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# *Vertebrate fauna (Mammals & Herpetofauna) Habitat Assessment*

# of

## NIETGEDACHT EXT 4 TOWNSHIP

**April 2025**

Report author: **Mr. J.C.P. van Wyk** (Pri.Sci.Nat: M.Sc)

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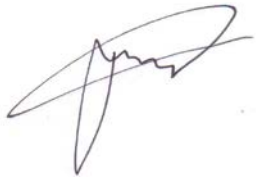
# Declaration of Independence:

I, Jacobus Casparus Petrus van Wyk (6808045041084) declare that I:

- hold an MSc in the Biological Sciences, which allows registration by SACNASP (SA Council for National Scientific Professions) as a Professional Zoologist and sanctions me to function independently as a specialist scientific consultant
- as per prerequisite of the Natural Scientific Professions Act No. 27 of 2003, present this project as my work from inception and reflects exclusively my observations and unbiased scientific interpretations, executed to the best of my ability
- abide by the Code of Ethics of the SACNASP
- am committed to biodiversity conservation but concomitantly recognise the need for economic development. Even though I appreciate the opportunity to learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of Zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the project "Mammal & Herpetofauna Habitat Assessment for Nietgedacht Ext 4 Township, Gauteng Province" described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014 (as amended).
- Our intellectual property in this report will only be transferred to the client (the party/ company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent of the client will be required for release of any part of this report to third parties.



J.C.P. van Wyk

# 1. INTRODUCTION

Galago Environmental CC. was appointed to undertake a Mammal & Herpetofaunal Assessment on Portion 39 of the farm Nietgedacht 535 JQ, Gauteng Province, scheduled for the development of a church as associated activities.

This report focuses on the reigning status of threatened and sensitive mammals & herpetofauna likely to occur on the proposed development site and whose conservation status should be considered in the decision-making process. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the proposed development. The secondary objective of the investigation was to gauge which mammals and herpetofauna might still reside on the site and comment on the mammal and herpetofauna diversity of the study area.

This assignment is in accordance with the 2014 EIA Regulations, as amended, emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

## 1.1 Protocol for faunal specialist assessment

This document is completed as per the “Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species” as set out in Government Notice No 320 (Government gazette 43855) (March 2020). The site sensitivity for this site according to the National Screening tool report is provided in Figure 1.


**Figure 1: Map of relative animal species theme sensitivity of the site**

Prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration, identified by the screening tool, must be confirmed by undertaking a site sensitivity verification.

The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.

The site sensitivity verification must be undertaken through the use of: (a) a desktop analysis, using satellite imagery; (b) a preliminary site inspection by a Zoologist and (c) any other available and relevant information.

The outcome of the site sensitivity verification must be recorded in the form of a report that: (a) confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status, etc.; (b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and (c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

**Table 1:Terrestrial Animal Species Specialist Assessment Report requirement for High sensitivity.**

| Section in GN No. 1150 | Yes | No | Remarks / Section in the report |
|---|---|---|---|
| Has a Site verification report been undertaken by a Zoologist Specialist? | X | | See the findings of the Verification report below. |
| The Terrestrial Animal Species Specialist Assessment Report must be prepared by a SACNASP registered specialist under one of the fields of ecological sciences. | X | | Zoological scientist registered at SACNASP with number: 400062/09 |
| The Terrestrial Animal Species Specialist Assessment Report must be applicable within the study area | X | | See Locality Map in Section 3 |
| The compliance statement must contain, as a minimum, the following information: the contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae; | X | | SACNASP Registration number: 400062/09 Zoological field of expertise CV attached to the report – see CV for contact details (Section 11) |
| a signed statement of independence by the specialist; | X | | Page 4 of the report |
| a statement on the duration, date and season of the site inspection and the relevance of the season | X | | See Section 4 |

| Section in GN No. 1150 | Yes | No | Remarks / Section in the report |
|---|---|---|---|
| to the outcome of the assessment; | | | |
| the methodology used to verify the sensitivities of the terrestrial biodiversity features on the site, including equipment and modelling used, where relevant; | X | | See Section 4 of the report |
| a description of if the mean density of observations/number of sample sites per unit areas and the site inspection observations | X | | See Section 4. |
| a description of the assumptions made and any uncertainties or gaps in knowledge or data; and | X | | See Section 7 |
| details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported. | X | | See Sections 5.1.3 -5.1.5; 5.2.3, 6.2.2 and 6.2.3 |
| the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area. | X | | See Section 4.2 and 4.3 |
| The location areas not suitable for development and to be avoided during construction where relevant. | X | | See Sections 6 and 11 |
| a discussion on the cumulative impacts | X | | See Sections 4.4, 5, 6, 8 and 11 |
| the impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr); | X | | See proposed mitigation measures in Section 6.4 & 10 |
| A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and whether the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; | X | | See Section 6 and 9 |
| a motivation must be provided if there were any development footprints identified as per paragraph above that were | | X | N/A |

| Section in GN No. 1150 | Yes | No | Remarks / Section in the report |
|---|---|---|---|
| identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate | | | |
| A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental impact Assessment Report. | X | | See below |
| Signature of specialist: |  | | Jaco Van Wyk MSc Zoology (Pr.Sci.Nat) Zoological scientist registered at SACNASP with number: 400062/09 |

## 1.2 Protocol compliance statement

The proposed development footprint must be restricted mostly to the disturbed area of the study area.

The niches created by the abiotic habitat enable the persistence of specific vertebrates, including some Red Data species. The Endangered Species treat the site as part of their home ranges / territories. There is a possibility that eight mammal species with Red Data status may occur on the site. The Rough-haired golden mole, Robert’s marsh rat, Southern African hedgehog, Blasius’s (Peak-saddle) horseshoe bat, Short-eared trident bat, African clawless otter and Spotted-necked otter are included as a precautionary measure.

According to the Screening Tool Report for the study site, Maquassie musk shrew (*Crocidura maquassiensis*), Robert’s marsh rat (*Dasmys robertsii*) and spotted-necked otter (*Hydrictis maculicollis*), have a medium sensitivity.

However, the site is disturbed and too small and therefore the Maquassie musk shrew should not occur on the site. Due to presence of aquatic habitat and aquatic vegetation on the site, Robert’s marsh rat and spotted-necked otter could occur on the site.

Animal species sensitivity is given as **High** by the screening tool for the study site. After the site visit, the impression is that the animal species sensitivity for mammals and herpetofauna is rather **Medium**. The nearby Jukskei River has possibly inflated the estimate of animal species sensitivity. The Terrestrial Biodiversity is regarded as **Very**

**High** by the screening tool. After the site visit, though, the impression is that the Terrestrial Biodiversity for mammals and herpetofauna are rather **Medium.** The Aquatic Biodiversity is regarded as **Very High** by the screening tool, and this is the same conclusion (**Very High**) after the site visit.

Therefore, from a mammal and herpetological perspective, there is no objection against the proposed development if the mitigation measures are adhered to.

# 2. SCOPE AND OBJECTIVES OF THE STUDY

This report:

- is a survey of mammal and herpetofauna habitats, with comments on preferred habitats;
- comments on ecologically sensitive areas;
- comments on connectivity with natural vegetation and habitats on adjacent sites;
- evaluates the conservation importance and significance of the site with special emphasis on the current status of resident threatened species;
- offers recommendations to reduce or minimise impacts, should the proposed development be approved

# 3. STUDY AREA

This study site lies in the quarter degree grid cell 2527DD (Broederstroom). The study site lies on Portion 39 of the farm Nietgedacht 535 JQ, Lanseria, City of Johannesburg Metropolitan Municipality, Gauteng. The site is located east of the N14 Road and west of the R114 Road. East of the site is the Southernwoods Road (Figure 2). The study site lies on the northern bank of the Jukskei River and is bordered on the east by the Heron Bridge College. North of the site is the Riverfield Lodge. The study site is about 14 hectares in extent. The study site is spatially defined by the coordinates 25°9486651°S; 27°9622675°E.

An important topographical feature of the study site is the Jukskei River that flow at the southern boundary of the study site. The study site enjoys good connectivity along the Jukskei River. The study site lies inside the Egoli Granite Grassland (Gm 10) vegetation type (Mucina & Rutherford, 2006), but very little remnants of this vegetation type is found on site.

Part of the site has been altered by ground clearing, fences, exotic plants, buildings, greenhouses, tents, grass cutting, dumping site, vegetable gardens, diggings, chicken pens and water pollution.

Some of the trees on the site are indigenous such as the river bushwillow (*Combretum erythrophyllum*), karee (*Searsia lancea*), Witstinkhout (*Celtis africana*), sweet thorn (*Vachellia karroo*), but invasive plants such as *Eucalyptus sp.*, weeping willow (*Salix babylonica*), syringa (*Melia azedarach*), white mulberry (*Morus alba*), common lantana (*Lantana camara*), common thorn-apple (*Datura stramonium*) and kikuyu (*Pennisetum clandestinum*) occurs on the site.

