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Ecological Impact Assessment Report

AN ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED STUDENT HOUSING DEVELOPMENT ON PORTION 191 OF THE FARM TWEEFONTEIN 915 LS, LIMPOPO PROVINCE

June 2020

Prepared for: KPD Property Development
Compiled by Dr BJ Henning
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AN ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED STUDENT HOUSING DEVELOPMENT ON PORTION 191 OF THE FARM TWEEFONTEIN 915 LS, LIMPOPO PROVINCE

June 2020

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	LEDET
	Registered Interested and Affected Parties

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Declaration

I, Dr BJ Henning declare that -

- I act as the independent specialist;
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent;
- 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 project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the 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 18 of the NEMA EIA Regulations;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the project proponent 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 project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent;
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

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SIGNATURE OF SPECIALIST

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NOTATIONS AND TERMS

Biota: living things; plants, animals, bacteria

Bottomland: the lowlands along streams and rivers, on alluvial (river deposited) soil.

Connectivity: in this context, referring to either the upstream-downstream or lateral (between the channel and the adjacent floodplain) connectivity of a drainage line. Upstream-downstream connectivity is an important consideration for the movement of sediment as well as migratory aquatic biota. Lateral connectivity is important for the floodplain species dependent on the wetting and nutrients associated with overbank flooding

Endorheic: closed drainage e.g. a pan.

Floristic: of flora (plants).

Floodplain: wetland inundated when a river overtops its banks during flood events resulting in the wetland soils being saturated for extended periods of time.

Gley: soil material that has developed under anaerobic conditions because of prolonged saturation with water. Grey and sometimes blue or green colours predominate but **mottles** (yellow, red, brown and black) may be present and indicate localised areas of better aeration.

Groundwater: subsurface water in the zone in which permeable rocks, and often the overlying soil, are saturated under pressure equal to or greater than atmospheric.

Horizon: see soil horizons.

Hydrophyte: any plant that grows in water or on a substratum that is at least periodically deficient in oxygen because of soil saturation or flooding; plants typically found in wet habitats.

Hydro-geomorphic: refers to the water source and geology forms.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland.

Infilling: dumping of soil or solid waste onto the wetland surface. Infilling generally has a very high and permanent impact on wetland functioning and is like drainage in that the upper soil layers are rendered less wet, usually so much so that the area no longer functions as a wetland.

Mottles: soils with variegated colour patters are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.

Organic soil material: soil material with a high abundance of un-decomposed plant material and humus.

Palustrine (wetland): all non-tidal wetlands dominated by persistent emergent plants (e.g. reeds) emergent mosses or lichens, or shrubs or trees (see Cowardin *et al.*, 1979).

Perched water table: the upper limit of a zone of saturation in soil, separated by a relatively impermeable unsaturated zone from the main body of groundwater.

Permanently wet soil: soil which is flooded or waterlogged to the soil surface throughout the year, in

most years.

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as **riparian wetlands**. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Roughness coefficient: an index of the roughness of a surface; a reflection of the frictional resistance offered by the surface to water flow.

Runoff: total water yield from a catchment including surface and subsurface flow.

Seasonally wet soil: soil which is flooded or waterlogged to the soil surface for extended periods (>1 month) during the wet season but is predominantly dry during the dry season.

Sedges: grass-like plants belonging to the family *Cyperaceae*, sometimes referred to as nutgrasses. Papyrus is a member of this family.

Soil drainage classes: describe the soil moisture conditions as determined by the capacity of the soil and the site for removing excess water. The classes range from very well drained, where excess water is removed very quickly, to very poorly drained, where excess water is removed very slowly. Wetlands include all soils in the very poorly drained and poorly drained classes, and some soils in the somewhat poorly drained class. These three classes are roughly equivalent to the permanent, seasonal and temporary classes

Soil horizons: layers of soil that have uniform characteristics and have developed through pedogenic processes; they are bound by air, hard rock or other horizons (i.e. soil material that has different characteristics).

Soil profile: the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991).

Soil saturation: the soil is considered saturated if the water table or **capillary fringe** reaches the soil surface (Soil Survey Staff, 1992).

Temporarily wet soil: the soil close to the soil surface (i.e. within 50 cm) is wet for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated at the surface for longer than a month.

Terrain unit classes: areas of the land surface with homogenous form and slope. Terrain may be seen as being made up of all or some of the following units: crest (1), scarp (2), midslope (3), footslope (4) and valley bottom (5).

Transpiration: the transfer of water from plants into the atmosphere as water vapour

Unchanneled valley bottom: linear fluvial, net depositional valley bottom surfaces which do not have a channel. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas.

Vegetation is defined in this context as the vegetation structural and compositional state.

Water regime: when and for how long the soil is flooded or saturated.

Water Quality largely self-explanatory and reflecting the changes in quality as a consequence of

changes in land use or as a direct result of activities within the wetland itself that could lead to changes in the quality of the water flowing through and within the wetland

Waterlogged: soil or land saturated with water long enough for anaerobic conditions to develop.

Wetland: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Wetland catchment: the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.

Wetland delineation: The determination and marking of the boundary of a wetland on a map.

LIST OF ABBREVIATIONS

Abbreviation	Description
ARC	Agricultural Research Council
C-Plan	Limpopo Conservation Plan
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPR	Environmental Management Programme Report
ENPAT	Environmental Potential Atlas
LEDET	Limpopo Department of Economic Development, Environment & Tourism
GIS	Geographic Information Systems
GPS	Geographical Positioning System
HGM	Hydro-Geomorphic
HFI	Hydrological Function and Importance
IHI	Index of Habitat Integrity
IUCN	World Conservation Union
MAE	Mean Annual Evaporation
MAMSL	Meter Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
PES	Present Ecological State
PESC	Present Ecological Status Class
PQ4	Priority Quaternary Catchment
QDS	Quarter Degree Square
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
WMA	Water Management Area
WHO	World Health Organisation

1 ASSIGNMENT

AGES Limpopo (Pty) Ltd was appointed by KPD Property Development to conduct an ecological impact assessment for the proposed student housing development on Portion 191 of the Farm Tweefontein 915 LS, Polokwane, Limpopo Province.

This report will include a detailed impact assessment of the proposed development on the biodiversity. This assessment is essential as it will contribute to meeting the requirements of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) in conjunction with Regulation 982 of 4 December 2014 (as amended), promulgated in terms of Section 24 (5) of NEMA.

The assignment is interpreted as follows: Compile an ecological study on the flora (vegetation units), fauna and general ecology of the site and determine the potential impacts of the proposed development on the fauna and flora of the area as well propose mitigation measures. The study will be done according to guidelines and criteria set by the Limpopo Department of Economic Development, Environment & Tourism (LEDET) for biodiversity studies. To compile this, the following had to be done:

1.1 INFORMATION SOURCES

- All relevant topographical maps, aerial photographs and information (previous studies and environmental databases) related to the ecological components in the study area;
- Requirements regarding the fauna and flora survey as requested by LEDET;
- Legislation pertaining to the fauna and flora study as relevant;
- Red data species list from the South African National Biodiversity Institute (SANBI).
- Information on plant and animal species recorded for the various Quarter Degree Squares was extracted from the SABIF/SIBIS database hosted by SANBI and the faunal databases hosted by the Animal Demography Unit (ADU). This includes a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas were obtained from the various coverages produced by the Limpopo C-Plan (2014).

1.2 REGULATIONS GOVERNING THIS REPORT

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) - Regulation No. R982

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 38282 Government Notice R. 982 of 4 December 2014 (as amended). Appendix 6 – Specialist reports include a list of requirements to be included in a specialist report:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae;
    b. A declaration that the specialist is independent in a form as may be specified by the competent authority;
    c. An indication of the scope of, and purpose for which, the report was prepared;
    d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment;
    e. A description of the methodology adopted in preparing the report or carrying out the specialized process;
    f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
    g. An identification of any areas to be avoided, including buffers;
    h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
    i. A description of any assumptions made and any uncertainties or gaps in knowledge;
    j. A description of the findings and potential implications of such findings on the impact of the activity, including identified alternatives, on the environment;
    k. any mitigation measures for inclusion in the EMPr;
    l. any conditions for inclusion in the environmental authorisation;
    m. any monitoring requirements for inclusion in the EMPr or environmental authorisation

n. a reasoned opinion –

   i. As to whether the activity or portions thereof should be authorised and

   ii. If the opinion is that the activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan;

o. A description of any consultation process that was undertaken during the course of preparing the specialist report;

p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

q. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

1.2.2 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

This Act regulates the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

1.2.3 National Environmental Management Biodiversity Act (Act 10 of 2004) (NEMBA)

The following aspects of the NEMBA (2004) are important to consider in the compilation of an ecological report. It:

- Lists ecosystems that are threatened or in need of national protection;
- Links to Integrated Environmental Management processes;
- Must be taken into account in EMPs and IDPs;
- The Minister may make regulations to reduce the threats to listed ecosystems.

1.2.4 The National Forest Act (Act 84 of 1998) (NFA)

In terms of section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister of Agriculture, Forestry and Fisheries.

1.2.5 Limpopo Environmental Management Act (Act 7 of 2003) (LEMA)

The LEMA deals with the conservation of wild animals, freshwater fish and the conservation and protection of flora in the Limpopo Province. Animals and plants are both listed in the schedules with different degrees of protection afforded to each.

1.3 TERMS OF REFERENCE

1.3.1 Objectives

1. The primary aim of this project is to investigate options for enhancing and / or maintaining biodiversity to mitigate the impact of the development and related infrastructure with the overall objective of preventing further loss of biodiversity. The end product would be a tool for promoting and lobbying for the recognition of the importance of species habitat and habitat conservation. Options available to maintain the current level of floral diversity include:
    a. Protection of native vegetation restored elsewhere in return for unavoidable clearing;
    b. Minimisation of habitat fragmentation;
    c. Minimisation of any threats to the native flora and fauna and their habitats during the construction and operational phases of the developments and;
    d. Rehabilitation to establish plant communities / landscaping that will provide future habitat values.
2. To produce a clear and agreed species and habitat priorities for conservation actions. This includes the following:
    i. Determine the ecological impacts and actions the development will have on the biodiversity on a species and habitat level;
    ii. Conduct a risk analyses of the impacts identified to determine the significance of the impacts on the fauna and flora of the study area;
    iii. Protection and enhancement of vegetation / habitats of high conservation value;
    iv. The retention of a substantial amount of native vegetation / habitat of adequate size and configuration to promote the conservation of the existing flora communities;
    v. The retention and / or creation of vegetation links, wildlife corridors and vegetation buffers wherever possible, subject to the appropriate bush fire risk management; and
    vi. The protection of water quality in the locality so as not to threaten native aquatic flora that rely on the watercourse for survival.
3. Provide recommendations on the ecological mitigation measures to be implemented by the developer and the way forward.

1.3.2 Scope

1. Conduct a field study to determine the state of the vegetation on site:
    i. After studying the aerial photograph determine the previous state of the vegetation compared to the current state of the vegetation on site;
    ii. Conduct a site visit and list the plant species (trees, shrubs, grasses, succulents and other herbaceous species of special interest) present for plant communities still present after construction;
    iii. Identify potential red data plant species, possible encroacher species, medicinal plants of value and exotic plant species.
2. Determine the ecological impact the development will have on the fauna and flora of the site and conduct an impact rating assessment.
3. Fauna scoping
    a. List the potential fauna (mammal species, red data birds, reptiles, amphibians, invertebrates) present linked to the specific potential habitats that occur as identified in the vegetation survey.
    b. Analyse the data and identify potential red data fauna species, as well as other endemic or protected species of importance.
    c. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the fauna of the area.
4. General
    a. Identify and describe ecologically sensitive areas. Create a sensitivity map to indicate specific sensitive areas based on various environmental parameters such as natural vegetation in a good condition, rockiness, slopes, flood lines etc.
    b. Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, degraded areas, reclamation areas.
    c. Make recommendations, impact ratings and risk assessments for each specific impact.

1.3.3 Limitations and assumptions

- Maintaining due cognisance of the integrity and accuracy of the ecological survey, it should be stated that the ecological resources identified during the study do not necessarily represent all the ecological resources present on the property;
- To obtain a comprehensive understanding of the dynamics of communities and the status of endemic, rare or threatened species in an area, ecological studies should ideally be replicated over several seasons and over a few years. However, due to project time constraints such long-term studies are not feasible;

- Most threatened plant species are extremely seasonal and only flower during specific periods of the year,
- The majority of threatened faunal species are extremely secretive and difficult to survey even during thorough field surveys conducted over several seasons;

Thus, even though it might be assumed that survey findings are representative of the ecosystem of the site for the development activities, it should be stated that the possibility exists that individual plants species might have been missed due to the nature of the terrain and size of the study area. Therefore, maintaining due cognisance of the integrity and accuracy of the ecological survey, it should be stated that the ecological resources identified during the study do not necessarily represent all the ecological resources present on the property.

2 METHODS

2.1 VEGETATION SURVEY

Two basic methods were used during the vegetation survey:

- Line transects were walked on the site surveyed to record the plant species present. Rare and threatened plant species and any botanically sensitive sites or habitats were searched for in the various vegetation units.
- The Braun-Blanquet survey technique to describe plant communities as ecological units was also used for this study. It allows for the mapping of vegetation and the comparison of the data with similar studies in the area.

The vegetation survey was conducted on site during May 2020. The vegetation was in a moderate to good condition and most species could be identified, although some species might have been missed because of the dense vegetation cover. No further surveys were necessary for the project area.

2.1.1 Data recorded:

Plant names used in this report are in accordance with Arnold & De Wet (1993), except for a few newly revised species. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence as well as potential fauna habitat that might occur.

2.1.2 Red data species

A species list of the red data species previously recorded in the vicinity of the development was obtained from the South African Biodiversity Institute (SANBI), South Africa as classified by the IUCN red data list categories.

2.1.3 Protected trees

A species list of the protected tree species was obtained from the Department of Forestry. These trees are listed by the NFA (Act 84 of 1998) as protected.

2.1.4 Protected plants

A list of protected and specially protected plants was obtained from the LEMA.

2.1.5 Data processing

A classification of vegetation data was done to identify, describe and map vegetation types. The descriptions of the vegetation units include the tree, shrub and herbaceous layers.

Conservation priority of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Limpopo Province, as

well as the vegetation type.

The following four conservation priority categories were used for each vegetation unit:

- High: Ecologically sensitive and valuable land with high species richness that should be conserved and no development allowed.
- Medium: Land that should be conserved but on which low impact development could be considered with the provision of mitigation measures.
- Medium-low: Land that has some conservation value but on which development could be considered with limited impact on the vegetation / ecosystem. It is recommended that certain sections of the vegetation be maintained.
- Low: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation / ecosystem.

2.2 FAUNA SURVEY

The fauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the vegetation units. Fauna observed on site or any specific indication of species was noted as confirmed in the species lists.
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area.

2.2.1 Data recorded:

A list of all species of fauna and their status as observed on the site or that could potentially occur on the site, were compiled. Notes were made of any specific sensitive or specialized habitats that occur on the site.

2.2.2 Red data species lists

A species list of the red data species of the different faunal classes was obtained from the following references:

- Red Data Book of the Mammals of South Africa (Friedman & Daly, 2004)
- The Atlas of the Southern African Birds - digital data on quarter degree grid data (Avian Demography Unit, University of Cape Town)
- Atlas and red data book of the frogs of South Africa, Lesotho and Swaziland (Minter et al. 2004)
- South African Red Data Book – Reptiles and Amphibians. National Scientific Programmes Report no. 151;

2.2.3 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the faunal species. In addition to species observed on the site, lists of the potential mammal, bird, reptile, amphibian and insect species were compiled and mitigating measures recommended if needed.

