INVERTEBRATE SURVEY OF RANDWATER PIPELINE ALTERNATIVES IN THE RIETVLEI NATURE RESERVE AND BRONBERG RIDGE.

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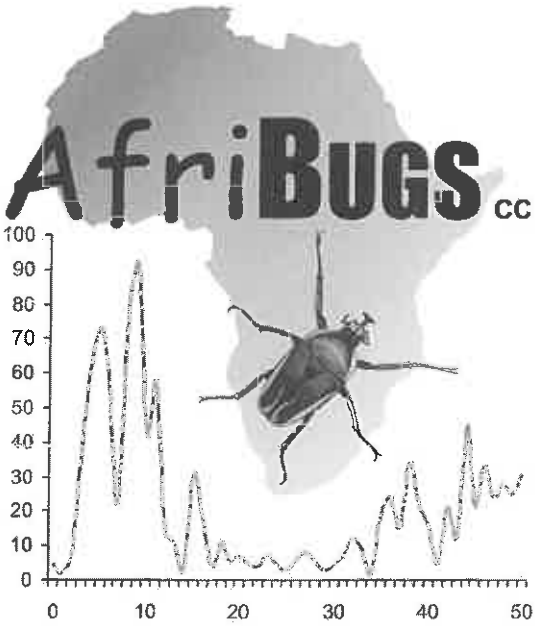

2 TERMS OF REFERENCE

2.1 *GDARD requirements for invertebrate surveys*

Current GDARD requirements (GDACE 2008) for invertebrate surveys stipulate that:

- The site must be surveyed for all invertebrate species of concern (Red Data, rare and endemic) predicted for and historically recorded on the site.
- Where trapping is applicable surveys must be carried out during the summer months and over a minimum period of 4 weeks to allow a comprehensive survey of all invertebrate species of concern confirmed on the site.
- Mapping of the extent of populations of all species of concern confirmed on the site must be provided.
- Any deviations from the above must be fully motivated by the specialist carrying out the survey.

2.2 *Scope of Work*

Survey the pipeline portions that pass through the Rietvlei Nature Reserve and traverse the Bronberg ridge system to assess the potential impact on invertebrate species of conservation concern.

2.3 *Deliverables*

Report providing *inter alia*:

- List of species of concern that might be expected to occur in the area, based on data from GDARD and other sources.
- Information on presence/absence and, where possible, abundance estimates of Red Data invertebrates and other priority species and groups.
- GPS coordinates for all priority specimens found and maps indicating locations of all priority species confirmed on the site.
- Assessments of the present state of the habitat, potential short, medium and long-term impacts of the proposed pipeline installation and significance of these impacts from a local and regional perspective.
- Implications, if any, from the perspective of the ridges policy (GDACEL 2001).
- Suggested mitigation measures.

Photographic documentation of the general state of the site as well as any priority species found is also included.

1 INTRODUCTION

1.1 *Proposed pipeline installation*

Rand Water intends to apply for environmental authorisation for the installation of water pipelines, parts of which would pass through the Rietvlei Nature Reserve and over the Bronberg ridge. AfriBugs was commissioned to carry out the invertebrate component of the environmental surveys required for this application.

1.2 *Invertebrates in EIA studies*

Invertebrates comprise the majority of all biodiversity on earth (May 1988) and the lack of attention paid to this group in most biodiversity studies is a significant impediment to managing our biodiversity. As signatory to the Convention on Biological Diversity, South Africa has an obligation to conserve biodiversity as a whole and not only the groups that previous conservation efforts have tended to concentrate on. The South African Government has recognised that invertebrates and other poorly known groups have been neglected in past approaches to conservation and is committed to taking appropriate action to conserve such groups (DEAT 1998). Invertebrate studies are therefore playing an ever-increasing role in conservation and environmental management decision-making processes in South Africa.