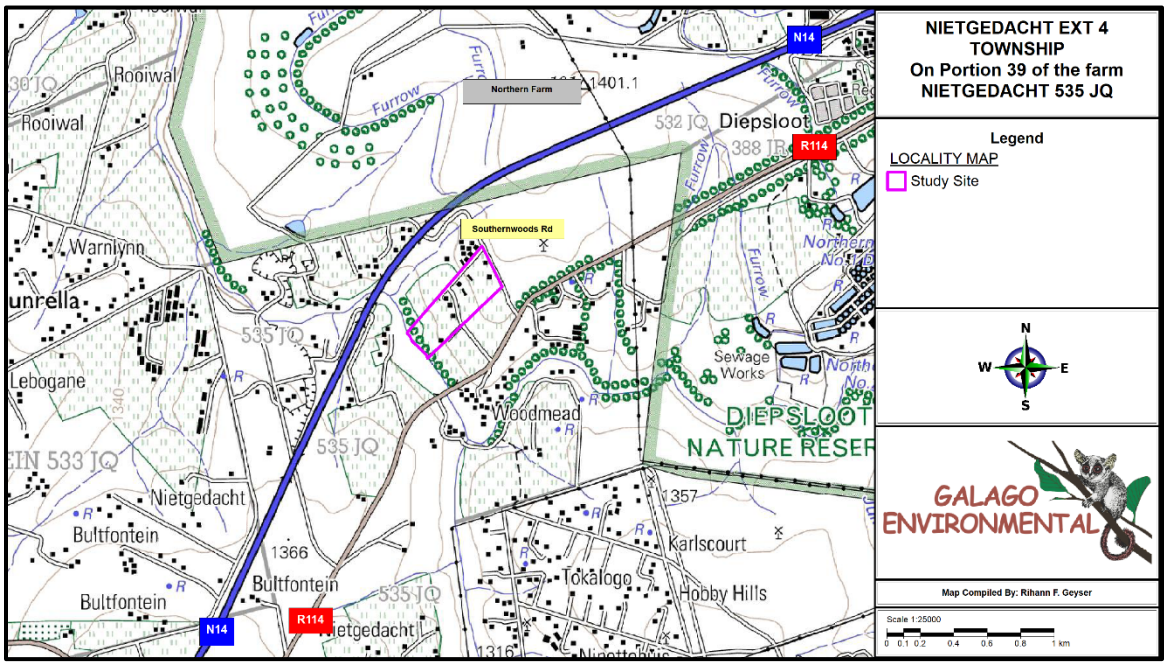



**Figure 2: Locality map of the study area**

The study site lies inside the Egoli Granite Grassland (Gm 10) vegetation type (Mucina & Rutherford, 2006) (Figure 3).

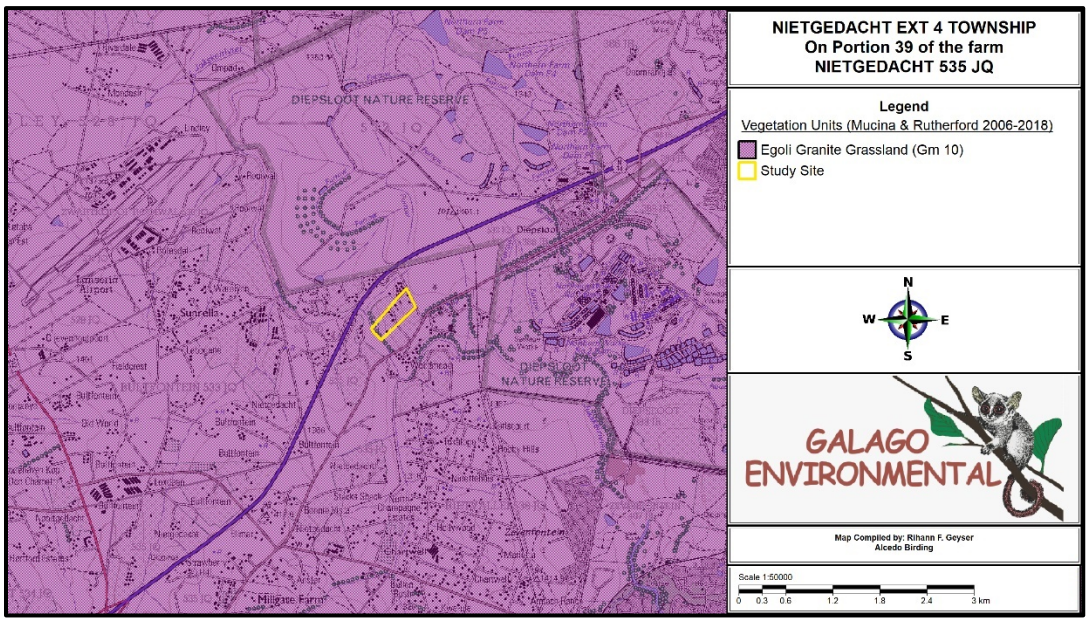


**Figure 3: The Vegetation map of the study site according to Mucina and Rutherford.**

# 4. METHOD

A four-hour site visit was conducted on 21 April 2025. During this visit the observed and derived presence of mammals and herpetofauna associated with the recognised habitat types of the study site was recorded. This was done with due regard to the well-recorded global distributions of Southern African mammals and herpetofauna, coupled with the qualitative and quantitative nature of recognised habitats.

The 500 metres of adjoining properties were scanned for important mammal and herpetofauna habitats.

## 4.1 Field Surveys

During the site visit mammals were identified by visual sightings through random transect walks. No trapping or mist netting was conducted, as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

During the site visit, reptiles and amphibians were also identified by sightings through random transect walks. Amphibian diversity was established by means of acoustic identification. No trapping was conducted, as the terms of reference did not require such intensive work.

## 4.2 Desktop Surveys

### 4.2.1 Mammals

As the majority of mammals are secretive, nocturnal, hibernators and/or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season. During the field work phase of the project, this derived list of occurrences was audited.

The probability of occurrences of mammal species was based on their respective geographical distributional ranges and the suitability of on-site habitat.

Conclusions were drawn based on the impressions gathered during the site visit, as well as publications such as The Complete Book of Southern African Mammals (Mills & Hes, 1997), The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005), Smithers' Mammals of Southern Africa; A Field Guide (2012) and Stuarts' Field Guide to

Mammals of Southern Africa (Stuart & Stuart, 2015). The latest taxonomic nomenclature was used. The vegetation type was defined according to the standard handbook by Mucina and Rutherford (eds) (2006).

### 4.2.2. Herpetofauna

As the majority of reptiles and amphibians are secretive, nocturnal and/or poikilothermic or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

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

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

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

Based on the impressions gathered during the site visit, as well as publications such as FitzSimons' Snakes of Southern Africa (Broadley, 1990), Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998), A Guide to the Reptiles of Southern Africa (Alexander and Marais, 2007), Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014), A Complete Guide to the Snakes of Southern (Marais, 2022), Conservation Status of the reptiles of South Africa, Eswatini and Lesotho (Tolley, Conradie, Pietersen, Weeber, Burger & Alexander, 2023), Amphibians of Central and Southern Africa (Channing, 2001), Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter, et al, 2004), Frogs of Southern Africa; A Complete Guide (Du Preez & Carruthers, 2017) and Field Guide to the Frogs & Other Amphibians of Africa (Channing & Rodel, 2019), a list of species which may occur on the site was compiled.

## 4.3 Specific Requirements

### 4.3.1. Mammals

During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data mammal species in the Gauteng Province (Skinner & Chimimba, 2005, Apps, 2012, Stuart & Stuart, 2015 & Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert, 2016) such as:

Juliana's golden mole (*Neamblosomus juliana*), rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Robert's marsh rat (*Dasymys robertsii)*, white-tailed rat (*Mystromys albicaudatus*), a number of shrews such as the swamp musk shrew (*Crocidura mariquensis*), Maquassie musk shrew (*Crocidura maquassiensis*), Southern African hedgehog *(Atelerix frontalis),* a number of bats such as the short-eared trident bat (*Cloeotis percivali*) and Blasius's (Peak-saddle) horseshoe bat (*Rhinolopus blasii*), mountain reedbuck (*Redunca fulvorufula*); grey rhebok (*Pelea capreolus*); oribi (*Ourebia ourebi*), African clawless otter (*Aonyx capensis*), spotted-necked otter (*Hydrictis maculicollis*) African striped weasel (*Poecilogale albinucha)*, serval *(Leptallurus serval*), leopard (*Panthera pardus*) and brown hyena (*Hyaena brunnea*).

### 4.3.2 Herpetofauna

During the visit the site was surveyed and assessed for the potential occurrence of Red Data herpetofauna species in the Gauteng Province; (Du Preez & Carruthers, 2017 and Tolley, *et al*, 2023) such as: Giant Bullfrogs (*Pyxicephalus adspersus*); Lobatse Hinged Tortoise (*Kinixys lobatsiana*); Striped Harlequin Snake (*Homoroselaps dorsalis*); Coppery Grass Lizard (*Chamaesaura aenea*); Nile crocodile (*Crocodylus niloticus*) and Southern African Python (*Python natalensis*).

## 4.4 Impact Assessment Criteria

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase will be assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
» The **extent,** wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being site specific or within 100 metres of the site boundaries, 2 = local (site + immediate surrounds) Impact might occur during the construction phase, 3 = regional, beyound 5km of the Landfill site and within the provincial boundaries 4 = national, beyond provincial boundaries,

but within national boundaries and a score of 5 being international or beyond the national boundaries).