2.3 IMPACT RATING ASSESSMENT MATRIX

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability. This describes the likelihood of the impact occurring:

- Improbable: The possibility of the impact occurring is very low, due to the circumstances, design or experience.
- Probable: There is a probability that the impact will occur to the extent that provision must be made therefore.
- Highly Probable: It is most likely that the impact will occur at some stage of the development.
- Definite: The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.

Duration. The lifetime of the impact:

- Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- Medium term: The impact will last up to the end of the phases, where after it will be negated.
- Long term: The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale. The physical and spatial size of the impact:

- Local: The impacted area extends only as far as the activity, e.g. footprint.
- Site: The impact could affect the whole, or a measurable portion of the above-mentioned properties.

- Regional: The impact could affect the area including the neighbouring areas.

Magnitude/ Severity. Does the impact destroy the environment, or alter its function:

- Low: The impact alters the affected environment in such a way that natural processes are not affected.
- Medium: The affected environment is altered, but functions and processes continue in a modified way.
- High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance. This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required:

- Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8

Aspect	Description	Weight
Significance	Sum (Duration, Scale, Magnitude) x Probability	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for the development.

2.4 SENSITIVITY ASSESSMENT

The ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity.

2.4.1 Ecological function

The ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

2.4.2 Conservation importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

2.4.3 Sensitivity scale

- High – sensitive ecosystem with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems or with high species diversity and usually provide suitable habitat for a few threatened or rare species. These areas should be protected;
- Medium – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems or ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species;
- Low – Degraded and highly disturbed / transformed systems with little ecological function and which are generally very poor in species diversity.

2.5 EIA SCREENING TOOL

The significance of a site or natural feature may only become apparent when it is evaluated in terms of a broader biodiversity context. Put differently, local impacts on biodiversity may

seem unimportant, but can become highly significant when interpreted beyond the immediate boundaries of a site. Even if a locality has a history of disturbance such as alien infestation, cultivation or recurrent fires, and it does not host any plant or animal species of special concern, it may nevertheless be significant for biodiversity conservation when viewed from a landscape or even national perspective.

According to the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended, the following species might occur on site and the biodiversity assessment should focus on these species during the field work:

Flora:2 forb species

- *Commelina rogersii*
    - Sensitivity: Medium
    - Status: Vulnerable
- *Sensitive species 1278*
    - Sensitivity: Medium
    - Status: Endangered
- *Sensitive species 1252*
    - Sensitivity: Medium
    - Status: Vulnerable
- *Sensitive species 550*
    - Sensitivity: Medium
    - Status: Critically Endangered
- *Sensitive species 605*
    - Sensitivity: Medium
    - Status: Critically Endangered
- *Sensitive species 278*
    - Sensitivity: Medium
    - Status: Endangered.

3 STUDY AREA

3.1 LOCATION AND DESCRIPTION OF ACTIVITY

The project is within the Capricorn District Municipality and Polokwane Local Municipality and is located east of the R81 road about 2 kilometers southwest of the Mall of the North (see Figure 1). At present access to the site is gained directly from the R81 and Romulus Drive (see figure 1). The project entails the development of student housing on portion 191 of the farm Tweefontein 915 LS. The site is located approximately 1340m above mean seal level (masl). The surrounding topography is generally slightly undulating plains. The aerial map of the site is presented in Figure 2.

Figure 1. Regional location map of the project area

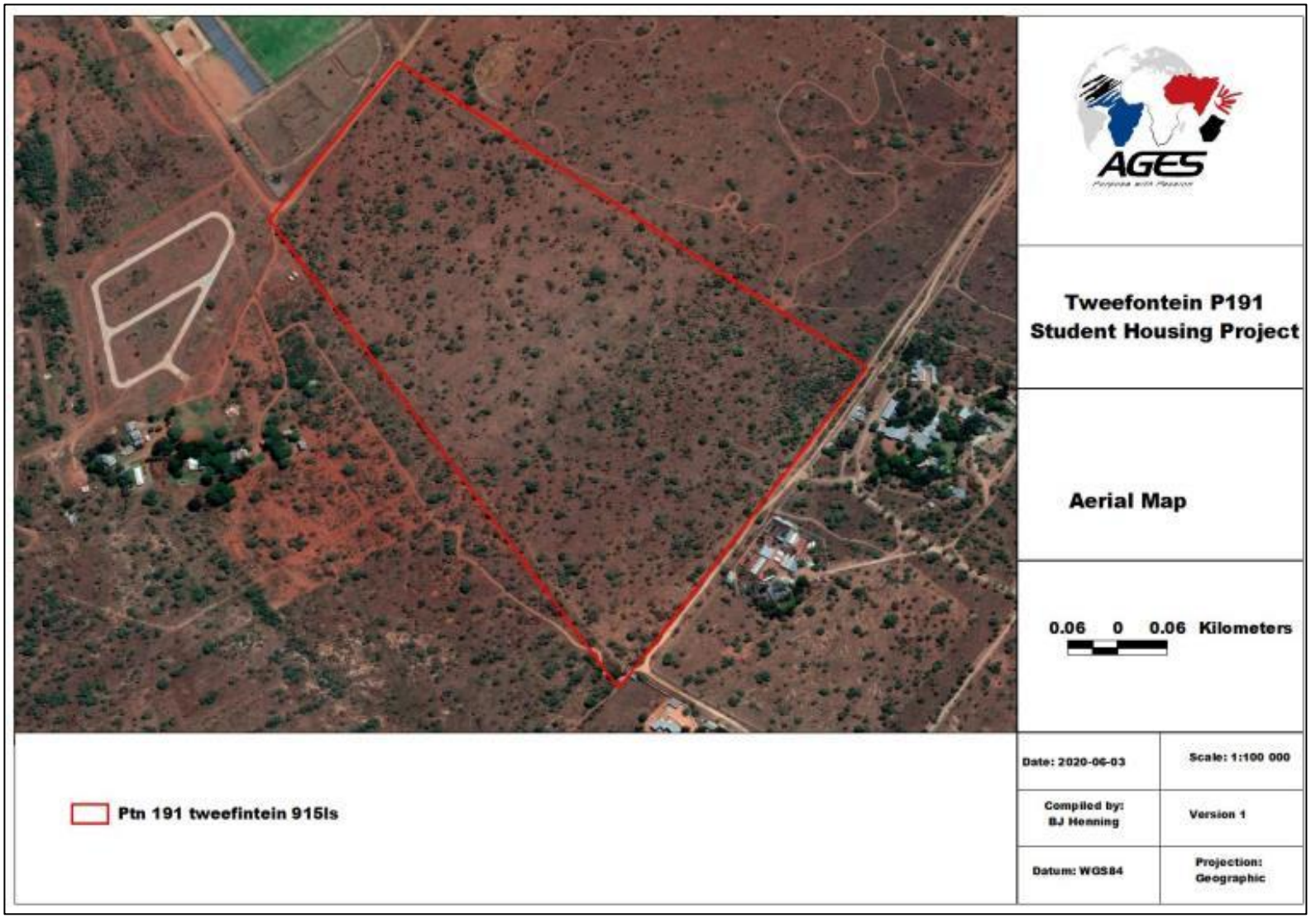

Figure 2. Aerial map of the project area

3.2 CLIMATE

Climate in the broad sense is a major determinant of the geographical distribution of species and vegetation types. However, on a smaller scale, the microclimate, which is greatly influenced by local topography, is also important. Within areas, the local conditions of temperature, light, humidity and moisture vary greatly, and it is these factors which play an important role in the production and survival of plants (Tainton, 1981). In terrestrial environments, limitations related to water availability are always important to plants and plant communities. The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987). Furthermore, aspects like topography, slope and altitude may further result in differences in precipitation and water availability to plants within the study area.

Mean annual precipitation varies between 400 to 600mm. Furthermore, aspects like topography, slope and altitude may result in differences in precipitation and water availability to plants within the study area. Frost occurs infrequent. Mean monthly maximum and minimum temperatures for Polokwane are 33.2˚C and 0.6˚C for October and June, respectively.

3.3 GEOLOGY AND SOIL TYPES

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type unit represented within the study area include the Fa538 (Land Type Survey Staff, 1987) (ENPAT, 2001). The soil types in the study area are mostly determined by position on the landscape, and the most dominant soils on the development site are deep, red apedal soils of the Hutton soil form on the slightly undulating plains, while the shallower soils in between the deeper soils represent gravelly Glenrosa or very rocky Mispah soils. The land types, geology and associated soil types are presented in Table 1 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Table 1. Land types, geology and dominant soil types of the proposed development site

Landtype	Soils	Geology
Fa538	Glenrosa and/or Mispah forms (other soils may occur), lime rare or absent in the entire landscape	Leucocratic migmatite and gneiss, grey and pink hornblende-biotite gneiss, grey biotite gneiss; minor muscovite-bearing granite, pegmatite, and gneiss of the Mount River Gneiss. Grey and pink biotite granite of the Turfloop Granite.

3.4 TOPOGRAPHY

When assessing the ecology of an area, it is important to know in which eco-region it is located. The study area forms part of the Northern Plateau Eco-region. According to the Environmental Potential Atlas of South Africa (ENPAT, 2000) the project area is classified as being “Dissected Plains”. The slopes of the study area are classified as being between 1 and 9 degrees. The project area is characterised by slightly undulating plains, with a rocky outcrop area in the southern section of the

site. The topography across the site is slightly undulating with the average elevation of 1540 mamsl.

3.5 DRAINAGE

The project area is situated within the quaternary catchments, A71A (small northern section) and A71B (remainder of the site). The Sand River is located to the west of the site. The study area is drained mainly by surface run-off (i.e. sheetwash) with surface water flowing into non-perennial streams of the study area. This water eventually drains into the Sand River. It must be noted that stream flow along the non-perennial drainage channels occurs only during and directly after heavy precipitation events and may continue for a short period directly after a particularly good rainy season.

3.6 LAND USE AND EXISTING INFRASTRUCTURE

The land-use of the proposed development site is used for livestock grazing, while the surrounding areas are mainly used for residential estates and livestock grazing. The major land use of the study area as classified by the Environmental Potential Atlas of South Africa (2000) is vacant land.

4 RESULTS

4.1 VEGETATION

4.1.1 Biomes

The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Polokwane Plateau Bushveld.

4.1.2 Vegetation types

The terrain morphology is slightly undulating plains. The indigenous flora of the Polokwane Plateau Bushveld (Mucina & Rutherford, 2006) has been degraded to a large extent because of agricultural activities and overgrazing. As a result, very little pristine habitats exist in this sensitive ecosystem. The Polokwane Plateau Bushveld as an entity is however still classified as having a least threatened conservation status with about 9% statutorily conserved and more than 3% transformed, mainly by cultivation. The vegetation units of the site vary between open woodland to denser woodland associated with outcrops.

4.1.3 Vegetation units

Vegetation units were identified during the ecological surveys according to plant species composition, previous land-use, soil types and topography. The state of the vegetation of the proposed development site varies from open woodland to a pristine rocky ridge. The study area is vacant land at present.

The vegetation map indicates the location of the plant communities in the larger project area (Figure 3). The vegetation communities identified on the proposed development site during the ecological surveys are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are classified according to the land-use and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics. A species list for the area was identified during the field surveys and photographs are included. The aim of the study was to determine the suitability of the area from an ecological perspective for the proposed development activities.

After the initial ecological surveys of the study area, the analysis of the data resulted in the identification of 3 major vegetation units on the proposed development site. The plant species for the QDS as listed by the Sanbi PRECIS database is included in Appendix A, while the detailed species list for each vegetation unit is included in Appendix B. The following vegetation units was documented on site:

- *Vachellia tortilis – Dichrostachys cinerea* woodland
- *Open Vachellia tortilis – Gymnosporia senegalensis – Aloe marlothii* woodland
- *Combretum molle – Searsia leptodictea – Aloe marlothii* rocky ridge

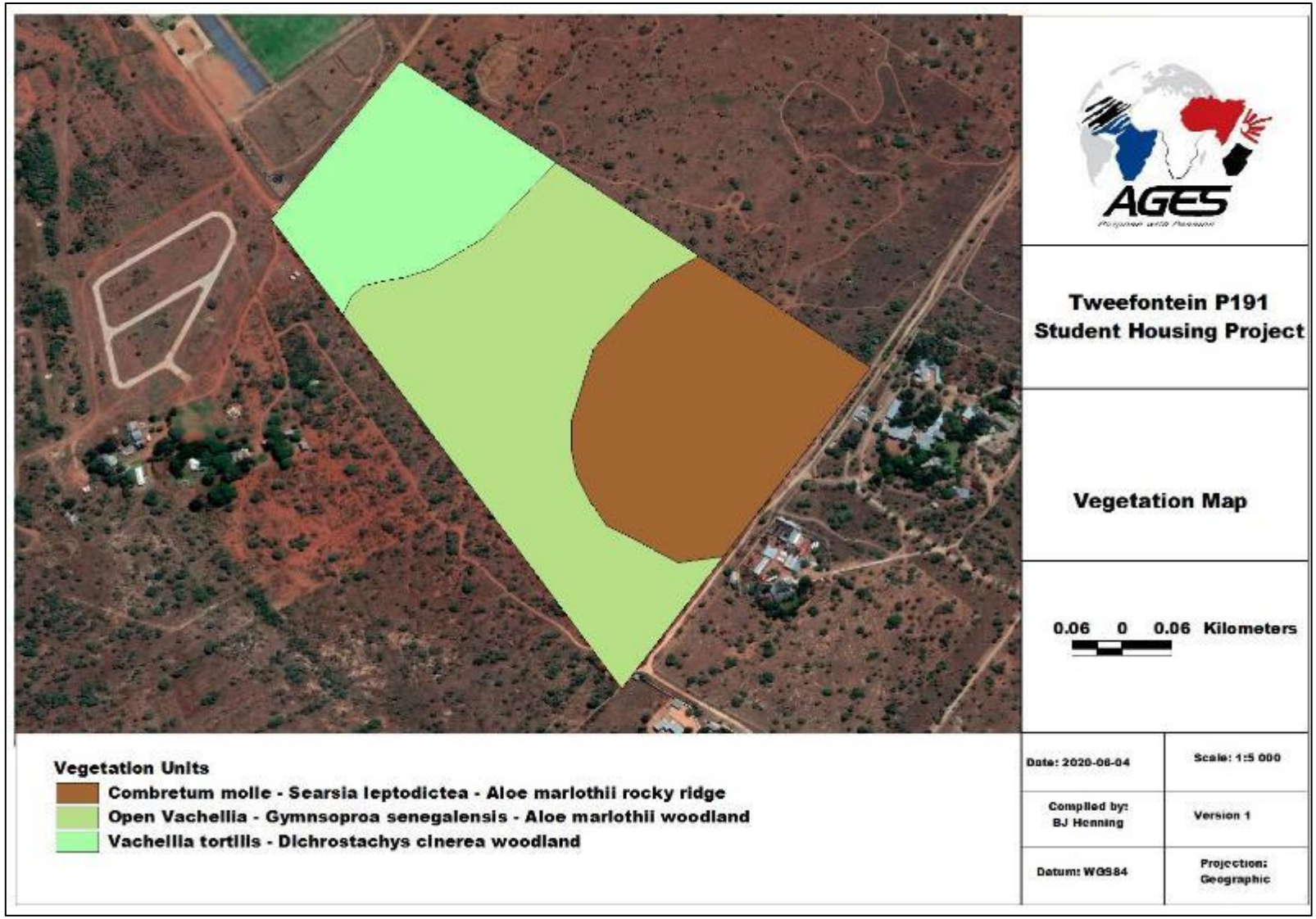

Figure 3. Vegetation Unit Map of the proposed development area

4.1.3.1 *Vachellia tortilis – Dichrostachys cinerea* woodland

The microphyllous woodland occurs in the northern section of the project area on the slightly undulating to flat plains on red apedal soils derived from Gneiss. The woody layer is characterised by *Vachellia tortilis* and *Dichrostachys cinerea*, while the grass layer is dominated by species such as *Aristida congesta, Eragrostis rigidior* and *Digitaria eriantha*. No red data species occurs; probably because of the habitat being different compared to the potential red data species that could occur. The state of the vegetation is indicated in photograph 1, while the characteristics of the variations of this vegetation unit are summarized in Table 2.