Invertebrate conservation efforts and decision-making in Gauteng Province are currently based largely on a few groups and species of particular concern. While it is probable that many endangered species exist in groups not considered, there is at present inadequate data for their meaningful inclusion in such decision-making processes. In order to optimise resources, the survey therefore concentrated on obtaining data pertinent to the priority groups and species as listed by GDACE, although observations on other invertebrate groups that could aid in evaluating the conservation value of the site were also made.

TABLE OF CONTENTS

Predicted impacts

Construction of the currently preferred option within the RNR would have adverse short and medium- to long-term impacts on the *Metisella meninx* population in the northeast of the reserve; the severity of the impacts would depend on whether the pipeline is to be installed underground or raised above the surface at this point. The latter option would be expected to reduce impacts on surface and ground water flows, and hence minimise impacts on the butterfly population. Impacts on *Ichnestoma stobbiai* are unlikely as this species does not appear to occur anywhere on or near the proposed pipeline routes. Impacts on other species are not expected to be of high significance as none is currently considered to be threatened and the area of their habitat that would be disturbed is small relative to their known distributions.

Conclusions and Recommendations

It is clear that the preferred Option 1 would result in the greatest disturbance to priority invertebrate populations in the RNR, and that at least one Red Data species would be negatively affected; this suggests that alternative routes should be given serious consideration. Since only the extreme northern portion of the preferred route is expected to have serious impacts on priority invertebrate species, alternatives utilising the preferred route up to this point and then deviating could be considered, but this would still have the undesirable consequence of bisecting the reserve with a disturbed area during construction and for a considerable period thereafter. The central route bisecting the RNR is therefore not recommended, and the alternative along the eastern boundary is preferred from an invertebrate perspective.

Construction of the proposed pipeline across the Bronberg ridge is expected to have some negative impacts on two protected invertebrate species, as well as another whose conservation status is at present unknown. However, these impacts are not predicted to be of high significance, especially if installation is carried out as far as possible in areas already disturbed by invasive plant species; removal of these plants and rehabilitation of the pipeline route would be expected to result in a net positive impact of the installation from an invertebrate perspective; there is thus no objection to this section of the pipeline from an invertebrate perspective.

Detailed mitigation measures, specific to pipeline installations and aimed at minimising impacts on invertebrates, are provided in section 6.2.1 of the main report.

EXECUTIVE SUMMARY

Background

Rand Water intends to apply for environmental authorisation for the installation of water pipelines, parts of which would pass through untransformed areas within the Rietvlei Nature Reserve (RNR) and portions of the Bronberg classified as a Class 2 ridge.

This survey

This survey was commissioned to cover only those portions of the proposed pipelines passing through the Rietvlei Nature Reserve and traversing the untransformed portion of the Bronberg.

The main invertebrate species of conservation importance predicted for the Rietvlei site was *Ichnestoma stobbiai*; no priority species were predicted for the Bronberg ridge portion of the route. However, several other invertebrate species of potential significance were also identified as possibly occurring on one or other of the sites, so surveys were carried out with these species in mind in addition to the primary focus on *I. stobbiai*. In total seven site visits were carried out as follows: 4 December 2008 (RNR & Bronberg), 7 October 2009 (RNR), 10 October 2009 (Bronberg), 13 October 2009 (RNR and Hornsnek control site), 26 October 2009 (RNR), 18 December 2009 (RNR) 28 January 2010 (Bronberg).

Results

Priority species: Potential habitat of relatively low suitability for *Ichnestoma stobbiai* was observed along the preferred pipeline route in the RNR during the course of the site inspection; more detailed surveys in the appropriate season were carried out to determine whether or not this species was present. Although the site was surveyed on three occasions during conditions considered suitable for *Ichnestoma* activity, and this species was observed at a control site immediately after one of these visits, no *I. stobbiai* were observed at any stage in the RNR. It is therefore considered very unlikely that this species occurs on the proposed pipeline route.

