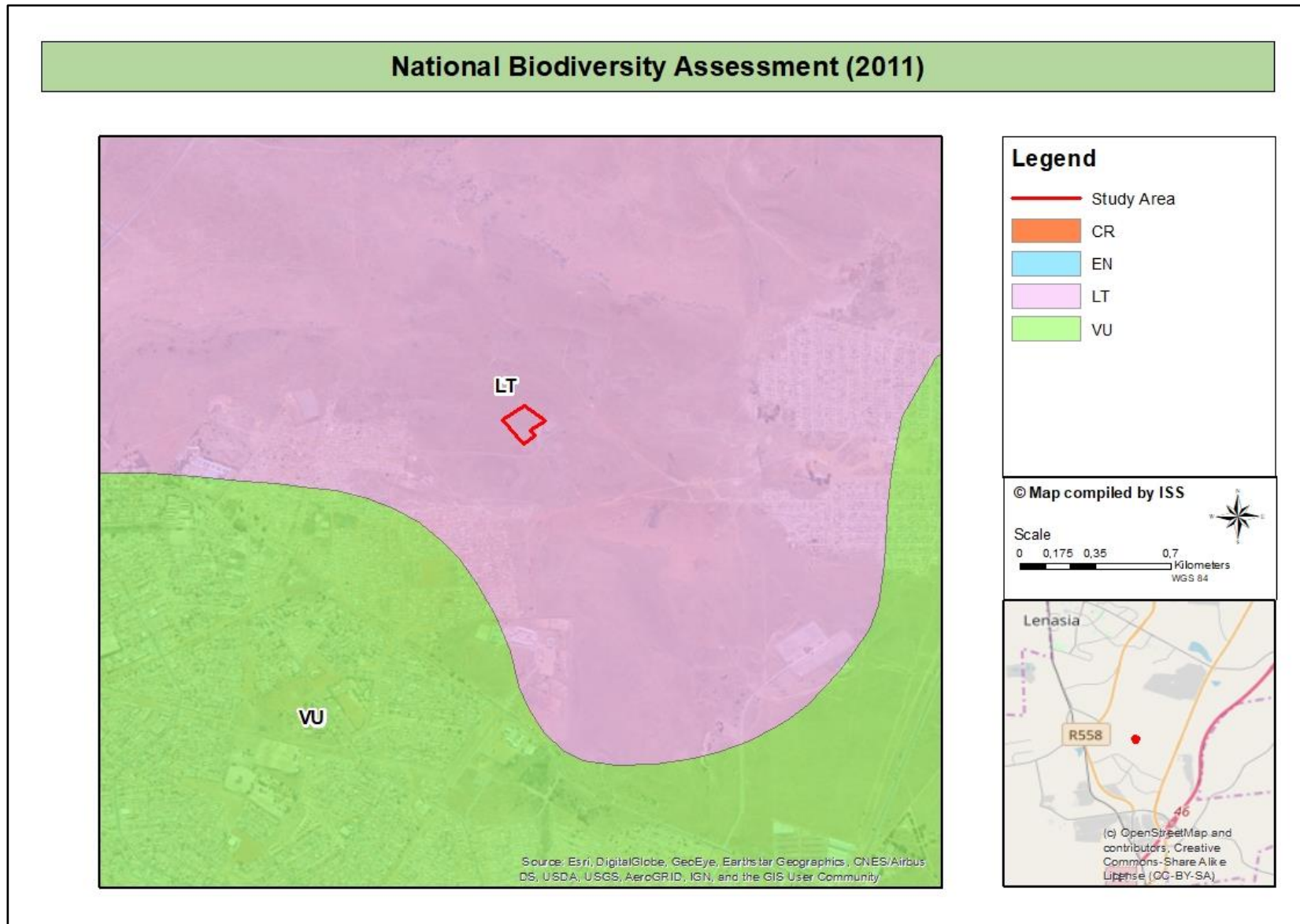


Figure 5: Threat status of terrestrial ecosystems associated with the proposed Lenasia South reservoir development based on the National Biodiversity Assessment (NBA, 2011)

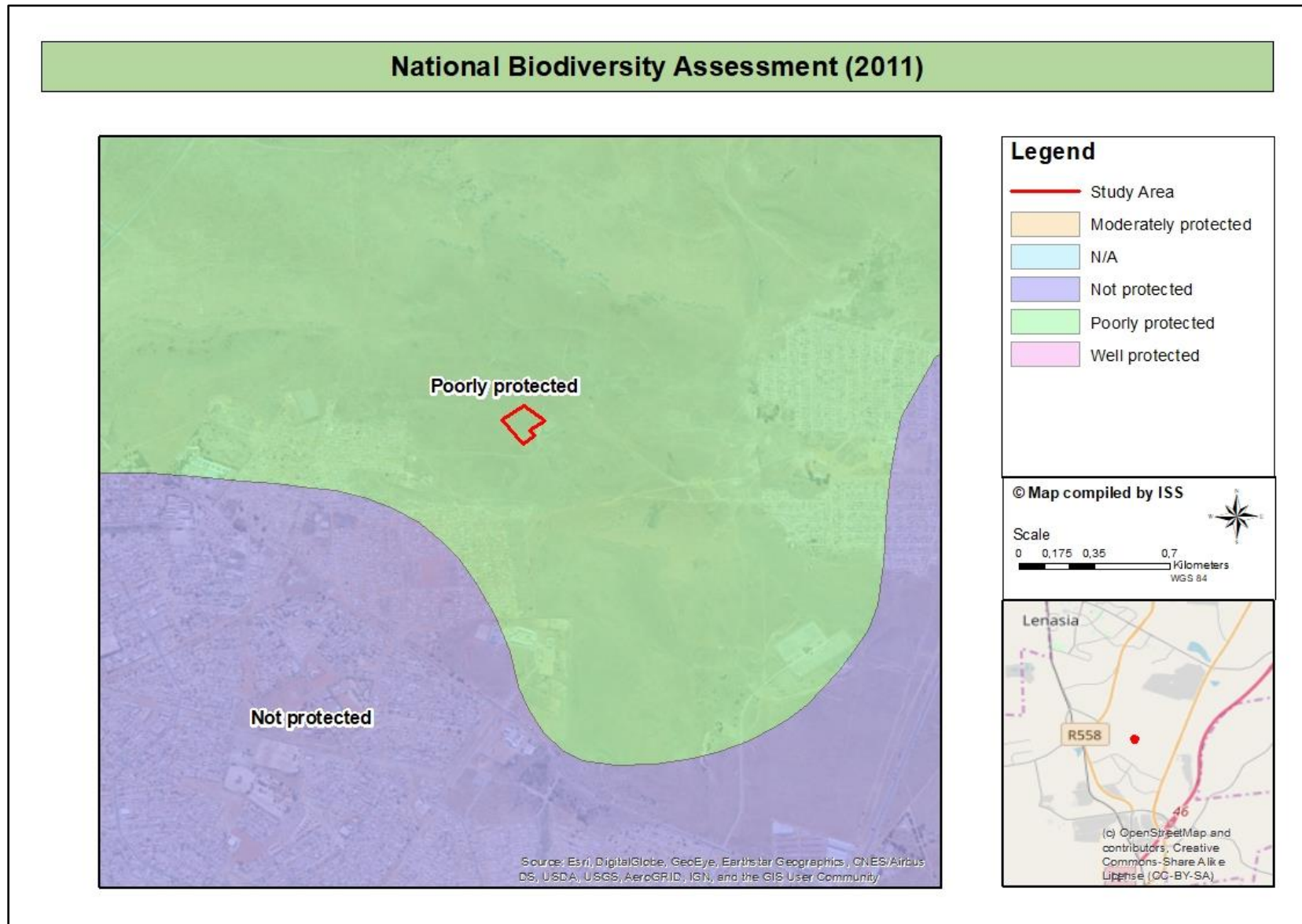


Figure 6: Protection level of terrestrial ecosystems associated with the proposed Lenasia South development based on the National Biodiversity Assessment (NBA, 2011)

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 study:

- The Vegetation of South Africa, Lesotho & Swaziland (Mucina and Rutherford, 2006);
- Botanical Database of Southern Africa (BODATSA) (SANBI, 2018)
- The Southern Africa Bird Atlas Project (SABAP2, 2018);
- Mammal information was referenced from the Animal Demography Unit (ADU, 2018), Skinner & Chimimba (2005) and the International Union for Conservation of Nature (IUCN) spatial database (IUCN, 2018); and
- Reptiles and amphibians were referenced from ADU (2018), Bates *et al.* (2014), Du Preez and Carruthers (2009) and the IUCN spatial database (IUCN, 2018) respectively.

The evaluation of species of concern was considered after the field study which served to identify their potential for occurrence. Therefore, all species identified under the above-mentioned references were not necessarily analysed in detail. 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.

3.2. Site Survey

The survey included the following:

- Compilation of expected species lists;
- A survey of the terrestrial habitats within the proposed development area (where applicable);
- 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.

3.3. Vegetation Sensitivity

The analysis methodology has been described and previously applied by Antoinette Eyszel 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. The significance of the impact is calculated as follows and rating significance is explained below:

$$\text{Significance} = \text{Consequence (Extent + Duration+ Magnitude)} \times \text{Probability}$$

- 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 extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- III. The duration, wherein it will be indicated whether
 - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - medium-term (5–15 years) – assigned a score of 3;
 - long term (> 15 years) - assigned a score of 4; or
 - permanent - assigned a score of 5;
- IV. The magnitude, quantified on a scale from 0-10, where
 - 0 is small and will have no effect on the environment,
 - 2 is minor and will not result in an impact on processes,
 - 4 is low and will cause a slight impact on processes,
 - 6 is moderate and will result in processes continuing but in a modified way,
 - 8 is high (processes are altered to the extent that they temporarily cease), and
 - 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- V. The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where
 - 1 is very improbable (probably will not happen),
 - 2 is improbable (some possibility, but low likelihood),
 - 3 is probable (distinct possibility),
 - 4 is highly probable (most likely) and
 - 5 is definite (impact will occur regardless of any prevention measures).
- VI. The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- VII. The status, which will be described as either positive, negative or neutral.
- VIII. The degree to which the impact can be reversed.
- IX. The degree to which the impact may cause irreplaceable loss of resources.
- X. The degree to which the impact can be mitigated.

The significance weightings for each potential impact are as follows:

- < 30 points: **Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area),

- 30-60 points: **Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- 60 points: **High** (i.e. where the impact must have an influence on the decision process to develop in the area).

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. Desktop Assessment

The desktop assessment was limited to literature investigation based on flora, avifauna, mammals and herpetofauna (reptiles and amphibians).

4.1.1. 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).

4.1.1.1. Vegetation Map

The proposed Lenasia South reservoir is situated in the savannah 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 *Senegalia*, *Vachellia* and *Albizia*) and a generally dense herbaceous layer (Scholes and Walker, 1993).

The study area occurs within the Gauteng Shale Mountain Bushveld (Mucina and Rutherford, 2006) (Figure 8). The Gauteng Shale Mountain Bushveld occurs on low, broken ridges and with high surface rock cover. Vegetation in this unit is short, semi-open thicket dominated by a variety of woody species such as *Senegalia caffra*, *Searsia leptodictya*, and *Cussonia spicata*. The conservation status of this vegetation unit is vulnerable

(Mucina and Rutherford, 2006). This vegetation unit is also not listed as a threatened or protected ecosystem in GN 1002 (GG 34809 of 9 December 2011) published under the NEM:BA.