Table 2. Botanical analysis and characteristics of the *Vachellia tortilis – Dichrostachys cinerea* woodland

State of the vegetation:	Indigenous woodland in a slightly degraded state
Characteristics	Open woodland on red apedal soils
Dominant plant species	*Vachellia tortilis, Dichrostachys cinerea, Gymnosporia senegalensis, Aristida congesta, Eragrostis rigidior* and *Digitaria eriantha*
Density of woody layer	Trees: 5-10% (avg. height: 3-6m) Shrubs: 5-10% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 50-60% (avg. height: 0.8m) Forbs: <1% (avg. height: 0.5m)
Conservation priority	Medium
Sensitivity	Medium
Red data species	None observed
Protected tree species	Isolated Marula trees

The following specific recommendations and conclusions were made for this vegetation unit:

- The vegetation unit is classified as having a Medium Sensitivity due to the state of the vegetation and distribution of this vegetation entity through the area. The development in this area is considered suitable from an ecological point of view, if mitigation measures are implemented.

Photograph 1. State of the *Vachellia tortilis – Dichrostachys cinerea* woodland in the project area

4.1.3.2 Open *Vachellia tortilis – Gymnosporia senegalensis – Aloe marlothii* woodland

This woodland type forms a very open layer and occurs in the central and southwestern section of the site. The landscape is slightly undulating to moderately undulating plains on shallow rocky to gravelly soils. Where the substrate is deeper the woody layer is characterised in denser termitaria bushclumps dominated by species such as *Gymnospora senegalensis, Ziziphus mucronata, Searsia lancea, Clerodendrum glabrum* and *Ehretia rigida*. The area surrounding the bushclumps forms open woodland. The woody layer is characterised by *Gymnosporia senegalensis, Aloe marlothii* and *Senegalia caffra*, while the grass layer is dominated by species such as *Aristida congesta, Eragrostis lehmanniana* and *Schizachyrium sanguineum*. No red data species occurs; probably because of the habitat being different compared to the potential red data species that could occur. The state of the vegetation is indicated in photograph 2, while the characteristics of the variations of this vegetation unit are summarized in Table 3.

Table 3. Botanical analysis and characteristics of the Open *Vachellia tortilis – Gymnosporia senegalensis – Aloe marlothii* woodland

State of the vegetation:	Open to very open woodland / grassland in a natural to slightly degraded (overgrazed) state
Characteristics	Open woodland on red apedal soils
Dominant plant species	*Vachellia tortilis, Senegalia caffra, Gymnosporia senegalensis, Aristida congesta, Eragrostis lehmanniana* and *Schizachyrium sanguineum*

Density of woody layer	Trees: 2-5% (avg. height: 3-6m) Shrubs: 2-5% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 50-60% (avg. height: 0.8m) Forbs: <1% (avg. height: 0.5m)
Conservation priority	Medium
Sensitivity	Medium
Red data species	None observed

Photograph 2. Open *Vachellia tortilis – Gymnosporia senegalensis – Aloe marlothii* woodland in the project area

The following are recommended for development in this vegetation unit:

- The vegetation unit is classified as having a Medium Sensitivity due to the state of the vegetation and distribution of this vegetation entity through the area. The development in this area is considered suitable from an ecological point of view, if mitigation measures are implemented.
- A permit application needs to be submitted to the Department of Forestry to obtain a licence for the eradication of the Marula trees if needed, otherwise the trees could be incorporated as part of the landscaping.

4.1.3.3 Combretum molle – Searsia leptodictea – Aloe marlothii rocky ridge

This vegetation unit forms part of the ridge in the south-eastern and southern section of the site. The area is characterised by slightly to moderately undulating slopes, although the area

is not as steep as the typical ridges in the larger area. The woody layer forms an open woodland structure in between typical rocky grassland (Photograph 3) characterised by indicator woody species such as *Combretum molle, Aloe marlothii, Senegalia caffra, Vangueria infausta*, *Dombeya rotundifolia* and *Searsia leptodictea*, while the herbaceous layer is dominated by grass species such as *Loudetia simplex, Schizachyrium sanguineum, Xerophyta retinervis* and *Brachiaria serrata.* Dense stands of *Aloe marlothii* indicate the presence of an old iron age site of archaeological significance (Photograph 4) on top of the ridge area.

Rocky outcrops in the Savanna and Grassland Biomes of South Africa are often habitats for red data and endemic species of an area, while also supporting a unique floral and faunal species composition. No red data species were documented during the surveys. The area could potentially support red data species though and plays an important role for smaller mammals and reptiles that utilize the area.

The main factors which contributed to the area being classified as a high sensitivity (ridge section) was the slopes, rockiness, plant species composition, pristine state of the vegetation, microhabitats and potential red data fauna that utilize this area as habitat. A unique diversity of plant species occur within this unit. The characteristics of both variations of this vegetation unit are presented in Table 4, while the state of the vegetation is presented in photograph 3 and 4:

Table 4. Botanical analysis and characteristics of the rocky ridge in the project area

State of the vegetation:	Pristine state to slightly degraded
Characteristics	Varies from an open woodland to a typical rocky grassland. Medium – large sized rocks on outcrops with some rocky sheets along footslopes. Areas with boulders provide habitat to various woody species and shrubs
Dominant plant species	*Combretum molle, Aloe marlothii, Senegalia caffra, Vangueria infausta*, *Dombeya rotundifolia* and *Searsia leptodictea*, *Loudetia simplex, Schizachyrium sanguineum, Xerophyta retinervis* and *Brachiaria serrata*
Density of woody layer	Trees: 10% (avg. height: 3-6m) Shrubs: 10% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 30-40% (avg. height: 1.2m) Forbs: <1 (avg. height: 0.5m)
Sensitivity	High (ridge)
Conservation priority	High
Red data species	None observed although high potential for various species
Protected tree species	None observed

The following are recommended for development in this vegetation unit:

- The rocky ridge is classified as having a High Sensitivity due to the rocky nature of

the soils, potential red data species habitat and unique plant species composition as part of the larger landscape. The development should aim to conserve this area as part of the educational facility for hiking trails and environmental awareness excursions.

Photograph 3. Rocky ridge in the project area

Photograph 4. Dense stands of *Aloe marlothii* on top of the ridge indicating an old archaeological site

4.2 FLORA: SPECIES LEVEL ASSESSMENT

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. The major threats to plants in the study area are urban expansion, non-sustainable harvesting, collecting, overgrazing/browsing, mining and agriculture. The objective of this section was to compile a list of plant species for which there is conservation concern. This included threatened, rare, declining, protected and endemic species.

4.2.1 Species of conservation concern

Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient – Insufficient Information (DDD). It should also be noted that not all species listed as protected are threatened or vice versa.

Threatened species are also seen as indicators of the overall health of an ecosystem (Hilton-Taylor, 1996). No individuals of the endemic or biogeographically important plants listed by Mucina & Rutherford for the relevant vegetation types were observed during the survey as a result of the habitat not being suitable, while the degraded state of the vegetation for the remainder of the area makes the probability of finding these species improbable, even though it might have been previously found in the larger area. Habitat degradation is one of the main reasons for plant species becoming extinct in an area. A list of SCC plant species previously recorded in the study area was obtained from the Plants of Southern Africa (POSA) database of SANBI. Figure 4 indicates the classification system used by SANBI for SCC:

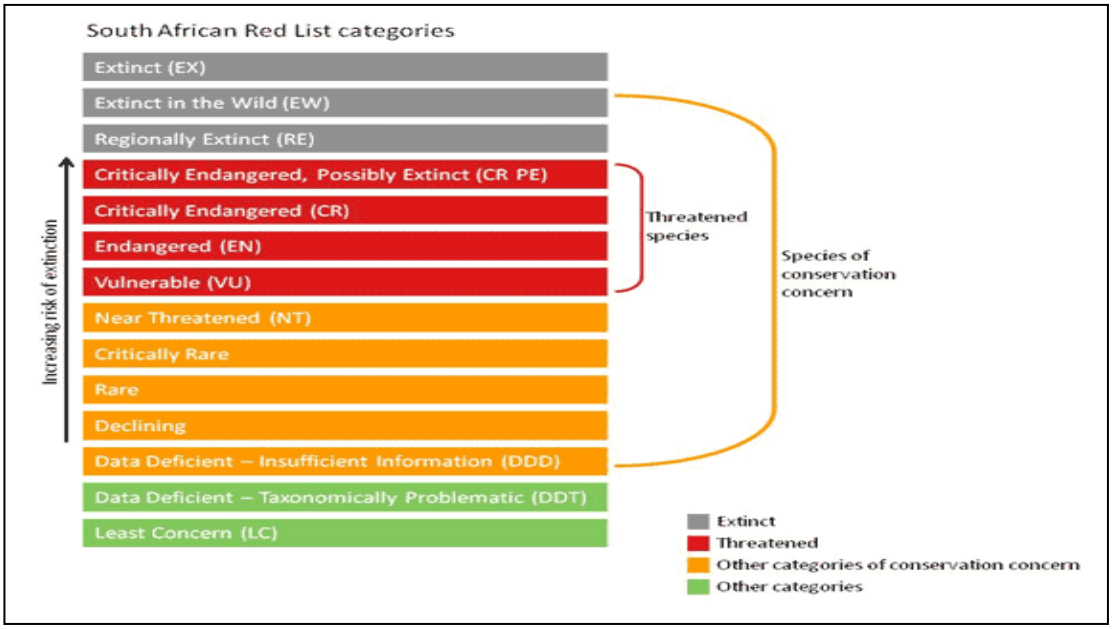

Figure 4 South African red list categories indicating the categories to be used for Species of Conservation Concern

According to the SANBI POSA database for the area, no red listed species occur in the project area. The EIA screening tool however indicated the potential presence of the species *Commelina rogersii.*

4.2.1.1 Site assessment for red listed species according to the EIA screening tool

4.2.1.1.1 *Commelina rogersii* and habitat features

Commelina rogersii is classified as VULNERABLE by the SANBI red listed database. This forb species is a rarely collected species recorded from grasslands around Polokwane with one collection from the Soutpansberg near Louis Trichardt. Its range is estimated at 3800 km² and known from less than 10 locations. On the northern and southern ends of its range it is declining due to urban expansion and habitat degradation from livestock overgrazing.

The potential that any population of *Commelina rogersii* potentially occur on the application site is considered as LOW, due to degraded habitats in the surrounding areas and most of the site representing woodland that is not considered optimal habitat for the species.

The field surveys on the areas also indicated that no populations of *Commelina rogersii* occur on site.

4.2.1.1.2 Sensitive species 1278

This species occurs in rocky outcrops and hill slopes in short, open sparse woodland and is a rare and very poorly known species. Its EOO is estimated <1000 km², plants at two known locations continue to decline due to ongoing habitat loss and degradation.

This species is threatened by habitat loss to crop cultivation at Mookgophong, and urban expansion around Polokwane. Dyer (1980) states that Galpin indicated that the species was extremely rare due to the edible tubers being collected. It has possibly declined in rural areas due to plants being used for food.

Probability of occurrence on site: MODERATE due to suitable habitat occurring in the project area, although no population was documented. Monitoring should be implemented during construction phase of the development.

Probability of impact during vegetation clearance: LOW, due to none of the suitable habitat forming part of the development footprint area. No population of the species was documented.

4.2.1.1.3 Sensitive species 1252

There was a large population decline from 1955-1960 as a result of indiscriminate commercial harvesting for diosgenin, a substance that was used to manufacture cortisone and other steroid hormones. Exploitation of tubers for the local medicinal plant trade is ongoing and is preventing recovery. The overall decline is estimated to be >30% over the past 90 years (generation length estimated to be 30 years).

Cunningham (1993) classified the species as "vulnerable and declining" in a preliminary assessment of the threat status of a number of heavily exploited medicinal plants. According to Scott-Shaw (1999) the species is becoming very rare in areas where it is heavily exploited. However, according to David Styles (pers. comm. 2007) although whole tubers of this species are frequently seen in the Durban muthi markets, it can still be found with relative ease in the wild, even in places relatively close to Durban such as the KwaZulu-Natal Midlands around Nottingham Road. Cunningham (1993) estimated that about 16.3 tons of the species is traded in the Durban markets annually. This translates to between 500 and 2 000 plants per year, based on Codd's estimate that the average tuber weighs between 9 and 30 kg (Codd 1960). Although this species is highly sought after (Scott-Shaw 1999), Mander (1998), in a detailed study of the KwaZulu-Natal medicinal plant trade, do not include the species among the most popular species or species nominated by traders as being in short supply.

The species occurs mainly in wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.

Probability of occurrence on site: LOW due to no suitable habitat occurring in the project area.

Probability of impact during vegetation clearance: LOW, due to no suitable habitat observed on site. No population of the species was documented.

4.2.1.1.4 Sensitive species 550

A 91% population decline was observed in two known subpopulations between 1987 and 2007 due to urban expansion, poor fire management, high levels of herbivory and harvesting for horticultural purposes. The two subpopulations represent two locations that are severely fragmented and declining. AOO 0.05 km². A population viability model incorporating four different management scenarios was developed for the subpopulation protected within the nature reserve based on demographic data collected between 1987 and 1996 (Pfab and Witkowski 2000). The model predicted an 88% probability of extinction within 20 years based on the management practices that was in place at the time. Recommendations were that fire frequency should be increased, herbivores excluded and ex situ individuals be introduced into the population to bring down the extinction risk to 2% within 100 years. The reserve management however conceded only to increase the fire frequency in the reserve, which still meant a 58% probability of extinction within 50 years. This subpopulation has by 2008 declined to less than 10 mature individuals due to the ongoing impacts of herbivory by native antelope as well as rodents (R.H. Archer pers. comm.) and possibly disease (M. Leroy pers. comm.) The other remaining subpopulation is under severe development pressure and is continually being degraded by human impacts due to its situation on the urban edge.

Preferred habitat is gentle slopes of quartzite ridges in savanna.

Probability of occurrence on site: MODERATE due to suitable habitat occurring in the project area, although no population was documented. Monitoring should be implemented

during construction phase of the development.

Probability of impact during vegetation clearance: LOW, due to none of the suitable habitat forming part of the development footprint area. No population of the species was documented.