Numerous *Metisella meninx* (the Red Data Marsh Sylph butterfly) were found in a wetland traversed by the northern portion of the preferred route in the RNR, an area of less suitable habitat for this species was observed in the south where the pipeline route enters the reserve and a further area of potential, but low quality, habitat was observed along the eastern border of the reserve. Other areas probably suitable for *M. meninx* were identified by inspection of aerial photographs in the eastern central portion of the reserve, but these would not be impacted on by any of the pipeline alternatives.

Other invertebrates of interest: Burrows of *Opistophthalmus pugnax*, a protected but currently not threatened scorpion species, were observed along the route within the Rietvlei Nature Reserve, and two specimens were found in burrows under stones. Several specimens of *Entypesa ?schoutedeni*, a wishbone trapdoor spider species recorded in Gauteng for the first time in 2007 (and possibly representing an undescribed species), were found under rocks on the portion of the pipeline route traversing the Bronberg ridge. Two protected but currently not threatened scorpion species, *Opistophthalmus glabrifrons* and *Hadogenes gunningi*, were also found adjacent to the pipeline route within the Bronberg ridge portion.

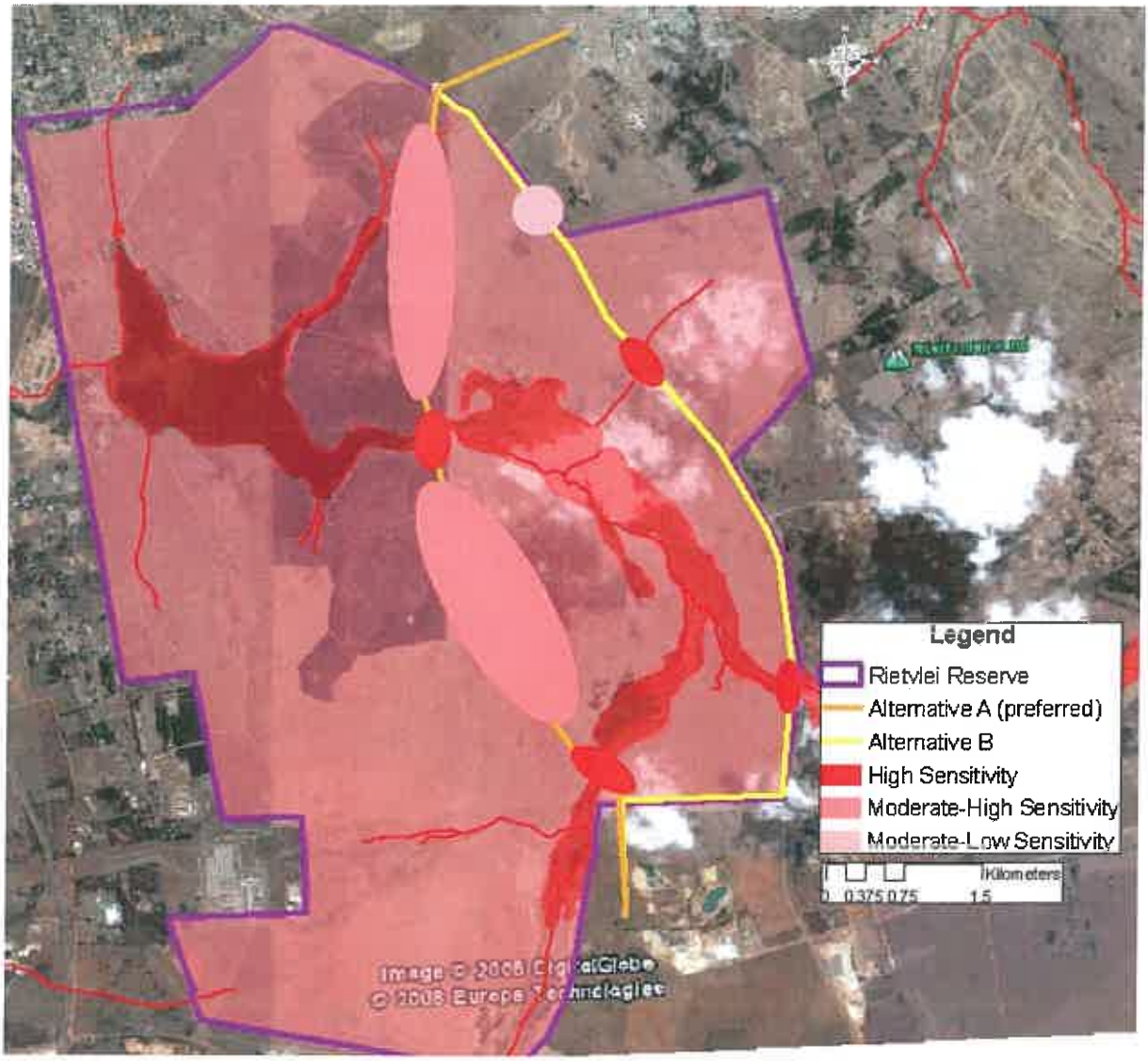

Figure 4.2.2a. Sensitive habitats for mammals identified at Rietvlei Nature Reserve

well as most carnivores (some of which are Red Data listed) which will frequent these systems for drinkable water on a daily basis. The river and wetland crossings have been highlighted in this figure as this is where most damage could occur should this alternative be chosen, and care must be taken not to affect water flow or to block the passage of aquatic species such as the otters from one side of the pipeline to the other. Litter also accumulates quite regularly in culverts created to provide constant flow.