» The **duration**, wherein it will be indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2 years) impact might occur during the construction phase - assigned a score of 2;
  * medium- to long term (Impact might occur during the operational phase/life of the activity – 40years) – assigned a score of 3;
  * long term, impact ceases after operational phase/life of the activity > 40 years - assigned a score of 4; or
  * permanent or impact in perpetuity- assigned a score of 5;

» The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment (Bio-physical and/or social functions and/or processes will remain unaltered), 2 is minor and will not result in an impact on processes (Bio-physical and/or social functions and/or processes might be negligibly altered), 4 is low and will cause a slight impact on processes (Bio-physical and/or social functions and/or processes might be slightly altered), 6 is moderate and will result in processes continuing but in a modified way (Bio-physical and/or social functions and/or processes might be notably altered), 8 is high (processes are altered to the extent that they temporarily cease) (Bio-physical and/or social functions and/or processes might be considerably altered), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes (Bio-physical and/or social functions and/or processes might be severely altered).

» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 0–5, 0 Zero probability, where 1 is very improbable (< 5% chance of the potential impact occurring), 2 is improbable or low probability (some possibility, but low likelihood, 5% - 25% chance of the potential impact occurring), 3 is medium probable (distinct possibility; 25% - 75% chance of the potential impact occurring), 4 is highly probable (most likely; 75% -95% chance of the potential impact occurring) and 5 is definite (impact will occur regardless of any prevention measures; >95% chance of the potential impact occurring).

» The **irreplaceable** loss of resources. Irreplaceable will be estimated on a scale of 0–5, 0 Zero Irreplaceable, where 1 is very low potential for loss of irreplaceable resources, 2 low potential for loss of irreplaceable resource, 3 moderate potential for loss of irreplaceable resource, 4 high potential for loss of irreplaceable resource and 5 definite potential for loss of irreplaceable resource.

» The **reversibility** of impact. Reversibility will be estimated on a scale of 0–5, 0 no impact, where 1 impact will be reversible (Reversible), 2 high potential that impact might be reversed (High Reversibility), 3 moderate potential that impact might be reversed (Moderate Reversibility) 4 low potential that impact might be reversed (low irreversibility) and 5 impact cannot be reversed (Irreversible).
» the **significance Score**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
» the **status**, which will be described as either positive, negative or neutral.
» the degree to which the impact can be reversed.
» the degree to which the impact may cause irreplaceable loss of resources.
» the *degree* to which the impact can be *mitigated.*

» **Scale utilised for the evaluation of the Environmental Risk Ratings**

| Evaluation Component | Rating scale and description / criteria |
|---|---|
| **CUMULATIVE** impacts | **High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.<br>***Medium****:* The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.<br>***Low****:* The activity is localised and might have a negligible cumulative impact.<br>***None****:* No cumulative impact on the environment. |

Once the Environmental Risk Ratings have been evaluated for each potential environmental impact, the **significance** is calculated by combining the criteria in the following formula:

**SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**
SS= (M+D+E+I+ R) P
S = Significance Score
M = Magnitude
D = Duration
E = Extent
I = Irreplaceable
R = Reversibility
P = Probability

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Environmental Significance of each potential environmental impact as per Table 8.2 below. The Environmental Significance rating process is completed for all identified potential environmental impacts both before and after implementation of the recommended mitigation measures.

**Scale used for the evaluation of the Environmental Significance Ratings**

| Significance Score | Environmental Significance | Description / criteria |
|---|---|---|
| 125 – 150 | Very high (VH) | An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options. |
| 100 – 124 | High (H) | An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options. |
| 75 – 99 | Medium-high (MH) | If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked at. |
| 40 – 74 | Medium (M) | If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project. |
| <40 | Low (L) | An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. |
| + | Positive impact (+) | A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project. |

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. Complete a table and associated ratings for **each** impact identified during the assessment.

***Example of Impact table summarising the significance of impacts (with and without mitigation)***

| ***Nature:*** **[Outline and describe fully the impact anticipated as per the assessment undertaken]** | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | High (3) | Low (1) |
| ***Duration*** | Medium-term (3) | Medium-term (3) |
| ***Magnitude*** | Moderate (6) | Low (4) |
| ***Probability*** | Probable (3) | Probable (3) |
| ***Significance*** | **Medium (36)** | **Low (24)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Yes | Yes |
| ***Mitigation:*** “Mitigation“, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind. | | |

| |
|---|
| ***Cumulative impacts:***<br>"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[1]. |
| ***Residual Risks:***<br>"Residual Risk", means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014). |

**Environmental Management Plan Table format:**

Measures for inclusion in the draft Environmental Management Programme must be laid out as detailed below:

OBJECTIVE: Description of the objective, which is necessary in order to meet the overall goals; these take into account the findings of the environmental impact assessment specialist studies

| | |
|---|---|
| **Project component/s** | List of project components affecting the objective |
| **Potential Impact** | Brief description of potential environmental impact if objective is not met |
| **Activity/risk source** | Description of activities which could impact on achieving objective |
| **Mitigation: Target/Objective** | Description of the target; include quantitative measures and/or dates of completion |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| List specific action(s) required to meet the mitigation target/objective described above | Who is responsible for the measures | Time periods for implementation of measures |

| | |
|---|---|
| **Performance Indicator** | Description of key indicator(s) that track progress/indicate the effectiveness of the management plan. |
| **Monitoring** | Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting |

[1] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 982

# 5. RESULTS

The vegetation types of the site were analysed according to Mucina and Rutherford (2006).

### 5.1.1 Mammal Habitat Assessment:

Acocks (1988), Mucina and Rutherford (2006), Low & Rebelo (1996), Knobel and Bredenkamp (2006), SANBI & DEAT (2009) discuss the distinguishing plant associations of the study area in broad terms. It should be acknowledged that botanical geographers have made immense strides in defining plant associations (particularly assemblages denoted as vegetation units or veld types), whereas this cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant associations. For instance, Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006). Hence, although the former works have been superseded by the latter work of the botanists, the characteristics and extent of biomes are similar, remain valid for vertebrates and are therefore recognized as a reasonable determinant of distribution.

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

From a mammal perspective, it should thus be appreciated that three of the four the major habitats, are present on the site, namely terrestrial, arboreal (tree-living), and wetlands.

Terrestrial habitat is spatially the dominant habitat type and consists of a few spots of natural veld, but most of the site is altered by ground clearing, fences, exotic plants, buildings, greenhouses, tents, building rubble, grass cutting, dumping sites, vegetable gardens, diggings, chicken pens and water pollution buildings. However, at the time of the site visit the basal cover was good in many places and would not provide adequate cover for small terrestrial mammals Figure 4). A few termitaria were recorded, but no moribund termitaria, which provide ideal retreats for small mammals, were present on the site.

**Figure 4: Good basal cover was present on the site.**

There are no important natural rupicolous habitats on the study site. Manmade rupicolous habitats were found in a few places on the study site provide good rupicolous habitat for common mammals (Figure 5). Due to the absence of large natural rupicolous habitat, some species like the eastern rock elephant shrew, Jameson's red rock rabbit, mountain reedbuck and rock hyrax were omitted from the species list in Table 2.

**Figure 5: Rupicolous habitat on the site,**

Riparian vegetation along the Jukskei River provide corridors for some arboreal mammals (Figure 6). Due to the presence of arboreal habitat, some arboreal species like bushbabies were added to the species list in Table 2. Some of the bats listed (Table 2) are likely to find roosts in trees, be that in hollow trunks, under loose bark or simply hanging up in deep shade. Despite of firewood collection, there are a few dead logs which would provide shelter and food for some mammals in some areas.

**Figure 6: Arboreal habitat on the study site.**

The Jukskei River is deemed as a very important and functional ecological entity. This water course is a distribution corridor for many water-dependent mammals, which may also forage on the study site. The Jukskei River can support larger aquatic mammals such as marsh mongoose and clawless otters. In some areas, the thick canopy of trees around the Jukskei River forms an almost impenetrable barrier, preventing sunlight from reaching the soil, which remains moist. The semi-aquatic vegetation along the riverbanks forms ideal habitat for smaller mammals such as shrews and vlei rats. These water bodies are also likely to support insect populations which swarm over the water at dusk during summers, as such forming rich feeding patches for marauding bats (Table 2).

**Figure 7: Aquatic habitat on the study site.**

The study site does not have caves suitable for cave-dwelling bats. The buildings near the site may act as substitute daytime roosts. It is likely that common bats commute from roosting sites elsewhere to hawk for insects over the drainage line.

Sight records were also used to compile this mammal report.

### 5.1.2 Expected and Observed Mammal Species Richness

Initially charismatic mammals (like elephants, buffaloes, rhinos, lions, leopards, spotted hyenas and others) have been extirpated for sport and later to favour cattle farming. Some medium-sized mammal species (black-backed jackals, aardvark, common duiker, steenbok and others) may persist on the study site and its buffer area. All the small mammals such as scrub hares, mongooses and the smaller species also survived the farming era of the property.

Due to the presence of the Jukskei River wetland-reliant species such as rough-haired golden moles, marsh mongooses and the two species of otters are reality. These carnivores are to a large degree reliant of aquatic creatures for prey. Cane rats, vlei rats and shrews are also listed as possible occupants since they forage away from the water amongst rank semi-aquatic vegetation.

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

The areas with soft red sand are conducive to burrowing mammals such as aardvarks, springhares and gerbils. Some small mammals are inclined to use moribund termite mounds for refuge, and these structures can be taken as indicative of the absence of dwarf shrews and pygmy mice.

It is concluded that duiker and steenbok still occur since immigration from the district is likely, in spite of fences.

Black-backed jackals are almost certain to still occur in the district and can be expected to at least occasionally venture onto the site. The small carnivores (mongooses, genets and the polecat) are exceptionally reticent in habits, apart from having wide habitat tolerances and forgiving diets. As a result, they persist in areas in close association of human occupation as long as prey densities remain on sustainable levels.