4.2.1.1.5 Sensitive species 605

Preferred habitat of the species is gentle, northwest-facing slopes of small granite hills and ridges between bands of schist or in gritty red sandy loam soil, 1100-1500 m.

The main threats to most remaining subpopulations of this species are quarrying of schist and limestone for the construction of tar roads and severe overgrazing and trampling. Subpopulations close to Polokwane and the rural village of Mothiba are under immediate threat of being destroyed by housing developments, and habitat on another farm is potentially threatened by destruction for a golf estate development. Two subpopulations are also in imminent danger of destruction through the expansion of an industrial brickworks site, that has already lead to extensive declines at this site in the last 10 years. This species is also popular with succulent collectors, being a rare and endangered species, and collecting is likely to account for a significant proportion of the decline, but the exact extent is unknown. A subpopulation on one farm recorded in 1986 has disappeared, presumably because of overcollecting. Infrastructure development (road construction) and the building of a lodge could impact the largest subpopulation. All other subpopulations are small and might not be viable. A further locality was lost due to urban development around the 1980s - the locality is now a suburb of Polokwane.

Probability of occurrence on site: MODERATE due to suitable habitat occurring in the project area, although no population was documented. Monitoring should be implemented during construction phase of the development.

Probability of impact during vegetation clearance: LOW, due to none of the suitable habitat forming part of the development footprint area. No population of the species was documented.

4.2.1.1.6 Sensitive species 278

Occur on hills south and east of Polokwane. This species occurs in a small area enclosed by expanding urban and rural settlements, and the area has been transformed by agriculture. However, this species is unlikely to have lost significant proportions of its habitat to agricultural expansion due to its occurrence on rocky hills unsuitable for cultivation, but the habitat is impacted by overgrazing and trampling (R. van Tonder, unpublished data). It is likely to be declining due to ongoing habitat loss to development of rural settlements. Many of the hills in this area are used for quarries. Quarrying is likely to cause continuing decline of at least one subpopulation, where hill on which it grows has already been largely destroyed (R. van Tonder unpublished data). In addition, this species is highly sought after in horticultural

collections. Plants are selling for around 85 US$ on the internet (A.J. Hankey pers. comm. 2016). Illegal collection of wild plants is a very severe threat to the highly localized population.

Probability of occurrence on site: MODERATE due to suitable habitat occurring in the project area, although no population was documented. Monitoring should be implemented during construction phase of the development.

Probability of impact during vegetation clearance: LOW, due to none of the suitable habitat forming part of the development footprint area. No population of the species was documented.

4.2.2 Protected tree species

The National Forest Act, 1998 (Act No. 84 of 1998) provides a list of tree species that are considered important in a South African perspective because of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DWAF (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys, the following protected tree species occur within the study area (Table 5):

Table 5. List of protected tree species found in the area

Tree species	Habitat
Sclerocarya birrea	Sandy to gravelly soils on site

A few scattered individuals occur on the proposed development site. A permit application needs to be submitted to the Department of Forestry to obtain a licence for the eradication of the Marula trees if needed, otherwise the trees could be incorporated as part of the landscaping.

4.2.3 Protected Plants (LEMA)

Plant species are also protected in the Limpopo Province according to the Limpopo Environmental Management Act. According to this ordinance, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. The Appendices to the ordinance provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species if they are expected to be affected by the proposed project.

After a detailed survey, none of the listed protected species were documented on site.

4.2.4 Invasive alien species (NEMA GNR 599, 2014)

Invasive alien plants pose a direct threat not only to South Africa's biological diversity, but

also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate.

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

- 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 programme. 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 programme. 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 Cat 3 plants to exist in riparian zones.

The fight against invasive alien plants is spearheaded by the Working for Water (WfW) programme, launched in 1995 and administered through the DWA. This programme works in partnership with local communities, to whom it provides jobs, and also with Government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, provincial departments of agriculture, conservation and environment, research foundations and private companies.

WfW currently runs over 300 projects in all nine of South Africa’s provinces. Scientists and field workers use a range of methods to control invasive alien plants. These include:

- Mechanical methods - felling, removing or burning invading alien plants.
- Chemical methods - using environmentally safe herbicides.
- Biological control - using species-specific insects and diseases from the alien plant’s

country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species.

- Integrated control - combinations of the above three approaches. Often an integrated approach is required to prevent enormous impacts.

Vehicles often transport many seeds, and some may be of invader species, which may become established along the roads through the area, especially where the area is disturbed. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, will result in a risk of importation of alien species throughout the life of the project. The following alien invasive and exotic plant species were recorded on the surrounding site during the surveys as stipulated in the Alien and Invasive Species Regulations (GNR 599 of 2014) (Table 6):

Table 6. List of exotic plant species of the study area

Species	Category
Datura stramonium	1b
Opuntia ficus-indica	1b
Xanthium strumarium	2

4.2.5 General

An important aspect relating to the proposed development site should be to protect and manage the biodiversity (structure and species composition) of the vegetation types which surround the project area. The unnecessary impact on the surrounding woodland areas outside the development area should be avoided as far as possible. The site should be managed to prevent any further impacts.

4.3 FAUNAL ASSESSMENT

4.3.1 Overview

A healthy environment is inhabited by animals that vary from micro-organisms to the birds and mammals. The species composition and diversity are often parameters taken into consideration when determining the state of the environment. A comprehensive survey of all animals is a time-consuming task that will take a long time and several specialists to conduct. The alternative approach to such a study is to do a desktop study from existing databases and conduct a site visit to verify the habitat requirements and condition of the habitat. If any rare or endangered species are discovered in the desktop study that might be negatively influenced by the proposed development, specialist surveys will be conducted.

A survey was conducted during May 2020 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals,

reptiles, amphibians) occurring in the quarter degree grid.

The number of mammal species supported by a plant community depends on several factors like the primary production, seasonal availability of resources, floral heterogeneity, diversity of plant structure, nature of the substratum and previous history (Delany, 1982). Each mammal species has a niche, which can be regarded as the sum of all ecological requirements of a species namely food, space, shelter and physical conditions. Mills & Hes (1997) stated that the distribution and abundance of animal species does not rigorously follow that of plant communities or biomes. Instead, mammal species seem to have certain preferences for a specific habitat type (Skinner & Smithers, 1990). Several authors have shown this preference of mammals to certain habitats through analysis (Beardall et al. 1984; Ben-Shahar, 1991; Dekker et al. 1996). Detailed species list for the area is included in Appendix C, D and E.

4.3.2 Fauna habitats of the project area

Two major fauna habitats were observed in the area namely:

- Mixed woodland;
- Rocky habitats;

4.3.2.1 Habitat A: Mixed woodland associated with plains and valleys

The woodland area of the plains play an important role as habitat for various generalized fauna species. Birds and arboreal reptiles would utilize the larger trees species (Marula) for breeding, roosting and foraging. Smaller antelope species and predators utilize these habitats throughout the year and will periodically move in and out of these areas according to seasonal migrations

4.3.2.2 Habitat B: Rocky ridge

The rocky habitat on site is an important habitat for various fauna species of conservation concern of which the most important would be reptiles, bats and smaller mammal species. The rocky ridges occupy isolated pockets of the project area. The ridges and outcrops create important microhabitats for fauna on site.

Although larger mammal species may not be as common in this habitat type, smaller species such as the Jameson's red rock rabbit are important prey species to predators in this habitat type. Other typical nocturnal animals which may occur in this habitat type include large spotted genet, small spotted genet, and species with a wide habitat tolerance such as African wild cat, porcupine, pangolin, honey badger and striped polecat.

4.3.3 Mammals

Large mammals such as elephant, lion, buffalo and rhinoceros species that occurred historically at the site are mainly restricted to game reserves and national parks in the area. This loss of large species on the private land that forms part of the project area means that

the mammal diversity on these sites is far from its original natural state not only in terms of species richness but also with regards to functional roles in the ecosystem.

The surrounding habitat will still be utilized by mammals such as antelopes, small predators, small mammals and rodents. Therefore, the expected mammalian richness is considered low.

Antelope species such as duiker and steenbok still roam this area (dung, spoor identified). Smaller mammal species such as honey badgers and serval can become habituated to anthropogenic influences, while other species will rather move away from the township areas and will seldom use the area. Predators that still roam freely in the area include smaller predators such as black backed jackal, while predators such as brown hyena, caracal, serval and honey badger are rare in the area. Many of the bat species of conservation concern in the project area are cave-dependant for roosting. Any individuals that utilize the area would therefore either be foraging or migrating and would not be affected by the localized loss of habitat due to the proposed development. The dominant species composition therefore comprises of widespread taxa with unspecialised life history traits.

The impact of the proposed development area will be low on mammal populations if one compares the footprint of the proposed development site, overall range of individual species and the fact that most of the surrounding area represent built-up land. It is therefore considered highly unlikely that the rare species will be affected negatively by the development and infrastructure. The connectivity[1] of the project site to the remainder of the larger area is poor due to the tar roads, surrounding developments, agricultural activities and township areas to the south, northwest and west of the site.

The use of trapping techniques was not deemed necessary due to the small area that will be modified, although the development will have some impact on small mammal species and reptiles that occur within the study area. The mammals in the area have already been largely displaced to the surrounding areas because of the development activities on the neighbouring properties.

4.3.4 Birds (avifauna)

The woodland biome covers the greater part of Southern Africa, although it is largely restricted to the north and east of the region. Woodland is defined as vegetation with tree cover from sparse to almost closed canopy cover, and generally with a grassy understory. The woodland biome in Southern Africa supports the highest diversity of bird species of all the vegetation types in the sub region. This includes such characteristic and colourful woodland birds as rollers, bee eaters and waxbills, as well as large birds of prey such as vultures and eagles. The Golden-breasted Bunting is apparently unique in being found throughout the entire woodland biome, from the Eastern Cape Province northwards to dry woodland in Namibia, and it is even found in the extremely arid Kalahari. Most other

1 C**onnectivity (habitat connectivity)** - Allowing for the conservation or maintenance of continuous or connected habitats, so as to preserve movements and exchanges associated with the habitat.

woodland species show complex patterns of presence, absence and changes in relative abundance in the various woodland vegetation zones.

Broad-leaved, winter-deciduous woodlands typically occur on nutrient poor (leached) soils in the wetter (>600 mm/annum) eastern regions compared with microphyllous woodlands but the two woodland types are often mixed, with microphyllous woodlands on the alluvial plains and broad-leaved woodlands on the higher slopes. Examples of typical broad-leaved woodland trees are *Combretum apiculatum*. Broad-leaved woodlands typically show lower bird numbers, but higher bird diversity, than microphyllous woodlands. Examples of typical broad-leaved-woodland birds are Pale Flycatcher and Green-capped Eremomela. The broadleaved woodland occurring in the project area has quite a higher diversity of birds because of the crossover of habitats. Typical examples of broad-leaved-woodland birds are Pallid Flycatcher, Greencapped Eremomela, White-bellied Korhaan and Meyer's Parrot.

According to Birdlife South Africa, the study area falls outside any Important Bird Area (IBA), identified within South Africa (www.birdlife.org.za).

4.3.5 Herpetofauna (Reptiles and Amphibians)

There is a low potential presence of some toads and sand frogs in the drainage channel and dam to the west of the farm portion, although the site itself is poor habitat for amphibians. Amphibian species potentially occurring in the area include Common River Frog, Natal Sand Frog, Gutteral Toad, Raucous Toad and Bubbling Kassina. These species are non-threatened and widespread species, and as such the development will not have any impact on amphibian conservation within the region.

The only species of conservation concern for the project area is the giant bullfrog and no habitat occur on the proposed development site.

Reptile species such as the southern rock python, puff adder, boomslang, vine snake, spotted bush snake and several members of the green snakes (*Philothamnus* spp.) are expected to occur in the habitats of the project area, although the presence of these snakes is dependent on the presence of their prey species (rodents, frogs etc.). The general habitat type for reptiles consists of open to very dense bushveld, with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks and other reptiles. Arboreal species are the more prominent components of the local herpetofauna. The gravelly to rocky habitat in the area is optimal habitat for snakes, skinks and lizards. These areas will not be affected by the proposed development.

4.3.6 Insects and invertebrates

Insects and spiders are very good indicators of the plant diversity and ecological sensitivity of an area. Butterflies can be used in the field as indicators of biodiversity. An insect and spider desktop survey were done in addition to the field observations.

All the potential invertebrate habitats are well represented by a high family richness of insects

and spiders. Spiders occur throughout all the habitats, and both web builders and active hunters find their ways in trapping and actively hunt around for potential food.

The 4 red listed butterfly species potentially occurring in the area are all specialists occurring in the Wolkberg Mountains more than 20 kilometers southeast of the project area. The species occurrence is discussed in sections 4.3.7.1.

4.3.7 Red data species

According to the existing databases and field survey the following number of fauna species included in the IUCN red data lists can potentially be found in the study area (Table 7):

Table 7. Red data list of potential fauna for the study area

English Name	Conservation status	Probable habitat in area
BIRDS (SABAP 2 LIST SPECIES)		
Eagle, Tawny	Vulnerable	Moderate
Bustard, Kori	Endangered	Moderate
Stork, Abdim's	Near Threatened	High
Roller, European	Near Threatened	High
Korhaan, White-bellied	Near Threatened	High
Falcon, Lanner	Vulnerable	Moderate
Ibis, Southern Bald	Vulnerable	Moderate
Vulture, White-backed	Vulnerable	Moderate
Vulture, Cape	Endangered	Moderate
Eagle, Martial	Endangered	High
Secretarybird	Endangered	High
MAMMALS		
Roan Antelope	Endangered (2016)	Zero – confined to game reserves
Rusty Pipistrelle	Near Threatened	Moderate
Brown Hyena	Near Threatened (2015)	Moderate
Serval	Near Threatened (2016)	Moderate
Smithers' Horseshoe Bat	Near Threatened (2016)	Low
Tsessebe	Vulnerable (2016)	Zero – confined to game reserves
Leopard	Vulnerable (2016)	Low
HERPETOFAUNA		
Giant Bull Frog	Near Threatened	Low
INVERTEBRATES		
Stevenson's copper	Endangered	Zero – no habitat present
Royal Blue	Endangered	Zero – no habitat present
Swanepoels Brown	Endangered	Zero – no habitat present
Wolkberg widow	Endangered	Zero – no habitat present

The cumulative negative impacts of the proposed development will have a medium to low impact on the fauna of the area. Recommendations and mitigating measures still need to be implemented to ensure the survival of these species, other fauna habitats and feeding grounds as stipulated below:

- Some of the red data and other mammal species have a low probability of occurring in the area because of the following:
    - The anthropogenic influences of the farms and other residential developments in the area will cause some fauna to migrate from the area to more natural areas with less disturbance;
    - Habitat not being suitable or marginal;
    - The habitat of many of the red data species would be in the riparian woodland of the water courses and potentially also on the shores of the dam to the west of the site during the rainy season. No impact will occur on these areas which occur on another farm portion;
- If one considers the habitat descriptions of the red data species, some of them are limited in range or threatened as a direct result of habitat loss in the southern African sub region, although many of the species in the table above are not limited by direct habitat loss due to their widespread occurrence (e.g. martial eagles have large home ranges).
- The area in general is quite homogenous due to the agricultural fields which resulted in the habitat becoming fragmented;
- The protection of surrounding habitat types in the area will be important to ensure the survival of the different animals due to each species' individual needs and requirements. Sufficient natural corridor sections should be protected around the development footprint areas to allow fauna to move freely between the different vegetation units in the larger area;
- The development of the housing units will influence the natural feeding and movement patterns of the existing fauna in the area, although not to a significant extent.

