VERTEBRATE ASSESSMENT OF THE FARMS BLESBOKLAAGTE 296 JS AND LEEUPOORT 283 JS, EMALAHLENI, MPUMALANGA

by

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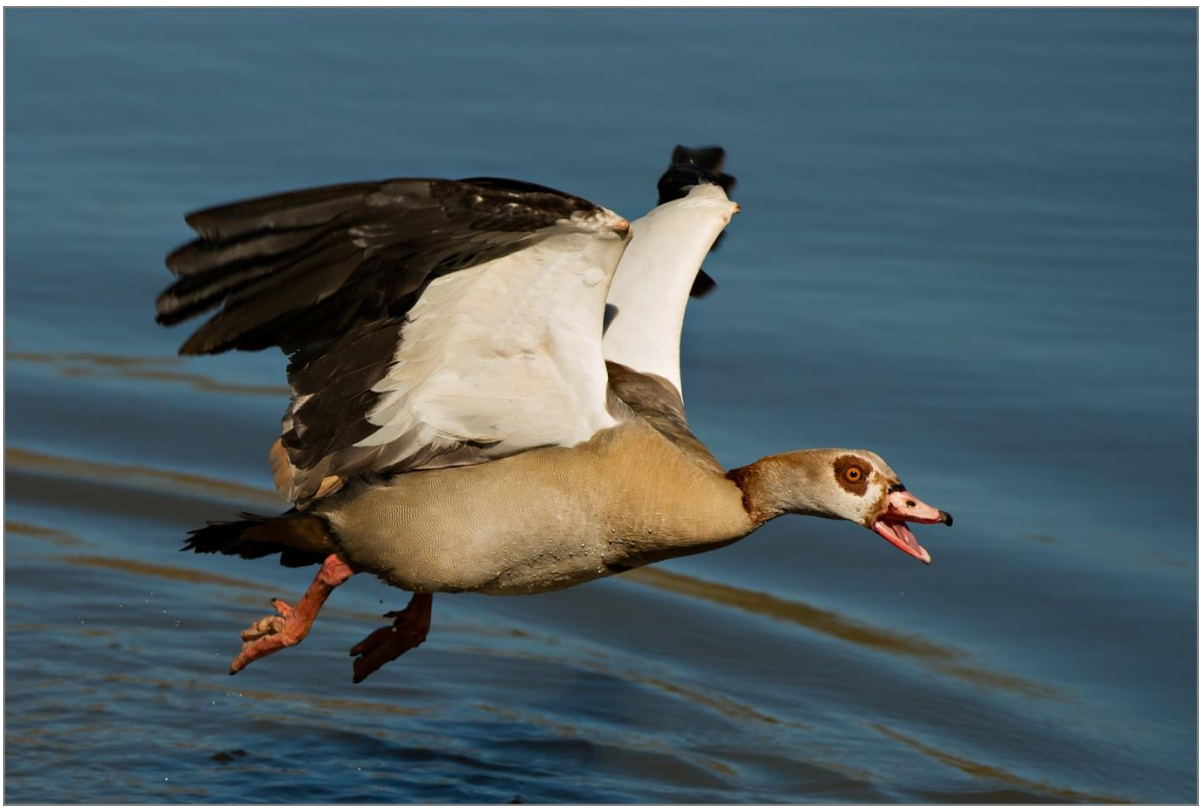

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Declaration of Professional Standing and Independence:

We,

Ignatius Lourens Rautenbach (SACNASP # 400300/05),
Alan Charles Kemp (SACNASP # 400059/09), and
Jacobus Casparus Petrus van Wyk (SACNASP # 400062/09)
declare that we:

- hold higher degrees in the biological sciences, which allowed registration by S.A. Council for National Scientific Professions (SACNASP) as Professional Zoologists that sanction us to function independently as specialist scientific consultants;
- declare that as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003 this project was our own work from inception and reflects exclusively our observations and unbiased scientific interpretations, and executed to the best of our abilities;
- abide by the Code of Ethics of the SACNASP;
- are committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas we appreciate opportunities to learn through constructive criticism and debate, we reserve the right to form and hold our own opinions within the constraints of our training, experience and results and therefore will not submit willingly to the interests of other parties or change our statements to appease them;
- are subcontracted as specialist consultants for the project "Vertebrate Assessment of the Farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga", as described in this report;
- have no financial interest in the proposed development other than remuneration for the work performed;
- do not have, and will not have in the future, any vested or conflicting interests in the proposed development;
- undertake to disclose to the consultant and its client(s) as well as to the competent authority any material information that may have the potential to influence any decisions by the competent authority, as required in terms of the Environmental Impact Assessment Regulations 2006;
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- In addition, remuneration for services provided by Eco-Agent CC is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.



I.L. Rautenbach J.C.P. van Wyk A.C. Kemp

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ABSTRACT

It is foreseen that most of the site, as manifested by the flat, open grounds (and possibly the slopes), will be developed into a residential area as an extension of existing adjacent urbanization. Although terrestrial animals will mostly be displaced, it is argued that the loss of Red Data and sensitive species has largely been discounted by earlier environmental degradation. However, the streams, dams and riparian zones, with their relatively undisturbed moist and semi-aquatic vegetation, are recognized as sensitive and should be awarded appropriate conservation attention, even though some of this system is manmade. Appropriate actions are suggested in the recommended mitigation measures (Section 10). To protect the integrity of the wetland system, managing storm water runoff will be the largest challenge. The wetland system harbours a unique cohort of discerning species, whereas the 32 meters buffer zones outside the riparian zones will offer a strip of grassland suitable for terrestrial species and offer them dispersal opportunities.

Given the rigid protection of the wetland system and prerequisite buffer zones, no justifiable objection can be raised about the development of the project on the terrestrial portion of the site. From a vertebrate perspective, development along the weakly developed ridges will not amount to an environmental setback.

1. INTRODUCTION

We were engaged by Limosella Consulting to assess the habitat and concomitantly the mammal, bird, reptile and amphibian species richness of a proposed residential development on Portions of the Farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga.

2. ASSIGNMENT – Protocol

This assignment is in accordance with the 2010 EIA Regulations (No. R. 543-546, Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The assignment is interpreted as follows: Compile a scholarly report of the vertebrate fauna of the site, with emphasis on Red Data species and critical ecosystems that occur or may occur on the site. In order to compile this, the following had to be done:

2.1 Initial preparations:

Obtain all relevant maps and information on the natural environment of the concerned area. This includes information on Red Data vertebrate species that may occur in the to-be-affected area.

2.2 Fauna assessment

- Compile lists of the vertebrates that can be expected in the area.
- Assess the quantitative and qualitative condition of suitable habitat for the Red Listed vertebrates that may occur in the area.
- Identify the Red Data species that occur (or may occur).
- Express an opinion pertaining to the conservation status of Red Data species habitats.

2.3 General

- Identify and describe particular ecologically sensitive areas.
- Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, water pollution, degraded areas, reclamation areas.
- Make recommendations on aspects that should be monitored during and after development.

3. RATIONALE

Environmental conservation is no longer the prerogative of vocal left-wing 1960s-style green activist NGOs. Instead it is now universally appreciated that a rapidly-growing and more demanding human population is continuing to place exponential stress on the earth's resources with irredeemable costs to ecosystems. It is also recognized that ecosystems are in fact nature's 'engine room' to manufacture fundamental live-support products for plants, animals and humans. Environmental degradation ranges from mega-problems such as global warming, demand for power, land-use practices to indiscriminate use of household chemicals.

The new conservation awareness is settling at all levels ranging from consumers, school curricula, communities to governments. This new consciousness is typified by vigorous debate and empathy, and sometimes by decisiveness (viz. new legislation).

In South Africa, a number of acts (viz. the Environmental Conservation Act [Act 73 of 1989], the National Water Act. [Act No 36 of 1998], The National Heritage Resources Act [No. 25 of 1999], Environmental Conservation Act [Act 73 of 1989], The Constitution of the Republic of South Africa Act [No 108 of 1996], the National Environmental Management Act [NEMA] [Act 107 of 1998 as amended in 2010], the National Heritage Resources Act No. 25 of 1999, the National Environmental Management Biodiversity Act, [Act 10 of 2004], the National Environmental Management: Waste Act [NEM:WA] [Act 59 of 2008], and the Environmental Impact Assessment Regulations: GN R. 543-546 of 18 June 2010, as amended (Gazette No 33306 – Regulation 547)) call developers (and by implication consumers), the scientific community and conservation agencies to task to minimise environmental impact. The conduct of natural scientists is directed by The Natural Scientific Professions Act (Act 27 of 2003). Nowadays a development prerogative is to precede new constructions by a multidisciplinary environmental investigation to assess the conservation costs. This is to ensure that best conservation practices are applied during the planning, construction and operational phases of new developments.

4. SCOPE AND OBJECTIVES OF THE STUDY

- To define and describe vertebrate habitat types identified on the site;
- To qualitatively and quantitatively assess the significance of vertebrate habitat components and current general conservation status;
- To identify and comment on ecological sensitive areas;
- To comment on connectivity;
- To provide a list of mammals, birds, reptiles and frogs that occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the vertebrate species richness of the study site, and

- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

5. STUDY AREA

Portions of Blesboklaagte 296 JS and Leeupoort 283 JS (2529CC) (the site) are presently used for cattle grazing, whereas some earthworks (Fig.10) towards the north-east mar its natural character. The site is 505 hectares in extent and lacks any form of development in the form of buildings, but earthworks to the east have entirely transformed the terrestrial habitat. The property is scheduled to be developed into a residential area.

The site is located north-west of Emalahleni town and borders on its Pine Ridge suburb (Figs. 12, 13, 14, 15 & 16) and the R540 road. The south-easterly portion of the site overlooking the suburb consists of a rocky slope. Another north-facing slope is some distance from the Blesbokspruit tributary, but is actually an indistinct rim of the Blesbokspruit basin (Fig. 4). The major feature of the site is the perennial Blesbokspruit which, for some distance, separates Pine Ridge from the site but to the north-west falls entirely within the site (Fig. 2). A tributary of the Blesbokspruit bisects the north-eastern corner of the site (Fig. 2). Dams were constructed across both streams (Figs. 6 & 9). The banks of the streams and dams are overgrown with semi-aquatic vegetation *inter alia* bulrushes and reeds (Figs. 8, 9 & 13). These wetland / aquatic systems, together with a rocky slope just outside the site, collectively prompted this portion of the site to be classified as “Important and Necessary" in the provincial C-Plan (Fig. 1).

Notionally, the site falls in the Rand Highveld Grassland vegetation unit (Gm11 of Mucina and Rutherford, 2006). However, large parts of the site consist of regenerating fallow fields, covered with dense stands of pioneer grasses (Figs. 11 & 12). The latter are currently being grazed by cattle. The majority of the site, including the area subjected to earthworks, is ranked as “Least Concern” and/or “No Natural Habitat Remaining” by the provincial C-Plan (Fig. 1).

The topography of the site and surrounding area consists of undulating grassy plains typical of the Highveld Grassland biome of the interior. The soil is generally light and sandy, at places with protruding rocks and gravel (Fig. 5). The slopes are rocky with light-brown soil (Fig. 13). Termitaria were recorded.

Bar low indigenous shrubs along the slopes and exotics such as scattered blue gums, the site is treeless. It lacks any caves suitable for cave-dwelling bats.

To the west and south, the site is bordered by established suburbia, and to the east by the extensive and intensively excavated earthworks. However, to the north the

site borders on undeveloped grazing land. Terrestrial vertebrate connectivity can therefore be expected to be operational along the streams as well as to the north.