The listed free-tailed and Vespertilionidae bats showed remarkable adaptability by having expanded their distributional ranges and population numbers significantly by capitalizing on the roosting opportunities offered by manmade structures on the Highveld, in this instance in the houses in the vicinity. Versper bats are more tolerant towards roost opportunities, and it is more than likely that small colonies found roosting opportunities in the roofs of building near the study site. Free-tailed bats are likewise partial to narrow-

entrance roosts provided by buildings; in some instances, roost occupation could reach epidemic proportions. The study site offers no caves or suitable structures answering to the exacting roosting requirements of cave-dwelling bats (Hipposideridae, Rhinolophidae, Nycteridae), but it is likely that they have roosts elsewhere and at times commute to the site to hawk for invertebrates rising over the Jukskei River during summer sunsets.

The present-day species richness is low due to the small size and disturbed nature of the site. It must be emphasised that the study site is too small to sustain a viable population of any vertebrate species that occurs (or historically occurred) there. However, over time vagrants may opportunistically utilise some of the life-supporting services (viz. food, prey, refuge). The overall quality of conservation is largely ranked as poor to fair. It is estimated that 53 species of mammals may occur on or near the study site (Table 2) from time to time. Only one mammal species was confirmed during the site visit (Table 3).

**Table 2: Mammal species observed or deduced to occupy the site.**

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| | **Order: AFROSORICIDA** | |
| | **Family: Chrysochloridae** | **Golden Mole** |
| ***VU***? | *Chrysospalax villosus* | Rough-haired golden mole |
| | **Order: LAGOMORPHA** | |
| | **Family: Leporidae** | **Hares, Rabbits and Rock Rabbits** |
| √ | *Lepus saxatilis* | Scrub hare |
| | **Order: RODENTIA** | |
| | **Family: Bathyergidae** | **Mole-rats** |
| √ | *Cryptomys hottentotus* | African mole rat |
| | **Family: Hystricidae** | **Porcupines** |
| * | *Hystrix africaeaustralis* | Cape porcupine |
| | **Family: Thrynomyidae** | **Canerats** |
| | *Thryonomys swinderianus* | Greater canerat |
| | **Family: Muridae** | **Rats and Mice** |
| √ | *Rhabdomys pumilio* | Four-striped grass mouse |
| ***VU***? | *Dasymus robertsii* | Robert's marsh rat |
| √ | *Mus minutoides* | Pygmy mouse |
| √ | *Mastomys natalensis* | Natal multimammate mouse |
| * | *Mastomys coucha* | Southern multimammate mouse |
| √ | *Aethomys ineptus* | Tete veld rat |
| ? | *Aethomys namaquensis* | Namaqua rock mouse |
| ? | *Gerbilliscus leucogaster* | Bushveld gerbil |
| √ | *Gerbilliscus brantsii* | Highveld gerbil |
| √ | *Saccostomus campestris* | Pouched mouse |
| ? | *Dendromus melanotis* | Grey pygmy climbing mouse |
| ? | *Dendromus mesomelas* | Brants' climbing mouse |
| | **Order: PRIMATES** | |
| | **Family: Galagidae** | **Galagos** |
| * | *Galago moholi* | South African galago |
| | **Order: Eulipotypha** | |
| | **Family: Soricidae** | **Shrews** |

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| ? | *Myosorex varius* | Forest shrew |
| ? | *Suncus varilla* | Lesser dwarf shrew |
| ***NT***? | *Crocidura mariquensis* | Swamp musk shrew |
| ? | *Suncus infinitesimus* | Least dwarf shrew |
| ? | *Crocidura fuscomurina* | Tiny musk shrew |
| * | *Crocidura cyanea* | Reddish-grey musk shrew |
| ? | *Crocidura silacea* | Lesser grey-brown musk shrew |
| * | *Crocidura hirta* | Lesser red musk shrew |
| | **Family: Erinaceidae** | **Hedgehogs** |
| ***NT**** | *Atelerix frontalis* | Southern African hedgehog |
| | **Order: Chiroptera** | Bats |
| | **Family: Pteropodidae** | **Fruit-eating bats** |
| ? | *Epomophorus wahlbergi* | Wahlberg's epauletted fruit bat |
| ? | *Eidolon helvum* | Straw-coloured fruit bat |
| | **Family: Embalonuridae** | **Sheath-tailed bats** |
| √ | *Taphozous mauritianus* | Mauritian tomb bat |
| | **Family: Molossidae** | **Free-tailed bats** |
| * | *Sauromys petrophilus* | Flat-headed free-tailed bat |
| √ | *Tadarida aegyptiaca* | Egyptian free-tailed bat |
| | **Family: Vespertilionidae** | **Vesper bats** |
| ? | *Miniopterus natalensis* | Natal long-fingered bat |
| ? | *Myotis welwitchii* | Welwitsch's hairy bat |
| ? | *Myotis tricolor* | Temminck's hairy bat |
| √ | *Neoromicia capensis* | Cape serotine bat |
| √ | *Scotophilus viridis* | Greenish yellow house bat |
| | **Family: Nycteridae** | Slit-faced bats |
| ? | *Nycteris thebaica* | Egyptian slit-faced bat |
| | **Family: Rhinolophidae** | **Horseshoe bats** |
| * | *Rhinolophus clivosus* | Geoffroy's horseshoe bat |
| ? | *Rhinolophus darlingi* | Darling's horseshoe bat |
| ***NT***? | *Rhinolophus blasii* | Blasius's (Peak-saddle) horseshoe bat |
| ? | *Rhinolophus simulator* | Bushveld horseshoe bat |
| | **Family: Hipposideridae** | **Trident bats and leaf-nosed bats** |
| ? | *Hipposideros caffer* | Sundevall's roundleaf bat |
| ***ED***? | *Cloeotis percivali* | Short-eared trident bat |
| | **Order: Carnivora** | |
| | **Family: Viverridae** | **Civets and genets** |
| * | *Genetta genetta* | Small-spotted genet |
| ? | *Genetta tigrine* | South African large-spotted genet |
| | **Family: Herpestidae** | **Suricates and Mongooses** |
| * | *Galerella sanguinea* | Slender mongoose |
| * | *Cynictis penicillata* | Yellow mongoose |
| √ | *Atilax paludinosus* | Marsh mongoose |
| | **Family: Canidae** | Foxes, wild dogs and jackals |
| ? | *Canis mesomelas* | Black-back jackal |
| | **Family: Mustelidae** | **Otters, honey badger, weasel and polecat** |
| ***NT*** * | *Aonyx capensis* | African clawless otter |

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| ***VU***? | *Hydrictis maculicollis* | Spotted-necked otter |
| | **Order: RUMINANTIA** | |
| | **Family: Bovidae** | **Antelopes and buffalo** |
| * | *Sylvicapra grimmia* | Common duiker |

(Systematics and taxonomy as proposed by Bronner et .al [2003], Skinner & Chimimba [2005], Apps [2012], Stuart & Stuart [2015] and Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert [2016]).

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

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

**Table 3: Mammal species positively confirmed on the study site, observed indicators and habitat.**

| SCIENTIFIC NAME | ENGLISH NAME | OBSERVATION INDICATOR | HABITAT |
|---|---|---|---|
| *Lepus saxatilis* | Scrub hare | Scat on site | Terrestrial |

The scrub hare in Table 3 should not be common on the study site, but this species is common elsewhere in its range in Southern Africa.

### 5.1.3 Threatened and Red Listed Mammal Species

Eight mammal species with Red Data status could possibly occur on or near the site (Table 2).

Generally, all Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats.

The site falls outside the natural distribution range of the Juliana's golden mole. This species does not occur on the study site.

Due to the presence of especially wetland-associated vegetation cover on the study site, the possibility of Red listed mammal species increases dramatically.

The swamp musk shrew and Cape clawless otter occur in moist habitats and such habitat is available on the site and these species could occur on the study site.

The Southern African hedgehog occurs in a wide variety of habitat types but must have vegetation. The possibility exists that some individuals may from time to time occur on the study site.

The rough-haired golden mole occurs in grassland, with a preference for dry, sandy ground on the fringes of marshes or vleis. Such habitat is available on the site and this species could occur on the study site.

Due to the small size of the site and the lack of large natural rupicolous habitat on the study site, mountain reedbuck and grey rhebok do not occur on the site.

The oribi is a rare animal with the Red Data status of *Endangered* and has become locally extinct in many areas. The site is also too disturbed for the oribi antelope, and this species was exterminated many years ago in this area.

The white-tailed mouse is often found in rocky areas with good grass cover, which is not present at the study site. The white-tailed mouse does not occur on the site.

Considering the attraction of wetlands on the site and neighbouring properties in the vicinity of the site, it is possible that the Red Listed bats such as Blasius's (Peak-saddle) horseshoe bat and short-eared trident bat would hawk for invertebrates at dawn.

The habitat of the site is severely disturbed in areas and there are not many prey items, so the possibility that Red Data carnivores would occur here is extremely small. The serval, brown hyena, leopard and the African striped weasel do not occur on the site.

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

### 5.1.4 Robert's Marsh Rat (*Dasymus robertsii*)

According to the Screening Tool Report for the study site the Robert's marsh rat (*Dasymys robertsii)* has a medium sensitivity.

Two species have been split from the African Marsh Rat (*Dasymus incomtus*), namely Cape marsh rat (*D. capensis*) and Robert's marsh rat (*D. robertsii*) (Mullin et.al. 2004). The newly described *D. robertsii* is patchily distributed in the lowveld of northern South Africa and Zimbabwe (Mullin et al. 2005).