The cumulative negative impacts of the proposed development site during future development will be moderate to low. Ongoing management of the area should take the mitigation and management actions into consideration to minimize impacts on faunal populations of the area.

- A speed limit should be imposed on the roads to minimise road kills. Speed humps should be constructed at strategic places along the access road to enforce lower speeds;
- Hunting, trapping, poisoning and shooting of animals should be prevented;
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the vulture birds of prey occurring in the

area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist;

- Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum.

4.3.7.1 EIA screening tool listed species

No red listed species occur for the project area according to the EIA screening tool:

5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE FLORA AND FAUNA

The impact of the proposed construction of the residences will be on slightly degraded areas, with most of the site still representing indigenous vegetation. The vegetation on site varies from slightly degraded to pristine.

The following section deals with the impacts and specific mitigation measures needed for the proposed residential developments from a biodiversity point of view:

5.1 DIRECT HABITAT DESTRUCTION

5.1.1 Description of impact:

The construction of the housing development will result in loss of and damage to natural habitats. Rehabilitation of some of these areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction of housing units.

The impact of the habitat destruction will be on the flora and fauna of the study area in the following ways:

- The construction will lead to the loss of individual plants such as grasses, forbs, trees and shrubs that will be cleared on the footprint area. This will mostly occur during the construction phase;
- Loss of threatened, near-threatened and endemic taxa: The anticipated loss of some of the natural habitats that support endemic species will result in the local displacement of endemic listed flora;
- Due to habitat loss and construction activities animals will migrate from the construction area and animal numbers will decrease;
- Loss of threatened, “near-threatened” and conservation important taxa: The anticipated loss of the natural woodland will result in the local displacement of some fauna species. In some cases isolated populations of threatened fauna might be removed from the area, although no such populations or knowledge thereof was found in the study area. This impact could also take place because of hunting and snaring of animals in natural areas not used for the housing development or its infrastructure.
- Changes in the community structure: It is expected that the faunal species composition will shift, due to an anticipated loss in habitat surface area. In addition, it is predicted that more generalist species (and a loss of functional guilds) will dominate the study area. Attempts to rehabilitate will attract taxa with unspecialised and generalist life-histories. It is predicted that such taxa will persist for many years before conditions become suitable for succession to progress.

5.1.2 Mitigation measures:

- The removal of plant species should only occur on the footprint area of the development and not over the larger area;
- Conduct flora species search and rescue efforts before ground clearing begins to reduce negative impacts on species of concern;
- Remove and relocate any plants of botanical or ecological significance as indicated by the ecologist or Environmental Control Officer (ECO);
- Vegetation to be removed as it becomes necessary;
- Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area;
- Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the flora of the area;
- The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation;
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications;
- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during pipeline construction;
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors (refer to Appendix C) occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist;

5.2 HABITAT FRAGMENTATION

5.2.1 Description of impact:

The construction of buildings, fences and roads will inevitably result in natural movement patterns being disrupted and, to a varying degree depending on how different species react to these barriers will result in the fragmentation of natural populations. The development will have a moderate impact in fragmenting the habitats on the property.

5.2.2 Mitigation measures:

- All possible efforts must be made to ensure as little disturbance as possible to the rocky ridge during construction;
- Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place;
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance must occur outside these areas.

5.3 INCREASED SOIL EROSION AND SEDIMENTATION

5.3.1 Description of impact:

The soils in the project area vary from shallow gravelly soils to deeper red apedal sandy loam soils on the undulating plains. The excavation of foundation trenches, and most service trenches in the northern and central section of the site, is expected to be possible by hand or light mechanical excavator, although bedrock may occur at relatively shallow depth beneath the diagnostic horizons defining these soil forms.

The construction activities associated with the developments may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil, sediments and associated contaminants are transported into water bodies such as rivers and streams, resulting in the loss or alteration of habitats for aquatic organisms, as well as changes in water quality. Soil erosion also promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora.

5.3.2 Mitigation measures:

The following mitigation measures should be implemented to prevent erosion along sensitive soils, wetlands and drainage channels during the construction and operational phase of the housing development:

- Cover disturbed soils as completely as possible, using vegetation or other materials;
- Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.
- Sediment trapping, erosion and stormwater control should be addressed by a hydrological engineer in a detailed stormwater management plan;
- All aspects related to dust and air quality should be addressed by an air quality specialist in a specialist report;
- Protect sloping areas that are susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas;

- Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth;
- Gravel roads must be well drained to limit soil erosion;
- Minimize clearance of vegetation. Retain natural trees, shrubbery, and grass species wherever possible;

5.4 SOIL AND WATER POLLUTION

5.4.1 Description of impact:

Construction work for the proposed housing development will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. The pollution could have a detrimental impact locally on plant communities or specific species or populations. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on flora. During the constructional phase heavy machinery and vehicles as well as sewage and domestic waste from workers would be the main contributors to potential pollution problems.

5.4.2 Mitigation measures:

- Appropriate sanitary facilities must be provided during construction and all waste removed to an appropriate waste facility.
- Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously;
- Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off;
- Spill kits should be on-hand to deal with spills immediately;
- All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.

5.5 HABITAT DEGRADATION DUE TO DUST

5.5.1 Description of impact:

The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development will have an impact on the vegetation of the area when dust settles on plant material reducing the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment. The following activities will typically cause air pollution at the proposed housing development:

- Land clearing operations and scraping;
- Materials handling operations (truck loading & unloading, tipping, stockpiling);
- Vehicle entrainment on paved and unpaved roads;
- Windblown dust-fugitive emissions (stockpiles).

One of the primary impacts associated with development activities on the biophysical environment is linked to emission of dusts and fumes from the transportation system. Dust pollution will impact the most severe during the construction phase on the flora of the surrounding areas. Construction vehicles and equipment are the major contributors to the impact on air quality. Dust is generated during site clearance for the construction of infrastructure. Diesel exhaust gasses and other hydrocarbon emissions all add to the deterioration in air quality during this phase. Vehicles travelling at high speeds on dirt roads significantly aggravate the problem.

Dust deposited on the ground may cause changes in soil chemistry (chemical effects) and may over the long-term result in changes in plant chemistry, species composition and community structure. Sensitivities to dust deposition of the various plant species present in the area are not known. It is therefore difficult to predict which species may be susceptible. Dust in the area will be greatly increased in the dry season due to the nature of the soil in the area which is characterised by very small particulates.

Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions.

5.5.2 Mitigation measures:

- A speed limit should be enforced on dirt roads (preferably 30 km/h) during construction.
- Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.

5.6 SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES

5.6.1 Description of impact:

The construction of the housing units and associated infrastructure almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

5.6.2 Mitigation measures:

- Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines. The control of these species should even begin prior to the construction phase considering that small populations of these species were observed during the field surveys;
- Institute strict control over materials brought onto site, which should be inspected for seeds of noxious plants and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual herbicides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species listed by the CARA regulations should be eradicated;
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish;
- A plan should be developed for control of noxious weeds and invasive plants that could occur because of new surface disturbance activities at the site. The plan should address monitoring, weed identification, the way weeds spread, and methods for treating infestations. Only certified weed-free mulching must be used in the gardens. Prohibit the use of fill materials from areas with known invasive vegetation problems. The spread of invasive non-native plants should be avoided by keeping vehicles and equipment clean and reseeding disturbed areas with native plants;
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme should be implemented to ensure that the species' do not spread to surrounding natural ecosystems.

5.7 NEGATIVE EFFECT OF HUMAN ACTIVITIES

5.7.1 Description of impact:

An increase in human activity on the site and surrounding areas is anticipated. The risk of wood harvesting, poaching and fires is increased which could have a definite impact on the flora and fauna of the larger area. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive flora is increased. The presence of many construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc.

5.7.2 Mitigation measures:

- Staff should not be accommodated on site. No temporary accommodation must be erected on the site. Adequate rubbish bins and sanitation facilities should be provided to construction workers;
- The ECO should regularly inspect the site, including storage facilities and compounds. A monitoring programme should also be implemented around these areas to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds;
- Maintain proper firebreaks around the entire development footprint.
- Educate construction workers regarding fire risks and the occurrence of important resources in the area and the importance of protection;
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance must occur outside these areas.
- Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the affected residents.
- Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
- Camp fires at construction sites must be strictly controlled to ensure that no veld fires are caused.

5.8 ROAD MORTALITY

5.8.1 Description of impact:

Large numbers of fauna are killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle itself in the case of avifauna or flying invertebrates. The impact is intensified at night, especially for flying insects, mammals, and nocturnal birds as a result of their attraction to the lights of vehicles.

5.8.2 Mitigation measures:

- More fauna is normally killed the faster vehicles travel. A speed limit should be enforced (speed on site max 30 km/hour; Outside of the site 60 km/h. In rain max 20 km/h). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences).
- Travelling at night should be avoided or limited as much as possible. No travelling at night should be allowed without approval by the site manager;
- Lights should be positioned 5 m from the roads or paved areas.

5.9 IMPACT ASSESSMENT MATRIX

Table 9 indicates the impacts described above and specific ratings of significance the impact will potentially have on the major ecosystems during the proposed development activities:

Table 8. Impact assessment matrix for the proposed development

Nr	Activity	Impact	P	D	S	M	Significance Before Mitigation		Mitigation Measures	P	D	S	M	Significance	
Construction Phase									**Construction Phase**						
1	Clearing of vegetation for construction of infrastructure, access roads etc.	Habitat destruction	5	5	1	6	60	Moderate-high	See section 6.1.2	5	5	1	2	40	Moderate-Low
2	Clearing of vegetation for construction of infrastructure, access roads etc.	Habitat fragmentation	5	5	1	6	60	Moderate-high	See section 6.2.2	5	5	1	2	40	Moderate-Low
3	Exposure of soils to rainfall and wind during construction	Soil erosion	5	5	3	8	80	High	See section 6.3.2	4	2	2	6	40	Moderate-Low
4	Movement of vehicles on site during construction	Spillages of harmful substances	4	4	3	6	52	Moderate	See section 7.1.4.2	4	3	2	2	28	Low
5	Exposure of soils to rainfall and wind during construction	Dust contamination (air pollution)	5	3	2	6	55	Moderate	See section 6.5.2	4	3	2	2	28	Low
6	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	4	5	2	6	52	Moderate	See section 6.6.2	2	3	2	2	14	Negligible
7	Construction of infrastructure, access roads etc.	Negative effect of human activities on flora	4	3	2	6	44	Moderate	See section 6.7.2	2	3	2	2	14	Negligible
8	Continued movement of vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Fauna mortality on roads	4	3	2	6	44	Moderate	See section 6.8.2	4	3	2	2	28	Low

6 SENSITIVITY ANALYSIS AND CONSERVATION ANALYSIS TOOLS

There are several assessments for South Africa as a whole, as well as on provincial levels that allow for detailed conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to consult for development projects and will form an important part of the sensitivity analysis. Areas earmarked for conservation in the future, or that are essential to meet biodiversity and conservation targets, should not be developed and have a high sensitivity as they are necessary for overall functioning. In addition, sensitivity analysis in the field is based on much finer scale data and can be used to ground truth the larger scale assessments and put it into a more localised context.

6.1 CRITICAL BIODIVERSITY & ECOLOGICAL SUPPORT AREAS OF THE PROJECT AREA

The purpose of the Limpopo Conservation Plan version 2 (LCPv2) is to develop the spatial component of a bioregional plan (i.e. map of Critical Biodiversity Areas (CBA) and associated land-use guidelines).

The Limpopo Conservation Plan categories for the developments are presented in Figure 5. The following can be concluded regarding developments:

- The project area is largely located in "Other Natural Areas" (ONA) and a small section of the site being a CBA1. The state of the vegetation within the CBA1 should be classified with the remainder of the site as ONA considering that the area does not represent any sensitive vegetation components or fauna populations.

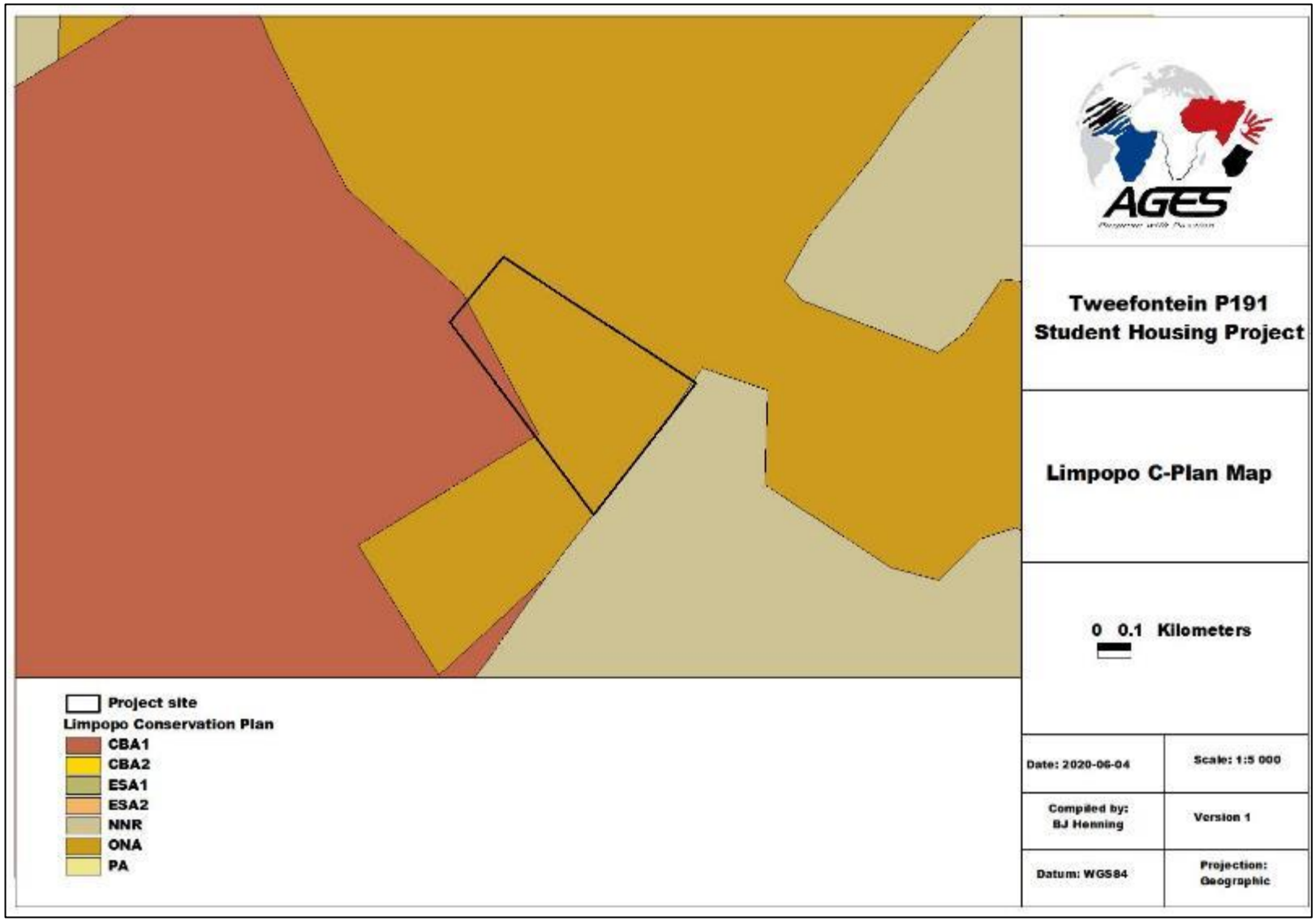

Figure 5. Limpopo C-Plan Map for the project area

6.2 PROTECTED AREAS NETWORK AND NATIONAL PROTECTED AREAS EXPANSION STRATEGY (NPAES)

Officially protected areas, either Provincially or Nationally that occur close to a project site could have consequences as far as impacts on these areas are concerned. For the proposed development, the Polokwane Game Reserve (within 10 km) and Kuschke Nature Reserve (18km) are the closest protected areas to the site (Figure 8).