The Gauteng Shale Mountain Bushveld is bordered by the Carltonville Dolomomite Grassland (Gh 15) and the Soweto Highveld Grassland (Gm 8). Therefore, it is expected that the study area is ecotonal exhibits characteristics and floristic composition of either the savannah or grassland biome. Species richness is expected to be high within the study area.

4.1.1.2. BODATSA

The polygon used to obtain the plant species data from BODATSA is illustrated in Figure 7 below:

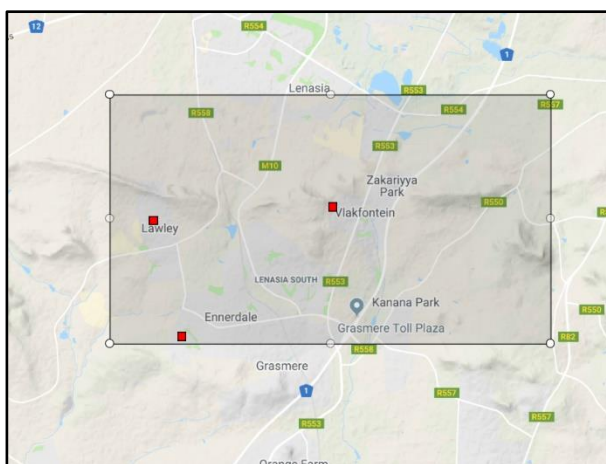


Figure 7: Records included in the search for protected species close to the site from the BODATSA (SANBI, 2016)

A total of 78 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) includes 1 NT, 1 EN, and 2 Data Deficient (DD) species (Table 1). 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 1: Plant of conservation concern which may occur within the project area

SPECIES	IUCN (2017)	ECOLOGY	HABITAT
<i>Pauridia canaliculata</i>	EN	Indigenous	Coastal fynbos, seasonally damp depressions.
<i>Lithops lesliei</i>	NT	Indigenous	Savannah; Calcareous, well-drained soil in areas that receive 250-400 mm rainfall per year.
<i>Lepidium mossii</i>	DD	Indigenous; Endemic	Terrestrial grassland.
<i>Lessertia mossii</i>	DD	Indigenous; Endemic	Terrestrial grassland.

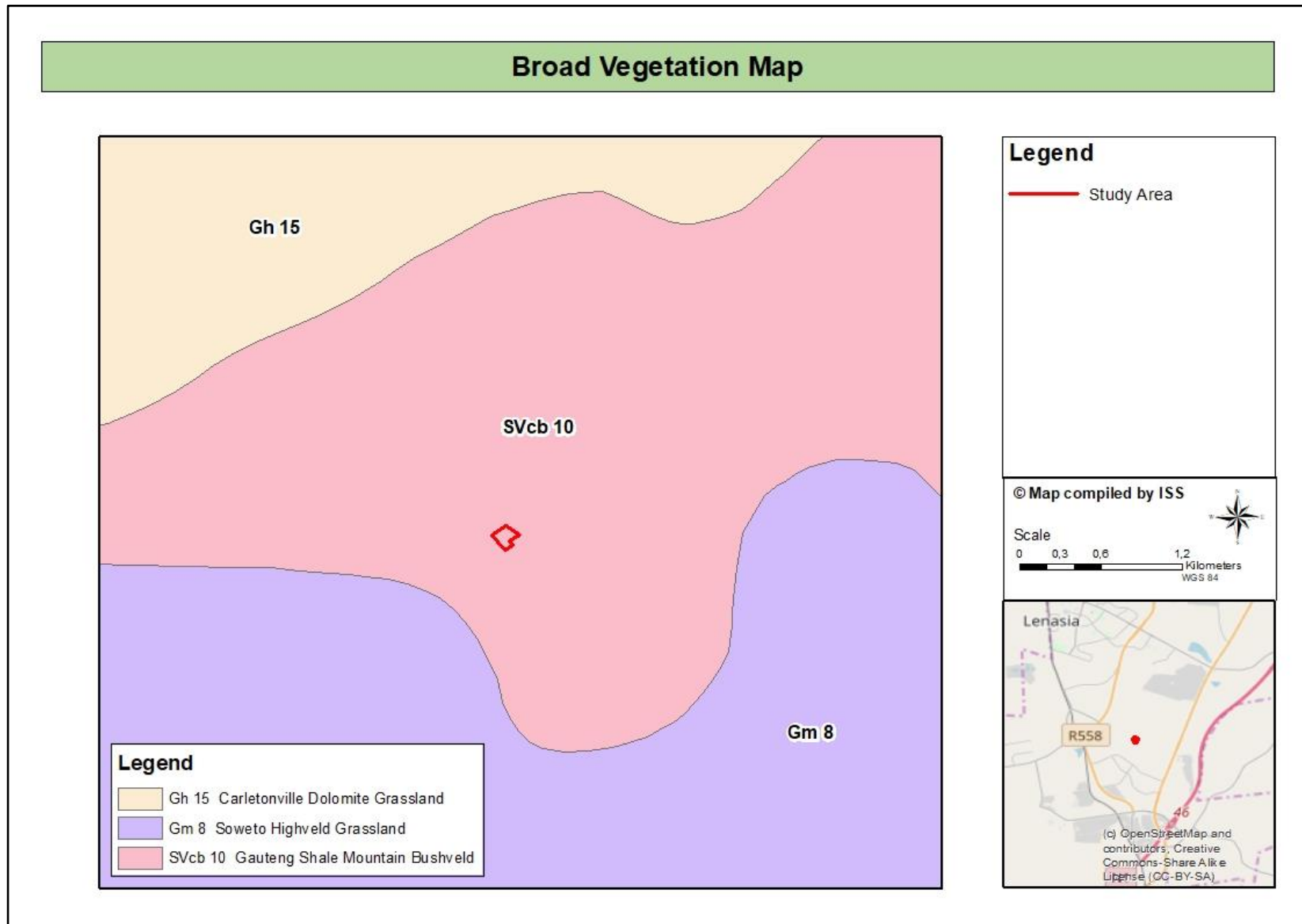


Figure 8: Lenasia South reservoir project area showing the vegetation type based on the Vegetation of South Africa, Lesotho & Swaziland (SANBI, 2006-)

4.1.2. Avifauna

Based on the South African Bird Atlas Project (SABAP, Version 2) 262 bird species are expected to occur in pentad 2620_2750. The full list of potential bird species is provided in Annexure A. The likelihood of occurrence of expected bird species was rated based on the number of occurrences of each species within the pentad. The likelihood of occurrences was calculated as follows:

- High – species recorded in > 66.6% of records;
- Moderate – species recorded in 33.3 to 66.6% of records;
- Low – species recorded in 10.0 to 33.3% of records;
- Very low – species recorded in < 10% of records; and
- Unlikely – no species records.

Of the expected bird species, 17 (6.48%) are listed as Species of Conservation Concern (SCC) either on a regional or global scale (Table 2). Of the 17 bird SCC, 15 are rated as unlikely to occur in the area, one (1) is rated as having a very low likelihood of occurrence, and one (1) is rated as having a low likelihood of occurrence (Table 2).

Of the expected bird species *Anthropoides paradiseus* (Blue crane) is listed as protected in the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Amendment 2015.

The bird SCC include the following:

- Two (2) species that is listed as Endangered (EN) either on a global and/or regional scale;
- Five (5) species that are listed as Vulnerable (VU) on either a global and/or regional scale; and
- Eleven (11) species that are listed as Near Threatened (NT) on either a global and/or regional scale (Table 2).

Table 2: List of bird species of regional or global conservation importance that are expected to occur in pentad 2620_2750 as well as likelihood of occurrence (SABAP2, 2018, BLSA, 2017; IUCN, 2018)

SPECIES NAME	COMMON NAME	LIKELIHOOD OF OCCURRENCE (%)	IUCN (2017)	BIRDLIFE SA (2017)
<i>Oxyura maccoa</i>	Duck, Maccoa	15.38	NT	NT
<i>Falco vespertinus</i>	Falcon, Red-footed	7.69	NT	NT
<i>Anthropoides paradiseus</i>	Crane, Blue	0.0	VU	NT
<i>Aquila verreauxii</i>	Eagle, Verreaux's	0.0	LC	VU
<i>Phoenicopterus ruber</i>	Flamingo, Greater	0.0	LC	NT
<i>Phoenicopterus minor</i>	Flamingo, Lesser	0.0	NT	Unlisted
<i>Tyto capensis</i>	Grass-owl, African	0.0	LC	VU
<i>Circus maurus</i>	Harrier, Black	0.0	EN	EN

SPECIES NAME	COMMON NAME	LIKELIHOOD OF OCCURRENCE (%)	IUCN (2017)	BIRDLIFE SA (2017)
<i>Eupodotis senegalensis</i>	Korhaan, White-bellied	0.0	LC	VU
<i>Certhilauda brevirostris</i>	Lark, Agulhas Long-billed	0.0	Unlisted	NT
<i>Circus ranivorus</i>	Marsh-harrier, African	0.0	LC	EN
<i>Glareola nordmanni</i>	Pratincole, Black-winged	0.0	NT	NT
<i>Monticola explorator</i>	Rock-thrush, Sentinel	0.0	NT	Unlisted
<i>Coracias garrulus</i>	Roller, European	0.0	LC	NT
<i>Calidris ferruginea</i>	Sandpiper, Curlew	0.0	NT	LC
<i>Sagittarius serpentarius</i>	Secretarybird, Secretarybird	0.0	VU	VU
<i>Ciconia abdimii</i>	Stork, Abdim's	0.0	LC	NT

4.1.3. Mammals

The IUCN Red List Spatial Data (IUCN, 2018) lists 81 mammal species that could be expected to occur within the project area (Annexure B). Of these 20 are either large mammal species or conservation dependant species, such as *Diceros bicornis* (Black rhinoceros) and *Ceratotherium simum* (Southern white rhinoceros) that in South Africa are restricted to protected areas. They were therefore removed from the expected SCC list. They are however still shown included in Annexure B. Of the remaining 61 small to medium sized mammal species, eleven (18.0%) are listed as being SCC on a regional or global basis (Table 2).

The following protected mammal species are amongst the expected species:

- *Felis nigripes* (Black-footed cat);
- *Leptailurus serval* (Serval);
- *Vulpes chama* (Cape fox) (NEM:BA Amendment 2015).

The likelihood of occurrence of mammal SCC was rated based on assessment of each species' habitat requirements and the habitat observed on the site during the field survey. Of the eleven SCC, four are rated as having as having a low likelihood and seven as unlikely (Table 3).

The list of potential species includes:

- One (1) mammal species is listed as EN on a global scale with a low likelihood of occurrence;
- Three (3) species are listed as VU on either a global and/or regional scale. Two are rated as having a low likelihood of occurrence and 1 as unlikely;
- Seven (7) species that are listed as NT on a global and/or regional scale with all rated as either low or unlikely to occur; and
- Seven (7) species that are listed as Protected (NEM:BA Amendment 2015) with all rated as either low or unlikely to occur (Table 3).