Marsh Rats are dependent on intact wetland ecosystems, as they have not been found in artificial or degraded wetlands and are thus patchily distributed in their distribution range (Pillay, et.al 2016). Marsh rats are opportunistic omnivores and good swimmers, adapted to living in very marshy habitats where they build runways and nests in dense ground cover (Monadjem et al. 2015).

During the site visit, such habitat was found on the site and therefore Robert's marsh rats could occur on the site.

### 5.1.5 Maquassie musk shrew (*Crociduara maquassiensis*)

According to the Screening Tool Report on the study site, the Maquassie musk shrew (*Crociduara maquassiensis*) has a medium sensitivity.

This rare species is only known from selected localities (Skinner & Chimimba, 2005). With so few records it is impossible to assess the habitat requirements of the species properly. However, rocky areas in a grassland seem to be the preferred areas, but no such habitat occurs on the site. The Maquassie musk shrew should not occur in such an anthropogenically altered habitat.

### 5.1.6 Spotted-necked otter (*Hydrictis maculicollis*)

According to the Screening Tool Report on the study site the Spotted-necked otter (*Hydrictis maculicollis*) has a medium sensitivity.

There is suitable habitat for spotted-necked otters on the study site in the form of the Jukskei River wetland ecosystem. Despite the pollution in the Jukskei River, the spotted-necked otter could occur on or near the study site from time to time.

## 5.2 Herpetofauna

### 5.2.1 Herpetofaunal Habitat Assessment

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

The terrestrial habitat of the study site has been transformed in parts by ground clearing, fences, exotic plants, buildings, greenhouses, tents, grass cutting, dumping site, vegetable gardens, diggings, chicken pens and water pollution and is thus partly ecologically disturbed. No moribund termitaria were recorded. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for the study site is lower. At the time of the site visit the basal cover was good in many places and would not provide adequate cover for small terrestrial herpetofauna. However, at other area on the study site there was good basal cover.

There are no natural rupicolous habitats on the study site, but excellent manmade rupicolous habitat exists in the form of buildings, fence and building rubble (Figure 8). These man-made habitats offer nooks and crannies as refuge for some common rupicolous herpetofauna. Due to the absence of natural rupicolous habitat, some species like common girdled lizard and rock agama should were omitted from the species list in Table 4.

**Figure 8: Manmade rupicolous habitat on the site.**

Natural arboreal habitat consists of indigenous river bushwillow, karee (Figure 9), sweet thorn, but invasive trees like *Eucalyptus*, weeping willow and syringa grow also on the site. The larger trees may offer refuge to tree-living reptiles like flap-neck chameleons. There are a few dead logs in the site, which provide shelter and food for some herpetofauna.

**Figure 9: Planted indigenous trees on the site.**

An important topographical feature of the study site is the Jukskei River that forms the southern border of the study site. Old man-made fishponds and other man-made wetlands (Figure 10) also occur near the Jukskei River in the 100-year flood line. These water sources provide habitat for frogs and water-dependent reptiles.

**Figure 10: Man-wet wetlands on the site**

Connectivity between the study site and along the Jukskei River is good, which is important from a biodiversity perspective.

Sight records were also used to compile this mammal report.

### 5.2.2 Expected and Observed Herpetofauna Species Richness:

Of the 86 reptile species which may occur on the study site (Table 4), one was confirmed during the site visit (Table 5) and of the 29 amphibian species which may possibly occur on the study site (Table 4), one was confirmed during the site visit. Table 4 lists the reptiles & amphibians which were observed on or deduced to occupy the site. It must be emphasised that the species richness is for the general area and NOT for the study site itself.

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

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table) are fairly common and widespread (viz. the South African helmeted terrapin, Nile monitor, common house snake, mole snake, speckled rock skink, common river frog, guttural toad, red toad, raucous toad, platana and Boettger's Caco).

The species richness is poor to fair due to the small size and disturbed nature of the study site (Table 4).

**Table 4**: **Reptile and Amphibian species observed or deduced to occupy the site.**

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| | **CLASS: REPTILIA** | **REPTILES** |
| | **Order: TESTUDINES** | **TORTOISES & TERRAPINS** |
| | **Family: Pelomedusidae** | **Side-necked Terrapins** |
| √ | *Pelomedusa galeata* | South African Helmeted Terrapin |
| | **Family: Testudinidae** | Tortoises |
| *?* | *Stigmochelys pardalis* | Leopard Tortoise |
| | | |
| | **Order: SQUAMATA** | **SCALE-BEARING REPTILES** |
| | **Suborder:LACERTILIA** | **LIZARDS** |
| | **Family: Gekkonidae** | **Geckos** |
| √ | *Hemidactylus mabouia* | Common Tropical House Gecko |
| √ | *Lygodactylus capensis* | Common Dwarf Gecko |
| √ | *Pachydactylus affinis* | Transvaal Gecko |
| ***** | *Pachydactylus capensis* | Cape Gecko |
| | **Family: Amphisbsenidae** | **Amphisbaenians** |
| *?* | *Monopeltis infuscate* | Dusky Worm Lizard |
| | **Family: Lacertidae** | **Old World Lizards or Lacertids** |
| *?* | *Ichnotropis capensis* | Cape Rough-scaled Lizard |
| ***** | *Meroles squamulosus* | Savanna Lizard |
| ***** | *Nucras holubi* | Holub's Sandveld Lizard |
| *?* | *Nucras intertexta* | Spotted Sandveld Lizard |
| *?* | *Nucras lalandii* | Delanande's Sandveld Lizard |
| *?* | *Nucras ornata* | Ornate Sandveld Lizard |
| ***** | *Pedioplanis lineoocellata* | Spotted Sand Lizard |
| | **Family: Gerrhosauridae** | **Plated Lizards** |
| √ | *Gerhosaurus flavigularis* | Yellow-throated Plated Lizard |
| | **Family: Scincidae** | **Skinks** |
| *?* | *Acontias gracilicauda* | Thin-tailed Legless Skink |
| *?* | *Acontias occidentalis* | Western Legless Skink |
| *?* | *Mochlus sundevallii* | Sundevall's Writhing Skink |
| √ | *Afroablepharus wahlbergii* | Wahlberg's Snake-Eyed Skink |
| √ | *Trachylepis capensis* | Cape Skink |
| √ | *Trachylepis punctatissima* | Speckled Rock Skink |
| *?* | *Trachylepis varia* | Variable Skink |
| | **Family: Chamaeleonidae** | **Chameleons** |
| ***** | *Chamaeleo dilepis* | Flap-Neck Chameleon |
| | **Family: Agamidae** | **Agamas** |
| √ | *Agama aculeata* | Common Ground Agama |
| | **Family: Varanidae** | **Monitors** |
| √ | *Varanus niloticus* | Water Monitor |
| | | |

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| | **Suborder: SERPENTES** | **SNAKES** |
| | **Family: Leptotyphlopidae** | **Thread Snakes** |
| ? | *Leptotyphlops conjunctus* | Cape Thread Snake |
| ? | *Leptotyphlops distanti* | Distant's Thread Snake |
| ? | *Leptotyphlops incognitus* | Incognito Thread Snake |
| √ | *Leptotyphlops scutifrons* | Peter's Thread Snake |
| | **Family: Typhlopidae** | **Blind Snakes** |
| ? | *Afrotyphlops bibronii* | Bibron's Blind Snake |
| ? | *Rhinotyphlops lalandei* | Delalande's Beaked Blind Snake |
| | **Family: Viperidae** | **Adders** |
| ? | *Bitis arietans arietans* | Puff Adder |
| √ | *Causus rhombeatus* | Rhombic Night Adder |
| | **Family: Atractaspididae** | |
| ? | *Amblyodipsas polylepis* | Common Purple-glossed Snake |
| ? | *Aparallactus capensis* | Black-headed Centipede Eater |
| ? | *Atractapis bibronii* | Bibron's Stiletto Snake |
| ? | *Homoroselaps lacteus* | Spotted Harlequin Snake |
| | **Family: Colubridae** | |
| ? | *Philothamnus hoplogaster* | South-eastern Green Snake |
| √ | *Crotaphopeltis hotamboeia* | Red-Lipped Snake |
| √ | *Dasypeltis scabra* | Rhombic Egg Eater |
| | **Family: Elapidae** | **Cobras, Mambas and Others** |
| ? | *Elapsoidea sunderwallii* | Sundevall's Garter Snake |
| √ | *Hemachatus haemachatus* | Rinkhals |
| | **Family: Lamprophiidae** | |
| √ | *Boaedon capensis* | Common House Snake |
| ? | *Lamprophis aurora* | Aurora House Snake |
| ? | *Limaformosa capensis* | Common File Snake |
| ? | *Lycodonomorphus inornatus* | Olive Ground Snake |
| √ | *Lycodonomorphus rufulus* | Brown Water Snake |
| √ | *Lycophidion capense* | Cape Wolf Snake |
| | **Family: Psammophiidae** | |
| √ | *Psammophis brevirostris* | Short-snouted Grass Snake |
| ? | *Psammophis crucifer* | Cross-marked Whip Snake |
| ? | *Psammophis leightoni* | Variable Sand Snake |
| ? | *Psammophis subtaeniatus* | Western Stripe-bellied Sand Snake |
| ? | *Psammophylax rhombeatus* | Spotted Skaapsteker |
| ? | *Psammophylax tritaeniatus* | Striped Skaapsteker |
| | **Family: Prosymnidae** | |
| ? | *Prosymna sundevallii* | Sundevall's Shovel-snout |
| | **Family: Pseudaspididae** | |
| √ | *Pseudaspis cana* | Mole Snake |