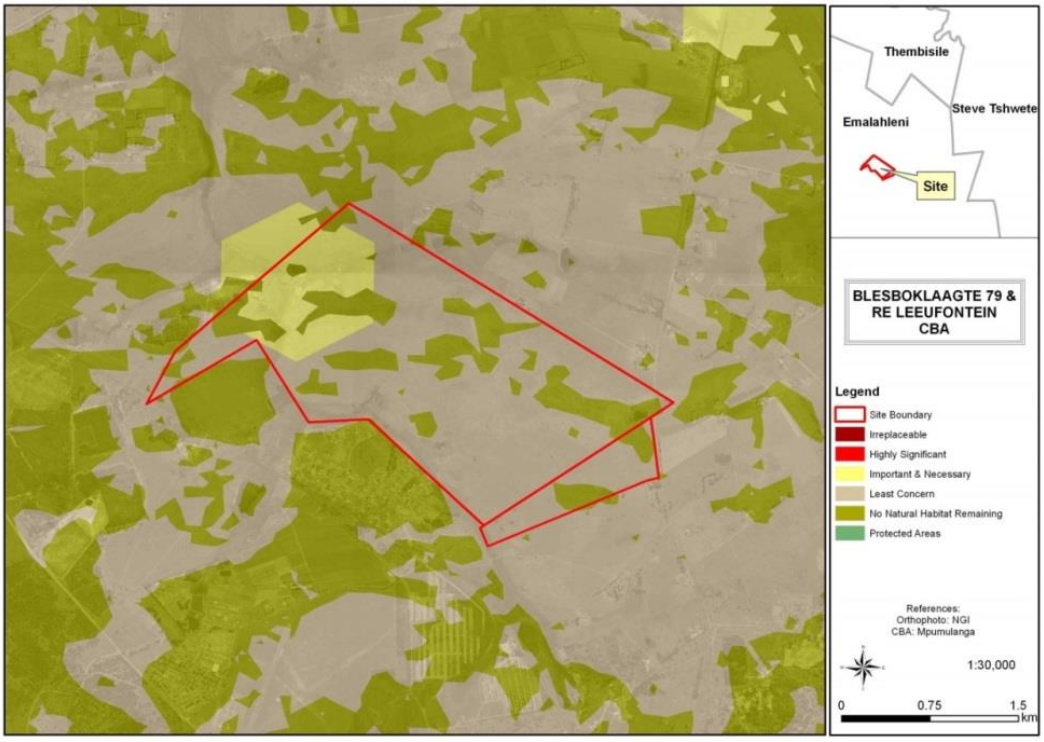

Figure 1: Mpumalanga C-Plan of the site, denoting conservation status of subsections.

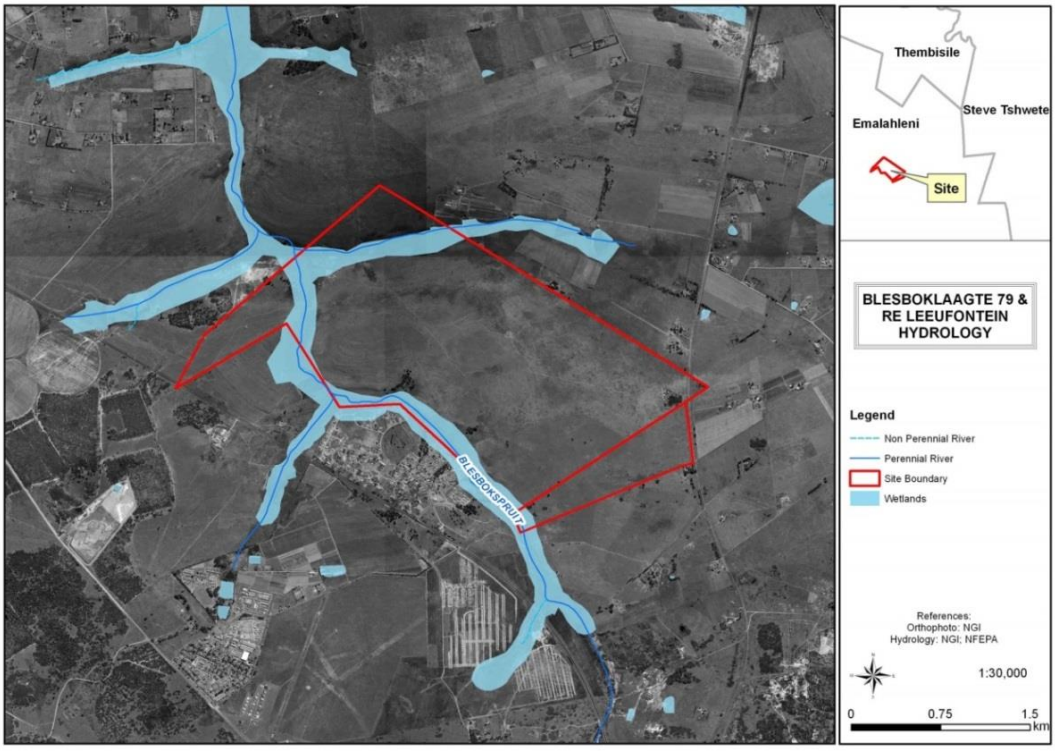

Figure 2: The hydrological properties of the study site. The vegetation along the stream banks offers rank habitat for wetland animals.

Figure 3: The Blesbokspruit and the riparian wetlands along its banks, photographed at 25º 48' 19"S; 29º 11' 34"E. On the outside of the wetland zones, bands of moist grassland forming a lush terrestrial habitat are located.

Figure 4: A southerly view over the Blesbokspruit and its wetland riparian zone, and beyond that the moist grassland and on the horizon the rocky ridge. Also photographed from 25º 48' 19"S; 29º 11' 34"E.

Figure 5: The rocky ridge on the outside of the riparian wetland of the Blesbokspruit. The substrate consists of soft sandy soil.

Figure 6: One of the dams across the tributary of the Blesbokspruit at 25º 48' 04"S; 29º 11' 40"E. The *Eucalyptus* trees hold no attraction to indigenous mammals, but are likely to be used as perches and maybe nesting sites for some bird species.

Figure 7: The sandy zone just outside the wetland zone of the Blesbokspruit tributary, photographed at 25º 48' 04"S; 29º 11' 40"E. This substrate was water-logged during the site visit, after good rains, and probably acts as a sponge to feed the stream system.

Figure 8: The dense stand of bulrushes interspersed with patches of reeds along the Blesbokspruit tributary. The photo was taken looking downstream from on the dam wall at 25º 47' 57"S; 29º 12' 15"E.

Figure 9: The body of water accumulated by the same dam as Figure 8, looking upstream. Like the streams, the dams have luxurious wetlands in their riparian zones. The photo was taken from on the dam wall.

Figure 10: The biologically sterile earth works towards the eastern side of the study site.

Figure 11: The lush stand of secondary grassland on regenerating fallow fields towards the south-western portion of the site.

Figure 12: The outer limit of the grassy old field along the upper edge of a rock ridge, overlooking the well-established Pine Ridge suburban area.

Figure 13: The rocky slope of the ridge along the Blesbokspruit, with its overgrown riparian zone visible towards the upper right-hand side of the image. The rocky terrain has a dearth of nooks and crannies for rupicolous vertebrates and is thus deemed as sub-optimal. The photo was taken at 25º 48' 51"S; 29º 12' 17"E.

6. METHODS

Site visits were conducted on 3 April 2014. Before and after the field excursion, desk-top studies using Google Earth technology were conducted to gain bird's eye perspectives of the of the topography and the extent of the study site.

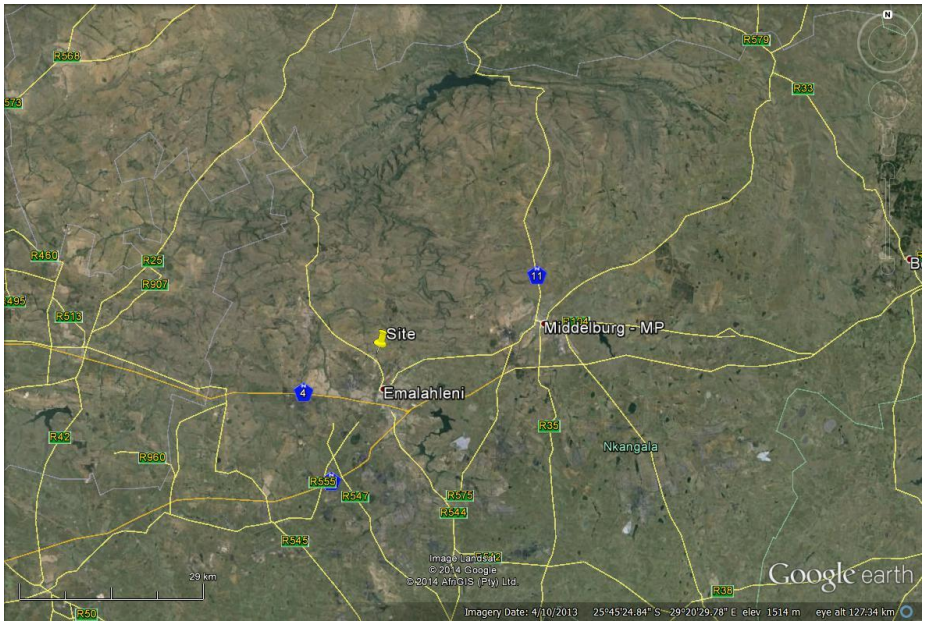

Figure 14: Wide satellite image of the site (yellow pointer) showing its position within the northeast-draining catchment of the Olifants River, and in relation to the nearest dams (Loskop – north; Bronkhorstspruit – west; Witbank – southeast; Middelburg – east) with their nature reserves, and the main roads and towns in the area. Note that Important Bird Area SA015 is prescribed for the Loskop Dam Nature Reserve (Barnes 1998).

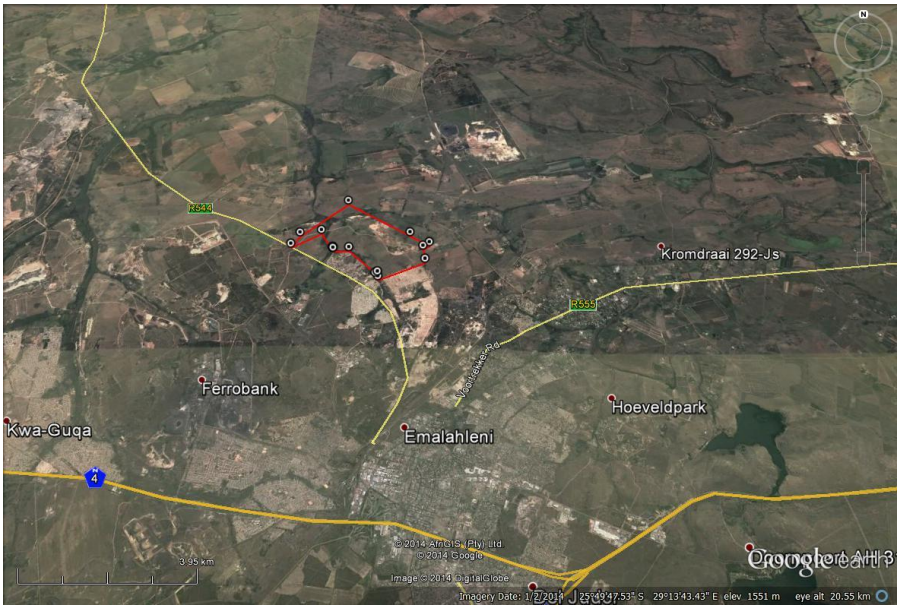

Figure 15: Medium satellite image of the site (red polygon) showing its position in relation to the surrounding drainage lines, sand/gravel excavations, and nearby roads and developments, including the Witbank Dam and its nature reserve to the southeast.