Table 3: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses and likelihood of occurrences (IUCN, 2018; SANBI, 2016)

SPECIES	COMMON NAME	IUCN (2018)	SANBI (2016)	TOPS (2007)	LIKELIHOOD OF OCCURRENCE
<i>Aonyx capensis</i>	Cape clawless otter	NT	NT	Protected	Unlikely
<i>Atelerix frontalis</i>	South African Hedgehog	LC	NT	Protected	Low
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	NT	LC	None	Unlikely
<i>Felis nigripes</i>	Black-footed cat	VU	VU	Protected	Low
<i>Hydriactis maculicollis</i>	Spotted-necked otter	NT	VU	Protected	Unlikely
<i>Leptailurus serval</i>	Serval	LC	NT	Protected	Low
<i>Mellivora capensis</i>	Honey Badger	LC	LC	Protected	Unlikely
<i>Mystromys albicaudatus</i>	White-tailed rat	EN	VU	None	Low
<i>Otomys auratus</i>	Vlei Rat (Grassland type)	NT	NT	None	Low
<i>Poecilogale albinucha</i>	African Striped Weasel	LC	NT	None	Low
<i>Vulpes chama</i>	Cape Fox	LC	LC	Protected	Unlikely

4.1.4. Reptiles

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2017) ten (10) reptile species are expected to occur in the project area (Annexure C). No species of conservation concern are expected; however, the list does include two species that are endemic to South Africa, and one species that is near-endemic to South Africa (Annexure C).

4.1.5. Amphibians

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database (ADU, 2017) nineteen (19) amphibian species are expected to occur in the project area (Annexure C). One (1) amphibian SCC, *Pyxicephalus adspersus* (Giant bullfrog) is listed as potentially occurring in the project area (Annexure C). This species is listed as NT on the IUCN Red List of Threatened Species however, based on the habitat observed in the project area the likelihood of occurrence of this species was rated as low (IUCN, 2018).

4.2. Site Survey

The field survey was conducted on the 26th September 2018 and the results presented and discussed below. Follow up surveys for specifically floristic composition are planned for November 2018 and results specifically in terms of vegetation should be seen as preliminary only.

4.2.1. Vegetation Assessment

One vegetation community was identified within the study area namely:

- Rocky grassland (Figure 9, Figure 11).

Surrounding land use includes the existing reservoir as well as what seems to be a constructed wetland with *Phragmites australis* (Common Reed) being the dominant species. (Figure 11). Although Mucina and Rutherford (2006) delineated the study area within the savannah biome during the site visit it was clear that the study area resembles the grassland biome. It is thought that therefore the study area can contain species from the Carltonville Dolomomite Grassland (Gh 15) and the Soweto Highveld Grassland (Gm 8).

Prior to the September site visit a fire event occurred. Most species observed within the study area were emergent after the fire event. During the November site visit the grass layer was still emergent and most grass species did not have a fully developed inflorescence present. Only grass species with a fully developed inflorescence present could be identified during the November survey preliminary investigation. The vegetation present within the study area is primary grassland with very limited levels of disturbance. Disturbance observed during the site visit was limited to littering and the fire event (Figure 9).

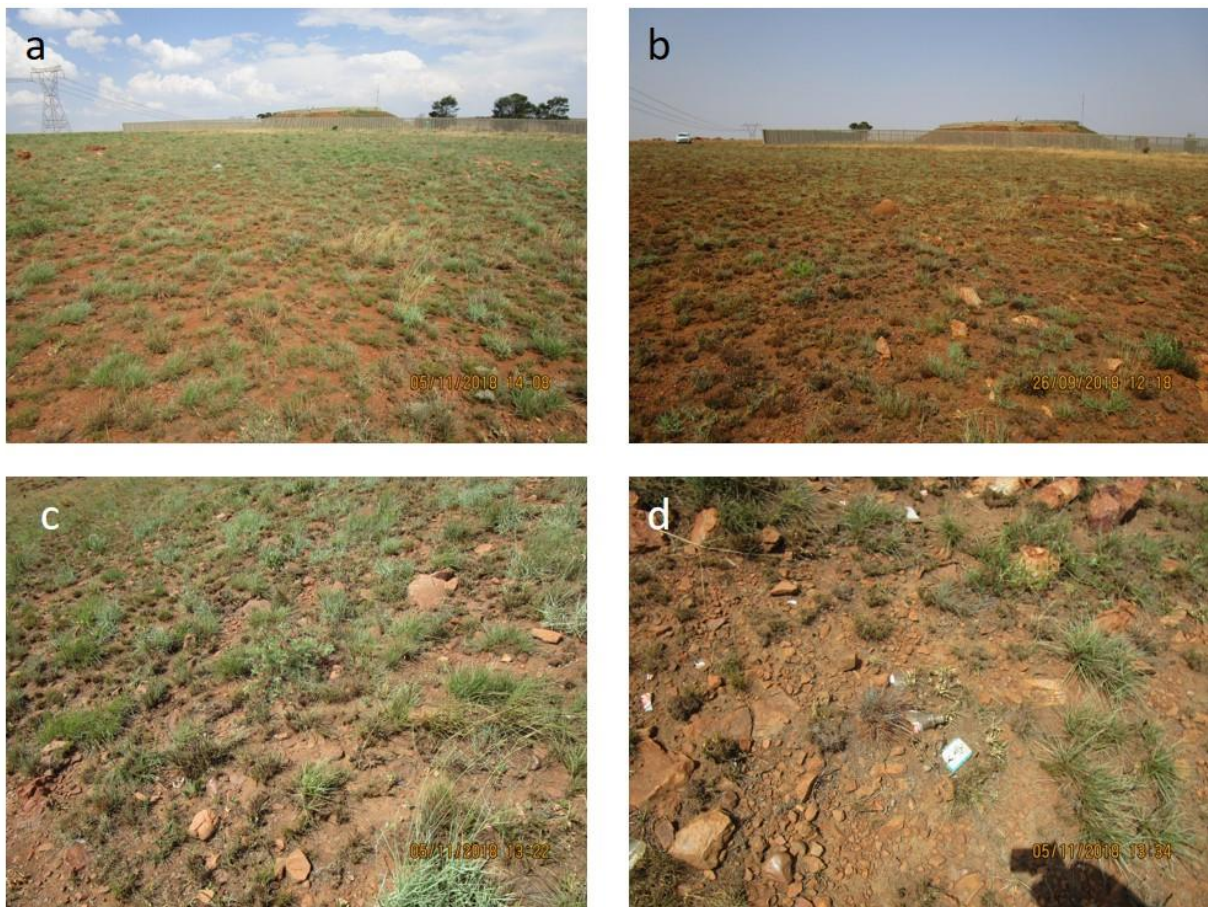


Figure 9: a) Rocky grassland with sparse vegetative cover in November b) Rocky grassland community after fire event observed in September c) Emergent grass layer b) Littering observed during the site visit

As the grassland was recently burnt dominance of species could not be established as the inflorescence of grass species were missing. Establishing dominance is crucial in the naming of plant communities according to the International Code of Phytosociological Nomenclature (Weber *et al.* 2000). Therefore, no plant community name was assigned as dominance could not be established. Vegetative cover was low due to the fire event (Figure 9). A total of 43 species were observed in the rocky grassland community during the site visit the majority of which were forbs and shrubs. One provincially protected species was observed namely the Orchid *Eulophia hians* var. *hians*. Three, individuals of *E. hians* var. *hians* were observed roughly eight meters outside of the study area (-26.375654°, 27.862895°, Figure 10). Limited amounts of invasion were observed in the rocky grassland community.

The artificial wetland was present outside of the study area and vegetative cover was also affected by the fire event. The dominant species observed included *Phragmites australis* (Figure 10).

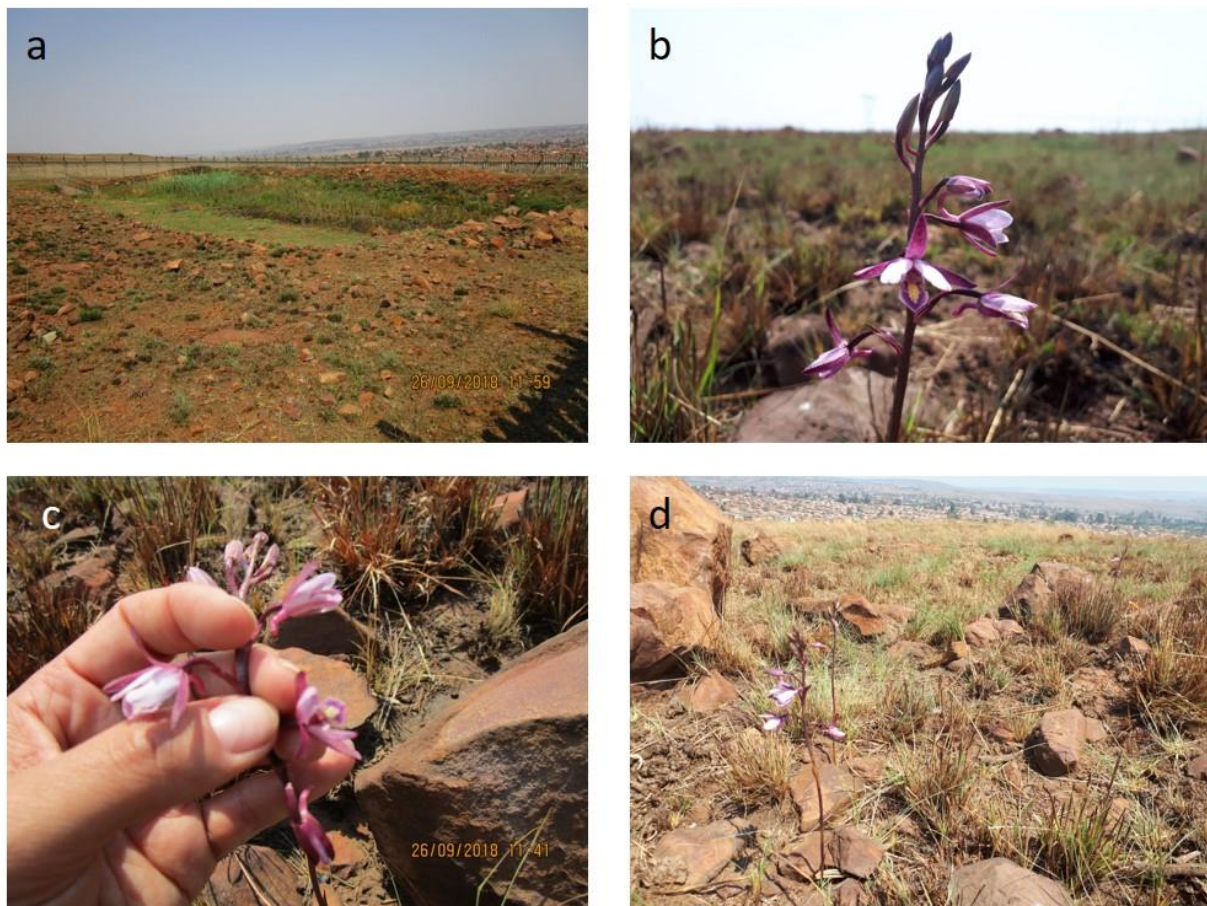


Figure 10: a,) Artificial wetland affected by the fire event b,c,d) The orchid species *Eulophia hians* var. *hians* situated amongst the rocky outcrops.