The NPAES are areas designated for future incorporation into existing protected areas (both National and informal protected areas). These areas are large, mostly intact areas required to meet biodiversity targets, and suitable for protection. They may not necessarily be proclaimed as protected areas in the future and are a broad scale planning tool allowing for better development and conservation planning. No NPAES occur near the project area, with the Limpopo Central Bushveld located further south of the site.

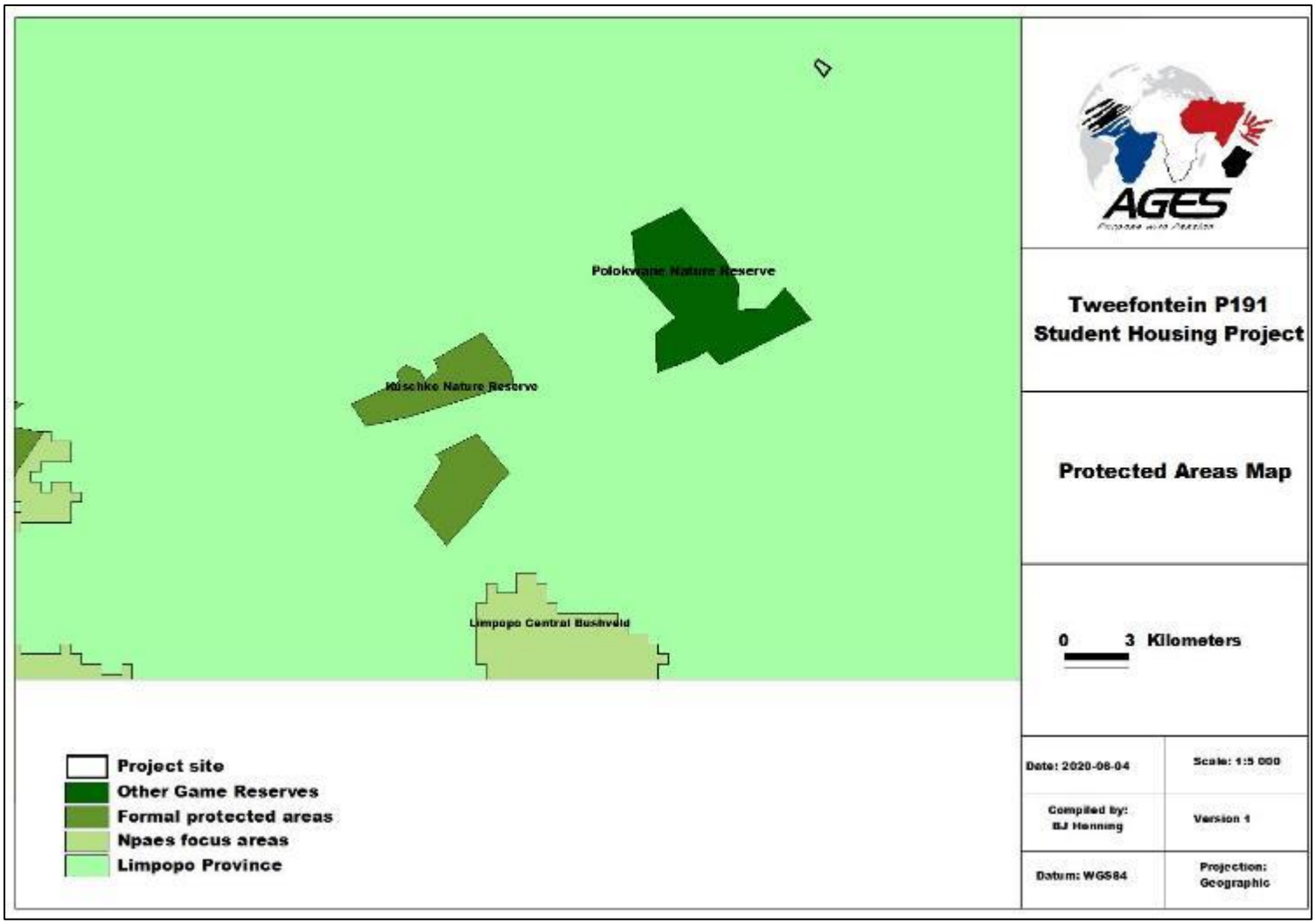

Figure 6. Location of the project area in relation to listed protected areas

6.3 IMPORTANT BIRD AREAS

An Important Bird Area (IBA) is an area recognized as being globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for our threatened, endemic and congregatory birds. The BirdLife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013).

No IBA is located within close proximity to the project area, with the closest IBA located about 8 kilometers southwest of the site, namely the Polokwane Game Reserve.

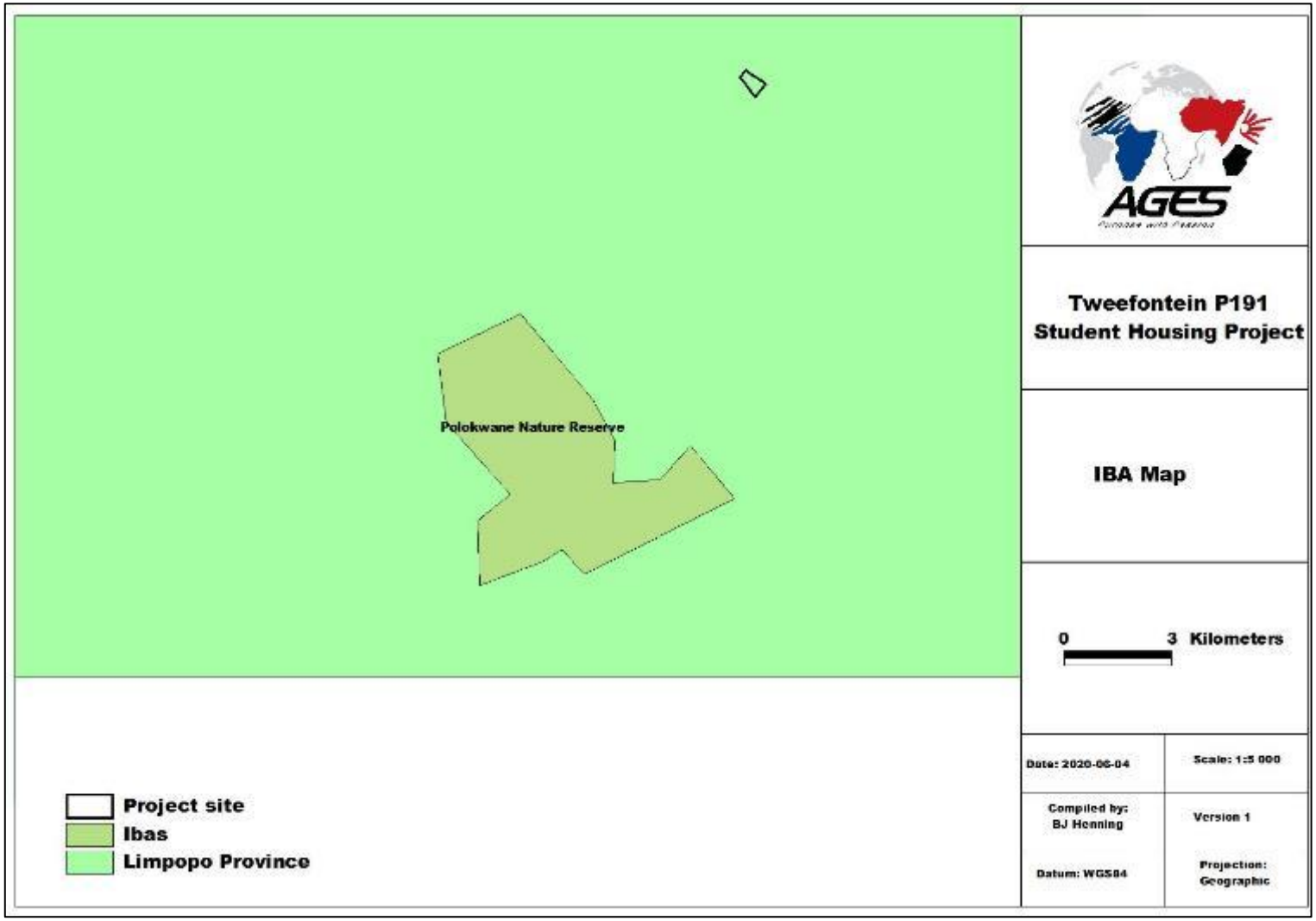

Figure 7. IBAs in close proximity to the project area (Birdlife SA)

6.4 NATIONALLY THREATENED ECOSYSTEMS

The list of national Threatened Ecosystems has been gazetted (NEM:BA: National list of ecosystems that are threatened and in need of protection) and result in several implications in terms of development within these areas. Four basic principles were established for the identification of threatened ecosystems. These include:

- The approach must be explicit and repeatable;
- The approach must be target driven and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed, and an ecosystem is listed based on its highest-ranking criterion; and
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of ecosystems.

Areas were delineated based on as fine a scale as possible and are defined by one of several assessments: These areas are essential for conservation of the country's ecosystems as well as meeting conservation targets. The proposed development site is not located within any listed threatened ecosystem.

6.5 ECOLOGICAL SENSITIVITY CLASSES

Following the ecological surveys, the classification of the study area into different sensitivity classes and development zones was based on information collected at various levels on different environmental characteristics. Factors which determined sensitivity classes were as follows:

- Presence, density and potential impact of development on rare, endemic and protected plant species;
- Conservation status of vegetation units;
- Soil types, soil depth and soil clay content;
- Previous land-use;
- State of the vegetation in general as indicated by indicator species.

Below included is the sensitivity map for the proposed student housing development, (Figure 8). Only criteria applicable to the specific vegetation units were used to determine the sensitivity of the specific unit.

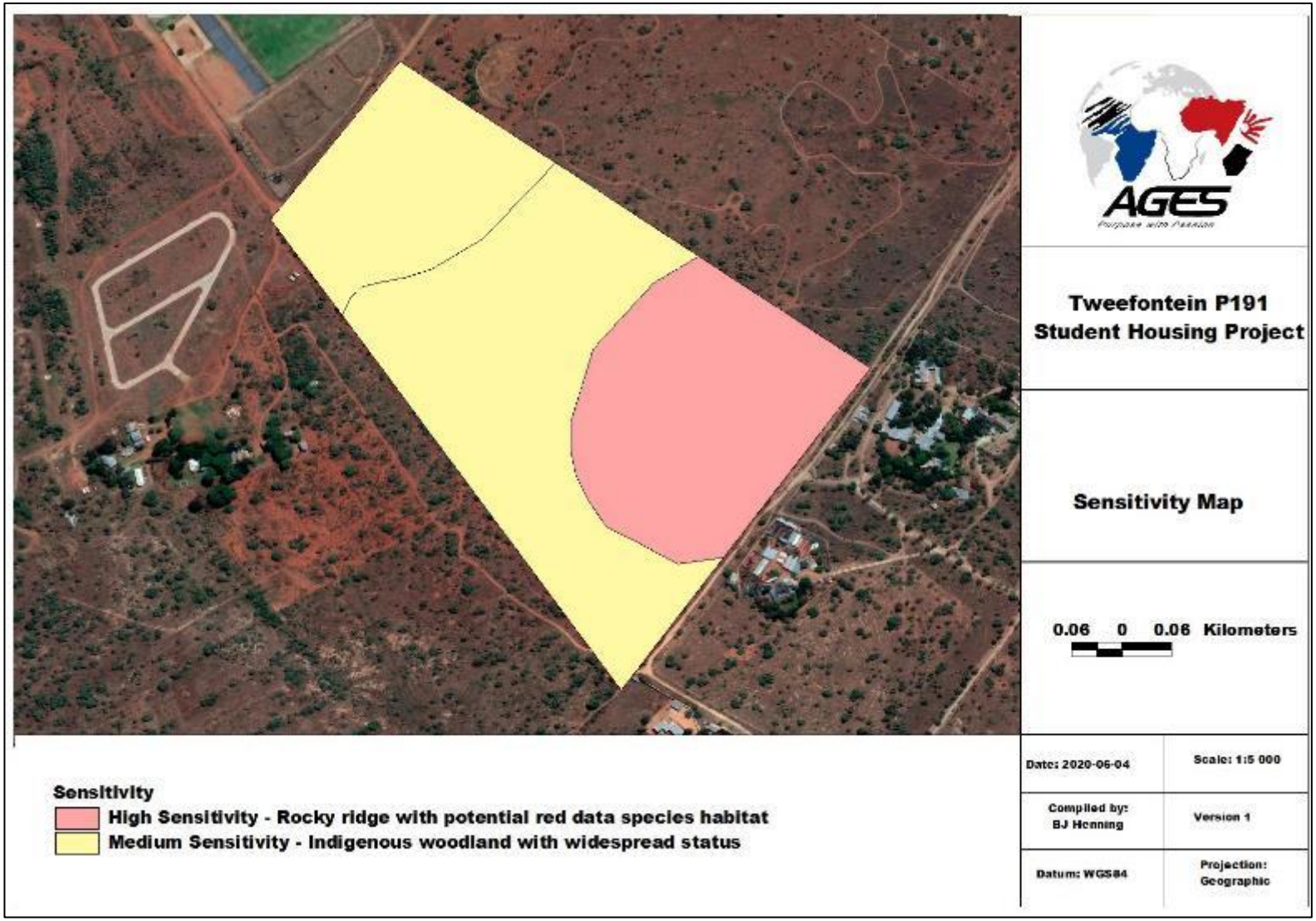

Figure 8. Sensitivity map of the project area

7 DISCUSSION

Following the investigation and potential ecological impact of the proposed student housing development on the fauna and flora vegetation of the area, some conclusions can be made:

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. The proposed development activities will modify the vegetation and faunal habitats of the development site to a certain extent varying according to the habitats on the site, although in general the vegetation on site where the development footprint is planned are classified as degraded.

Most sensitive sections: It is evident from the distribution of biodiversity, presence of threatened species and sites of scientific interest, that the proposed development for the area has the potential to impact on the flora and fauna of the site, especially considering that most of the site represent indigenous vegetation in a slightly degraded to pristine state. The layout should allow for open space in between the erven and conservation areas. The impacts will therefore be limited. The potential to impact is considered Moderate considering the area to be surrounded by other developments, although sensitive areas such as the rocky ridge should be protected.

Most sensitive habitats: Some threatened animal species are woodland specialists, linked to these habitats either for breeding, feeding or shelter. Indirect impacts (dust, erosion, spreading of alien invasive species) on the surrounding natural woodland and outcrops (further east and south of the site) should be avoided wherever possible during construction. Existing hydrodynamics must be protected to ensure that water regimes are maintained.