Figure 16: Close-up satellite image of the site (red polygon) showing the drainage lines, tracks, old fields and excavations on site, and the formal (Pine Ridge) and informal residential developments adjoining its southern border.

6.1 Field Survey

During the site visit, mammals, birds, reptiles and frogs were identified by visual sightings through random transect walks and patrolling with a vehicle. 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.

Three criteria were used to gauge the probability of occurrences of vertebrate species on the study site. These include known distribution ranges, habitat preferences and the qualitative and quantitative presences of suitable habitats.

6.2 Desktop Survey

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

The probability of occurrences of mammal, birds and herpetofauna 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 study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.
- *Medium* probability pertains to a 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 also taken into consideration. Species categorized as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.
- *Low* probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorized as *low* are generally deemed to be rare.

6.3 Specific Requirements

Mammals: During the visit the site was surveyed and assessed for the potential occurrence of Red Data and/or wetland-associated species such as Juliana's golden mole (*Neamblosomus juliana*), Highveld golden mole (*Amblysomus septentrionalis*), Rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Angoni vlei rat (*Otomys angoniensis*), Vlei rat (*Otomys irroratus*), White-tailed rat (*Mystromys albicaudatus*), a nember of shrews such as the Forest shrew (*Myosorex varius*), Southern African hedgehog *(Atelerix frontalis), a number of bats such as the* Short-eared trident bat (*Cloeotis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc.

Birds: To identify Red Data species likely to occur on the site and to express an opinion regarding their probable occurrence based of specific habitat requirements, guided also by the existing lists compiled for species within the relevant quarter-degree grid cells by regional and national bird atlases (Tarboton *et al*. 1987; Harrison *et al*. 1997; www.sabap2.org.za).

Herpetofauna: During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data species in Mpumalanga (Alexander and Marais, 2007; Minter, *et al*, 2004 and Du Preez & Carruthers, 2009), such as: Giant Bullfrogs (*Pyxicephalus adspersus*); Spotted Shovel-nosed Frog (*Hemisus guttatus*); Whistling Rain Frog (*Breviceps sopranus*); Plain Stream Frog (*Strongylopus wageri*); Sungazer (*Cordylus giganteus*); Breyer's Long-tailed Seps (*Tetradactylus breyeri*);

Natal Hinged Tortoise (*Kinixys natalensis*); Striped Harlequin Snake (*Homoroselaps dorsalis*); Swazi Rock Snake (*Lamprophis swazicus*); and Southern African Python (*Python natalensis*).

Two other herpetofauna species, whose current Red Data status in South Africa is "Least Concern", but which Mpumalanga Province have concern about, were also taken into consideration, namely Spotted Harlequin Snake (*Homoroselaps lacteus*) and Many-spotted Snake (*Amplorhinus mutimaculatus*).

7. RESULTS

7.1 Mammals

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. 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) as well Knobel and Bredenkamp (2006). Hence, although the former's work has been superseded by the work of the latter two, the definitions of biomes are similar and both remain valid for mammals and are therefore recognized as a reasonable determinant of mammal distribution.

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

7.1.1 Mammal Habitat Assessment

Three of the major habitat types are present on the study site, i.e. terrestrial, to a lesser extent rupicolous and wetlands. The indigenous woody plants along the slopes are too modest to accommodate arboreal small mammals, whereas local mammals are not adapted to exotic trees such as the blue-gum trees.

The terrestrial habitat is by far the most extensive (Figures 6, 7, 11 & 12). It has, however, been ecologically over-utilized by past tilling, grazing and possibly by irregular fires and can thus only be rated as in a "Very Low" to "Low" conservation condition. Secondary grasslands can be lush and thus good cover for terrestrial mammals (Figures 11 & 12).

The rupicolous habitat along the slopes is poorly developed and contains a dearth of refuges in the form of nooks and crannies amongst large rocks (Figures 5 and 13). However, it is most likely that less discerning species such as Namaqua rock rats and rock elephant shrews do indeed find refuge here and are therefore deemed present; red rock rabbits were in fact recorded. The basal cover of the slopes seems to be less degraded by grazing than along the lowlands and is therefore in an ecological state of repair justifying a conservation rating of "Average".

The wetland habitat along the Blesbokspruit, its tributary and the dams is the main feature of the site (Figures 2, 3, 4, 8 and 9). The semi-aquatic vegetation along the banks is excellent habitat for species such as shrews, vlei rats and marsh mongooses. The reed beds and stands of bulrushes as well as other semi-aquatic vegetation are not utilized by cattle and the conservation status of this habitat type can be rated as "good".

7.1.2 Observed and Expected Mammal Species Richness

All charismatic mammals (like elephants, buffaloes, rhinos, lions, leopards, hyenas) have long since been extirpated for sport and later to favour cattle farming. It is submitted that reticent but widespread species such as brown hyenas, caracal and leopards have also succumbed to encroachment by civilization. Mammal species reliant on a rupicolous habitat have *a priori* been omitted from the list of potential occurrences in the district (Table 7.1.2.1).

It is concluded that 40 species of mammals are still part of the present-day mammal species assemblage. The occurrence of three species was confirmed (Table 7.1.2.2)

The presence of persistent species such as porcupines, cane rats, springhares was not confirmed, but considering the extent of the district and the excellent connectivity towards the north, it can be assumed that they are at least occasional vagrants onto the site. Most of the species of the resident diversity (Table 7.1.2.1) are common and widespread (viz. scrub hares, red rock rabbits, multimammate mice, pygmy mice, genets, mongooses and others). Many of the species listed in Table 7.1.2.1 are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses). It should, however, be emphasized that the species diversity (species richness super-imposed on population numbers) is low as result of the poor conservation index of the ground cover and the constraining effect of patches of unyielding compacted substrates.

Of note is the failure to record the presence of rodent moles. This ubiquitous rodent is however listed as a possible resident based on its universal occurrence in a variety of habitats.

It is submitted that duiker and steenbok still occur at least occasionally on the site since immigration from the district is likely. Old damage to termite mounds suggests that these were caused by aardvarks. Since no fresh signs were encountered it is uncertain whether aardvarks persist, but connectivity towards the northern undeveloped properties could allow immigrations.

Black-backed jackals are likely to still occur in the district and can be expected to at least occasionally venture onto the site. The small carnivores (mongooses and genets) 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. Although the dams offer good haunts for the two otter species, it is submitted that the dams and the streams are too isolated to have allowed immigration. However, marsh mongooses are not as restricted to open water as otters and are therefore better migrants: this species are thus regarded as a member of the mammal species assemblage.

The listed free-tailed bat and the Vespertilionidae bats showed remarkable adaptability by expanding 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 wetlands during summer sunsets.

The species richness is low for such an extensive area. That is ascribed to the fact that two of the three habitats are either being transformed by past land-use practices (terrestrial) or weakly developed (rupicolous). The quality of conservation is largely ranked as poor, and that resulted in the displacement of Red Data species (viz. rough-haired golden moles, white-tailed rats).

7.1.3 Red Listed Mammals

The four shrew species and the African weasel cited as 'DD' in Table 7.1.2.1 are not necessarily endangered. These small mammals have not been adequately studied to provide quantitative field data to accurately assign a conservation ranking. As a precaution they are thus considered as 'Data Deficient'. Shrews and weasels exist at the apex of the food pyramid, which means that their population numbers are inevitably significantly lower than that of similar-sized herbivorous mammals and especially of their smaller prey species. Because of the diet of these vociferous little insectivores / carnivores, they are furthermore not readily trapped with conventional bait or traps which may mean that their numbers are under-estimated. Good results obtained with drift fences and pitfalls support the latter statement.

Hedgehogs are 'Near Threatened' as result of interference by humans and their pets. Under natural conditions the passive defence mechanisms of these rather docile insectivores are sufficient to maintain breeding populations in a healthy condition. Considering the size of the district and connectivity towards the north it is considered possible that a small population of hedgehogs persist.

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).

7.1.4 Mammal Species Richness

Table 7.1.2.1: Mammal diversity. The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Bronner et.al [2003] and Skinner and Chimimba [2005]).

	SCIENTIFIC NAME	ENGLISH NAME
√	*Elephantulus myurus*	Eastern rock elephant shrew
?	*Orycteropus afer*	Aardvark
√	*Lepus saxatilis*	Scrub hare
√	*Pronolagus randensis*	Jameson's red rock rabbit
√	*Cryptomys hottentotus*	African mole rat
?	*Hystrix africaeaustralis*	Cape porcupine
*****	*Thryonomys swinderianus*	Greater cane rat
?	*Pedetes capensis*	Springhare
√	*Rhabdomys pumilio*	Four-striped grass mouse
NT?	*Dasymys incomtus*	African 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
√	*Otomys angoniensis*	Angoni vlei rat
√	*Otomys irroratus*	Vlei rat
√	*Gerbilliscus brantsii*	Highveld gerbil

?	*Dendromus melanotis*	Grey pygmy climbing mouse
?	*Dendromus mesomelas*	Brants' climbing mouse
?	*Dendromus mystacalis*	Chestnut climbing mouse
DD*	*Myosorex varius*	Forest shrew
DD*	*Suncus lixus*	Greater dwarf shrew
DD*	*Crocidura cyanea*	Reddish-grey musk shrew
DD√	*Crocidura hirta*	Lesser red musk shrew
NT?	*Atelerix frontalis*	Southern African hedgehog
*	*Tadarida aegyptiaca*	Egyptian free-tailed bat
√	*Neoromicia capensis*	Cape serotine bat
√	*Scotophilus dinganii*	African yellow house bat
√	*Scotophilus viridis*	Greenish yellow house bat
*	*Felis silvestris*	African wild cat
√	*Genetta tigrina*	SA large-spotted genet
√	*Cynictis penicillata*	Yellow mongoose
√	*Galerella sanguinea*	Slender mongoose
*	*Atilax paludinosus*	Marsh mongoose
*	*Canis mesomelas*	Black-backed jackal
DD?	*Poecilogale albinucha*	African weasel
*	*Ictonyx striatus*	Striped polecat
√	*Sylcicapra grimmia*	Common duiker
√	*Raphicerus campestris*	Steenbok

√ 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.

Note: Irrespective of the conservation ranking accorded to the Aardvark by Friedmann and Daly (2004), it is considered as Vulnerable in Gauteng.

Table 7.1.2.2: Mammal species positively confirmed from the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
O. afer	Aardvark	Damage to termitaria	Grassveld
P. randensis	Red rock rabbit	Faecal pelltes	Rocky slope
G. brantsii	Highveld gerbil	Burrows	Sand veld

The conservation status of aardvark has been elevated to "Least Concern". This species is in fact fairly widespread and common, *albeit* solitary and nocturnal in habit. Aardvarks open termitaria with the claws on their well-developed hind feet and feed on the inhabitants stuck on their sticky tongues. The holes are characteristic in size and form, and damage is often repaired by the termites. Several old characteristic openings were recorded, but no recent signs were found. It can be

assumed that new vagrants may venture onto the site. Red rock rabbits are common amongst the rocks on the slopes, whereas several Highveld gerbil colonies were recorded in sandy areas along low-lying areas.