Table 4: Plant species recorded during the September 2018 surveys

SPECIES	COMMON NAME	HABITAT NOTES	ROCKY GRASSLAND	ARTIFICIAL WETLAND
Grasses				
<i>Alloteropsis semialata</i>	Black-seed Grass	Rocky, sour soil.	1	
<i>Andropogon schirensis</i>	Stab Grass	Rocky slopes in well-drained soils, often in moist places.	1	
<i>Brachiaria serrata</i>	Saw-tooth grass	Rocky, undisturbed places	1	
<i>Elionurus muticus</i>	Copper grass / Wire Grass	Common in overgrazed veld, sour grassland. Increaser III, perennial grass	1	
<i>Eragrostis lehmanniana</i>	Lehmann's Grass	Sandy soil, mostly in disturbed land. Increaser II grass	1	
<i>Eragrostis racemosa</i>	Narrow Heart Love Grass	Various habitats, mostly sandy or rocky moist soils. Increaser II	1	
<i>Hyparrhenia hirta</i>	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass	1	
<i>Loudetia simplex</i>	Common Russet Grass	Open grassland, poor sandy soil to rocky slopes and vleis. Increaser II	1	
<i>Phragmites australis</i>	Common Reed	Grows close to water sources such as rivers and wetlands.		1
<i>Themeda triandra</i>	Red Grass	Undisturbed or disturbed open grassland. Decreaser Grass	1	
<i>Tristachya rehmannii</i>	Hairy Trident Grass	Open grassland, shallow rocky soil	1	
<i>Urelytrum agropyroides</i>	Qunine Grass	Open Grassland, rocky slopes and sandy (moist) soils	1	
Total number of grass species =12			11	1
Forbs/ shrubs				
<i>Acalypha angustata</i>	Copper Leaf	Grassland, rocky grassland	1	
<i>Albuca cf setosa</i>	Fibrous Slime Lily / Slangkop	Plains, rocky areas	1	
<i>Asclepias aurea</i>		Grassland	1	
<i>Asclepias stellifera</i>	Spring stars	Grassland	1	
<i>Cyanotis speciosa (M)</i>	Doll's Powderpuff	Grassland	1	
<i>Clerodendrum triphyllum var. triphyllum</i>		Grassland	1	
<i>Dianthus mmoiensis</i>	Friilly Dianthus	Grassland	1	
<i>Dicoma anomala</i>		Grassland	1	
<i>Eulophia hians var. hians (P)</i>	(Grassland orchid)	Grassland	1	
<i>Felicia muricata</i>		Grassland, proliferating in overgrazed/disturbed places	1	
<i>Felicia mossamedensis</i>	Yellow Felicia	Sandy areas	1	
<i>Gazania krebsiana</i>	Botterblom	Grassland, widespread in other habitats	1	
<i>Geigeria burkei</i>	Vermeerbos	Common in overgrazed and disturbed areas	1	
<i>Graderia subintegra</i>	Wild Penstemon	Grassland	1	
<i>Helichrysum aureum</i>	Yellow everlasting	Grassland	1	
<i>Hypoxis acuminata</i>		Grassland, particularly damp places	1	

SPECIES	COMMON NAME	HABITAT NOTES	ROCKY GRASSLAND	ARTIFICIAL WETLAND
<i>Hypoxis iridifolia</i>		Grassland	1	
<i>Ipomoea ommaneyi</i>	Beespatat	Grassland	1	
<i>Indigofera comosa</i>		Grassland and rocky ridges	1	
<i>Indigofera melanadenia</i>		Common on rocky slopes in grassland	1	
<i>Kohautia amatymbica</i>		Grassland, often appearing after fire.	1	
<i>Ledebouria ovatifolia (M)</i>		Grassland / bushveld	1	
<i>Leonotis microphylla</i>	Klipdagga	Grassland and Bushveld, often in disturbed areas.	1	
<i>Lotononis foiliosa</i>		Grassland on rocky ridges.	1	
<i>Nemesia fructicans</i>	Wildeleebekkie	Shallow soils on exposed rock, also in disturbed areas	1	
<i>Ocimum obovatum subsp obovatum (M)</i>		Grassland	1	
<i>Phymaspermum anthanasioides</i>		Grassland, wide spread	1	
<i>Psammotropha myriantha</i>		Grassland, often in rocky places	1	
<i>Scabiosa columbaria</i>	Wild Scabiosa	Grassland, mainly in rocky areas	1	
<i>Senecio coronatus (M)</i>	Woolly Grassland Senecio / Sybossie	Grassland usually in large colonies	1	
<i>Senecio oxyriifolius</i>	False nasturtium	Grassland, mainly amongst rocks	1	
<i>Senecio venosus</i>		Grassland, often in rocky places	1	
<i>Silene burchellii var. burchellii</i>	Gunpowder plant	Weed in disturbed places fallow fields, particularly on sandy soils	1	
<i>Stoebe plumosa</i>	Bankruptbush	Grassland, often proliferating in overgrazed areas.	1	
<i>Syncolostemon pretoriae</i>		Rocky grassland	1	
<i>Tephrosia elongata</i>		Grassland, particularly rocky outcrops	1	
<i>Thesium utile</i>	Besembossie	Hemi-root parasite in grassland	1	
<i>Vernonia galpinii</i>		Grassland, usually in rocky places	1	
<i>Vernonia sutherlandii</i>		Rocky ridges in summit grassland	1	
<i>Xerophyta viscosa</i>	Small black stick lily	Rocky grassland, on rocks	1	
Total number of forb and shrub species =40			40	0
Trees				
<i>Diospyros lycioides</i>	Bluebush	Wide variety of habitats	1	
<i>Elephantorrhiza elephantina (M)</i>	Elephant's root	Grassland. Bushveld, often in disturbed places.	1	
<i>Parinari capensis (Suffretex)</i>	Dwarf Mobola Plum	Grassland, usually rocky places	1	
<i>Searsia magalismsontana</i>	Bergtaabos	Grassland and Bushveld, on rocky ridges.	1	
Total number of trees species = 4			4	0
Sedges				

SPECIES	COMMON NAME	HABITAT NOTES	ROCKY GRASSLAND	ARTIFICIAL WETLAND
<i>Typha capensis</i> *	Bulrush	Grows in marshy areas and along watercourses.		1
Total number of sedge species =		1	0	1
Alien and invasive species				
<i>Acacia mearnsii</i>	Black Wattle	Category 2 invader (NEM:BA)	1	
<i>Solanum sisymbriifolium</i>	Wild Tomato	Exotic weed in disturbed places, Category 1b (NEM:BA)	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
Total number of alien and invasive species= 3			3	1
Total number of species per plant community			59	3

Key to the table:

1 – recorded in the vegetation grouping

NT - Near Threatened

M- Medicinal

D – Declining

P - Provincially protected

4.2.2. Sensitivity Analysis

As per Table 5 below, the result of the sensitivity assessment indicated that the Rocky grassland communities were assigned a high sensitivity and the artificial wetland community were assigned a low sensitivity. Additionally, a 500 m buffer surrounding the proposed study area was included to show that no wetlands were situated within this vicinity of the study area (Figure 12).

Table 5: 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
Rocky grassland	0	3	2	3	3	2	13
							High
Artificial Wetland	0*	0	3	0	3	0	6
							Low

*Vegetation is secondary

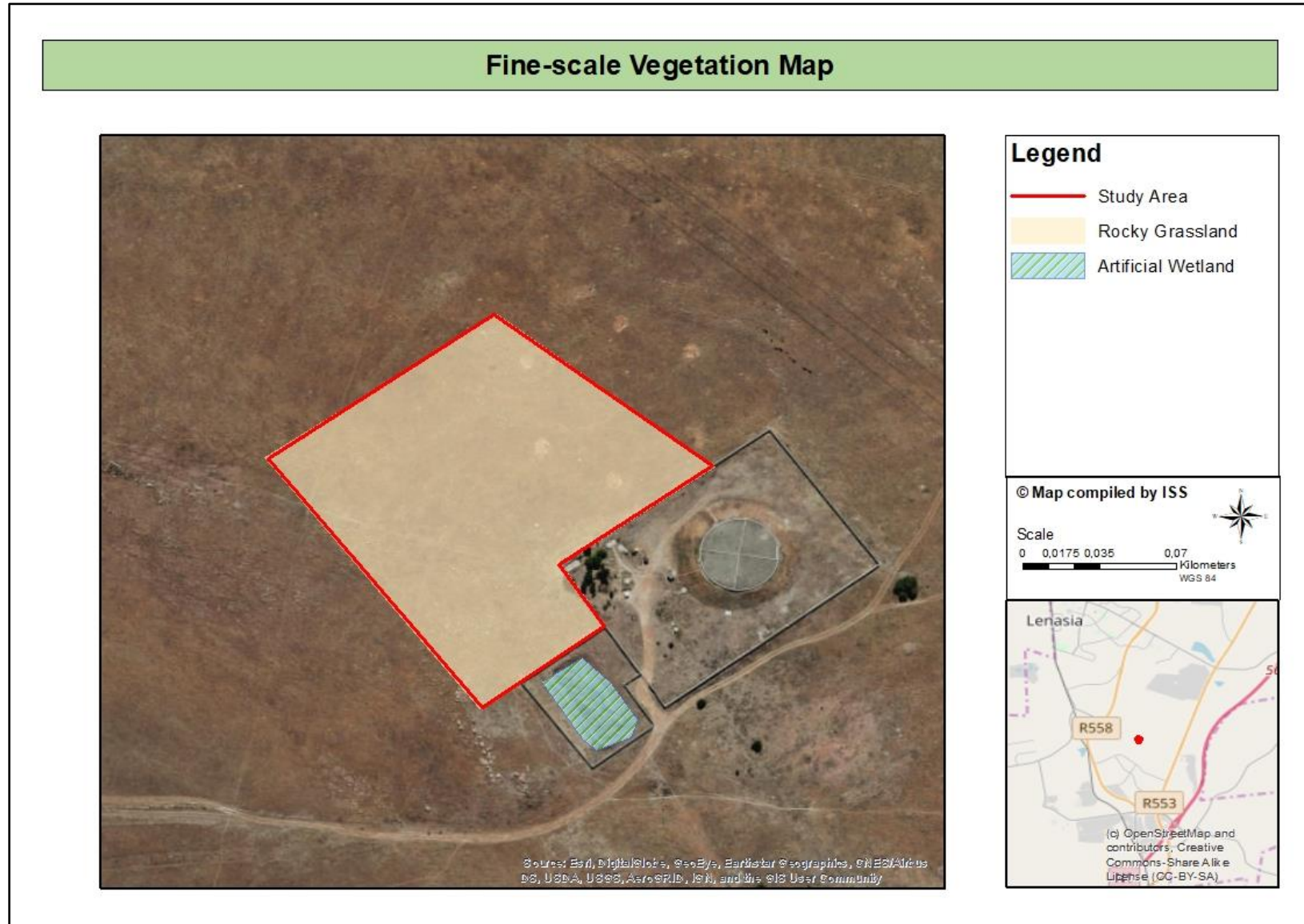


Figure 11: Fine-Scale vegetation map of the proposed Lenasia South Reservoir study area