| | SCIENTIFIC NAME | ENGLISH NAME |
|---|---|---|
| | **Family: Pseudoxyrhophiidae** | |
| ? | *Duberria lutrix* | Common Slug Eater |
| | | |
| | **CLASS: AMPHIBIA** | **AMPHIBIANS** |
| | **Order: ANURA** | **FROGS** |
| | **Family: Pipidae** | **Clawed Frogs** |
| √ | *Xenopus laevis* | Common Platanna |
| | **Family: Bufonidae** | **Toads** |
| √ | *Sclerophrys gutturalis* | Guttural Toad |
| * | *Sclerophrys capensis* | Raucous Toad |
| ? | *Sclerophrys poweri* | Western Olive Toad |
| √ | *Schismaderma carens* | Red Toad |
| | **Family: Hyperoliidae** | **Reed Frogs** |
| √ | *Kassina senegalesis* | Bubbling Kassina |
| | **Family: Phrynobatrachidae** | **Puddle Frogs** |
| ? | *Phrynobatrachus natalensis* | Snoring Puddle Frog |
| | **Family: Pyxicephalidae** | |
| √ | *Cocosternum boettgeri* | Boettger's Caco |
| * | *Pyxicephalus adspersus* | Giant Bullfrogs |
| √ | *Tomopterna cryptotis* | Tremolo Sand Frog |
| √ | *Tomopterna natalensis* | Natal Sand Frog |

Systematic arrangement and nomenclature according to Branch (1998), Alexander & Marais (2007), Minter, *et.al* (2004), Bates, *et.al* 2014, Du Preez & Carruthers (2017) and Tolley *et.al*. (2023)

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

**Table 5: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat.**

| SCIENTIFIC NAME | ENGLISH NAME | OBSERVATION INDICATOR | HABITAT |
|---|---|---|---|
| *Lygodactylus capensis* | Common Dwarf Gecko | Sight record of an adult on a building | Rupicolous |
| *Schismaderma carens* | Red Toad | Sight record of several juveniles under rocks. | Rupicolous |

The common dwarf gecko and red toad listed in Table 5 should be common on the study site and elsewhere in its range.

### 5.2.3 Threatened and Red listed Reptile and Amphibian Species

The study site falls outside the natural range of Nile crocodile and the Southern African python, and these species should not occur on the site.

The striped harlequin snake has been recorded on this quarter degree square [2527DD (Broederstroom)] (TVL Museum Records or Ditsong Museum of Natural History), but no moribund termitaria, where this species is most likely to be found, are present on the study site. It is very difficult to confirm whether this cryptic snake is present on any site, but this species should not occur on this particular study site.

The Coppery grass lizard (*Chamaesaura aenea*) has not been recorded on this quarter degree square (TVL Museum Records or Ditsong Museum of Natural History). If the study site were much larger and consisted of pristine grassveld, the Coppery grass lizard (*Chamaesaura aenea*) might have occurred on the study site, but due to the generally disturbed nature and small size of the study site, this species should not occur on the site at present.

The Lobatse hinged tortoise (*Kinixys lobatsiana*) occurs in the vicinity of the study site, because this species has been recorded in some parts of the Gauteng Province, which is part of its distribution range (Bates et.al. 2014).

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

Degradation of this species' habitat is mainly because of habitat destruction due to agricultural conversion, urban development, mining activities and alien species invasion. The use of mechanical bush clearing and fire as management tools is particularly destructive. There are also indications that this species is sometimes used for food, cultural purposes, and for the pet trade, which can cause local extinction (Hofmeyr & Boycott, 2018).

This species prefers rocky hillsides and rocky outcrops (Boycott & Bourquin, 2000). There is no such habitat available on the site. This development would not affect this species negatively because it should not occur on or near the site.

I have observed tadpoles and adults in this quarter degree grid square at several places which include the BP Garage Bullfrog Reserve along the N14, which is just south-west of

the study site. Although the study site is at the Jukskei River, the river is not suitable for giant bullfrogs due to the presence of fish in the river. The water of the Jukskei River is also constantly flowing and too cold for giant bullfrog to breed. The study site contains temporary dams, which are potential breeding places for giant bullfrogs. Giant bullfrogs prefer warm, stagnant water, which giant bullfrog tadpoles need for rapid development (Van Wyk, Kok & Du Preez, 1992). Bullfrog breeding sites are mostly temporary, in order to avoid predation from fish. Some of the dams on the study site and buffer area have gentle slopes, which giant bullfrogs prefer. A gentle slope allows for shallow water (less than 10cm deep), which enables the female bullfrog to stand when she lays her eggs outside the water for the male to fertilise. Many parts of the study site consist of sandy soil and are very suitable as dispersal areas, which combine feeding and aestivation. It is essential that the soil be suitable for burrowing on a daily basis during the short activity period at the beginning of the rainy season and for deeper retreats during the resting periods.

The conservation status of giant bullfrogs is controversial. In the latest literature (Measey (ed.) 2011 and Carruthers & Du Preez 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter *et al*, 2004) to Least Concern in South Africa, but in places like, Gauteng 80% of bullfrog habitat has disappeared (Carruthers, 2007). In Gauteng the decline in numbers has led to the species being regarded as a conservation concern (Du Preez & Carruthers, 2017).

# 6. FINDINGS AND POTENTIAL IMPLICATIONS

Humanity depends on the natural environment for a large number of ecological services provided by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts need to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practice and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

The study site has an important and sensitive topographical feature in the form of the Jukskei River and its buffer area enjoy statutory protection and are flagged as having a High Conservation Sensitivity. The Jukskei River provides an important movement corridor for various animals.

The study site contains natural terrestrial, arboreal and wetland habitats, and man-made rupicolous habitat. The terrestrial habitat of the study site has been transformed in parts by ground clearing, fences, exotic plants, buildings, greenhouses, tents, grass cutting, dumping site, vegetable gardens, diggings, chicken pens and water pollution.

Species richness: The species richness is low to fair due to the small size of the study site. The existing species richness of the site is currently in a downwards cycle of decline due to environmental transformation of the study site and it surrounding environment. 53 mammal species and 68 herpetofauna species are expected to occur on or near the study site. It must be emphasised that the species richness is for the general area and NOT for the study site itself.
Endangered species: The Endangered Species treat the site as part of their home ranges / territories. There is a possibility that eight mammal species with Red Data status may occur on the site. The Rough-haired golden mole, Robert's marsh rat, Southern African hedgehog, Blasius's (Peak-saddle) horseshoe bat, Short-eared trident bat, African clawless otter and Spotted-necked otter are included as a precautionary measure.

According to the Screening Tool Report for study site, Maquassie musk shrew (*Crocidura maquassiensis*), Robert's marsh rat (*Dasmys robertsii*) and spotted-necked otter (*Hydrictis maculicollis*), have a medium sensitivity.

However, the site is disturbed and too small and therefore the Maquassie musk shrew should not occur on the site. Due to presence of aquatic habitat and aquatic vegetation on the site, Robert's marsh rat and spotted-necked otter could occur on the site.

The possibility exists that at least some individuals of the giant bullfrog occur on the study site.

Sensitive species and/or areas (Conservation ranking): The study site lies inside the Egoli Granite Grassland (Gm 10) vegetation type (Mucina & Rutherford, 2006), which has an Endangered status. The study site lies in a Very High Terrestrial Biodiversity Sensitivity area according to the screening tool. However, the site is already seriously altered.

Habitat(s) quality and extent: Three of the four major habitats are naturally present on the study site, namely terrestrial, aquatic and arboreal. The Jukskei River forms the southern border of the study site and a 50m buffer from the riparian edge should be conserved for biodiversity.

The site has been mostly disturbed by anthropogenic influences such as ground clearing, fences, exotic plants, buildings, greenhouses, tents, grass cutting, dumping site, vegetable gardens, diggings, chicken pens and water pollution.

Impact on species richness and conservation: The Township will have a significant and lasting effect on species richness and conservation. This would involve new buildings, new roads carrying more vehicles and more habitat destruction, which will obviously have a hugely detrimental effect on any remaining vertebrates. These structures will form larger barriers for vertebrate movement and will result in a decrease in connectivity. The development will have a large and permanent footprint.

If the development should go ahead, a very important indirect effect would be the likely impact that the proposed development might have on the water quality of the Jukskei River due to surface water runoff. This could have a negative impact on the vertebrates specifically, but also on conserving biodiversity and maintaining ecosystem functioning in the long term.

Connectivity: Connectivity along the Jukskei River is good. Connectivity to and from the river varies from good (natural riverbank of the study site) to poor (due to building, security walls and pavements surrounding riverside properties). The site lies east of the N14 Road and west of the R114 Road which also effect the connectivity of the site.

Management recommendation: The natural slope of the riverbank, from the fence to the river edge, should be rectified and the riparian area rehabilitated.

Despite the fact that the site has a High Terrestrial Biodiversity sensitivity according to the screening tool, there are no grounds from a vertebrate perspective to prevent the proposed development. The site is of “medium” sensitivity for terrestrial biodiversity.

Assessment of alternative sites

No alternative sites were presented for assessment, but the proposed development must take place in such a way that the linear integrity, flow dynamics and water quality of the Jukskei River on and near the site would not be affected.