7.2 Birds

7.2.1 Bird Habitat Assessment

Three main avian habitats are distinguished on site, various forms of grassland, wetland and rocky habitat:

A. Grasslands: There appears to be little to no natural grasslands remaining on site, most of the area being tall secondary sub-climax grasslands dominated by *Hyparrhenia hirta* (Figs. 11 & 12), evidently at various stages of succession over previously fallow croplands and pastures. The substrate on site is predominately deep sands, exposed in as open patches by sparse ground cover in some areas (Figs. 7 & 13). Denser and more varied moist grasslands occur along the banks and alluvial borders of the Blesbokspruit (Figs. 3 & 4) and its tributary (Fig. 8). These grasslands are expected to support a subset of the more common highveld grassland avifauna, probably at relatively lower densities. Variations in pressures from grazing by cattle and burning are the main factors controlling local differences in grass composition, height and density, especially in the moister areas.

B. Wetland: The Blesbokspruit, running mainly along the south-western side of the site, is the main wetland feature, along with its tributaries, most obviously the one entering from the east (Fig. 2), and together they form the most sensitive habitats on site (Fig. 1). The watercourses have mainly narrow stream beds, bordered by areas of riparian and alluvial flats of varying width (Figs. 3, 4 & 13) and augmented by broad areas of open water where they have been dammed (Figs. 6, 9, 13). The site visits was made after exceptional rains, so flow and extent of water bodies were probably close to their maximum. Permanence of surface water probably depends on the patterns of storage in and seepage from the sandy substrates, plus the buffering by vegetation cover and sponges, so some sections may be seasonal and others perennial through time. Runoff and seepage even accumulated on the bare floor of the major excavation (Fig. 10).

The vegetation along the drainage lines and around the dams varies from tall dense stands of bulrushes and /or reeds (Figs. 6, 8, 9 & 13), to dense moist grasslands (Figs.3 & 4), and even to bare sandy and rocky shores around excavations (Fig. 10). The densest of the few woody areas on site are also generally riparian, apart from the taller and more scattered eucalypt trees. Riparian plant growth and diversity probably depends partly on nutrients entering and grazing pressures on the systems, such as the densification along the major tributary (Fig. 8). The wetlands, at least in their current form, are expected to support a reasonable proportion of the main aquatic and marsh bird species in the area, an avifauna that is adapted to moving

between these linear and/or patchy habitats as their condition and quality alters through the seasons and years.

C. Rocky areas: Where the sandy surface has been eroded away or excavated, the underlying rocky formations appear, as on the hill crests and in the floor of excavations (Figs. 5, 10, 13). These rocky areas appear as scattered large rocks of various sizes, rather than as solid formations that might form the cliffs, crags or caves favoured by rupicolous species. Relatively few bird species are specific to these rocky habitats in their limited form on site.

The suburban and communal residential areas that border the site, with their more diverse and wooded garden plants, provision of water sources and spillage of surplus foods, will support additional common bird species that may pass over or briefly visit the site for feeding or roosting, but that are not included as typical of the site. The few large exotic trees on site may serve as resting sites for these transients, but are unlikely to attract and support their own particular avifauna.

7.2.2 Observed and Expected Bird Species Richness

Out of the 198-260 bird species recorded respectively during the SABAP2 and SABAP1 national bird atlas projects for the 2529CC (Witbank) quarter-degree grid cell, within which the site occurs, only 180 are expected to occur on and around the study site in its present form (Harrison et al. 1997, www.sabap2.org.za; Table 7.2.2.1). Eighty (45%) species are expected to have a high probability of occurrence, 56 (31%) a medium probability and 43 (24%) a low probability, which indicates the limited potential of the best habitats but the relatively poor condition of the remainder.

The three different habitat types that I distinguished are expected to support somewhat different species of birds (Table 7.2.2.1). Twenty-seven generalist species (15%) are expected to use all three habitat types, including the 16 species (9%) classed as aerial feeders and expected to range across all habitats when feeding, while of the remainder, 28 species (16%) are expected to prefer two habitat types and 125 species (69%) only a single habitat type. Based on this total of 273 assessments of predicted habitat preference, the wetland habitats were potentially the richest and most distinctive habitat, predicted to be used by 133 (49%) of the expected species, compared to 80 (29%) for the open grasslands and 60 (22%) for the rocky grasslands. The 16 aerial-feeding species are included within the above analysis, not only for all the habitats they range across when feeding, but also if there are terrestrial habitats that some might use for breeding. Obviously, the wetland habitats are supporting about half of the expected species, a greater proportion relative to their extent, while the extensive grasslands are generally supporting a quite different suite of species.

Table 7.2.2.1: Bird species diversity observed and expected on and around the proposed site for residential development on portions of the farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga (2529CC). Based on the national list and annotations of Birdlife South Africa (2011), sorted in the order of 'Roberts VII' (Hockey *et al*. 2005), with probability of occurrence and habitat preferences assessed after a site visit on 3 April 2014 and comparison with lists from SABAP 1&2 (Harrison *et al*., 1997; www.sabap2.org). The species sighted on site (in bold) were kindly listed by JCP van Wyk.

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Orange River francolin	*Scleroptila levaillantoides*					M		1,3
Swainson's Spurfowl	***Pternistis swainsonii***				**H**			**1,2,3**
Common Quail	*Coturnix coturnix*		**NBM**			M		1
Helmeted Guineafowl	***Numida meleagris***				**H**			**1,2,3**
Fulvous Duck	*Dendrocygna bicolor*					M		2
White-faced Duck	*Dendrocygna viduata*				H			2
Egyptian Goose	***Alopochen aegyptiaca***				**H**			**2**
Spur-winged Goose	***Plectropterus gambensis***				**H**			**2**
Yellow-billed Duck	***Anas undulata***				**H**			**2**
Cape Shoveler	*Anas smithii*						L	2
Red-billed Teal	*Anas erythrorhyncha*				H			2
Southern Pochard	*Netta erythrophthalma*					M		2
Kurrichane Buttonquail	*Turnix sylvaticus*					M		1,3
Red-throated Wryneck	*Jynx ruficollis*					M		1,3
African Hoopoe	*Upupa africana*				H			1,3
Malachite Kingfisher	*Alcedo cristata*					M		2
Pied Kingfisher	*Ceryle rudis*					M		2
White-fronted Bee-eater	*Merops bullockoides*					M		2
European Bee-eater	*Merops apiaster*		**B/NBM**				L	Aerial

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Diderick Cuckoo	*Chrysococcyx caprius*		BM		H			1,2,3
Burchell's Coucal	*Centropus burchellii*				H			2
Alpine Swift	*Tachymarptis melba*		BM			M		Aerial
Common Swift	*Apus apus*		NBM				L	Aerial
African Black Swift	*Apus barbatus*				H			Aerial
Little Swift	*Apus affinis*				H			Aerial
Horus Swift	*Apus horus*					M		Aerial,2
White-rumped Swift	*Apus caffer*		BM		H			Aerial
Barn Owl	*Tyto alba*				H			1,2,3
African Grass-Owl	*Tyto capensis*	VU,LC					L	2
Spotted Eagle-Owl	*Bubo africanus*				H			1,2,3
Marsh Owl	*Asio capensis*				H			2
Speckled Pigeon	***Columba guinea***					**M**		**1,2,3**
Laughing Dove	***Streptopelia senegalensis***				**H**			**1,2,3**
Cape Turtle-Dove	***Streptopelia capicola***				**H**			**1,2,3**
Red-eyed Dove	*Streptopelia semitorquata*					M		2
Namaqua Dove	*Oena capensis*						L	1
Northern Black Korhaan	*Afrotis afraoides*				H			1
White-bellied Korhaan	*Eupodotis senegalensis*	VU,LC				M		1
Blue Crane	*Anthropoides paradiseus*	NT,VU					L	1,2
Red-chested Flufftail	*Sarothrura rufa*					M		2
African Rail	*Rallus caerulescens*				H			2
African Crake	*Crecopsis egregia*		BM			M		2
Black Crake	*Amaurornis flavirostra*				H			2

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Baillon's Crake	*Porzana pusilla*						L	2
African Purple Swamphen	*Porphyrio madagascariensis*					M		2
Common Moorhen	***Gallinula chloropus***				**H**			**2**
Red-knobbed coot	***Fulica cristata***				**H**			**2**
African Snipe	***Gallinago nigripennis***				**H**			**2**
Marsh Sandpiper	*Tringa stagnatilis*		**NBM**			M		2
Common Greenshank	*Tringa nebularia*		**NBM**			M		2
Wood Sandpiper	*Tringa glareola*		**NBM**		H			2
Common Sandpiper	*Actitis hypoleucos*		**NBM**		H			2
Ruff	*Philomachus pugnax*		**NBM**			M		2
Greater Painted-snipe	*Rostratula benghalensis*	**VU,NT**					L	2
Spotted Thick-knee	*Burhinus capensis*				H			1,3
Black-winged Stilt	*Himantopus himantopus*				H			2
Pied Avocet	*Recurvirostra avosetta*						L	2
Kittlitz's Plover	*Charadrius pecuarius*						L	2
Three-banded Plover	*Charadrius tricollaris*				H			2
Blacksmith Lapwing	***Vanellus armatus***				**H**			**2**
African Wattled Lapwing	*Vanellus senegallus*				H			2
Crowned Lapwing	***Vanellus coronatus***				**H**			**1,3**
Temminck's Courser	*Cursorius temminckii*					M		1,3
Black-winged Pratincole	*Glareola nordmanni*	**NT,NT**	**NBM**			M		Aerial
Grey-headed Gull	*Chroicocephalus cirrocephalus*						L	2
Whiskered Tern	*Chlidonias hybrida*					M		2
Black-shouldered Kite	*Elanus caeruleus*						L	1,2,3

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Cape Vulture	*Gyps coprotheres*	EN,VU					L	1,3
Black-chested Snake-Eagle	*Circaetus pectoralis*						L	1,3
African Marsh-Harrier	*Circus ranivorus*	EN,LC					L	2
Pallid Harrier	*Circus macrourus*	NT,NT	NBM				L	1
Montagu's Harrier	*Circus pygargus*		NBM				L	1
Steppe Buzzard	*Buteo buteo*		NBM		H			1,3
Secretarybird	*Sagittarius serpentarius*	VU,VU			H			1
Lesser Kestrel	*Falco naumanni*		NBM			M		1
Greater Kestrel	*Falco rupicoloides*				H			1
Amur Falcon	*Falco amurensis*		NBM		H			1,3
Lanner Falcon	*Falco biarmicus*	VU,LC				M		1,2,3
Little Grebe	***Tachybaptus ruficollis***				**H**			**2**
African Darter	*Anhinga rufa*				H			2
Reed Cormorant	***Phalacrocorax africanus***				**H**			**2**
White-breasted Cormorant	*Phalacrocorax lucidus*						L	2
Little Egret	*Egretta garzetta*					M		2
Yellow-billed Egret	*Egretta intermedia*						L	2
Grey Heron	*Ardea cinerea*					M		2
Black-headed Heron	*Ardea melanocephala*				H			1,2
Purple Heron	*Ardea purpurea*						L	2
Cattle Egret	***Bubulcus ibis***				**H**			**2**
Squacco Heron	*Ardeola ralloides*					M		2
Green-backed Heron	*Butorides striata*						L	2
Hamerkop	*Scopus umbretta*						L	2