Monitoring of threatened species: Many threatened and sensitive species have been recorded in the region. The EMP for the construction phase should highlight the conservation status of these species and note that steps must be undertaken in conjunction with conservation authorities to protect or translocate any populations encountered during project actions. Ecological monitoring is recommended for the construction phase of the development.

The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the constructional phase of the development footprint sites should be considered a high priority. The proposed construction footprints vary from being in a slightly degraded state to pristine.

Detailed ecological (fauna habitat & flora) surveys were conducted during May 2020 to verify the ecological sensitivity, floristic components and vegetation of the site at ground level. A sensitivity analyses was conducted for the vegetation units to identify the most suitable site for the development. From this investigation and ecological surveys, the

following main observations were made:

- The slightly degraded woodland areas have a Medium Sensitivity and development can be supported in the area provided certain mitigation measures are implemented;
- The rocky ridge has a High Sensitivity, and no development should occur in these areas. No development should impede on any of the rocky ridge and the layout plan should be amended where it would impede into these areas.

A number of potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance, including the following:

- Destruction or disturbance to sensitive ecosystems leading to reduction in the overall extent of a particular habitat;
- Increased soil erosion;
- Impairment of the movement and/or migration of animal species resulting in genetic and/or ecological impacts;
- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species;
- Establishment and spread of declared weeds and alien invader plants;
- Air pollution through dusts and fumes from construction vehicles (construction phase;
- Fauna mortalities on the road during construction and operational phases of the development;

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Furthermore, the proposed layout plan of the development should be consistent with the sensitivity map and recommendations stipulated in this report, and the impact on the sensitive habitats on site should be kept to a minimum.

8 CONCLUSION

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. If we can bring about a more integrated approach to living within our ecosystems, we are much more likely to save the fundamental structure of biodiversity. Positive contributions can be made even on a small scale such as within the proposed development. All stakeholders in the development need to be involved to mitigate the impacts associated with the development from causing a significant loss.

The proposed development should avoid sensitive areas such as the ridge area in the south-eastern section of the site. This is needed to minimize impacts on sensitive vegetation types and potential red listed species (fauna and flora) potentially occurring in the area. Negative impacts can be minimised by strict enforcement and compliance with an Environmental Management Plan which considers the recommendations for managing impacts detailed above.

Provided that the proposed development and layout plans are consistent with the sensitivity map and take all the mitigation measures into consideration as stipulated in this report, the planned development can be supported.

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APPENDIX A. PLANT SPECIES LISTS FOR QDS

Family	Genus	Sp1	IUCN
Burseraceae	*Commiphora*	*mollis*	LC
Burseraceae	*Commiphora*	*africana*	LC
Lamiaceae	*Stachys*	*spathulata*	LC
Solanaceae	*Solanum*	*catombelense*	LC
Solanaceae	*Lycium*	*cinereum*	LC
Malvaceae	*Waltheria*	*indica*	LC
Burseraceae	*Commiphora*	*marlothii*	LC
Phyllanthaceae	*Phyllanthus*	*incurvus*	LC
Asteraceae	*Felicia*	*mossamedensis*	LC
Asteraceae	*Senecio*	*harveianus*	LC
Combretaceae	*Combretum*	*apiculatum*	LC
Euphorbiaceae	*Croton*	*gratissimus*	LC
Poaceae	*Hyparrhenia*	*anamesa*	LC
Polygonaceae	*Persicaria*	*madagascariensis*	
Asteraceae	*Parapolydora*	*fastigiata*	
Asphodelaceae	*Trachyandra*	*saltii*	LC
Poaceae	*Pogonarthria*	*squarrosa*	LC
Fabaceae	*Vachellia*	*hebeclada*	LC
Asteraceae	*Kleinia*	*longiflora*	LC
Convolvulaceae	*Ipomoea*	*crassipes*	LC
Poaceae	*Themeda*	*triandra*	LC
Fabaceae	*Rhynchosia*	*totta*	
Boraginaceae	*Heliotropium*	*ciliatum*	LC
Scrophulariaceae	*Buddleja*	*salviifolia*	LC
Asteraceae	*Litogyne*	*gariepina*	LC
Asteraceae	*Hirpicium*	*bechuanense*	LC
Amaranthaceae	*Atriplex*	*semibaccata*	
Violaceae	*Hybanthus*	*enneaspermus*	
Acanthaceae	*Blepharis*	*integrifolia*	LC
Fabaceae	*Crotalaria*	*laburnifolia*	LC
Poaceae	*Tricholaena*	*monachne*	LC
Malvaceae	*Melhania*	*rehmannii*	LC
Geraniaceae	*Pelargonium*	*dolomiticum*	LC
Poaceae	*Urochloa*	*mosambicensis*	LC
Acanthaceae	*Blepharis*	*acuminata*	LC
Moraceae	*Ficus*	*thonningii*	
Poaceae	*Schmidtia*	*pappophoroides*	LC
Poaceae	*Setaria*	*sphacelata*	LC
Poaceae	*Eragrostis*	*rigidior*	LC
Asteraceae	*Senecio*	*striatifolius*	LC
Crassulaceae	*Kalanchoe*	*brachyloba*	LC
Poaceae	*Aristida*	*meridionalis*	LC
Cleomaceae	*Cleome*	*oxyphylla*	LC

Family	Genus	Sp1	IUCN
Convolvulaceae	*Ipomoea*	*obscura*	LC
Fabaceae	*Indigofera*	*circinnata*	LC
Fabaceae	*Peltophorum*	*africanum*	LC
Hyacinthaceae	*Ledebouria*	*revoluta*	LC
Poaceae	*Heteropogon*	*contortus*	LC
Hyacinthaceae	*Merwilla*	*plumbea*	NT
Caryophyllaceae	*Pollichia*	*campestris*	LC
Asteraceae	*Dicoma*	*macrocephala*	LC
Loranthaceae	*Tapinanthus*	*quequensis*	LC
Rubiaceae	*Canthium*	*armatum*	LC
Celastraceae	*Gymnosporia*	*senegalensis*	LC
Convolvulaceae	*Ipomoea*	*oblongata*	LC
Orchidaceae	*Bonatea*	*antennifera*	LC
Lamiaceae	*Leonotis*	*sexdentata*	LC
Fabaceae	*Vachellia*	*permixta*	LC
Fabaceae	*Ptycholobium*	*plicatum*	LC
Asteraceae	*Osteospermum*	*muricatum*	LC
Lamiaceae	*Tetradenia*	*brevispicata*	LC
Convolvulaceae	*Xenostegia*	*tridentata*	LC

APPENDIX B PLANT SPECIES LISTS FOR SITE

Woody species
Aloe marlothii
Combretum apiculatum
Combretum molle
Dichrostachys cinerea
Diospyros lycioides
Dombeya rotundifolia
Eleadendron transvaalense
Ehretia rigida
Euclea crispa
Euphorbia ingens
Grewia flava
Gymnosporia buxifolia
Gymnosporia senegalensis
Mundulea sericea
Oromocarpum trichocarpum
Ozoroa paniculosa
Ozoroa sphaerocarpa
Pappea capensis
Pavetta zeyheri
Peltophorum africanum
Rhigozum obovatum
Sclerocarya birrea
Searsia leptodictea

Searsia pyroides
Senegalia caffra
Senegalia hebeclada
Vachellia permixta
Vachellia rehmanniana
Vachellia tortilis
Vangueria infausta
Ximenia caffra
Ziziphus mucronata
Grasses
Aristida congesta
Btachiaria serrata
Chloris virgata
Cymbopogon pisposchillii
Cynodon dactylon
Digitaria eriantha
Enneapogon cenchroides
Enneapogon scoparius
Eragrostis lehmanniana
Eragrostis nindensis
Eragrostis rigidior
Elionorus muticus
Heteropogon contortus
Hyparrhenia hirta
Panicum maximum
Schizachyrium sanguineum
Schmidtia pappophoroides
Themeda triandra
Urochloa mosambicensis
Forbs
Acretome hispida
Aloe davyana
Asparagus laricinus
Asparagus suaveolens
Boophane disticha
Ceratotheca triloba
Conyza bonariensis
Datura stramonium
Elephanthorhiza elephanthina
Euphorbia maleolens
Felicia mosammedensis
Huernia hystrix
Ipomoea omnaeyi
Jamesbrittenea burkeana
Kalanchoe paniculata
Kalanchoe thyrsiflora
Leonotis leonorus
Lippia javnica
Lopholaena coriifolia

Neurautanenia ficifolius
Opuntia ficus indica
Schkuria pinnata
Senna italica
Sesamum triphyllum
Solanum incanum
Stapelia gigantea
Tagetes minuta
Tephrosia capensis
Vernonia galpinni
Vernonia oligocephala
Xanthium strumarium
Ziziphus zeyheriana

APPENDIX B. PLANT SPECIES LIST FOR QDS

Family	**Genus**	**Sp1**	**IUCN**
Burseraceae	*Commiphora*	*mollis*	LC
Burseraceae	*Commiphora*	*africana*	LC
Lamiaceae	*Stachys*	*spathulata*	LC
Solanaceae	*Solanum*	*catombelense*	LC
Solanaceae	*Lycium*	*cinereum*	LC
Malvaceae	*Waltheria*	*indica*	LC
Burseraceae	*Commiphora*	*marlothii*	LC
Phyllanthaceae	*Phyllanthus*	*incurvus*	LC
Asteraceae	*Felicia*	*mossamedensis*	LC
Asteraceae	*Senecio*	*harveianus*	LC
Combretaceae	*Combretum*	*apiculatum*	LC
Euphorbiaceae	*Croton*	*gratissimus*	LC
Poaceae	*Hyparrhenia*	*anamesa*	LC
Polygonaceae	*Persicaria*	*madagascariensis*	
Asteraceae	*Parapolydora*	*fastigiata*	
Asphodelaceae	*Trachyandra*	*saltii*	LC
Poaceae	*Pogonarthria*	*squarrosa*	LC
Fabaceae	*Vachellia*	*hebeclada*	LC
Asteraceae	*Kleinia*	*longiflora*	LC
Convolvulaceae	*Ipomoea*	*crassipes*	LC
Poaceae	*Themeda*	*triandra*	LC
Fabaceae	*Rhynchosia*	*totta*	
Boraginaceae	*Heliotropium*	*ciliatum*	LC
Scrophulariaceae	*Buddleja*	*salviifolia*	LC
Asteraceae	*Litogyne*	*gariepina*	LC
Asteraceae	*Hirpicium*	*bechuanense*	LC
Amaranthaceae	*Atriplex*	*semibaccata*	
Violaceae	*Hybanthus*	*enneaspermus*	
Acanthaceae	*Blepharis*	*integrifolia*	LC
Fabaceae	*Crotalaria*	*laburnifolia*	LC

Family	Genus	Sp1	IUCN
Poaceae	*Tricholaena*	*monachne*	LC
Malvaceae	*Melhania*	*rehmannii*	LC
Geraniaceae	*Pelargonium*	*dolomiticum*	LC
Poaceae	*Urochloa*	*mosambicensis*	LC
Acanthaceae	*Blepharis*	*acuminata*	LC
Moraceae	*Ficus*	*thonningii*	
Poaceae	*Schmidtia*	*pappophoroides*	LC
Poaceae	*Setaria*	*sphacelata*	LC
Poaceae	*Eragrostis*	*rigidior*	LC
Asteraceae	*Senecio*	*striatifolius*	LC
Crassulaceae	*Kalanchoe*	*brachyloba*	LC
Poaceae	*Aristida*	*meridionalis*	LC
Cleomaceae	*Cleome*	*oxyphylla*	LC
Convolvulaceae	*Ipomoea*	*obscura*	LC
Fabaceae	*Indigofera*	*circinnata*	LC
Fabaceae	*Peltophorum*	*africanum*	LC
Hyacinthaceae	*Ledebouria*	*revoluta*	LC
Poaceae	*Heteropogon*	*contortus*	LC
Hyacinthaceae	*Merwilla*	*plumbea*	NT
Caryophyllaceae	*Pollichia*	*campestris*	LC
Asteraceae	*Dicoma*	*macrocephala*	LC
Loranthaceae	*Tapinanthus*	*quequensis*	LC
Rubiaceae	*Canthium*	*armatum*	LC
Celastraceae	*Gymnosporia*	*senegalensis*	LC
Convolvulaceae	*Ipomoea*	*oblongata*	LC
Orchidaceae	*Bonatea*	*antennifera*	LC
Lamiaceae	*Leonotis*	*sexdentata*	LC
Fabaceae	*Vachellia*	*permixta*	LC
Fabaceae	*Ptycholobium*	*plicatum*	LC
Asteraceae	*Osteospermum*	*muricatum*	LC
Lamiaceae	*Tetradenia*	*brevispicata*	LC
Convolvulaceae	*Xenostegia*	*tridentata*	LC

APPENDIX C. BIRD SPECIES LIST FOR QDS ACCORDING TO SABAP2 DATABASE

Common_group	Common_species	Genus	Species
Barbet	Acacia Pied	*Tricholaema*	*leucomelas*
Barbet	Crested	*Trachyphonus*	*vaillantii*
Batis	Chinspot	*Batis*	*molitor*
Bee-eater	European	*Merops*	*apiaster*
Bee-eater	Little	*Merops*	*pusillus*
Boubou	Southern	*Laniarius*	*ferrugineus*
Brubru	Brubru	*Nilaus*	*afer*

Common_group	Common_species	Genus	Species
Bunting	Cinnamon-breasted	*Emberiza*	*tahapisi*
Bunting	Golden-breasted	*Emberiza*	*flaviventris*
Buzzard	Steppe	*Buteo*	*vulpinus*
Canary	Black-throated	*Crithagra*	*atrogularis*
Canary	Brimstone	*Crithagra*	*sulphuratus*
Canary	Yellow-fronted	*Crithagra*	*mozambicus*
Chat	Anteating	*Myrmecocichla*	*formicivora*
Cisticola	Rattling	*Cisticola*	*chiniana*
Cisticola	Zitting	*Cisticola*	*juncidis*
Crombec	Long-billed	*Sylvietta*	*rufescens*
Crow	Pied	*Corvus*	*albus*
Cuckoo	Black	*Cuculus*	*clamosus*
Cuckoo	Diderick	*Chrysococcyx*	*caprius*
Cuckoo	Jacobin	*Clamator*	*jacobinus*
Cuckoo	Levaillant's	*Clamator*	*levaillantii*
Dove	Laughing	*Streptopelia*	*senegalensis*
Dove	Namaqua	*Oena*	*capensis*
Dove	Rock	*Columba*	*livia*
Drongo	Fork-tailed	*Dicrurus*	*adsimilis*
Egret	Cattle	*Bubulcus*	*ibis*
Eremomela	Burnt-necked	*Eremomela*	*usticollis*
Falcon	Amur	*Falco*	*amurensis*
Finch	Scaly-feathered	*Sporopipes*	*squamifrons*
Firefinch	African	*Lagonosticta*	*rubricata*
Fiscal	Common (Southern)	*Lanius*	*collaris*
Fish-eagle	African	*Haliaeetus*	*vocifer*
Flycatcher	Marico	*Bradornis*	*mariquensis*
Flycatcher	Spotted	*Muscicapa*	*striata*
Francolin	Crested	*Dendroperdix*	*sephaena*
Go-away-bird	Grey	*Corythaixoides*	*concolor*
Goose	Egyptian	*Alopochen*	*aegyptiacus*
Guineafowl	Helmeted	*Numida*	*meleagris*
Heron	Black-headed	*Ardea*	*melanocephala*
Hoopoe	African	*Upupa*	*africana*
Hornbill	Southern Red-billed	*Tockus*	*rufirostris*
Hornbill	Southern Yellow-billed	*Tockus*	*leucomelas*
Kestrel	Greater	*Falco*	*rupicoloides*
Kestrel	Lesser	*Falco*	*naumanni*
Kingfisher	Striped	*Halcyon*	*chelicuti*
Kite	Black-shouldered	*Elanus*	*caeruleus*
Kite	Yellow-billed	*Milvus*	*aegyptius*
Korhaan	Northern Black	*Afrotis*	*afraoides*
Korhaan	Red-crested	*Lophotis*	*ruficrista*
Korhaan	White-bellied	*Eupodotis*	*senegalensis*