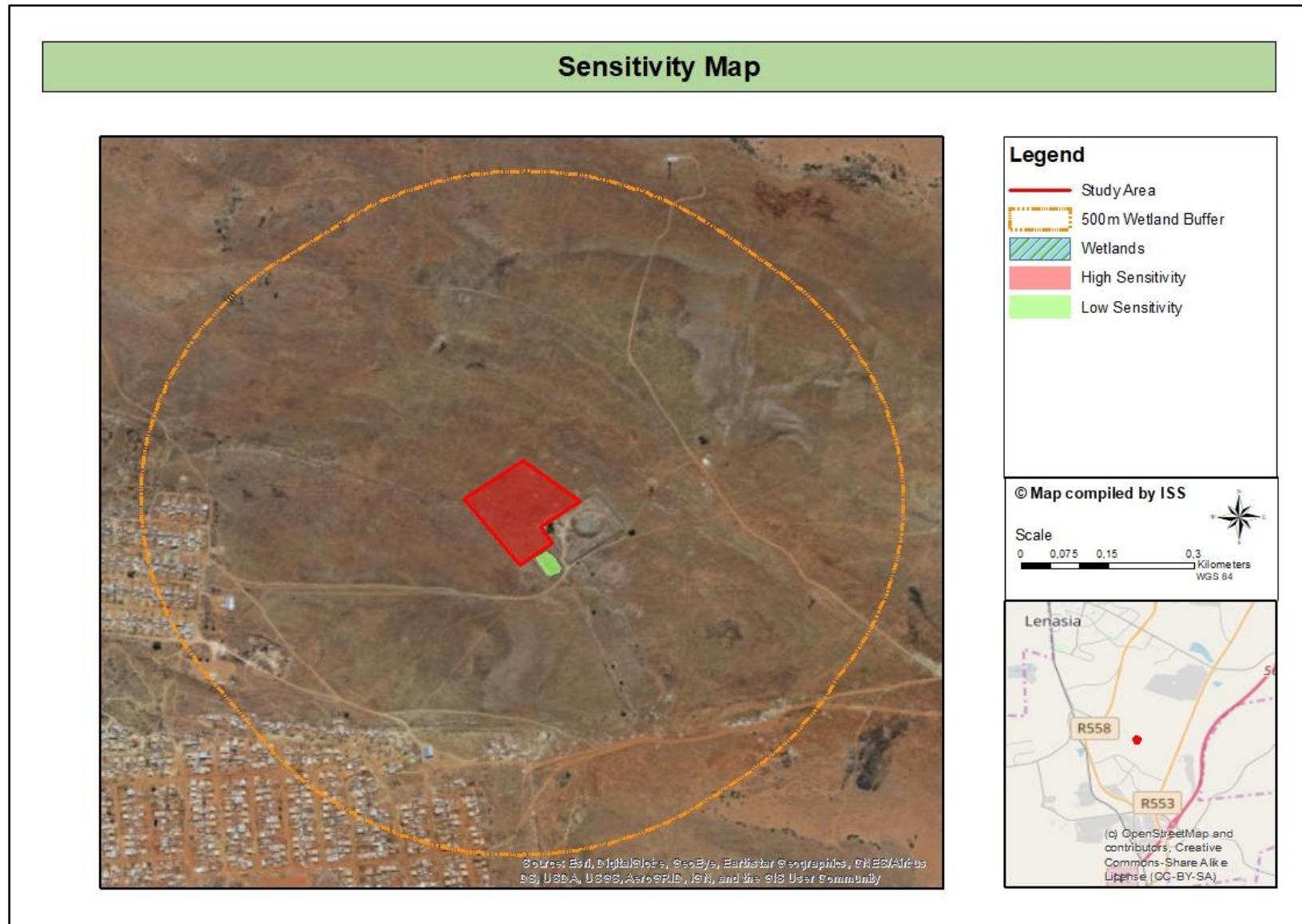


Figure 12: Vegetation sensitivity map

4.2.2.1. 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.

One (1) category 1b and one (1) category 2 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 4.

4.2.3. Avifauna

A total of 4 bird species were recorded in the project area during the September 2018 survey (Table 6). No bird SCC were recorded during the survey (Table 6). The recorded bird species are all common and abundant.

Table 6: Bird species recorded in the project area during the August 2018 field surveys

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Streptopelia capicola</i>	Turtle-dove, Cape	LC	Unlisted
<i>Euplectes progne</i>	Widow, Long-tailed	LC	Unlisted
<i>Anthus cinnamomeus</i>	Pipit, African	LC	Unlisted
<i>Ploceus velatus</i>	Masked-weaver, Southern	LC	Unlisted

4.2.4. Mammals

No mammals were observed during the September 2018 survey but the dung of two mammal species was recorded (Figure 13) as well as the presence of mounds of *Cryptomys hottentotus* (Common Mole-Rat) (Figure 14). The dung of a lagomorph species, most likely *Lepus saxatilis* (Scrub hare) was observed in the project area (Figure 13A). The scat of a small carnivore species was observed (Figure 13B). Based on the habitat in the project area the species is most likely *Cynictis penicillate* (Yellow mongoose) but *Herpestes sanguineus* (Slender mongoose) is also a possibility.

No mammal SCC were recorded during the survey. The low mammal diversity was attributed to the transformed nature of the surrounding area, as well as the relatively high human density in the areas surrounding the proposed Lenasia South Reservoir. It should however be noted that no intensive mammal sampling was conducted as this was beyond the scope of this assessment. It is very likely that intensive sampling, Sherman trapping, camera trapping etc., will increase the number of mammals recorded.

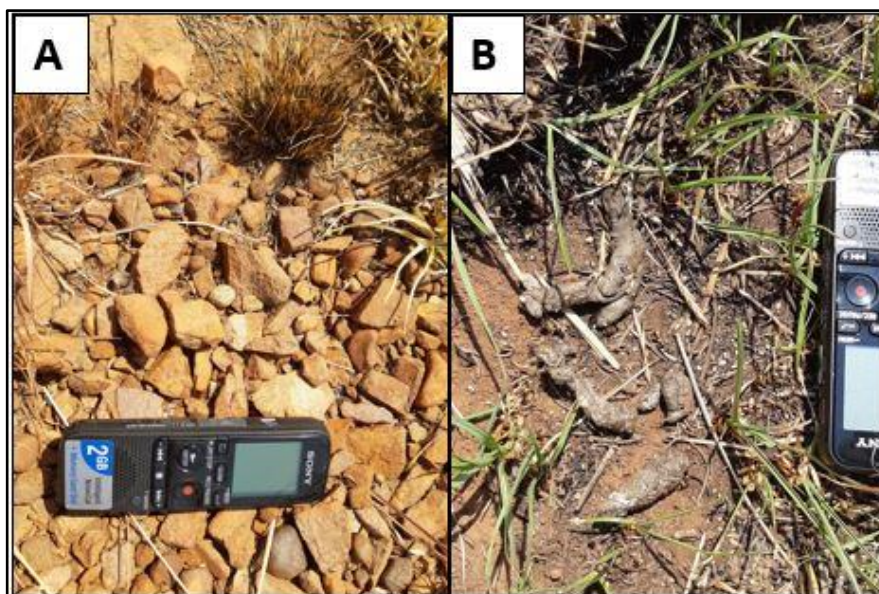


Figure 13: Mammal dung recorded in the Lenasia South Reservoir project area during the September 2018 survey included: A: Lagomorph most likely *Lepus saxatilis* (Scrub hare) and B: Small carnivore scat most likely *Cynictis penicillate* (Yellow mongoose)



Figure 14: Mounds of *Cryptomys hottentotus* (Common Mole-Rat) recorded within the Lenasia South Reservoir project area

Table 4: Mammal species deduced to be present in the project area based on dung and mounds observed during the September 2018 survey

SPECIES	COMMON NAME	IUCN (2018)	SANBI (2016)
<i>Cryptomys hottentotus</i>	Common mole-rat	LC	LC
<i>Lepus saxatilis</i>	Scrub hare	LC	LC
<i>Cynictis penicillate</i>	Yellow mongoose	LC	LC

4.2.5. Herpetofauna

A total of five (5) herpetofauna species were observed on the site during the September 2018 survey (Figure 15). No herpetofauna SCC were recorded during the survey (Table 7). However, considering the short time span of the survey, the amount of herpetofauna species found indicates that the habitat on site is still very much intact.



Figure 15: Images of the herpetofaunal species recorded during the September 2018 survey

Table 7: Herpetofauna species observed during the September 2018 survey

SPECIES	COMMON NAME	IUCN (2018)	SANBI (2016)
<i>Trachylepis striata</i>	Striped skink	LC	LC
<i>Agama aculeata</i>	Ground agama	LC	LC
<i>Gerrhosaurus flavigularis</i>	Yellow-throated plated lizard	LC	LC
<i>Dasypeltis scabra</i>	Rhombic egg eater	LC	LC
<i>Pachydactylus affinis</i>	Transvaal thick-toed gecko	LC	LC

5. Impact Assessment and suggested mitigation measures

The impact assessment was conducted are per methodology explained in section 3.4.

5.1. Impact Statement

Potential impacts associated with the proposed development include the following:

- Loss of terrestrial habitat including potential habitat for species of conservation concern;
- Loss of Important Area habitat located in the southern section of the study area;
- Degradation of grasslands and subsequent loss of plant diversity including protected plant species; and
- Increase in alien and invasive plant species.

5.2. Assessment of Significance

5.2.1. Loss of terrestrial habitat

The significance of the loss of terrestrial habitat prior to and post mitigation is shown in Table 8. The significance of this impact was rated as moderate prior to mitigation due to:

- The presence of plant species of conservation concern; and
- The presence of intact terrestrial habitat for both flora and fauna species located within the study area.

Table 8: Assessment of significance of loss of terrestrial habitat prior to and post mitigation

CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Probability	Highly Probable (4)	Probable (3)
Duration	Permanent (5)	Permanent (5)
Extent	Local (1)	Local (1)
Magnitude	Moderate (6)	Low (4)
Significance	Medium (48)	Medium (30)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	Although faunal diversity was moderate, the study area is demarcated as an Ecological Support Area, as well as an Important Area	Although faunal diversity was moderate, the study area is demarcated as an Ecological Support Area, as well as an Important Area
Can impacts be mitigated?	Yes, to a certain extent	
<p>Mitigation: Faunal species encountered on site during construction may not be killed but need to be removed or collected by trained professionals. In particular, be aware of the potential presence of species of conservation concern. If any faunal species</p>		

are encountered these need to be relocated by an accredited specialist. Construction should not occur within the Important Area, and the use of existing roads should be prioritised as far as possible.
Cumulative impacts: The loss of terrestrial habitat contributes to the regional loss of habitat although the project footprint is approximately 1 hectare in size which is relatively small. The study area is located within an Ecological Support Area, which links with Important Areas in the vicinity.
Residual risks: None

5.2.2. Loss of Important Area Habitat

The significance of the loss of CBA - Important Area habitat was rated as medium and post mitigation the significance was rated as low (Table 9). This was attributed to the small size of the project footprint, as well as the small size of the area classified as an Important Area. The site is situated in the southern section of the study area and may possibly be avoided during construction activities.

Table 9: Assessment of significance of loss of CBA – Important Area habitat prior to and post mitigation

Nature: A small portion in the south of the proposed Lenasia South Reservoir study area is situated in a CBA - Important Area. Therefore, the proposed development will possibly result in loss of Important Area habitat. It is recommended that the development is not conducted on the area demarcated as an Important Area.		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Probability	Probable (3)	Improbable (2)
Duration	Permanent (5)	Permanent (5)
Extent	Local (1)	Local (1)
Magnitude	Moderate (6)	Minor (2)
Significance	Medium (36)	Low (16)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	Although faunal diversity was moderate, the study area is demarcated as an Ecological Support Area, as well as an Important Area	Although faunal diversity was moderate, the study area is demarcated as an Ecological Support Area, as well as an Important Area
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: The development should not be conducted on the area demarcated as an Important Area. Construction should not occur within the Important Area, and the use of existing roads should be prioritised as far as possible.		
Cumulative impacts: None		
Residual risks: None		

5.2.3. Loss of Ecological Support Area Habitat

The significance of the loss of Ecological Support habitat was rated as high both prior and post mitigation (Table 10). The area occurs primarily in an Ecological Support Area, which links to CBA areas to the north of the study area, and to the south. The CBA areas to the south are already being transformed by residential areas, which highlights the importance of the Ecological Support Areas in this location (Table 10).