Second to the wetlands and water bodies is the sensitivity of the grassland plains (moderate-high sensitivity) – any disturbance running through this open area may act as a barrier for crossing for many species, which will be especially problematic during the breeding season. Also, the proposed pipeline runs relatively parallel and close to the drainage line, and both the project impact and the wetland will provide barriers for mammals, thus isolating them in a small patch between the two. Again, this must be avoided especially during the breeding season when food availability and territoriality play

a significant role. If the disturbance is of short enough duration and rehabilitation starts immediately after the impact, this may have a lesser effect on the populations.

Furthermore, the presence of rough-haired golden mole has been confirmed along the route (see report by S Maree), especially along the section between the two river crossings where golden mole burrows were located next to the pegs marking the proposed line. Moving the proposed pipeline further east towards the wetland may avoid the golden moles, however it will then impact on the wetland and affect species such as the otters.

Finally, the sinkhole identified along Alternative B has been highlighted as being of moderate to low sensitivity. The sinkhole is very deep, too deep to be able to confirm the presence of a cave at the bottom. The sides of the sinkhole ran straight down with no signs of crevices or possible nesting sites. It is thus unlikely that any species other than possibly bats may find suitable habitat here, hence I would suggest waiving the need for a 500m buffer from a mammal perspective. It is however essential that the stability of the sinkhole is not compromised.

Figure 4.2.2b indicates sensitive areas within the Bronberg site. While the entire Bronberg should be considered moderately-highly sensitive due to the presence of Juliana's Golden Mole (see report by S Maree), especially the ridge in the centre of this site is of high sensitivity as it will be most affected by the project. The presence of Juliana's Gooden Mole was confirmed here, and there is a significant likelihood of occurrence of several small species such as data deficient shrews based on the suitability of the habitat.