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Glossy Ibis	*Plegadis falcinellus*						L	2
Hadeda Ibis	***Bostrychia hagedash***				**H**			**2**
Southern Bald Ibis	*Geronticus calvus*	VU,VU		**(*)**		M		1,3
African Sacred Ibis	*Threskiornis aethiopicus*				H			2
African Spoonbill	*Platalea alba*				H			2
Yellow-billed Stork	*Mycteria ibis*	EN,LC					L	2
Abdim's Stork	*Ciconia abdimii*	NT,LC	**NBM**				L	1
White Stork	*Ciconia ciconia*		**NBM**			M		1
Fork-tailed Drongo	*Dicrurus adsimilis*						L	2
Bokmakierie	*Telophorus zeylonus*					M		1,3
Cape Crow	***Corvus capensis***				**H**			**1**
Pied crow	***Corvus albus***				**H**			**2,3**
Red-backed Shrike	*Lanius collurio*		**NBM**		H			2
Lesser Grey Shrike	*Lanius minor*		**NBM**			M		1
Common Fiscal	***Lanius collaris***				**H**			**1,2,3**
Brown-throated Martin	*Riparia paludicola*				H			Aerial
Banded Martin	*Riparia cincta*				H			Aerial, 1
Barn Swallow	***Hirundo rustica***		**NBM**		**H**			Aerial
White-throated Swallow	***Hirundo albigularis***		**BM**		**H**			Aerial
Greater Striped Swallow	***Cecropis cucullata***		**BM**		**H**			Aerial
Red-breasted Swallow	*Cecropis semirufa*					M		Aerial
South African cliff-Swallow	*Petrochelidon spilodera*			**B(*)**	H			Aerial
Common House-Martin	*Delichon urbicum*		**NBM**			M		Aerial
Dark-capped Bulbul	*Pycnonotus tricolor*					M		2
Little Rush-Warbler	*Bradypterus baboecala*				H			2

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
African Reed-Warbler	***Acrocephalus baeticatus***		**BM**		**H**			**2**
Great Reed-Warbler	*Acrocephalus arundinaceus*		**NBM**			M		2
Lesser Swamp-Warbler	*Acrocephalus gracilirostris*				H			2
Cape White-eye	*Zosterops capensis*			**(*)**		M		2
Lazy Cisticola	*Cisticola aberrans*						L	3
Wailing Cisticola	*Cisticola lais*						L	3
Levaillant's Cisticola	*Cisticola tinniens*				H			2
Neddicky	*Cisticola fulvicapilla*					M		2,3
Zitting Cisticola	*Cisticola juncidis*				H			1
Desert Cisticola	*Cisticola aridulus*				H			1
Cloud Cisticola	*Cisticola textrix*			**(*)**	H			1
Wing-snapping Cisticola	*Cisticola ayresii*					M		1
Tawny-flanked Prinia	*Prinia subflava*				H			2
Black-chested Prinia	***Prinia flavicans***				**H**			**2,3**
Melodious Lark	*Mirafra cheniana*	**LC,NT**		**(*)**		M		1
Rufous-naped Lark	*Mirafra africana*				H			1
Eastern clapper Lark	***Mirafra fasciolata***					**M**		**1,3**
Spike-heeled Lark	*Chersomanes albofasciata*				H			1
Eastern Long-billed Lark	*Certhilauda semitorquata*			**(*)**			L	3
Chestnut-backed Sparrowlark	*Eremopterix leucotis*					M		1
Red-capped Lark	*Calandrella cinerea*				H			1
Pink-billed Lark	*Spizocorys conirostris*						L	1
Cape Rock-Thrush	*Monticola rupestris*			**(*)**			L	3
Groundscraper Thrush	*Psophocichla litsitsirupa*						L	2

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Karoo Thrush	*Turdus smithi*			(*)		M		2
Fiscal Flycatcher	*Sigelus silens*			(*)		M		2
Spotted flycatcher	*Muscicapa striata*		NBM			M		2
Cape Robin-Chat	*Cossypha caffra*					M		2
African Stonechat	***Saxicola torquatus***				**H**			**2**
Mountain Wheatear	*Oenanthe monticola*						L	3
Capped Wheatear	*Oenanthe pileata*				H			1
Familiar Chat	*Cercomela familiaris*					M		2,3
Ant-eating Chat	***Myrmecocichla formicivora***				**H**			**1**
Cape Glossy Starling	*Lamprotornis nitens*					M		2
Pied Starling	*Lamprotornis bicolor*			(*)	H			2,3
Wattled Starling	*Creatophora cinerea*					M		2
Common Myna	*Acridotheres tristis*		I		H			1,2,3
Amethyst Sunbird	*Chalcomitra amethystina*						L	2,3
White-bellied Sunbird	*Cinnyris talatala*					M		2,3
Cape Weaver	*Ploceus capensis*			(*)		M		2
Southern Masked-Weaver	***Ploceus velatus***				**H**			**1,2,3**
Red-billed Quelea	*Quelea quelea*				H			1,2
Yellow-crowned Bishop	*Euplectes afer*					M		2
Southern Red Bishop	*Euplectes orix*				H			2
White-winged Widowbird	*Euplectes albonotatus*				H			2
Red-collared Widowbird	*Euplectes ardens*						L	2
Long-tailed Widowbird	***Euplectes progne***				**H**			**1**
Thick-billed Weaver	*Amblyospiza albifrons*						L	2
Orange-breasted Waxbill	*Amandava subflava*						L	2
African Quailfinch	*Ortygospiza fuscocrissa*				H			1

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Red-headed Finch	*Amadina erythrocephala*				H			2
Common Waxbill	*Estrilda astrild*				H			2
Bronze Mannikin	*Spermestes cucullata*						L	2
Pin-tailed Whydah	*Vidua macroura*				H			1,2
Cuckoo Finch	*Anomalospiza imberbis*					M		1
House Sparrow	*Passer domesticus*		I				L	2
Cape Sparrow	*Passer melanurus*				H			2
Southern Grey-headed Sparrow	*Passer diffusus*					M		2
Cape Wagtail	*Motacilla capensis*				H			2
Cape Longclaw	***Macronyx capensis***				**H**			**1**
African Pipit	*Anthus cinnamomeus*				H			1
Plain-backed Pipit	*Anthus leucophrys*					M		1
Buffy Pipit	*Anthus vaalensis*						L	1
Long-billed Pipit	*Anthus similis*						L	3
Black-throated Canary	***Crithagra atrogularis***				**H**			**2**
Streaky-headed Seedeater	*Crithagra gularis*						L	2
Cinnamon-breasted Bunting	*Emberiza tahapisi*					M		2,3
Cape Bunting	*Emberiza capensis*						L	3

Red Status	Status in south Africa (S)	Endemism in South Africa (E)
NA = Not Assessed	BM = breeding migrant	Endemism in South Africa (E) (not southern Africa as in field guides)
LC = Least Concern	NBM = non-breeding migrant	
NT = Near-Threatened	V = vagrant	* = endemic
VU = Vulnerable	I = introduced	
EN = Endangered	R = rare	(*) = near endemic (i.e. ~70% or more of population in RSA)

CR = Critically Endangered	PRB = probable rare breeder	B* = breeding endemic
EX = Extinct Regionally	RB = rare breeder	B(*) = breeding near endemic
NR = Not Recognised	RV = rare visitor	W* = winter endemic
Red Status is from *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland,* Taylor (2014).		

7.2.3 Red Listed Birds

Threatened species are included on the list of expected species if they have been previously recorded and/or are suspected to occur in the study area, regardless of the probability of their occurrence, so that, based on the Precautionary Principle, they are included even if they have a low probability. Based on a preview of the revised Red Data list of South African birds by BirdLife South Africa (IUCN Red Data species from Birdlife International 2013, BirdLife South Africa 2014, Taylor 2014), 13 species of international and/or national conservation concern may occur on site, ranging from Least Concern to Endangered, although none was recorded during the survey. Most of these threatened species fall into a few obvious categories by habitat preference (Table 7.2.3.1) and their likelihood of occurrence on site (Table 7.2.3.2); especially once one appreciates what habitats are useful and available to them on site (Table 7.2.3.3).

Table 7.2.3.1: List of threatened species that will possibly make use of the habitats on and around the proposed residential development on the farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga, showing their preferred habitat types. Note that one species may have more than one habitat preference.

Threatened Status	Species	Preferred Habitat Type(s)	
		Grasslands	Wetlands
Least Concern	Melodious Lark	X	
Near Threatened	Blue Crane	X	X
	Black-winged Pratincole	X	X
	Pallid Harrier	X	
	Abdim's Stork	X	
Vulnerable	African Grass-Owl		X
	White-bellied Korhaan	X	
	Secretarybird	X	
	Lanner Falcon	X	X
	Southern Bald Ibis	X	
Endangered	Cape Vulture	X	
	African Marsh-Harrier		X
	Yellow-billed Stork		X
TOTALS	**13**	**10**	**6**

Table 7.2.3.2: The expected frequency of occurrence of threatened bird species on and around the proposed residential development on the farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga, based on the quantity and quality of habitats available.

Threatened Status	Species	Expected frequency of occurrence on site			
		Regular resident	Frequent visitor	Erratic visitor	Infrequent vagrant
Least Concern	Melodious Lark		X		
Near Threatened	Blue Crane				X
	Black-winged Pratincole			X	
	Pallid Harrier			X	
	Abdim's Stork				X
Vulnerable	African Grass-Owl				X
	White-bellied Korhaan			X	
	Secretarybird			X	
	Lanner Falcon			X	
	Southern Bald Ibis		X		
Endangered	Cape Vulture				X
	African Marsh-Harrier				X
	Yellow-billed Stork				X
TOTALS	**13**	**0**	**2**	**5**	**6**

Table 7.2.3.3: Estimated suitability of favoured habitats to support requirements of threatened bird species on and around the proposed residential development on the farms Blesboklaagte 296 JS and Leeupoort 283 JS, Emalahleni, Mpumalanga, based on the quantity and quality of habitats available and scored as Good (G), Mediocre (M), Poor (P), Absent (A) or Not Applicable (N/A).

Threatened Status	Species	Potential support for:			
		Movement	Feeding	Roosting	Breeding
Least Concern	Melodious Lark	G	G	G	M
Near Threatened	Blue Crane	M	P	M	P
	Black-winged Pratincole	P	P	P	N/A
	Pallid Harrier	M	M	P	N/A
	Abdim's Stork	M	M	M	N/A
Vulnerable	African Grass-Owl	P	P	P	A
	White-bellied Korhaan	G	M	M	P
	Secretarybird	G	M	A	A
	Lanner Falcon	G	M	P	A
	Southern Bald Ibis	M	M	A	A
Endangered	Cape Vulture	P	P	A	A
	African Marsh-Harrier	P	P	P	A
	Yellow-billed Stork	P	P	P	A
TOTALS	**13**	**G4,M4,P5**	**G1,M6,P6**	**G1,M3,P6, A3**	**M1,P2,A3, N/A3**

Most threatened species are expected to make use of the grasslands, a few including use of the wetlands, but only three are largely dependent on the wetlands (Table 7.2.3.1). Only two species are expected to be frequent visitors, the Least

Threatened **Melodious Lark** when the grasslands form suitably patchy habitat for it to occupy the area and maybe even breed, and the Vulnerable **Southern Bald Ibis,** but only for foraging when short and/or burnt grasslands are formed for nomads from breeding colonies as close to the east as the Middleburg area (Fig. 14). The remaining species are expected as erratic visitors or infrequent vagrants, due to a combination of the inferior habitats available and/or a low visitation rate to the region (Table 7.2.3.2).

Most threatened species are only expected to use the habitats on site to the support them on movements through the area and, where appropriate, to feed along the way (Table 7.2.3.3). Only two species might be expected to sometimes stay over in the area for longer periods (**Melodious Lark** and the Vulnerable **White-bellied Korhaan**), roosting and maybe even breeding should conditions be conducive – although it should be noted that the latter species is only expected as an erratic visitor at best based on the quality of habitats available.

Under the previous listings (Barnes 2000), 12 threatened Red Data species were reported for the 2430CC grid cell under SABAP 1, with no additional species more recently reported under SABAP 2. In addition to the species already possible to occur on site above, Half-collared Kingfisher and Black Stork have been omitted because they are no longer classified as threatened.