General: Measures will have to be taken to reduce water pollution of the Jukskei River in general. The removal of exotic trees will improve the water quality and habitat of water-dependent vertebrates. Any development should be in line with legislation and the integrity of the Jukskei River should not be jeopardised in any way by development

.

The proposed development will have a large and permanent footprint but no Red Data mammals and herpetofauna should be negatively affected by the development. The recommendation is that the development could go ahead if the developer adheres to the mitigation measures, because the site is of “medium” sensitivity for terrestrial biodiversity.

## 6.1 Assessment Criteria

The possible impacts, as described in the next section, were assessed based on the Significance Score. The Significance Score of the impact is calculated as follows and rating significance is explained below:

**SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

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

II. The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

III. The **duration**, wherein it will be indicated whether
- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

IV. The **consequences (magnitude)**, quantified on a scale from 0-10, where
- 0 is small and will have no effect on the environment,
- 2 is minor and will not result in an impact on processes,
- 4 is low and will cause a slight impact on processes,
- 6 is moderate and will result in processes continuing but in a modified way,
- 8 is high (processes are altered to the extent that they temporarily cease), and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

V. The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where
- 1 is very improbable (probably will not happen),
- 2 is improbable (some possibility, but low likelihood),
- 3 is probable (distinct possibility),
- 4 is highly probable (most likely) and
- 5 is definite (impact will occur regardless of any prevention measures).

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

VII. The **status**, which will be described as either positive, negative or neutral.

VIII. The degree to which the impact can be reversed.

IX. The degree to which the impact may cause irreplaceable loss of resources.

X. The degree to which the impact can be mitigated.

The **significance** weightings for each potential impact are as follows:

- **< 30 points:** **Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **30-60 points:** **Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **60 points:** **High** (i.e. where the impact must have an influence on the decision process to develop in the area).

## 6.2 Impact Assessments

The tables below list the activities that could impact on the vertebrate fauna because of the proposed development, as well as impacts that may be associated with the operation thereof. The tables also list recommended mitigation measures to limit the impacts.

### 6.2.1 Destruction of sensitive vertebrate habitat

| |
|---|
| ***Nature:*** Currently the negative impact has already taken place in most areas of the proposed township. The proposed development will increase the footprint and it will be permanent. This will lead to some terrestrial species becoming permanently and proportionally rarer within local context. |
| **ACTIVITY:** The sources of these impacts include the removal of vegetation by clearing the bush and felling of protected trees. The pollution of the drainage line will have an impact on the survival of many vertebrate species. |

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **CONSTRUCTION** | | |
| ***Magnitude*** | High (8) | Low (6) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of*** | Definite potential of loss (5) | High potential of loss (4) |
| ***Reversibility*** | Irreversible (5) | Low Reversibility (4) |
| ***Probability*** | Definite (5) | High probable (4) |
| ***Significance*** | **120 (Very high)** | **76 (Medium-high)** |
| ***Status (positive or negative)*** | Negative | Negative |
| **OPERATIONAL** | | |
| ***Magnitude*** | Moderate (8) | Low (6) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of*** | Definite potential of loss (5) | High potential of loss (4) |
| ***Reversibility*** | Irreversible (5) | Low Reversibility (4) |
| ***Probability*** | Definite (5) | High Probable (4) |
| ***Significance*** | **125 (Very high)** | **48 (Medium-high)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation:***
1. Keep the impact as small as possible in the proposed development area.
2. Sensitive habitat (Jukskei River) should ideally be cordoned off to prevent access. The 50m buffer outside the riparian area must be conserved for the Jukskei River.

***Cumulative impacts:*** Construction activities outside the proposed area will result in cumulative impact to the sensitive vertebrate habitat near the study site and even beyond. It is imperative that effective protective measures should be put into place and monitored in the sensitive area of the Jukskei River in the township area. A rehabilitation plan should be put into action should this sensitive area suffer degradation.

***Residual Risks:*** Impacts on sensitive areas are likely to be permanent unless the development takes place only in the proposed footprint area.

### 6.2.2 Red Data Mammals

***Nature:*** All Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats. Most of the Red Data mammals have already been killed or driven from the area.
The impacts could include:

- Removal of vegetation
- Pollution of the Jukskei River and other water sources
- Killing of mammals

This could lead to the loss of Red Data mammal species of conservation concern.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **CONSTRUCTION PHASE** | | |
| ***Magnitude*** | High (8) | Moderate (6) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of resources*** | High potential of loss (4) | Moderate potential of loss (3) |
| ***Reversibility*** | Low Reversibility (4) | Moderate Reversibility (3) |
| ***Probability*** | Highly probable (4) | Low Probable (2) |
| ***Significance*** | **88 (medium-high)** | **34 (low)** |
| ***Status (positive or negative)*** | **Negative** | **Negative** |
| **OPERATIONAL PHASE** | | |
| ***Magnitude*** | High (8) | Moderate (6) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of resources*** | High potential of loss (4) | Moderate potential of loss (3) |
| ***Reversibility*** | Low Reversibility (4) | Moderate Reversibility (3) |
| ***Probability*** | High Probable (4) | Low Probable (2) |
| ***Significance*** | **92 (medium-high)** | **36 (low)** |
| ***Status (positive or negative)*** | **Negative** | **Negative** |
| ***Can impacts be mitigated?*** | Reasonably | |

***Mitigation:***
*Planning:*

- All the development must be located within the proposed footprint area and outside the 50m buffer from the riparian area to preserved biodiversity along the Jukskei River corridor.

*Construction:*

- Prevent any pollution of the Jukskei River.
- Educate the people about littering and the removal of refuse with sign boards

*Operational:*

- Monitor the area to ensure that the development stays within the proposed footprint area. Monitor colonisation by exotics or invasive plants and control these as they emerge.
- Discourage the use of hunting dogs to kill mammals.

***Cumulative impacts:*** Pollution of the Jukskei River

***Residual Risks:*** The decline of mammal species is likely to continue unless the development stays in the current proposed area and if the construction workers and local people are not educated about mammals in particular and Red Data mammals specifically.

### 6.2.3 Red Data Herpetofauna

***Nature:*** All Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats. Most of the Red Data herpetofauna have already been killed or driven from the area.
The impacts could include:

- Removal of vegetation
- Pollution of Jukskei River and other water sources
- Killing of herpetofauna
- This could lead to the loss of Red Data herpetofauna species of conservation concern.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **CONSTRUCTION PHASE** | | |
| ***Magnitude*** | High (8) | Moderate (6) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of resources*** | High potential of loss (4) | Moderate potential of loss (3) |
| ***Reversibility*** | Low Reversibility (4) | Moderate Reversibility (3) |
| ***Probability*** | Highly probable (4) | Low Probable (2) |
| ***Significance*** | **88 (Medium-High)** | **34 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| **OPERATIONAL PHASE** | | |
| ***Magnitude*** | High (8) | Moderate (6) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of resources*** | High potential of loss (4) | Moderate potential of loss (3) |
| ***Reversibility*** | Low Reversibility (4) | Moderate Reversibility (3) |
| ***Probability*** | High Probable (4) | Low Probable (2) |
| ***Significance*** | **92 (medium-high)** | **36 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Can impacts be mitigated?*** | Yes | |

***Mitigation:***
*Planning:*

- All development must be located inside of the proposed footprint area.
- A 50m buffer from the Riparian area must be conserved and rehabilitated where possible to enhance biodiversity along the Jukskei River corridor.
- Set up a meeting with community leaders.

*Construction:*

- The legal protection and value of a Tops species such as the Giant Bullfrog must be explained to the residents of the area.
- Prevent any pollution of the Jukskei River.
- Construct clean water outlets for people and their livestock
- Educate the people about littering and the removal of refuse with sign boards

*Operational:*

- Monitor the area so that the development stays within the proposed footprint area.
- Monitor colonisation by exotics or invasive plants and control these as they emerge.
- Discourage the people from killing herpetofauna, especially snakes.
- Plant indigenous vegetation from the surrounding areas to re-establish indigenous plant cover.

***Cumulative impacts:*** Erosion upslope from the Jukskei River could increase sedimentation in already degraded watercourses. However, this could be mitigated. Possible contamination of rivers and/or groundwater reserves due to hydrocarbon or other spillage and an increase of modified areas (together with surrounding developments) that will affect flora population dynamics and runoff patterns.

***Residual Risks:*** The decline of herpetofaunal species is likely to continue unless the development stays in the proposed footprint area, outside the buffer of the Jukskei River and if the people are not educated about herpetofauna in particular and Red Data herpetofauna specifically.

### 6.2.4 Poaching of wildlife in the vicinity

***Nature:*** The site is vulnerable to hunting/trapping by residents/ construction workers. Harassing and hunting by residents/ construction workers could be expected.