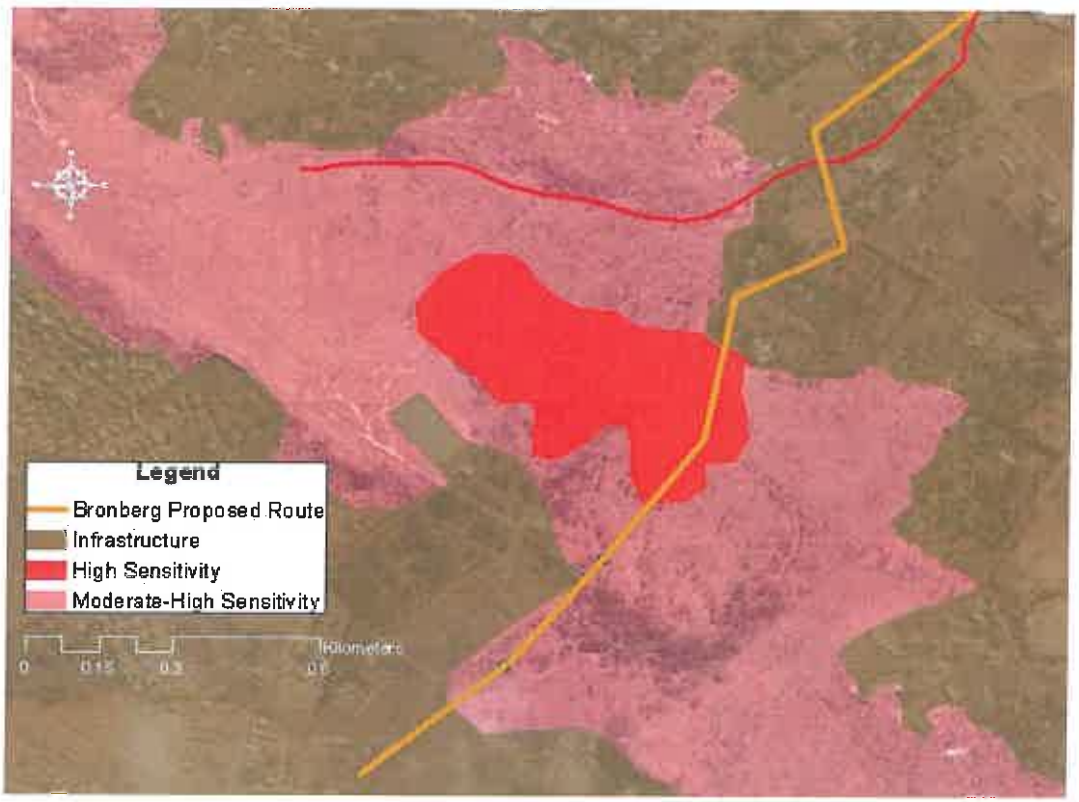

Figure 4.2.2b. Sensitive habitats for mammals identified at Bronberg

Species (and Order)	Common Name	Conservation Status	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Crocidura maquassiensis	Maquassie Musk Shrew	vulnerable	may occur	may occur
Miniopterus schreibersii	Schreiber's Long-fingered Bat	near threatened	may occur	may occur
Rhinolophus blasii	Blasius' Horseshoe Bat	vulnerable	confirmed*	may occur
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	near threatened	confirmed*	may occur
Myotis welwitschii	Welwitsch's Hairy Bat	near threatened	may occur	may occur
Rhinolophus darlingi	Darling's Horseshoe Bat	near threatened	confirmed*	may occur
Mycotis tricolor	Temminck's Hairy Bat	near threatened	may occur	may occur
Pipistrellus rusticus	Rusty Pipistrelle	near threatened	may occur	may occur
Manis temminckii	Ground Pangolin	vulnerable	confirmed*	unlikely to occur
Hyaena brunnea	Brown Hyaena	near threatened	confirmed*	unlikely to occur
Lutra maculicollis	Spotted-necked Otter	near threatened	may occur	unlikely to occur
Mellivora capensis	Honey Badger	near threatened	likely to occur	may occur
Ourebia ourebi	Oribi	endangered	confirmed*	unlikely to occur