Table 10: Assessment of significance of loss of Ecological Support habitat prior to and post mitigation

Nature: The study area is primarily located within an Ecological Support Area, which links with Important Areas surrounding it.		
CONSTRUCTION PHASE	WITHOUT MITIGATION	WITH MITIGATION
Probability	Definite (5)	Definite (5)
Duration	Permanent (5)	Permanent (5)
Extent	Local (1)	Local (1)
Magnitude	Moderate (6)	Moderate (6)
Significance	High (60)	High (60)
Status (+ or -)	-	-
Reversibility	Limited	Limited
Irreplaceable loss of resources?	The study area is primarily demarcated as an Ecological Support Area with pristine grassland habitat.	The study area is primarily demarcated as an Ecological Support Area with pristine grassland habitat.
Can impacts be mitigated?	No	
Mitigation: Although mitigation in the Ecological Support Area would be difficult, the use of existing roads should be prioritised to lessen the extent of impact as far as possible.		
Cumulative impacts: None		
Residual risks: None		

5.2.4. Degradation of grasslands and subsequent loss of plant diversity including protected plant species

During the construction activities removal of indigenous plant species will occur. The *Eulophia hians* var. *hians* which occurs outside of the footprint area is protected according to the Transvaal Nature Conservation Ordinance No. 12 Of 1983.

Table 11: Degradation of grasslands and subsequent loss of plant diversity including protected plant species

NATURE: CONSTRUCTION AND OPERATION OF RESERVOIR COULD HAVE A DIRECT AND/OR INDIRECT IMPACT ON THE HEALTH AND FUNCTIONING OF THE ROCKY GRASSLAND		
<p>ACTIVITY: Loss of vegetation and plants of conservation concern due to the proposed construction activities. The following factors can contribute to the loss of vegetation:</p> <ul style="list-style-type: none"> ▪ Construction vehicles causing compaction and damaging vegetation ▪ Construction personnel harvesting /damaging plants ▪ Dumping of construction material or excavated soils ▪ Alteration in natural fire regimes and subsequent loss of non-marginal and marginal vegetation. ▪ Increase in invasive species due to disturbance. <p>Likely to be more significant during the construction phase vs the operation phase.</p>		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Highly Probable (4)	Probable (3)
Duration	Long term (4)	Short (1)
Extent	Regional (3)	Footprint (1)
Magnitude	High (8)	Low (6)
Significance	88 (High)	30 (Low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Very Improbable (1)
Duration	Medium (3)	Short (1)
Extent	Footprint (1)	Footprint (1)
Magnitude	Low (6)	Low (6)
Significance	42 (Medium)	18 (Low)
Status (positive or negative)	Positive	Positive
Reversibility	Low	Moderate
Irreplaceable loss of resources?	High	Low
Can impacts be mitigated?	Yes	
<p>Mitigation:</p> <ul style="list-style-type: none"> ▪ Limit construction activities to footprint area to avoid the loss of the orchid species <i>Eulophia hians</i> var. <i>hians</i> which is located outside of the proposed footprint area. ▪ Construction workers may not tamper or remove plants of conservation concern, neither may anyone collect seed from the plants without permission from the local authority. ▪ No open fires are permitted within naturally vegetated areas. ▪ No dumping of construction material or soils are allowed within the disturbed grassland or any other proximate natural veld. ▪ During the operational phase the pipeline should be checked for leaks on an annual basis. ▪ Removal and relocation of plants of conservation concern prior to any construction activities. 		
<p>Cumulative impacts: Expected to be high. Due to the presence of sensitive vegetation communities as well as plants of conservation concern the impacts could be devastating.</p>		
<p>Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly, and effective rehabilitation of the site is undertaken where necessary</p>		

5.2.5. Increase in alien and 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 (Table 12).

Table 12: Introduction and increase in alien invasive plants

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 impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users.		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Highly Probable (4)	Improbable (2)
Duration	Medium term (3)	Short (1)
Extent	Regional (3)	Footprint (1)
Magnitude	High (8)	Low (6)
Significance	80 (High)	24 (Low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Very Improbable (1)
Duration	Short (1)	Short (1)
Extent	Footprint (1)	Footprint (1)
Magnitude	Low (6)	Low (6)
Significance	30 (Medium)	18 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	High	Low
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> ▪ Weed control ▪ Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards. ▪ Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish. ▪ Rehabilitate or revegetate disturbed areas. 		
Cumulative impacts: Regular monitoring should be implemented during construction, rehabilitation including for a period after rehabilitation is completed.		
Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly, and effective rehabilitation of the site is undertaken where necessary		

6. Conclusions and Recommendations

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

- The project area is classified as an Ecological Support Area, as well as a CBA - Important Area in the southern section, based on the Gauteng Conservation Plan;
- Faunal diversity on the site was found to be moderate. There was suitable habitat present at the study area, including rocky outcrops, termite mounds, and grassland for the occurrence of more species and potentially species of conservation concern such as *Mystromys albicaudatus* and *Otomys auratus*. The survey was short and with additional sampling methods, it is expected that more species may be found;
- Floral diversity was adversely affected by a fire event prior to the site survey. One provincially protected orchid species was identified approximately eight meters outside of the study area. The vegetation within the study area is considered primary and highly sensitive;
- The significance of loss of terrestrial habitat was rated as moderate. The faunal assessment indicated that the habitat found at the study area was largely intact;
- The significance of the loss of CBA - Important Area habitat was rated as low. However, the area which is classified as CBA – Important Area surrounding the proposed Lenasia South Reservoir has been increasingly developed, placing a high importance on conserving the remaining CBA and ESA areas in this location;
- The significance of the loss of Ecological Support Area habitat is rated as high. Although the development footprint (approximately 1 hectare) is small, the area is primarily an Ecological Support Area which links with Important Areas in the vicinity of the study area
- Despite being classified as occurring in the Savannah Biome on a desktop level, the site visit confirmed that the area is situated in a pristine grassland. Grasslands, particularly in the Gauteng Province, are one of the most threatened habitat types with very little formally conserved in South Africa.

The following is recommended to mitigate negative impacts of the proposed development on the faunal diversity in the proposed study area: The Important Area located in the southern section of the proposed study area should be avoided during construction, and the use of existing infrastructure such as roads should be prioritized to avoid unnecessary loss of terrestrial habitat as well as the orchid *Eulophia hians var. hians* which is located outside of the proposed footprint area.

7. Professional opinion

A professional opinion is required as per the NEMA regulations with regards to the proposed development. Due to the timing of the survey no final professional opinion could be reached. The proposed footprint of the expansion of the reservoir 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 Lenasia South Reservoir is favourably considered for approval.

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Limitations

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 for the study:

- This assessment comprised of one site visit conducted in September 2018 and early November 2018. Therefore, limited seasonal variation was not taken into consideration.
- 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 two site visits undertaken in September and November 2018. 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.

Assumptions

- All information provided to ISS was accurate and up to date.
- The position of study site was accurate.
- No weirs will be constructed as part of the rehabilitation efforts.

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Annexure A: Expected Avifaunal Species

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Streptopelia senegalensis</i>	Dove, Laughing	LC	Unlisted
<i>Lanius collaris</i>	Fiscal, Common (Southern)	LC	Unlisted
<i>Vanellus armatus</i>	Lapwing, Blacksmith	LC	Unlisted
<i>Ploceus velatus</i>	Masked-weaver, Southern	LC	Unlisted
<i>Acridotheres tristis</i>	Myna, Common	LC	Unlisted
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	LC	Unlisted
<i>Cisticola lais</i>	Cisticola, Wailing	LC	Unlisted
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT
<i>Scleroptila levaillantoides</i>	Francolin, Orange River	Unlisted	Unlisted
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	LC	Unlisted
<i>Plectropterus gambensis</i>	Goose, Spur-winged	LC	Unlisted
<i>Ardeola ralloides</i>	Heron, Squacco	LC	Unlisted
<i>Ceryle rudis</i>	Kingfisher, Pied	LC	Unlisted
<i>Afrotis afraoides</i>	Korhaan, Northern Black	LC	Unlisted
<i>Vanellus senegallus</i>	Lapwing, African Wattled	LC	Unlisted
<i>Hirundo fuligula</i>	Martin, Rock	Unlisted	Unlisted
<i>Cossypha caffra</i>	Robin-chat, Cape	LC	Unlisted
<i>Gallinago nigripennis</i>	Snipe, African	LC	Unlisted
<i>Passer diffusus</i>	Sparrow, Southern Grey-headed	LC	Unlisted
<i>Creatophora cinerea</i>	Starling, Wattled	LC	Unlisted
<i>Chlidonias hybrida</i>	Tern, Whiskered	LC	Unlisted
<i>Myrmecocichla formicivora</i>	Chat, Anteating	LC	Unlisted
<i>Cisticola textrix</i>	Cisticola, Cloud	LC	Unlisted
<i>Numida meleagris</i>	Guineafowl, Helmeted	LC	Unlisted
<i>Colius striatus</i>	Mousebird, Speckled	LC	Unlisted
<i>Netta erythrophthalma</i>	Pochard, Southern	LC	Unlisted
<i>Lamprotornis nitens</i>	Starling, Cape Glossy	LC	Unlisted
<i>Porphyrio madagascariensis</i>	Swamphen, African Purple	Unlisted	Unlisted
<i>Anas erythrorhyncha</i>	Teal, Red-billed	LC	Unlisted
<i>Burhinus capensis</i>	Thick-knee, Spotted	LC	Unlisted
<i>Turdus smithi</i>	Thrush, Karoo	LC	Unlisted
<i>Euplectes afer</i>	Bishop, Yellow-crowned	LC	Unlisted
<i>Crithagra atrogularis</i>	Canary, Black-throated	LC	Unlisted
<i>Corvus albus</i>	Crow, Pied	LC	Unlisted
<i>Chrysococcyx caprius</i>	Cuckoo, Diderick	LC	Unlisted
<i>Podiceps cristatus</i>	Grebe, Great Crested	LC	Unlisted
<i>Larus cirrocephalus</i>	Gull, Grey-headed	LC	Unlisted
<i>Ardea cinerea</i>	Heron, Grey	LC	Unlisted
<i>Urocolius indicus</i>	Mousebird, Red-faced	LC	Unlisted
<i>Charadrius tricollaris</i>	Plover, Three-banded	LC	Unlisted
<i>Prinia subflava</i>	Prinia, Tawny-flanked	LC	Unlisted
<i>Apus caffer</i>	Swift, White-rumped	LC	Unlisted
<i>Estrilda astrild</i>	Waxbill, Common	LC	Unlisted