**Activity:** The killing of wildlife like scrub hares, snakes and game birds by residents/ construction workers is a possibility.

| | Without mitigation | With mitigation |
|---|---|---|
| **CONSTRUCTION** | | |
| ***Magnitude*** | Moderate (6) | Low (4) |
| ***Duration*** | Long-term (4) | Long-term (4) |
| ***Extent*** | Limited to Local Area (2) | Limited to site (1) |
| ***Irreplaceable loss of*** | Moderate potential of loss (3) | Low potential of lost (2) |
| ***Reversibility*** | High Reversibility (2) | Reversibility (1) |
| ***Probability*** | High Probable (4) | Low probability (2)) |
| ***Significance*** | 68 (Medium) | 14 (Low) |
| ***Status (positive or negative)*** | Negative | Negative |
| **OPERATIONAL** | | |
| ***Magnitude*** | Moderate (6) | Low (4) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Extent*** | Limited to Local Area (2)) | Limited to site (1) |
| ***Irreplaceable loss of*** | Moderate potential of lost (3) | Low potential of lost (2) |
| ***Reversibility*** | High Reversibility (2) | Reversibility (1) |
| ***Probability*** | High Probable (4) | Low probability (2) |
| ***Significance*** | 72 (Medium) | 15 (low) |
| ***Status (positive or negative)*** | Negative | Negative |

| | |
|---|---|
| ***Can impacts be mitigated?*** | Yes |
| ***Mitigation:***<br>• Education of residents/ construction workers about the value of wildlife and environmental sensitivity.<br>• Restrict access to the suitable and sensitive habitats of faunal species.<br>• The residents/contractor/contractors must ensure that no animals are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. | |
| ***Cumulative impacts:*** Certain species becoming proportionally rarer or even becoming locally extinct. | |
| ***Residual Risks:*** With education, the impact can be kept to a minimum. | |

# 7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

Galago Biodiversity and Aquatic Specialists are committed to the conservation of biodiversity but concomitantly recognise the need for economic development. Even though we appreciate the opportunity to learn through the processes of constructive criticism and debate, we reserve the right to form and hold our own opinions and therefore will not willingly submit to the interest of other parties or change statements to appease them.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. To some extent, conclusions are drawn, and proposed mitigation measures suggested based on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may become known at a later stage. Galago Biodiversity and Aquatic Specialists can therefore not accept responsibility for conclusions drawn and mitigation measures suggested in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

# 8. RECOMMENDED MITIGATION MEASURES

**Protection of the Jukskei River:**
Every effort should be made to retain the linear integrity, flow dynamics and water quality of the Jukskei River near the site. The river as well as its 50m buffer zones should be considered as ecologically highly sensitive and must be conserved, since they also act as dispersal corridors. The best way to protect biodiversity is to keep the footprint within the disturbed areas.

The following mitigation measures are proposed by the specialist:

- The possibility exists that the rough-haired golden mole, Robert's marsh rat, Southern African hedgehog, Blasius's (Peak-saddle) horseshoe bat, short-eared trident bat, African clawless otter and spotted-necked otter may occur on the study site from time to time and are included as a precautionary measure.
- If the giant bullfrog or any other mammal or herpetofauna species be encountered or exposed during the construction phase of new buildings or roads, they should be removed and relocated to natural areas in the vicinity.
- Indigenous riparian tree, shrub and grass species should be planted to stabilise the riverbank. Natural plant species provide food for prey items of mammals, birds and herpetofauna and provide abundant refuge for small mammals and herpetofauna.
- During the construction phase there will be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction like roads during the winter months would mitigate the environmental impact.
- A thorough rehabilitation plan for the Jukskei River and buffer area must be put in place once construction has stopped.
- Alien and invasive plants must be removed.
- The education of people/workers about the value of mammals and herpetofauna is very important. No trapping or poaching should be allowed.

During the construction phase there will be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months will avoid this problem.

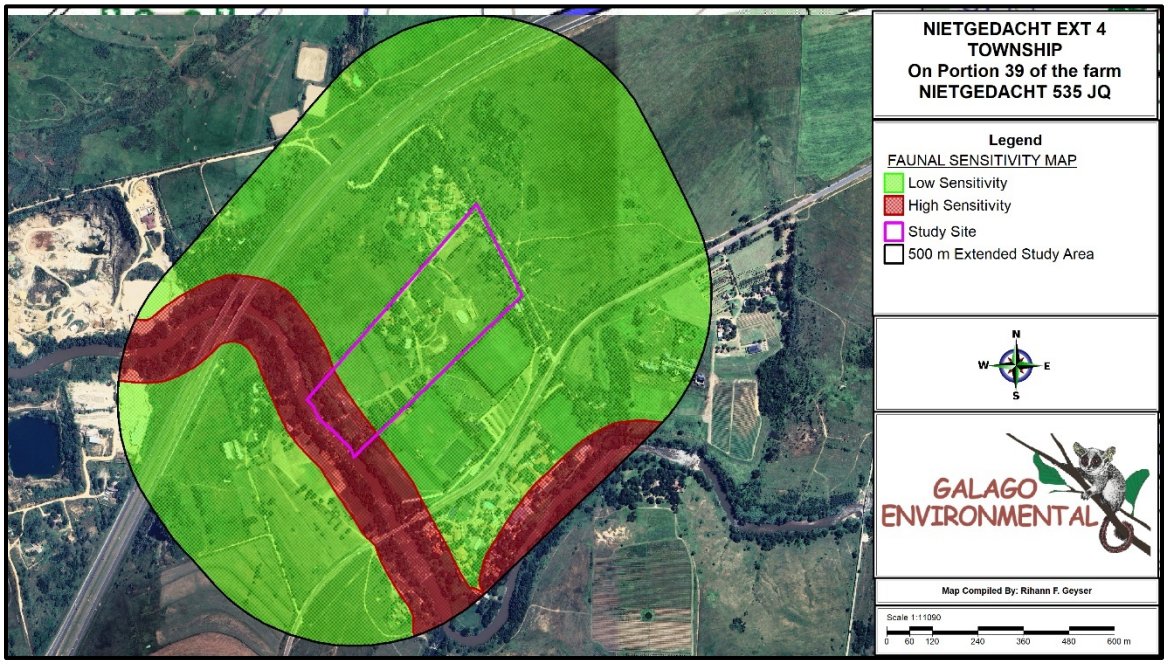



**Figure 11: Vertebrate Sensitivity Map.**

# 9. CONCLUSION

The study site contains mainly three of the four natural mammal habitats, namely terrestrial, aquatic and arboreal. The study site has an important and sensitive topographical feature in the form of the Jukskei River and its 50m buffer area enjoy statutory protection and are flagged as having a High Conservation Sensitivity.

A hall, buildings and pave foot paths were built along the bank of the Jukskei River. These structures are controversial. Some of these structures present a barrier for mammal and herpetofaunal species, which are unable to climb to the bank of the river. These structures at this stretch of water makes access to the river difficult for some frog species to breed, because there is no side with a gentle slope for frogs to move into the river for amplexus (mating) and to release the eggs into the water. Water-dependent mammals and reptilian species are also hampered in their movement to and from this part of the Jukskei River. The riparian habitat which is important for arboreal mammals because it form a distribution corridor, is damaged.

If the structures are damaged by 10-, 50- or 100-year flood it must not be reconstructed and the river bank rehabilitated. Any building rubble must be removed after such a flood (as it may stop the normal flow of the Jukskei River).

Legislation requires that no development should take place in the 32 metres buffer zone from a drainage line. It is however recommended that a **50m buffer** be conserved and rehabilitated for sensitive faunal biodiversity along the River.

A possibility of 8 mammal species with Red Data status may occur on or near the site. The Rough-haired golden mole, Robert's marsh rat, Southern African hedgehog, Blasius's (Peak-saddle) horseshoe bat, Short-eared trident bat, African clawless otter and Spotted-necked otter are included as a precautionary measure.

The possibility exists that at least some individuals of the giant bullfrog may occur on the study site from time to time.

If the development should go ahead, a very important indirect effect would be the likely impact that the proposed development might have on the water quality of the Jukskei River due to the wastewater and surface water runoff. This could have a negative impact on both mammals and herpetofauna.

Measures will have to be taken to prevent the building of roads or any development near the Jukskei River and to monitor water pollution.

Connectivity along the Jukskei River is good. Connectivity to and from the river varies from good (natural riverbank of the study site) to poor (due to building, security walls and

pavements surrounding riverside properties). The site lies east of the N14 Road and west of the R114 Road which also effect the connectivity of the site.

The removal of invasive plants will increase the quality of habitat for mammals and herpetofauna and large indigenous trees should also be protected.

Although the site has a High Terrestrial Biodiversity sensitivity according to the screening tool, this specialist finds that the site is of "medium" sensitivity for terrestrial biodiversity and from a mammal and herpetofauna perspective, there is no objection against the future development. It is also imperative that there should be a joint conservation plan for the entire Jukskei River.

From both a mammal and herpetofaunal perspective, there is no objection against the development as long as the integrity of the Jukskei River is not jeopardised in any way by the development.

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# 11. CURRICULUM VITAE FOR JACOBUS CASPARUS PETRUS (JACO) VAN WYK

| | |
|---|---|
| **Identity number** | 680804 5041 08 4 |
| **Gender** | Male |
| **Date of birth** | 4 August 1968 |
| **Nationality** | South African |
| **Home languages** | Afrikaans, fluent in English |
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| **Present position** | Co-Department Head, Environmental Education & Life Sciences, Hoërskool Waterkloof |
| **Consultant** | Specialist Environmental Assessments, EIAs, writing, photo-recording |
| **Qualifications** | **B.Sc**. (U.F.S.) **B.Sc. (Hon.)** (U.F.S.), **H.E.D** (U.F.S.), **M.Sc.** (U.F.S.) |
| **Honours** | Foundation of Research Development bursary holder |

Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400062/09

**Notable Research Contribution:** In-depth field study of the giant bullfrog

**Formal Courses Attended** Outcomes Based Education, University of the South Africa (2002)
Introductory Evolution, University of the Witwatersrand (2008)
OBE, GET & FET training, 2002-2008, Education Department

**Employment history**

**2009 – Present** Doing surveys of vertebrate groups and writing Environmental impact assessment reports.

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

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

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

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

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

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

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

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

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