7.2.4 Bird Species Richness

About half of the bird species expected on site are predicted to be attracted primarily by the wetland habitats available, at their most extensive during the site visit but surely much reduced and altered during drier seasons and years. The majority of wetland-favouring species are adapted to such fluctuating and ephemeral habitats which, by the linear and/or patchy distribution, always require the ability to move between sites that present the habitat requirements of particular species. From a conservation and management perspective, protection of wetland habitats will always be a priority, regardless of their size, since they all form an essential part of a mosaic of wetland patches in support of these mobile wetland avifaunas. For these reasons, it seems important to recognise the wetland systems on the site (see Fig. 2) as ecologically sensitive areas for birds, and to refrain and protect them from any developments surrounding them.

Grassland habitats, whether with more sandy or rocky substrates, are important to the other half of the bird species expected on site. Historically they were more extensive and interconnected than at present, so their fragmentation and general degradation and/or transformation by agriculture and development has created a wider range of grassland quality and stability than previously. In general, the grasslands on site are so degraded by previous cropland activities and more recent grazing pressures, together with transformed areas for sand/stone extraction that they offer only inferior habitat for most species and none of significance for any

threatened species. Because of the Endangered status of Rand Highveld Grassland as a national vegetation unit (Mucina & Rutherford 2006), the grasslands on site should probably be considered as of medium ecological sensitivity in principle, although their generally degraded status suggests that this is not an obstacle to their use for the proposed residential development.

7.3 Herpetofauna

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.

7.3.1 Herpetofauna Habitat Assessment

Noticeable absentees from the study site are indigenous trees, with only a few small ones occurring in one or two areas. Arboreal habitat is absent in a functional sense, since indigenous trees with higher and denser canopies are absent from this Highveld vegetation unit. Some low-canopy woody vegetation is present in the rocky ridges towards the south of the study site. These are too few and too small to accommodate arboreal reptiles, apart from being a considerable distance outside their distributional ranges. Most of the scattered trees present on the study site are exotics such as *Eucalyptus* and wattle. Due to the absence of indigenous trees, the low number of exotic trees on the study site and the collection of firewood, there are almost no dead logs, which could have provided shelter and food for some herpetofauna.

Natural rupicolous habitats are present in some places on the study site in the form of scattered stones and rocks. Rocky ridges near the south-eastern and northern sides of the study provide excellent natural rupicolous habitat for some herpetofauna species. Although limited in extent, this habitat is judged to be prime habitat for rupicolous reptiles and amphibians, due to the many large boulders and rocks which form nooks and crannies as refuges for herpetofauna. The presence of terrestrial, arboreal and wetland-associated vegetation cover in the nearby vicinity makes the site even more important. Good man-made rupicolous habitat exists in the form of buildings on the study site.

Permanent and temporary water sources occur in fair numbers on the study site. The major feature of the site is the perennial Blesbokspruit that for a distance separates Pine Ridge and the site, but to the north-west falls entirely within the site. A tributary of the Blesbokspruit bisects the north-eastern corner of the site. There are quite a few pans and dams on the study site. Although some wetlands are artificial and originate from farm dams, these are functional with several wetland plant species, and also wetland fauna. It is justified to state that the surrounding

areas of Emalahleni/Witbank are water-rich. As a consequence, ample habitat is available for water- and moisture-reliant herpetofauna.

All rivers, streams and wetlands are protected in Mpumalanga and are regarded as being sensitive. Connectivity as a whole varies from fair to good and real opportunities for migration exist along streams and near pristine grasslands, while existing roads are huge barriers to connectivity.

7.3.2 Observed and Expected Herpetofauna Species Richness

Of the 45 reptile species which may occur on the study site (Table 7.3.4.1), three were confirmed during the site visit (Table 7.3.4.2) and of the possible 19 amphibian species which may occur on the study site (Table 7.3.4.1); three were confirmed during the site visit (Table 7.3.4.2).

The 64 herpetofauna species are recorded as potential occupants of the study site. Most of these herpetofauna species are robust generalists with the ability to capitalise on disturbed environments. It should be noted that potential occurrence is interpreted as being possible over a period of time, as a result of expansions and contractions of population densities and ranges which stimulate migration.

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 in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 1) are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, rinkhals, eastern striped skink, common platanna, common river frog, Boettger's caco, bubbling kassina, guttural toad and raucous toad). The relatively high species richness is due to the fair size of the study site and the three different habitat types occurring on the study site.

7.3.3 Red Data Listed Herpetofauna

The study site falls outside the natural range of the sungazer, Breyer's long-tailed seps, Natal hinged tortoise, Swazi rock snake and the Southern African python, and these species should not occur on the study site.

The striped harlequin snake has not been recorded in the quarter degree square (TVL Museum Records). The study site contains moribund termitaria, where this species is most likely to be found. It is very difficult to confirm whether this cryptic snake is present on any study site, but a small possibility exists that the striped harlequin snake occurs on this particular study site.

There is a small chance that both species which Mpumalanga Province have concerns about occur near the study site. The spotted harlequin snake is usually found in deserted termite mounds or under rocks (Alexander & Marias, 2007). These types of micro habitats are not abundant on the study site, but do occur in some places.

The many-spotted snake is a secretive snake. This species forages for frogs, lizards and rodents in reed beds and waterside vegetation (Branch, 1998 and Alexander & Marias, 2007). Potential habitat for this snake species is wetland-associated vegetation cover at the water edge. If the water bodies with their buffer habitat are protected, this species should also be protected.

The study site falls outside the natural range of the plain stream frog, spotted shovel-nosed frog and whistling rain frog, and these species should not occur on the study site.

The distribution records for the giant bullfrog are extremely patchy for Mpumalanga Province, with only a few localities (Du Preez & Cook, 2004). Potential breeding sites for the giant bullfrog are present on the study site. These breeding sites are temporary, which bullfrogs prefer in order to avoid predation from fish. They also need water bodies of which at least one side has a very gentle slope. A gentle slope allows for shallow water (less than 9cm deep), which enables the female bullfrog to stand when she lays her eggs outside the water for the male to fertilise. Bullfrog tadpoles swim in schools and stay in the warm shallow water during the day for rapid development (Van Wyk *et al*., 1992).

Many parts of the study site consist of sandy soil and are very suitable as a dispersal area, which combines 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.

It is important to note that 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.

7.3.4. Herpetofauna Species Richness

Table 7.3.4.1: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Alexander and Marais (2007), Minter, *et.al* (2004) & Du Preez and Carruthers (2009).

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	REPTILES
	Order: TESTUDINES	TORTOISES & TERRAPINS
	Family: Pelomedusidae	Side-necked Terrapins
*	*Pelomedusa subrufa*	Marsh or Helmeted Terrapin

	SCIENTIFIC NAME	ENGLISH NAME
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder:LACERTILIA	LIZARDS
	Family: Gekkonidae	Geckos
*	*Pachydactylus affinis*	Transvaal Thick-toed or Transvaal Gecko
?	*Pachydactylus capensis*	Cape Thick-toed or Cape Gecko
√	*Pachydactylus vansoni*	Van Son's Thick-toed Gecko
	Family: Agamidae	Agamas
√	*Agama aculeata*	Ground Agama
?	*Agama atra*	Southern Rock Agama
	Family: Scincidae	Skinks
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis striata*	Eastern Striped Skink
√	*Trachylepis varia*	Variable Skink
?	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink
?	*Acontias gracilicauda*	Thin-tailed Leggless Skink
	Family:Lacertidae	Old World Lizards or Lacertids
√	*Pedioplanis lineoocellata*	Spotted Sand Lizard
*	*Nucras lalandii*	Delalande's Sandveld Lizard
	Family: Gerrhosauridae	Plated Lizards
*	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
	Family: Cordyidae	
?	*Chamaesaura aenea*	Coppery Grass Lizard
*	*Cordylus vittifer*	Transvaal Girdled Lizard
	Family: Varanidae	Monitors
*	*Varanus albigularis*	Rock Monitor
√	*Varanus niloticus*	Water Monitor
	Suborder: SERPENTES	SNAKES
	Family: Typhlopidae	Blind Snakes
?	*Typhlops bibronii*	Bibron's Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
*	*Leptotyphlops conjunctus*	Cape Thread or Worm Snake
*	*Leptotyphlops scutifrons*	Peter's Thread or Worm Snake
	Family: Atractaspididae	African burrowing Snakes
*	*Aparallactus capensis*	Cape or Black-headed Centipede Eater
?	*Homoroselaps lacteus*	Spotted Harlequin Snake
NT?	*Homoroselaps dorsalis*	Striped Harlequin Snake
?	*Amblyodipsas concolor*	Natal Purple-glossed Snake
	Family: Colubridae	Typical Snakes
√	*Lycodonomorphus rufulus*	Common Brown Water Snake
√	*Boaedon capensis*	Brown House Snake
*	*Lamprophis inornatus*	Olive House Snake
?	*Lamprophis guttatus*	Spotted House or Rock Snake
?	*Lamprophis aurora*	Aurora House Snake
?	*Lycophidion capense*	Cape or Common Wolf Snake
?	*Duberria lutrix*	Common Slug Eater
√	*Pseudaspis cana*	Mole Snake
?	*Amplorhinus mutimaculatus*	Many-spotted Snake
√	*Psammophylax rhombeatus*	Spotted Skaapsteker
?	*Psammophis brevirostris*	Short-snouted Grass or Sand Snake
√	*Psammophis crucifer*	Crossed Whip Snake

	SCIENTIFIC NAME	ENGLISH NAME
?	*Philothamnus natalensis*	Eastern Green Snake
?	*Philothamnus hoplogaster*	Green Water Snake
√	*Dasypeltis scabra*	Common or Rhombic Egg Eater
*	*Crotaphopeltis hotamboeia*	Herald Snake
	Family: Elapidae	Cobras, Mambas and Others
?	*Elapsoidea sunderwallii*	Sundevall's Garter Snake
√	*Hemachatus haemachatus*	Rinkhals
	Family: Viperidae	Adders
√	*Causus rhombeatus*	Rhombic Night Adder
√	*Brits arietans*	Puff Adder
	CLASS: AMPHIBIA	AMPHIBIANS
	Order: ANURA	FROGS
	Family: Pipidae	Clawed Frogs
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	Toads
√	*Amietaophrynus gutturalis*	Guttural Toad
√	*Amietaophrynus rangeri*	Raucous Toad
	Family: Hyperoliidae	Reed Frogs
?	*Hyperolius marmoratus*	Painted Reed Frog
√	*Kassina senegalesis*	Bubbling Kassina
√	*Semnodactylus wealii*	Rattling Frog
	Family Breviceptidae	Rain Frogs
?	*Breviceps mossambicus*	Mozambique Rain Frog
	Family Phrynobatrachidae	Puddle Frog
*	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family Ptychadenidae	Grass Frogs
*	*Ptychadena porosissima*	Striped Grass Frog
	Family: Pyxicephalidae	
√	*Amietia angolensis*	Common River Frog
*	*Amietia fuscigula*	Cape River Frog
√	*Strongylopus fasciatus*	Striped Stream Frog
*	*Strongylopus grayii*	Clicking Stream Frog
√	*Cocosternum boettgeri*	Boettger's Caco or Common Caco
*	*Cocosternum nanum*	Bronze Caco
NT?	*Pyxicephalus adspersus*	Giant Bullfrog
*	*Tomopterna cryptotis*	Tremolo Sand Frog
√	*Tomopterna natalensis*	Natal Sand Frog
?	*Tomopterna tandy*	Tandy's Sand Frog

√ 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 7.3.4.2: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Pedioplanis lineoocellata	Spotted Sand Lizard	Sight record	In short grasveld
Trachylepis striata	Eastern Striped Skink	Sight record	Individuals on man-made rupiculous habitat.
Pachydactylus affinis	Transvaal Gecko	Sight record	A few individuals underneath rocks in natural rupiculous habitat.
Xenopus laevis	Common Platanna	Sight record of a juvenile	Aquatic habitat. A juvenile in a rainwater pool.
Amietia angolensis	Common River Frog	Sight record	Edge of permanent water pools
Strongylopus fasciatusi	Striped Stream Frog	Vocalisation	Permanent water bodies

All six species in Table 7.3.4.2 should be abundant on the study site and elsewhere in its range.