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Oenanthe monticola</i>	Wheatear, Mountain	LC	Unlisted
<i>Cisticola juncidis</i>	Cisticola, Zitting	LC	Unlisted
<i>Phalacrocorax africanus</i>	Cormorant, Reed	Unlisted	Unlisted
<i>Dendrocygna viduata</i>	Duck, White-faced	LC	Unlisted
<i>Sigelus silens</i>	Flycatcher, Fiscal	LC	Unlisted
<i>Bradypterus baboecala</i>	Rush-warbler, Little	LC	Unlisted
<i>Hirundo rustica</i>	Swallow, Barn	LC	Unlisted
<i>Oenanthe pileata</i>	Wheatear, Capped	LC	Unlisted
<i>Euplectes ardens</i>	Widowbird, Red-collared	LC	Unlisted
<i>Anhinga rufa</i>	Darter, African	LC	Unlisted
<i>Cisticola fulvicapilla</i>	Neddicky, Neddicky	LC	Unlisted
<i>Cypsiurus parvus</i>	Palm-swift, African	LC	Unlisted
<i>Hirundo cucullata</i>	Swallow, Greater Striped	LC	Unlisted
<i>Hirundo albigularis</i>	Swallow, White-throated	LC	Unlisted
<i>Vidua macroura</i>	Whydah, Pin-tailed	LC	Unlisted
<i>Pycnonotus tricolor</i>	Bulbul, Dark-capped	Unlisted	Unlisted
<i>Plegadis falcinellus</i>	Ibis, Glossy	LC	Unlisted
<i>Gallinula chloropus</i>	Moorhen, Common	LC	Unlisted
<i>Columba guinea</i>	Pigeon, Speckled	LC	Unlisted
<i>Passer domesticus</i>	Sparrow, House	LC	Unlisted
<i>Anas undulata</i>	Duck, Yellow-billed	LC	Unlisted
<i>Tachybaptus ruficollis</i>	Grebe, Little	LC	Unlisted
<i>Ardea melanocephala</i>	Heron, Black-headed	LC	Unlisted
<i>Mirafra africana</i>	Lark, Rufous-naped	LC	Unlisted
<i>Riparia paludicola</i>	Martin, Brown-throated	LC	Unlisted
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	LC	Unlisted
<i>Elanus caeruleus</i>	Kite, Black-shouldered	LC	Unlisted
<i>Macronyx capensis</i>	Longclaw, Cape	LC	Unlisted
<i>Prinia flavicans</i>	Prinia, Black-chested	LC	Unlisted
<i>Apalis thoracica</i>	Apalis, Bar-throated	LC	Unlisted
<i>Lybius torquatus</i>	Barbet, Black-collared	LC	Unlisted
<i>Batis molitor</i>	Batis, Chinspot	LC	Unlisted
<i>Laniarius ferrugineus</i>	Boubou, Southern	LC	Unlisted
<i>Cisticola aridulus</i>	Cisticola, Desert	LC	Unlisted
<i>Cisticola ayresii</i>	Cisticola, Wing-snapping	LC	Unlisted
<i>Hirundo spilodera</i>	Cliff-swallow, South African	LC	Unlisted
<i>Phalacrocorax carbo</i>	Cormorant, White-breasted	LC	Unlisted
<i>Amaurornis flavirostris</i>	Crake, Black	LC	Unlisted
<i>Anas sparsa</i>	Duck, African Black	LC	Unlisted
<i>Egretta garzetta</i>	Egret, Little	LC	Unlisted
<i>Falco vespertinus</i>	Falcon, Red-footed	NT	NT
<i>Amadina erythrocephala</i>	Finch, Red-headed	LC	Unlisted
<i>Corythaixoides concolor</i>	Go-away-bird, Grey	LC	Unlisted
<i>Megaceryle maximus</i>	Kingfisher, Giant	Unlisted	Unlisted
<i>Alcedo cristata</i>	Kingfisher, Malachite	Unlisted	Unlisted
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	LC	Unlisted

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	LC	Unlisted
<i>Spermestes cucullatus</i>	Mannikin, Bronze	Unlisted	Unlisted
<i>Riparia cincta</i>	Martin, Banded	LC	Unlisted
<i>Colius colius</i>	Mousebird, White-backed	LC	Unlisted
<i>Anthus leucophrys</i>	Pipit, Plain-backed	LC	Unlisted
<i>Dryoscopus cubla</i>	Puffback, Black-backed	LC	Unlisted
<i>Quelea quelea</i>	Quelea, Red-billed	LC	Unlisted
<i>Acrocephalus baeticatus</i>	Reed-warbler, African	Unlisted	Unlisted
<i>Philomachus pugnax</i>	Ruff, Ruff	LC	Unlisted
<i>Crithagra gularis</i>	Seedeater, Streaky-headed	LC	Unlisted
<i>Tadorna cana</i>	Shelduck, South African	LC	Unlisted
<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	LC	Unlisted
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	LC	Unlisted
<i>Cinnyris talatala</i>	Sunbird, White-bellied	LC	Unlisted
<i>Apus horus</i>	Swift, Horus	LC	Unlisted
<i>Apus affinis</i>	Swift, Little	LC	Unlisted
<i>Anas hottentota</i>	Teal, Hottentot	LC	Unlisted
<i>Amandava subflava</i>	Waxbill, Orange-breasted	Unlisted	Unlisted
<i>Phoeniculus purpureus</i>	Wood-hoopoe, Green	LC	Unlisted
<i>Jynx ruficollis</i>	Wryneck, Red-throated	LC	Unlisted
<i>Euplectes orix</i>	Bishop, Southern Red	LC	Unlisted
<i>Bostrychia hagedash</i>	Ibis, Hadedda	LC	Unlisted
<i>Anthus cinnamomeus</i>	Pipit, African	LC	Unlisted
<i>Acrocephalus gracilirostris</i>	Swamp-warbler, Lesser	LC	Unlisted
<i>Motacilla capensis</i>	Wagtail, Cape	LC	Unlisted
<i>Cisticola tinniens</i>	Cisticola, Levaillant's	LC	Unlisted
<i>Bubulcus ibis</i>	Egret, Cattle	LC	Unlisted
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	LC	Unlisted
<i>Vanellus coronatus</i>	Lapwing, Crowned	LC	Unlisted
<i>Passer melanurus</i>	Sparrow, Cape	LC	Unlisted
<i>Saxicola torquatus</i>	Stonechat, African	LC	Unlisted
<i>Euplectes progne</i>	Widowbird, Long-tailed	LC	Unlisted
<i>Fulica cristata</i>	Coot, Red-knobbed	LC	Unlisted
<i>Columba livia</i>	Dove, Rock	LC	Unlisted
<i>Spreo bicolor</i>	Starling, Pied	LC	Unlisted
<i>Streptopelia capicola</i>	Turtle-dove, Cape	LC	Unlisted
<i>Recurvirostra avosetta</i>	Avocet, Pied	LC	Unlisted
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	LC	Unlisted
<i>Trachyphonus vaillantii</i>	Barbet, Crested	LC	Unlisted
<i>Merops apiaster</i>	Bee-eater, European	LC	Unlisted
<i>Ixobrychus minutus</i>	Bittern, Little	LC	Unlisted
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	LC	Unlisted
<i>Emberiza capensis</i>	Bunting, Cape	LC	Unlisted
<i>Emberiza tahapisi</i>	Bunting, Cinnamon-breasted	LC	Unlisted
<i>Emberiza flaviventris</i>	Bunting, Golden-breasted	LC	Unlisted
<i>Buteo rufofuscus</i>	Buzzard, Jackal	LC	Unlisted

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Buteo vulpinus</i>	Buzzard, Steppe	Unlisted	Unlisted
<i>Serinus canicollis</i>	Canary, Cape	LC	Unlisted
<i>Crithagra flaviventris</i>	Canary, Yellow	LC	Unlisted
<i>Crithagra mozambicus</i>	Canary, Yellow-fronted	LC	Unlisted
<i>Cercomela familiaris</i>	Chat, Familiar	LC	Unlisted
<i>Cisticola aberrans</i>	Cisticola, Lazy	LC	Unlisted
<i>Cisticola chiniana</i>	Cisticola, Rattling	LC	Unlisted
<i>Thamnolaea cinnamomeiventris</i>	Cliff-chat, Mocking	LC	Unlisted
<i>Centropus burchellii</i>	Coucal, Burchell's	Unlisted	Unlisted
<i>Centropus superciliosus</i>	Coucal, White-browed	LC	Unlisted
<i>Cursorius temminckii</i>	Cursorer, Temminck's	LC	Unlisted
<i>Porzana pusilla</i>	Crake, Baillon's	LC	Unlisted
<i>Anthropoides paradiseus</i>	Crane, Blue	VU	NT
<i>Corvus capensis</i>	Crow, Cape	LC	Unlisted
<i>Cuculus solitarius</i>	Cuckoo, Red-chested	LC	Unlisted
<i>Oena capensis</i>	Dove, Namaqua	LC	Unlisted
<i>Dendrocygna bicolor</i>	Duck, Fulvous	LC	Unlisted
<i>Sarkidiornis melanotos</i>	Duck, Knob-billed	LC	Unlisted
<i>Anas platyrhynchos</i>	Duck, Mallard	LC	Unlisted
<i>Thalassornis leuconotus</i>	Duck, White-backed	LC	Unlisted
<i>Aquila verreauxii</i>	Eagle, Verreaux's	LC	VU
<i>Bubo africanus</i>	Eagle-owl, Spotted	LC	Unlisted
<i>Bubo lacteus</i>	Eagle-owl, Verreaux's	LC	Unlisted
<i>Egretta alba</i>	Egret, Great	LC	Unlisted
<i>Egretta intermedia</i>	Egret, Yellow-billed	LC	Unlisted
<i>Falco amurensis</i>	Falcon, Amur	LC	Unlisted
<i>Haliaeetus vocifer</i>	Fish-eagle, African	LC	Unlisted
<i>Phoenicopterus ruber</i>	Flamingo, Greater	LC	NT
<i>Phoenicopterus minor</i>	Flamingo, Lesser	NT	Unlisted
<i>Stenostira scita</i>	Flycatcher, Fairy	LC	Unlisted
<i>Muscicapa striata</i>	Flycatcher, Spotted	LC	Unlisted
<i>Scleroptila levillantii</i>	Francolin, Red-winged	LC	Unlisted
<i>Tyto capensis</i>	Grass-owl, African	LC	VU
<i>Sphenoeacus afer</i>	Grassbird, Cape	LC	Unlisted
<i>Podiceps nigricollis</i>	Grebe, Black-necked	LC	Unlisted
<i>Tringa nebularia</i>	Greenshank, Common	LC	Unlisted
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	LC	Unlisted
<i>Circus maurus</i>	Harrier, Black	EN	EN
<i>Egretta ardesiaca</i>	Heron, Black	LC	Unlisted
<i>Ardea goliath</i>	Heron, Goliath	LC	Unlisted
<i>Ardea purpurea</i>	Heron, Purple	LC	Unlisted
<i>Prodotiscus regulus</i>	Honeybird, Brown-backed	LC	Unlisted
<i>Indicator minor</i>	Honeyguide, Lesser	LC	Unlisted
<i>Upupa africana</i>	Hoopoe, African	LC	Unlisted
<i>Delichon urbicum</i>	House-martin, Common	LC	Unlisted
<i>Actophilornis africanus</i>	Jacana, African	LC	Unlisted