Common_group	Common_species	Genus	Species
Lapwing	Crowned	*Vanellus*	*coronatus*
Lark	Dusky	*Pinarocorys*	*nigricans*
Lark	Rufous-naped	*Mirafra*	*africana*
Lark	Sabota	*Calendulauda*	*sabota*
Lark	Short-clawed	*Certhilauda*	*chuana*
Masked-weaver	Southern	*Ploceus*	*velatus*
Mousebird	Red-faced	*Urocolius*	*indicus*
Mousebird	Speckled	*Colius*	*striatus*
Neddicky	Neddicky	*Cisticola*	*fulvicapilla*
Paradise-whydah	Long-tailed	*Vidua*	*paradisaea*
Penduline-tit	Cape	*Anthoscopus*	*minutus*
Pigeon	Speckled	*Columba*	*guinea*
Pipit	Plain-backed	*Anthus*	*leucophrys*
Prinia	Black-chested	*Prinia*	*flavicans*
Prinia	Tawny-flanked	*Prinia*	*subflava*
Pytilia	Green-winged	*Pytilia*	*melba*
Quelea	Red-billed	*Quelea*	*quelea*
Robin-chat	White-throated	*Cossypha*	*humeralis*
Roller	European	*Coracias*	*garrulus*
Sandpiper	Wood	*Tringa*	*glareola*
Scimitarbill	Common	*Rhinopomastus*	*cyanomelas*
Scrub-robin	Kalahari	*Cercotrichas*	*paena*
Scrub-robin	White-browed	*Cercotrichas*	*leucophrys*
Shrike	Crimson-breasted	*Laniarius*	*atrococcineus*
Shrike	Lesser Grey	*Lanius*	*minor*
Shrike	Red-backed	*Lanius*	*collurio*
Shrike	Southern White-crowned	*Eurocephalus*	*anguitimens*
Snake-eagle	Black-chested	*Circaetus*	*pectoralis*
Sparrow	Cape	*Passer*	*melanurus*
Sparrow	House	*Passer*	*domesticus*
Sparrow	Southern Grey-headed	*Passer*	*diffusus*
Sparrow-weaver	White-browed	*Plocepasser*	*mahali*
Sparrowhawk	Little	*Accipiter*	*minullus*
Spurfowl	Swainson's	*Pternistis*	*swainsonii*
Starling	Cape Glossy	*Lamprotornis*	*nitens*
Stork	Abdim's	*Ciconia*	*abdimii*
Sunbird	Marico	*Cinnyris*	*mariquensis*
Sunbird	White-bellied	*Cinnyris*	*talatala*
Swallow	Barn	*Hirundo*	*rustica*
Swallow	Greater Striped	*Hirundo*	*cucullata*
Swift	White-rumped	*Apus*	*caffer*
Tchagra	Brown-crowned	*Tchagra*	*australis*
Thrush	Kurrichane	*Turdus*	*libonyanus*
Tit	Ashy	*Parus*	*cinerascens*

Common_group	Common_species	Genus	Species
Tit-babbler	Chestnut-vented	*Parisoma*	*subcaeruleum*
Turtle-dove	Cape	*Streptopelia*	*capicola*
Vulture	Cape	*Gyps*	*coprotheres*
Warbler	Willow	*Phylloscopus*	*trochilus*
Waxbill	Black-faced	*Estrilda*	*erythronotos*
Waxbill	Blue	*Uraeginthus*	*angolensis*
Waxbill	Violet-eared	*Granatina*	*granatina*
Weaver	Spectacled	*Ploceus*	*ocularis*
Whydah	Pin-tailed	*Vidua*	*macroura*
Whydah	Shaft-tailed	*Vidua*	*regia*
Woodpecker	Cardinal	*Dendropicos*	*fuscescens*
Wren-warbler	Barred	*Calamonastes*	*fasciolatus*

APPENDIX D. MAMMAL SPECIES LIST

Family	Scientific name	Common name	Red list
Bovidae	*Damaliscus lunatus lunatus*	(Southern African) Tsessebe	Vulnerable (2016)
Bovidae	*Syncerus caffer*	African Buffalo	Least Concern (2008)
Viverridae	*Civettictis civetta*	African Civet	Least Concern (2016)
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern (2016)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened (2015)
Bovidae	*Sylvicapra grimmia*	Grey Duiker	Least Concern (2016)
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern (2016)
Rhinolophidae	*Rhinolophus simulator*	Bushveld Horseshoe Bat	Least Concern (2016)
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern
Vespertilionidae	*Neoromicia capensis*	Cape Serotine	Least Concern (2016)
Felidae	*Caracal caracal*	Caracal	Least Concern (2016)
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern (2016)
Nesomyidae	*Steatomys pratensis*	Common African Fat Mouse	Least Concern (2016)
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern (2016)
Viveridae	*Genetta maculata*	Common Large-spotted Genet	Least Concern
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern (2016)
Rhinolophidae	*Rhinolophus darlingi*	Darling's Horseshoe Bat	Least Concern (2016)
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern (2016)
Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	Least Concern (2016)
Nycteridae	*Nycteris thebaica*	Egyptian Slit-faced Bat	Least Concern (2016)
Pteropodidae	*Epomophorus crypturus*	Epomophorus crypturus	Least Concern (2016)
Nesomyidae	*Dendromus melanotis*	Gray African Climbing Mouse	Least Concern (2016)
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern (2016)
Bovidae	*Aepyceros melampus*	Impala	Least Concern
Leporidae	*Pronolagus randensis*	Jameson's Red Rock Hare	Least Concern (2016)
Bovidae	*Oreotragus oreotragus*	Klipspringer	Least Concern (2016)
Felidae	*Panthera pardus*	Leopard	Vulnerable (2016)
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern (2016)

Family	Scientific name	Common name	Red list
Vespertilionidae	*Eptesicus (Eptesicus) hottentotus*	Long-tailed Serotine	Least Concern
Emballonuridae	*Taphozous (Taphozous) mauritianus*	Mauritian Tomb Bat	Least Concern
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	Least Concern
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern
Vespertilionidae	*Miniopterus natalensis*	Natal Long-fingered Bat	Least Concern (2016)
Muridae	*Mastomys natalensis*	Natal Mastomys	Least Concern (2016)
Bovidae	*Tragelaphus angasii*	Nyala	Least Concern (2016)
Equidae	*Equus quagga*	Plains Zebra	Least Concern (2016)
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern (2008)
Bovidae	*Hippotragus equinus*	Roan Antelope	Endangered (2016)
Vespertilionidae	*Pipistrellus (Pipistrellus) rusticus*	Rusty Pipistrelle	Near Threatened
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern
Felidae	*Leptailurus serval*	Serval	Near Threatened (2016)
Macroscelididae	*Elephantulus brachyrhynchus*	Short-snouted Elephant Shrew	Least Concern (2016)
Muridae	*Lemniscomys rosalia*	Single-Striped Lemniscomys	Least Concern (2016)
Rhinolophidae	*Rhinolophus smithersi*	Smithers' Horseshoe Bat	Near Threatened (2016)
Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	Least Concern (2016)
Giraffidae	*Giraffa giraffa giraffa*	South African Giraffe	Least Concern (2016)
Pedetidae	*Pedetes capensis*	South African Spring Hare	Least Concern (2016)
Nesomyidae	*Saccostomus campestris*	Southern African Pouched Mouse	Least Concern (2016)
Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)
Hipposideridae	*Hipposideros caffer*	Sundevall's Leaf-nosed Bat	Least Concern (2016)
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	Least Concern (2016)
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern (2016)
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern (2016)
Vespertilionidae	*Scotophilus dinganii*	Yellow-bellied House Bat	Least Concern (2016)
Vespertilionidae	*Pipistrellus zuluensis*	Zulu Serotine	Least Concern
Bovidae	*Connochaetes taurinus taurinus*	Blue wildebeest	Least Concern (2016)
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*	Waterbuck	Least Concern (2016)

APPENDIX E. AMPHIBIAN LIST

Family	Scientific name	Common name	Red list
Brevicepitidae	Breviceps adspersus	Bushveld Rain Frog	Least Concern
Bufonidae	Sclerophrys garmani	Olive Toad	Least Concern
Hyperoliidae	Kassina senegalensis	Bubbling Kassina	Least Concern
Microhylidae	Phrynomantis bifasciatus	Banded Rubber Frog	Least Concern
Pyxicephalidae	Amietia delalandii	Delalande's River Frog	Least Concern (2017)
Pyxicephalidae	Cacosternum boettgeri	Common Caco	Least Concern (2013)
Pyxicephalidae	Pyxicephalus adspersus	Giant Bull Frog	Near Threatened
Pyxicephalidae	Tomopterna cryptotis	Tremelo Sand Frog	Least Concern
Pyxicephalidae	Tomopterna marmorata	Russetbacked Sand Frog	Least Concern

APPENDIX F. REPTILE LIST

Family	Scientific name	Common name	Red list
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern (SARCA 2014)
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern (SARCA 2014)
Colubridae	*Dispholidus typus viridis*	Northern Boomslang	Not evaluated
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	Least Concern (SARCA 2014)
Colubridae	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)
Colubridae	*Thelotornis capensis capensis*	Southern Twig Snake	Least Concern (SARCA 2014)
Cordylidae	*Platysaurus intermedius intermedius*	Common Flat Lizard	Least Concern (SARCA 2014)
Elapidae	*Naja annulifera*	Snouted Cobra	Least Concern (SARCA 2014)
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Chondrodactylus turneri*	Turner's Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Lygodactylus capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)
Gerrhosauridae	*Matobosaurus validus*	Common Giant Plated Lizard	Least Concern (SARCA 2014)
Lacertidae	*Nucras holubi*	Holub's Sandveld Lizard	Least Concern (SARCA 2014)
Lamprophiidae	*Amblyodipsas polylepis polylepis*	Common Purple-glossed Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern (SARCA 2014)
Lamprophiidae	*Atractaspis bibronii*	Bibron's Stiletto Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Atractaspis duerdeni*	Duerden's Stiletto Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Gracililima nyassae*	Black File Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Prosymna bivittata*	Two-striped Shovel-snout	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Pseudaspis cana*	Mole Snake	Least Concern (SARCA 2014)
Pythonidae	*Python natalensis*	Southern African Python	Least Concern (SARCA 2014)
Scincidae	*Acontias cregoi*	Cregoi's Blind Legless Skink	Least Concern (SARCA 2014)
Scincidae	*Mochlus sundevallii*	Sundevall's Writhing Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis margaritifera*	Rainbow Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern (SARCA 2014)
Testudinidae	*Kinixys spekii*	Speke's Hinged Tortoise	Least Concern (SARCA 2014)
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern (SARCA 2014)
Typhlopidae	*Afrotyphlops schlegelii*	Schlegel's Beaked Blind Snake	Least Concern (SARCA 2014)
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern (SARCA 2014)
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)

APPENDIX G. CURRICULUM VITAE OF SPECIALIST

CURRICULUM VITAE

B J Henning

PhD Plant Ecology

PERSONAL DETAILS

Name:	BAREND JOHANNES HENNING
Date of Birth:	1976-09-06
Profession/Specialization:	Senior Ecologist
Years with Firm:	6 years (previously 2006-2012 & since May 2020)
Nationality:	South African
Years' experience:	15 years

QUALIFICATIONS

University attended:	University of Pretoria, Pretoria (1995- 2002) PhD Plant Ecology, MSc (Botany), BSc (Hons.), BSc

COURSES

Advanced Wetland Course (UP CE, 2010)

Wetland Rehabilitation Course (UFS, 2015)

Course on wetland offsets (SANBI)

KEY QUALIFICATIONS AND EXPERIENCE

- Senior Ecologist for Ages Limpopo since September 2006 to 2012 and again since May 2020 involved in the following aspects:
    - Vegetation surveys, sensitivity and zoning analysis of development sites, including eco-estates, mines, residential developments, shopping centres, roads, water supply and other related infrastructure etc (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160;)

  - Faunal analysis and scoping reports (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160)
  - Agricultural potential and land capability studies of soils on farms. (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160;)
  - Avifauna studies related to solar plant and power line connection developments;
  - Wetland delineations and functional capacity assessments (completed advanced wetland course of the Continued Education Department, University of Pretoria 2010 as well as Wetland rehabilitation course of the University of the Free State);
  - Wildlife Management Plans and habitat assessment for rare and endangered game species;
  - Spatial Development Frameworks;
  - Strategic Development Area Frameworks for local municipalities
  - GIS related functions;

- Senior Ecologist for Exigo (previously AGES Gauteng) November 2012 to April 2020. Involved in all of the abovementioned aspects;:
- Environmental Consultant for Envirodel Wildlife & Ecological Services cc and Dubel Integrated Environmental Services, Polokwane 2004 - 2006. Involved in the following aspects:
  - Wildlife management plans for game farms /reserves throughout the Limpopo Province
  - Environmental impact assessments (vegetation surveys and faunal scoping reports), habitat suitability analysis and report compilation.
  - Coordinating and performing grass monitoring surveys for the Limpopo Tourism and Parks Board
  - Soil potential studies.

- Environmental Consultant for Ficus – pro Environmental Services cc., Modimolle 2004 / 5. Involved mostly in fieldwork, report compilation or impact studies. Reference: Mr. R. Venter (0147173378)

- Subconsultant for AGES (Africa Geo-Environmental Services 2005-2006. Vegetation surveys and sensitivity zoning and analyses. Mr Johan Botha (0836449957)

- Eco-Agent environmental services cc, Pretoria 2002 - 2004. Involved in environmental impact studies. Prof G. J. Bredenkamp (0825767046), University of Pretoria.

- Enviroguard environmental services cc, Heidelberg 2002 - 2004. Involved in environmental impact studies. Prof L. R Brown (0825767046).

- GIS related aspects for all the above-mentioned aspects on projects.

POSITION AND DUTIES

Employed as Senior Ecological Specialist. Main duties and responsibilities include:

- Compilation of project proposals;
- Conducting specialist assessments
    - Ecological assessments
    - Soils and Land use potential studies;
    - Wetland assessments;
    - Wetland rehabilitation plans;
    - Ecological & wetland monitoring;
    - Biodiversity Action & Management Plans;
    - Agricultural assessments;
    - Avifauna assessments;
    - Wildlife Management Plans and assessments.
    - Rehabilitation Strategy & Implementation Programmes (RSIPs)
- Liaison with clients;
- GIS and map compilation;
- Project admin and management;
- Integration and interaction with the environmental consultants;
- Travelling;