8. FINDINGS AND POTENTIAL IMPLICATIONS

The terrestrial habitat type has been largely transformed by past land-use practices ranging from tilling and grazing to recent earthworks. Considering the ecological transformation super-imposed on the exponential pressure for human housing and the close proximity of the site to developed suburbia, no reasonable objection can be forwarded to oppose development of the study site. The conservation importance of the rocky slopes is border-line and their development will not greatly detract from faunal species diversity of the district or from the conservation status of any endangered vertebrate. However, the streams, dams and especially wetlands along their banks are flagged as ecologically sensitive; considering the fact that the development area falls within an urban area, these must be protected by a 32 meters buffer zone outside the riparian zones.

8.1 Impact Assessment

Species richness: The vertebrates from the terrestrial area (and the rocky slopes if those are developed) will be displaced. However, that will be no more than a localized and insignificant event on the periphery of existing suburbia.

Endangered species: Remaining Red Data species restricted to the terrestrial and to the quasi-rupicolous habitat (if any) will be displaced by the intended development. However, some of the terrestrial and all the on-site wetland-associated species will

enjoy better protection if the proposed mitigation measures are accepted and applied.

Sensitive areas: The conservation ranking of the wetland zones along the streams and dams is rated as "Good". These areas are not to be affected by the development.

Habitat(s) quality and extent: The terrestrial habitat is spatially largest but concomitantly the most disturbed. The development will be focused on this habitat type. It is unsure whether development will be approved along the slopes (Figure 13). Relatively speaking the intended development will not substantially change the reigning ecological character of the wetland area; it will unwittingly become a 'green belt' conservation area - provided that runoff from the development is controlled as suggested in the mitigations.

Impact on species richness and conservation: It is contended that the proposed development will not significantly impact negatively on the species assemblages and conservation of the general area to the north of town.

Connectivity: Unimpaired by human interference, especially along the stream and dams and their 32 meters buffer zones.

Management recommendation: See Section10: 'Proposed Mitigation Measures'.

General: Nil.

8.2 Potential Impacts

- *Loss of exotic species, declared weeds and invader plants*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Exotic vegetation	Scattered	Ongoing	Low to good	Low	Low

It is recommended that noxious alien trees, particularly blue-gums, are eradicated before construction is commenced. However, inevitably new gardens will be established by planting exotics. This may ecologically not be puritan but can be expected to favour an increase of garden birds.

- *Loss of ecological sensitive and important vegetation units*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Wetlands	Along the streams and dams	To be conserved *ad infinitum*	Low	High	High

When expressed as vertebrate habitat the wetlands and water bodies are deemed as sensitive and their integrity are not to be jeopardized during the construction or operational phases. It is recommended that cattle grazing are contained from the stage when the project is formalised.

- Loss of ecosystem function (e.g. reduction in water quality, soil pollution)

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Storm water	Wetland systems	Ongoing threat	Low	High	High

management					

Storm water run-off from the hard-cover areas of the development could amount to significant volumes inundating the wetlands, unless contained. Unmanaged water masses and quality can be expected to harm the wetlands and streambeds.

- Loss of faunal habitat

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Terrestrial and rupicolous	Most of the terrain	Permanent	High	Medium	Medium

The likelihood that the proposed development will displace the biological components of the plains and slopes is high, but the ecological impact of this loss is spatially and ecologically deemed as small.

- Loss/displacement of threatened or protected fauna

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Terrestrial and rupicolous	Most of the terrain	Permanent	High	Medium	Medium

Few, if any, of the Red Data species still persisting on the terrestrial and rupicolous habitats will survive. These will be displaced in the face of the planned development. Such a loss will be the ultimate stage of a spiral decline of species richness commenced decades ago.

9. LIMITATIONS, ASSUMPTIONS, GAPS IN INFORMATION AND INDEMNITY

The vertebrate team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on site visits. In instances where doubt exists, a species is assumed to be a possible occupant (viz. *Suncus* species, pythons and bull frogs); -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort. However, a third investigation phase is recommended, namely a 'walk-through' of the finalized preferred site and finalized power line routes.

10. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialists:

- Should hedgehogs be encountered during the development, these should be relocated (by a suitably qualified specialist) to natural grassland areas in the vicinity.

- The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.

Most of the site will be developed and terrestrial habitat (and possibly the slopes) will be displaced with housing. Here there will thus be no remaining natural components whose continued welfare can benefit from mitigation. However, the system flagged as sensitive (streams, dams, riparian zones and 32 meters buffer zones) will require attention, especially in terms of managing storm water runoff.

The following mitigation measures were developed by GDARD (GDACE) (Directorate of Nature Conservation, GDACE, 2008 and 2009) and are applicable to the study site.

Developments

- An appropriate management authority (e.g. the body corporate) that must be contractually bound to implement the Environmental Management Plan (EMP) and Record of Decision (ROD) during the operational phase of the development should be identified and informed of their responsibilities in terms of the EMP and ROD.
- All areas designated as sensitive in a sensitivity mapping exercise should be incorporated into an open space system.
- The open space system should be managed in accordance with an Ecological Management Plan that complies with the *Minimum Requirements for Ecological Management Plans* and forms part of the EMP.
- The Ecological Management Plan should:
    - include a fire management programme to ensure persistence of grassland
    - cattle grazing shall have to be contained
    - include an ongoing monitoring and eradication programme for all non-indigenous species, with specific emphasis on invasive and weedy species
    - include a comprehensive surface runoff and storm water management plan, indicating how all surface runoff generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions
    - ensure the persistence of all Red and Orange List species
    - include a monitoring programme for all Red and Orange List species

    - facilitate/augment natural ecological processes
    - provide for the habitat and life history needs of important pollinators
    - minimize artificial edge effects (e.g. water runoff from developed areas & application of chemicals)
    - include a comprehensive plan for limited recreational development (trails, bird hides etc.) within the open space system
    - include management recommendations for neighbouring land, especially where correct management on adjacent land is crucial for the long-term persistence of sensitive species present on the development site
    - result in a report back to the Directorate of Nature Conservation on an annual basis
    - investigate and advise on appropriate legislative tools (e.g. the NEMA: Protected Areas Act 57 of 2003) for formally protecting the area (as well as adjacent land where it is crucial for the long-term persistence of sensitive species present on the development site)
- The open space system should be fenced off prior to construction commencing (including site clearing and pegging). All construction-related impacts (including service roads, temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment/building materials/vehicles or any other activity) should be excluded from the open space system. Access of vehicles to the open space system should be prevented and access of people should be controlled, both during the construction and operational phases. Movement of indigenous fauna should however be allowed (i.e. no solid walls, e.g. through the erection of palisade fencing).
- When Giant Bullfrogs / Giant Bullfrog habitat will be retained in an open space system of a development situated within the urban edge, Giant Bullfrogs should be prevented from leaving the site and entering unsuitable habitat through the erection of an impermeable wall or appropriately designed fence prior to construction commencing. The wall/fence should be solid (i.e. without openings) below ground to the level of the foundations and for at least 20cm above ground.
- Outside lighting should be designed to minimize impacts on fauna. All outside lighting should be directed away from sensitive areas. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.
- In order to minimize artificially generated surface storm water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.
- The crossing of natural drainage systems should be minimized and only constructed at the shortest possible route, perpendicular to the natural drainage system. Where possible, bridge crossings should span the entire

stretch of the buffer zone (see *Sensitivity Mapping Rules for Biodiversity Assessments* for buffer zone requirements).

Roads / Pipelines / Powerlines

- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the route, but would otherwise be destroyed during construction, should be used for re-vegetation / landscaping purposes.
- Where a road / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / railway / pipeline/ power line has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes.
- Prior to construction, fences should be erected in such a manner to prevent access and damage to any sensitive areas identified in a sensitivity mapping exercise.
- Sealing of surfaces under a bridge or gabion construction should be avoided.
- Disturbance to any wetlands during construction should be minimized. A plan for the immediate rehabilitation of damage caused to wetlands should be compiled by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science. This rehabilitation plan should form part of the EMP and a record book should be maintained on site to monitor and report on the implementation of the plan.
- Engineering measures are recommended to lower the risk of spillages into any wetlands located within 200m of the road/railway/pipeline.
- Appropriate road design and traffic control measures are recommended to reduce air pollution and animal mortality.
- All storm water structures should be designed so as to block amphibian and reptile access to the road surface.
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the road development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.

- Where roads traverse streams/rivers, an underpass should provide for the movement of aquatic as well as terrestrial species through the inclusion of appropriate buffer zones within the underpass (a 32m buffer zone from the edge of the riparian zone recommended for rivers within the urban edge and a 100m buffer zone from the edge of the riparian zone recommended for rivers outside the urban edge).
- Suitable terrestrial underpasses should be provided to facilitate safe movement of animals, specifically where roads traverse provincially important species/climate change corridors or ridges or habitat suitable for any Red/Orange List amphibian / reptile / mammal species. The number and spacing of underpasses will need to be determined by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the fields of Ecological / Zoological Science. All underpasses should be dressed with a layer of sand (minimum 10cm), should be a minimum of 1.5m high and 1.0m wide so as to facilitate maintenance access and should be provided with small grates in the road surface to allow light penetration into the underpass. Underpasses should be accessible to maintenance staff and should be cleared of accumulated material at least at the start of each rainy season.
- A barrier (either prefab concrete wall or galvanized sheeting that extends as a continuous sheet above ground for at least 40cm and below ground for at least 30cm) that will physically block animals from accessing the road surface should be constructed for a distance of 200m on either side of all aquatic and terrestrial underpasses and at any point where roads are associated with suitable habitat for Grass Owls. Holes under barriers should be routinely filled in and areas directly adjacent to the barrier should be kept free of vegetation.
- Where roads are associated with suitable habitat for Grass Owls, road signs warning motorists to slow down on account of Grass Owls should be erected (in accordance with applicable legislation) and road margins should be regularly mowed to a distance of 5m from the hard edge of the road and/or regularly burned to prevent the accumulation of grass cover that could provide refuge for small mammals. In addition, a maximum speed limit of 60km/h should be enforced through the introduction of speed traps, rumble strips and speed bumps. Where a road-related mortality problem is encountered with other priority species, similar measures may be required.
- Where roads are routed past expected or confirmed Giant Bullfrog breeding areas, road signs warning motorists to slow down on account of Giant Bullfrogs should be erected (in accordance with applicable legislation).
- Where roads traverse natural corridors such as streams and ridges, traffic control measures are recommended (e.g. 60km/h speed limits, speed traps, rumble strips and speed bumps).
- Where roads are associated with power lines and telephone lines (these provide an attraction for species that hunt from perches), road margins should

be mowed and/or burned regularly to prevent the accumulation of grass cover that could provide refuge for small mammals.