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Falco rupicoloides</i>	Kestrel, Greater	LC	Unlisted
<i>Falco naumanni</i>	Kestrel, Lesser	LC	Unlisted
<i>Falco rupicolus</i>	Kestrel, Rock	LC	Unlisted
<i>Milvus migrans</i>	Kite, Black	LC	Unlisted
<i>Milvus migrans</i>	Kite, Black	LC	Unlisted
<i>Milvus aegyptius</i>	Kite, Yellow-billed	Unlisted	Unlisted
<i>Eupodotis senegalensis</i>	Korhaan, White-bellied	LC	VU
<i>Mirafrja marjoriae</i>	Lark, Agulhas Clapper	Unlisted	Unlisted
<i>Certhilauda brevirostris</i>	Lark, Agulhas Long-billed	Unlisted	NT
<i>Certhilauda benguelensis</i>	Lark, Benguela Long-billed	Unlisted	Unlisted
<i>Mirafrja apiata</i>	Lark, Cape Clapper	LC	Unlisted
<i>Certhilauda curvirostris</i>	Lark, Cape Long-billed	LC	Unlisted
<i>Certhilauda semitorquata</i>	Lark, Eastern Long-billed	LC	Unlisted
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	LC	Unlisted
<i>Mirafrja cheniana</i>	Lark, Melodious	LC	LC
<i>Spizocorys conirostris</i>	Lark, Pink-billed	LC	Unlisted
<i>Calandrella cinerea</i>	Lark, Red-capped	LC	Unlisted
<i>Calendulauda sabota</i>	Lark, Sabota	LC	Unlisted
<i>Circus ranivorus</i>	Marsh-harrier, African	LC	EN
<i>Riparia riparia</i>	Martin, Sand	LC	Unlisted
<i>Nycticorax nycticorax</i>	Night-Heron, Black-crowned	LC	Unlisted
<i>Caprimulgus rufigena</i>	Nightjar, Rufous-cheeked	LC	Unlisted
<i>Tyto alba</i>	Owl, Barn	LC	Unlisted
<i>Asio capensis</i>	Owl, Marsh	LC	Unlisted
<i>Terpsiphone viridis</i>	Paradise-flycatcher, African	LC	Unlisted
<i>Vidua paradisaea</i>	Paradise-whydah, Long-tailed	LC	Unlisted
<i>Anthus vaalensis</i>	Pipit, Buffy	LC	Unlisted
<i>Anthus similis</i>	Pipit, Long-billed	LC	Unlisted
<i>Charadrius hiaticula</i>	Plover, Common Ringed	LC	Unlisted
<i>Glareola nordmanni</i>	Pratincole, Black-winged	NT	NT
<i>Pytilia melba</i>	Pytilia, Green-winged	LC	Unlisted
<i>Coturnix coturnix</i>	Quail, Common	LC	Unlisted
<i>Ortygospiza atricollis</i>	Quailfinch, African	LC	Unlisted
<i>Rallus caerulescens</i>	Rail, African	LC	Unlisted
<i>Acrocephalus arundinaceus</i>	Reed-warbler, Great	LC	Unlisted
<i>Monticola explorator</i>	Rock-thrush, Sentinel	NT	Unlisted
<i>Coracias garrulus</i>	Roller, European	LC	NT
<i>Coracias caudatus</i>	Roller, Lilac-breasted	LC	Unlisted
<i>Actitis hypoleucos</i>	Sandpiper, Common	LC	Unlisted
<i>Calidris ferruginea</i>	Sandpiper, Curlew	NT	LC
<i>Tringa stagnatilis</i>	Sandpiper, Marsh	LC	Unlisted
<i>Tringa glareola</i>	Sandpiper, Wood	LC	Unlisted
<i>Cercotrichas paena</i>	Scrub-robin, Kalahari	LC	Unlisted
<i>Sagittarius serpentarius</i>	Secretarybird, Secretarybird	VU	VU
<i>Accipiter badius</i>	Shikra, Shikra	LC	Unlisted
<i>Anas smithii</i>	Shoveler, Cape	LC	Unlisted

SPECIES NAME	COMMON NAME	IUCN (2017)	BIRDLIFE SA (2017)
<i>Lanius minor</i>	Shrike, Lesser Grey	LC	Unlisted
<i>Lanius collurio</i>	Shrike, Red-backed	LC	Unlisted
<i>Circaetus pectoralis</i>	Snake-eagle, Black-chested	LC	Unlisted
<i>Passer griseus</i>	Sparrow, Northern Grey-headed	LC	Unlisted
<i>Eremopterix leucotis</i>	Sparrowlark, Chestnut-backed	LC	Unlisted
<i>Platalea alba</i>	Spoonbill, African	LC	Unlisted
<i>Onychognathus morio</i>	Starling, Red-winged	LC	Unlisted
<i>Himantopus himantopus</i>	Stilt, Black-winged	LC	Unlisted
<i>Calidris minuta</i>	Stint, Little	LC	LC
<i>Ciconia abdimii</i>	Stork, Abdim's	LC	NT
<i>Ciconia ciconia</i>	Stork, White	LC	Unlisted
<i>Chalcomitra amethystina</i>	Sunbird, Amethyst	LC	Unlisted
<i>Cinnyris afer</i>	Sunbird, Greater Double-collared	LC	Unlisted
<i>Nectarinia famosa</i>	Sunbird, Malachite	LC	Unlisted
<i>Hirundo semirufa</i>	Swallow, Red-breasted	LC	Unlisted
<i>Apus barbatus</i>	Swift, African Black	LC	Unlisted
<i>Tachymarpis melba</i>	Swift, Alpine	LC	Unlisted
<i>Apus apus</i>	Swift, Common	LC	Unlisted
<i>Anas capensis</i>	Teal, Cape	LC	Unlisted
<i>Chlidonias leucopterus</i>	Tern, White-winged	LC	Unlisted
<i>Psophocichla litsipsirupa</i>	Thrush, Groundscraper	Unlisted	Unlisted
<i>Turdus olivaceus</i>	Thrush, Olive	LC	Unlisted
<i>Parus cinerascens</i>	Tit, Ashy	LC	Unlisted
<i>Motacilla aguimp</i>	Wagtail, African Pied	LC	Unlisted
<i>Motacilla flava</i>	Wagtail, Yellow	LC	Unlisted
<i>Sylvia borin</i>	Warbler, Garden	LC	Unlisted
<i>Acrocephalus palustris</i>	Warbler, Marsh	LC	Unlisted
<i>Acrocephalus schoenobaenus</i>	Warbler, Sedge	LC	Unlisted
<i>Phylloscopus trochilus</i>	Warbler, Willow	LC	Unlisted
<i>Ploceus capensis</i>	Weaver, Cape	LC	Unlisted
<i>Amblyospiza albifrons</i>	Weaver, Thick-billed	LC	Unlisted
<i>Ploceus cucullatus</i>	Weaver, Village	LC	Unlisted
<i>Zosterops virens</i>	White-eye, Cape	LC	Unlisted
<i>Zosterops pallidus</i>	White-eye, Orange River	LC	Unlisted
<i>Dendropicos fuscescens</i>	Woodpecker, Cardinal	LC	Unlisted

Annexure B: Expected Mammal Species

SPECIES	COMMON NAME	IUCN (2018)	SANBI (2016)	TOPS (2007)
<i>Aethomys ineptus</i>	Tete Veld Rat	LC	LC	None
<i>Alcelaphus buselaphus</i>	Red hartebeest	LC	LC	None
<i>Antidorcas marsupialis</i>	Springbok	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>Connochaetes gnou</i>	Black wildebeest	LC	LC	Protected
<i>Connochaetes taurinus</i>	Blue Wildebeest	LC	LC	None
<i>Crociodura cyanea</i>	Reddish-grey Musk Shrew	LC	LC	None
<i>Crociodura maquassiensis</i>	Maquassie Musk Shrew	LC	LC	None
<i>Cryptomys hottentotus</i>	Common Mole-rat	LC	LC	None
<i>Cynictis penicillata</i>	Yellow mongoose	LC	LC	None
<i>Damaliscus pygargus</i>	Blesbok	LC	LC	None
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	LC	LC	None
<i>Diceros bicornis</i>	Southwestern black rhinoceros	CR	EN	EN
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	NT	LC	None
<i>Elephantulus brachyrhynchus</i>	Short-snouted Sengi	LC	LC	None
<i>Elephantulus myurus</i>	Eastern rock sengi	LC	LC	None
<i>Epomophorus wahlbergi</i>	Wahlberg's Epauletted Fruit Bat	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>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>Herpestes sanguineus</i>	Slender Mongoose	LC	LC	None
<i>Hydrictis maculicollis</i>	Spotted-necked otter	NT	VU	Protected
<i>Hystrix africae australis</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>Leptailurus serval</i>	Serval	LC	NT	Protected
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC	None
<i>Lepus victoriae</i>	African savannah 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

SPECIES	COMMON NAME	IUCN (2018)	SANBI (2016)	TOPS (2007)
<i>Mus musculus</i>	House Mouse	LC	LC	None
<i>Myotis tricolor</i>	Temminck's Hairy Bat	LC	LC	None
<i>Myotis welwitschii</i>	Welwitsch'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>Neoromicia zuluensis</i>	Aloe bat	LC	LC	None
<i>Nycteris thebaica</i>	Egyptian slit-faced bat	LC	LC	None
<i>Orycteropus afer</i>	Aardvark	LC	LC	None
<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC	LC	None
<i>Otomys auratus</i>	Vlei Rat (Grassland type)	NT	NT	None
<i>Ourebia ourebi</i>	Oribi	LC	EN	EN
<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>Pedetes capensis</i>	Springhare	LC	LC	None
<i>Pelea capreolus</i>	Grey rhebok	LC	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>Pronolagus randensis</i>	Jameson's red rock rabbit	LC	LC	None
<i>Proteles cristata</i>	Aardwolf	LC	LC	None
<i>Raphicerus campestris</i>	Steenbok	LC	LC	None
<i>Rattus rattus</i>	House rat	LC	LC	None
<i>Redunca fulvorufula</i>	Mountain reedbuck	LC	EN	None
<i>Rhabdomys pumilio</i>	Xeric Four-striped Mouse	LC	LC	None
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	LC	None
<i>Rhinolophus darlingi</i>	Darling's 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>Steatomys krebsii</i>	Krebs's Fat Mouse	LC	LC	None
<i>Steatomys pratensis</i>	Fat Mouse	LC	LC	None
<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>Tragelaphus oryx</i>	Eland	LC	LC	None
<i>Vulpes chama</i>	Cape Fox	LC	LC	Protected

Annexure C: Expected Herpetofauna

SPECIES	SPECIES NAME	IUCN (2017)	SANBI (2014)
Reptiles			
<i>Afroedura nivaria</i>	Amatola Flat Gecko	LC	Endemic
<i>Trachylepis punctatissima</i>	Speckled Sand Skink	LC	LC
<i>Lamprophis aurora</i>	Aurora Snake	LC	Endemic
<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>Hemachatus haemachatus</i>	Rinkhals	LC	Near-Endemic
Amphibians			
<i>Pyxicephalus adspersus</i>	Giant bull frog	LC	NT
<i>Amietia delalandii</i>	Delalande's River Frog	LC	LC
<i>Amietia fuscigula</i>	Dark-throated 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>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>Semnodactylus wealii</i>	Rattling Frog	LC	LC
<i>Breviceps adspersus</i>	Bushveld Rain Frog	LC	LC
<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC	LC
<i>Cacosternum boettgeri</i>	Boettger's Caco	LC	LC
<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	LC
<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	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,

Selected Project Experience

Large scale ecological projects

YEAR	PROJECT TITLE	LOCATION	Position
2014	Dry season baseline aquatic zoological report: Mogale City – Krugersdrop Game Reserve	Gauteng Province, South Africa	Aquatic specialist
2017	Gauteng Environmental Outlook: Biodiversity Chapter	Gauteng Province, South Africa	Biodiversity Team leader and aquatic specialist
2018	North West Environmental Outlook: Biodiversity Chapter	North West Province, South Africa	Biodiversity Team leader and aquatic specialist

*Full project list and references available on request