Table 4.2b. Species likely to occur that are protected under NEMBA

Species (and Order)	Common Name	Conservation Status under NEMBA
Chrysospalax villosus	Rough-haired Golden Mole	critically endangered
Ourebia ourebi	Oribi	endangered
Neamblysomus julianae	Juliana's Golden Mole	vulnerable
Manis temminckii	Ground Pangolin	vulnerable
Panthera pardus	Leopard	vulnerable
Aonyx capensis	Cape Clawless Otter	protected
Atelerix frontalis	South African Hedgehog	protected
Canis mesomelas	Black-backed Jackal	protected
Caracal caracal	Caracal	protected
Ceratotherium simum	White Rhinoceros	protected
Connochaetes gnou	Black Wildebeest	protected
Felis nigripes	Black-footed Cat	protected
Hyaena brunnea	Brown Hyaena	protected
Hystrix africaeustralis	Porcupine	protected
Leptailurus serval	Serval	protected
Lutra maculicollis	Spotted-necked Otter	protected
Mellivora capensis	Honey Badger	protected
Redunca arundinum	Reedbuck	protected
Sylvicapra grimmia	Common Duiker	protected
Vulpes chama	Cape Fox	protected

Table 4.2a. Species confirmed (visual) at Rietvlei and Bronberg

Species (and Order)	Common Name	Conservation Status	confirmed
Rhabdomys pumilio	Four-striped Grass Mouse	least concern	Rietvlei
Otomys irroratus	Vlei Rat	least concern	Rietvlei
Hystrix africaeaustralis	Cape Porcupine	least concern	Rietvlei
Chrysospalax villosus	Rough-haired Golden Mole	vulnerable	Rietvlei
Raphicerus campestris	Steenbok	least concern	Rietvlei
Sylvicapra grimmia	Common Duiker	least concern	Rietvlei
Cynictis penicillata	Yellow Mongoose	least concern	Rietvlei
Ceratotherium simum	White Rhinoceros	least concern	Rietvlei
Equus burchellii	Zebra	least concern	Rietvlei
Hippopotamus amphibius	Hippopotamus	least concern	Rietvlei
Andidorcas marsupiallis	Springbok	least concern	Rietvlei
Connochaetes gnou	Black Wildebeest	least concern	Rietvlei
Taurotragus oryx	Eland	least concern	Rietvlei
Alcelaphus buselaphus	Red Hartebeest	least concern	Rietvlei
Syncerus caffer	African Buffalo	least concern	Rietvlei
Cryptomys hottentotus	African Molerat	least concern	Rietvlei
Papio ursinus	Chacma Baboon	least concern	Rietvlei
Lepus saxatilis	Scrub Hare	least concern	Rietvlei
Pronolagus radensis	Jameson's Red Rock Rabbit	least concern	Bronberg
Neamblysomus julianae	Juliana's Golden Mole	vulnerable	Bronberg

Of the species of concern to conservation, only one was confirmed (visually by the specialist) on either site and 17 others may/are likely to occur (Table 4.2b). Furthermore, several of the species likely to occur or even confirmed on these sites are protected under the National Environmental Management: Biodiversity Act of 2004 (Threatened and Protected Species Regulations; referred to as NEMBA) (Table 4.2c).

Table 4.2b. Species of concern and their likelihood of occurrence

Species (and Order)	Common Name	Conservation Status	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Chrysospalax villosus	Rough-haired Golden Mole	vulnerable	confirmed (tunnels)	may occur
Amblysomus septentrionalis	Highveld Golden Mole	near threatened	may occur	may occur
Neamblysomus julianae	Juliana's Golden Mole	vulnerable	may occur	confirmed at Bronberg (tunnels)
Dasymys incomtus	Water Rat	near threatened	may occur near dams and wetland	unlikely to occur
Mystromys albicaudatus	White-tailed mouse	endangered	confirmed*	may occur
Atelerix frontalis	Southern African Hedgehog	near threatened	confirmed*	may occur