The following recommended mitigatory measures only apply to power lines / telephone lines / communication masts / cell phone towers:

- Where communication masts / cell phone towers / overhead lines (power lines or telephone lines) are to be constructed within / adjacent to urban open space systems or within rural areas, the Eskom-EWT strategic partnership should advise on appropriate mitigatory measures.
- The design (including mitigation measures) and location of any proposed power lines (whether new alignments or refurbishment/upgrading of existing lines) should be endorsed by the bird conservation experts of the Eskom-EWT strategic partnership.
- Anti-collision devices such as bird flappers should be installed where power lines cross corridors, rivers or ridges.

Reference: Directorate of Nature Conservation, GDACE. 2008 and revised on February 2009. GDACE Requirements for Biodiversity Assessments, Version 2. Gauteng Provincial Government.

11. CONCLUSION

It is foreseen that most of the site, as manifested by the flat, open grounds (and possibly the slopes), will be developed into a residential area as an extension of existing adjacent urbanization. Although terrestrial animals will mostly be displaced, it is argued that the loss of Red Data and sensitive species has largely been discounted by earlier environmental degradation. However, the streams, dams and riparian zones, with their relatively undisturbed moist and semi-aquatic vegetation, are recognized as sensitive and should be awarded appropriate conservation attention, even though some of this system is manmade. Appropriate actions are suggested in the recommended mitigation measures (Section 10). To protect the integrity of the wetland system, managing storm water runoff will be the largest challenge. The wetland system harbours a unique cohort of discerning species, whereas the 32 meters buffer zones outside the riparian zones will offer a strip of grassland suitable for terrestrial species and offer them dispersal opportunities.

Given the rigid protection of the wetland system and prerequisite buffer zones, no justifiable objection can be raised about the development of the project on the terrestrial portion of the site. From a vertebrate perspective, development along the weakly developed ridges will not amount to an environmental setback.

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13. CURRICULUM VITAE

RÉSUMÉ

IGNATIUS LOURENS RAUTENBACH Ph.D., Prof. Nat. Sci.

Independent Environmental Consultant – MAMMALOGY.

Identity Number	421201 5012 00 5
Gender	Male
Date of Birth	1 December 1942
Nationality	South African
Home Languages	Bilingual (English & Afrikaans)
Postal Address	45 Helgaard Street, Kilner Park, Pretoria, RSA 0186. Tel no +27 12 3334112, Cell +27 082 3351288. E-mail naasrauten@mweb.co.za
Former Position	Retired Director: Planning, Northern Flagship Institute
Present Position	Consultant – Specialist, Environmental Impact Assessments (Applied research), Photographing microstock for four agencies
Qualifications	**B.Sc**. (UP), **T.H.E.D** (Pta TTC), **M.Sc.** (UP), **Ph.D**. (Un. Natal)
Professional Honours	1. Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400300/05 2. Fellow of the Photographic Society of South Africa 3. Master photographer at club level 4. Honorary life member of the S.A. Wildlife Management Association.
Notable Research Contribution	In-depth survey of the Mammals of the Transvaal. 1982. 211pp. Ecoplan Monograph 1.
Notable Literary Contribution	Rautenbach, Naas & Annalene Rautenbach. 2008. *Photography for Focused Beginners.* 302pp with 250 images. Green Door Studio, Pretoria.
Formal Courses Attended	Computer Literacy, Project Management, Contract Design, Senior Management

Employment history

May 2001 - Present Self-employed, collaborator with Eco-Agent CC Ecological Consultants as well as Galago Environmental [environmental impact assessments], technical writing, and photography

April 1999 - August 2001 Director: Planning, Northern Flagship Institution

Jan 1991 - April 1999 Executive Director, Transvaal Museum

July 1967 - Dec 1990 Curator (in charge) of the Division of Mammalogy, Transvaal Museum. Promoted to Principal Scientist rank as of June 1985

March - June 1967 Research student at the Mammal Research Institute of the Zoology Department, University of Pretoria

July 1966, Nov l966 - Febr 1967 Member of the Smithsonian Institution's field teams collectively partaking in the 'African Mammal Project'

1966: Part-time research assistant to Prof. J. Meester, University of Pretoria

1962 - 1965 Temporary assistant during University holidays in the Nematology laboratories, Agricultural Technical Services

1991 - 2002 Founder member and non-executive director of the Board of Trustees of

1993 - 2001 Founder member and Trustee of the privatised Museums Pension Fund

1997 - 2001 Non-executive director of the Tswaing Section 21 Company

Professional Achievements

Managed a research institute of 125 members of staff. Solicited numerous grants totalling ≥ R1 000 000. Initiated and overseen building programmes of R30 million at the Transvaal Museum. Conceptualised and managed 12 display programmes.

Research: Author and co-author of 85 scientific publications re mammalogy in peer reviewed subject journals, 18 popular articles, 10 books, and >400 contractual EIA research reports. Extensive field work and laboratory experience in Africa, Europe, USA, Alaska, Brazil and Mexico. B -rated by FRD as scientist of international status 1983 – 1995.

Students: Additional to museum manager duties, **c**o-supervised 5 B.Sc. (Hons.), 2 M.Sc. and 2 Ph.D. students.

Public Recognition:

Public speaking *inter alia* Enrichment Lecturer on board the 6* *SS Silver Wind*, radio talks, TV appearances.

Hobbies

Technical writing, photography, field logistics, biological observations, wood working, cooking, designs.

Personal Evaluation

I am goal-orientated, expecting fellow workers and associates to share this trait. I am an extrovert, sensitive to amicable interpersonal relations. I have a wide interest span ranging from zoological consulting, photography, cooking, sport, news, gardening and out of necessity, DIY. To compensate for my less than perfect memory, I lead a structured and organised life to deal with the detail of a variety of interests. Often to the chagrin to people close to me, I have an inclination to “Think Out of the Box”.

DETAILS OF SPECIALIST CONSULTANT
Abridged Curriculum Vitae: Alan Charles Kemp

Born: 7 May 1944 in Gweru, Zimbabwe
Citizenship: South African, British
Marital status: Married, 1 daughter, 1 son

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Naturalists & Nomads, Postnet Suite #38, Private Bag X19, Menlo Park, 0102, South Africa

Qualifications:

1965 B.Sc. Rhodes University, Zoology and Entomology as majors
1966 B.Sc. Hons. Rhodes University, Zoology
1973 Ph.D. Rhodes University, Zoology of Pretoria

Thesis: (Ph.D.) on ecology, behaviour and systematics of hornbills in Kruger National Park

Professional titles:

• Pr.Sci.Nat. South African Council for Natural Scientific Professions (Zoological & Ecological Sciences) **Registration Number 400059/09**

Professional career:

- Field Research Assistant to Prof. Tom J. Cade, Section of Ecology and Systematics, Cornell University, in Kruger National Park, South Africa, Nov 1966 - Apr 1969.
- Department of Birds, Transvaal Museum, Pretoria, June 1969 – August 1999, Head of Department from 1971, rising to Senior Scientist and then Head Curator by 1974.
- Elected Manager, Transvaal Museum, September 1999 – July 2001, until voluntary early retirement.
- Edward Grey Institute of Ornithology, Oxford, December 2001 – April 2002, drafting specialist bird texts for Gale Publishing, USA and Andromeda Press, Oxford, UK.
- Berg 'n Dal & Pretoria, April 2002 - February 2003, presenting paper and later editorial assistant for book from the Mammal Research Institute, University of Pretoria, *The Kruger Experience: ecology and management of savanna heterogeneity.*
- Bangkok, March – June 2003, drafting research papers for colleague at Mahidol University; touring Laos.
- Pretoria, August-December 2003, editorial assistant for book from the Mammal

Research Institute, University of Pretoria, a revision of *The Mammals of Southern Africa.*

- Hala-Bala Wildlife Reserve, January – December 2004, a one-year rainforest study of hornbills, raptors and owls in southern Thailand for their National Center for Genetic Engineering and Biotechnology (BIOTEC).
- Pretoria, January 2005 – July 2007, organizing 4th International Hornbill Conference at Mabula Game Lodge and editing and publishing CD-ROM proceedings, and consulting on ground hornbills to Mabula, University of Cape Town and Endangered Wildlife Trust.
- Bangkok, India, Singapore, Sarawak, September 2006 – April 2008. Assisted colleagues at Mahidol University, Bankok, with compilation of research paper on molecular systematics of hornbills, and travelled to see other Asian habitats and meet with other colleagues.
- Bangkok, December 2011 – April 2012. Assisted colleagues at Mahidol University, Bangkok, with compilation of research papers and co-editing/writing three hornbill books together with colleagues in Singapore.

Academic career:

• Students:
- Completed post graduate students: M.Sc. 14; Ph.D. 5.

• Author of:
- 53 scientific papers or notes in refereed journals
- 48 papers at national and international congresses
- 6 scientific (unpublished) reports on environment and natural resources
- 74 popular scientific papers.
- 18 contributions in books

• Editorial Roles
- Ostrich, African Journal of Ornithology (editor 1973-75).
- Bird Conservation (International (editorial committee 1995-present)

• FRD evaluation category: C2 (Avian Biology and Systematics)

• Associate positions:
- University of the Witwatersrand, Honourary lecturer, Department of Zoology (1988-2001)
- Percy FitzPatrick Institute of African Ornithology, University of Cape Town, research associate (2001 – present).
- Transvaal Museum, Honourary curator (2004-present)
- Wildlife Conservation Society, New York, wildlife conservation associate (1996-present).

Membership:

- American Ornithologist's Union, Corresponding Fellow (1986- present)
- Birdlife South Africa (previously South African Ornithological Society), Ordinary Member (1969-present), President (1975-1993) of Northern Transvaal (Pretoria)

Branch, Honourary Life Member of Pretoria Bird Club (2000 – present).

Special committees:

- International Ornithological Committee of 100, elected member (1989-present).
- Raptor Research Foundation, Grants assessor, Leslie Brown Memorial Fund (1985-present).

Merit awards and research grants:

- 1969-86. Annual research grants from South African Council for Scientific and Industrial Research (CSIR).
- 1974. Chapman Fund Award, American Museum of Natural History, for field research in Borneo and India.
- 1986-98. Annual research award from South African Foundation for Research Development (FRD) as "C"-graded national scientist.
- 1989-95. Team member of FRD Special Programme in Conservation Biology.
- 1989-95. Team member of FRD Special Programme in Molecular Systematics.
- 1991-95. Various private sector sponsorships.
- 1992, 1994. FRD merit award to museum scientists.
- 2000. Special NRF Science Liaison award to attend 10th Pan-African Ornithological Congress, Kampala, Uganda.
- 2001. Special NRF Science Liaison award to attend 3rd International Hornbill Workshop, Phuket, Thailand.
- 2004. One year's support from Thailand's National Center for Genetic Engineering and Biotechnology (BIOTEC) for rainforest survey research.
- 2007-2008. Six month's funding to enable specialist assistance at Department of Microbiology, Mahidol University, Thailand.

Consultant

- Sept-Oct 1994 – Kruger National Park, specialist consultant on ground hornbills to BBC Natural History Unit for filming of Wildife on One programme, 6 weeks.
- Oct-Nov 1996. Kruger National Park, specialist consultant on various birds to David Attenborough for BBC series Life of Birds, 3 weeks.
- Sep-Oct 1998. Kruger National Park, specialist hornbill consultant to National Geographic magazine team, 4 weeks.
- October 2001 – Mala Mala, specialist consulting on ground hornbills for National Geographic film unit, 1 week.
- 2004-present - >15 specialist birding and nature tours as a National South African Tourist Guide, registration number GP0770.
- 2005-present – >30 Biodiversity assessments for a Ramsar wetland proposal, Important Bird Area proposal, and general scoping, G20 and specialist avifaunal EIAs.

ABRIDGED CURRIVULUM VITAE VAN WYK:
JACOBUS CASPARUS PETRUS (JACO)

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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
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 >150 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.