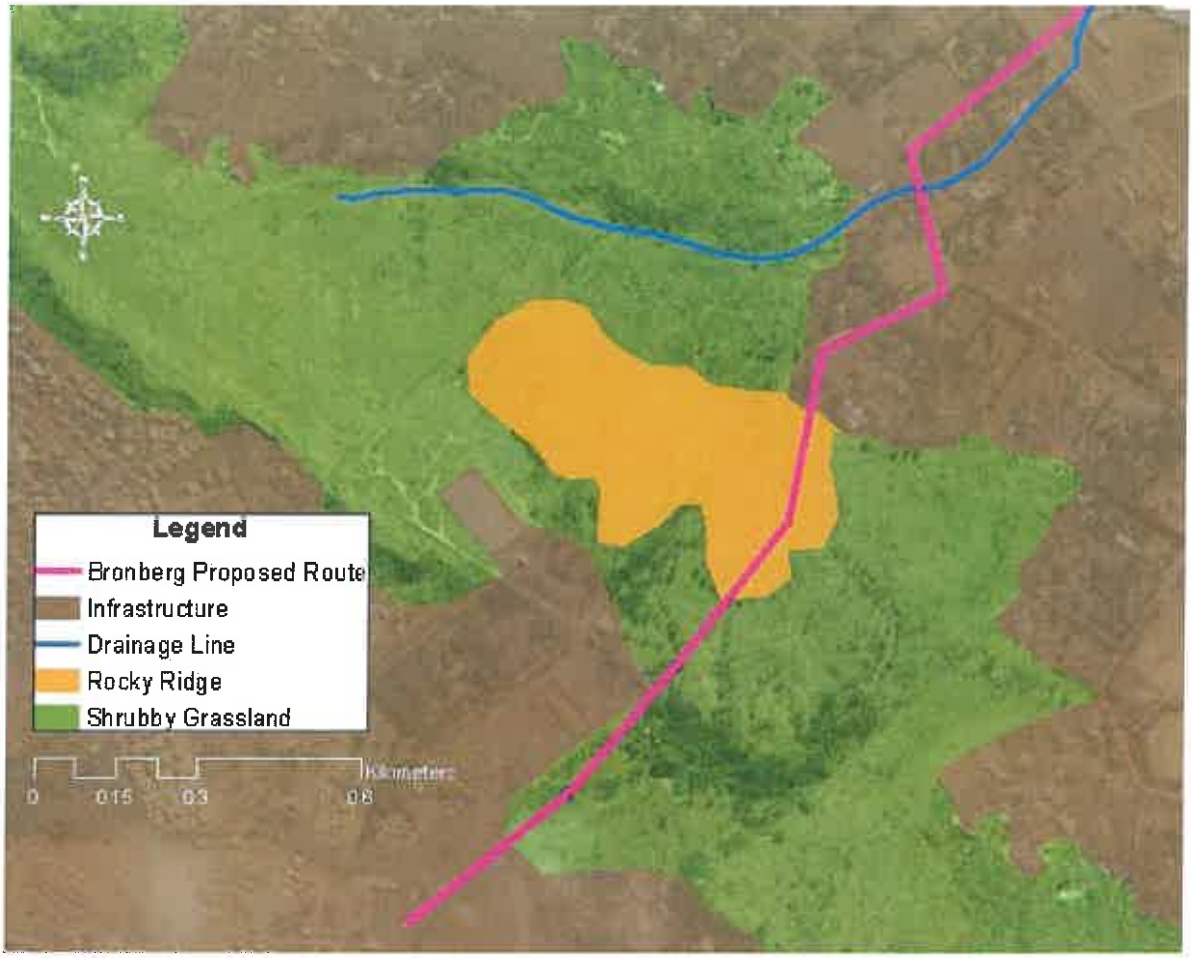

Figure 4.1b. Broad habitat types identified at Bronberg

While the preferred route through Rietvlei Nature Reserve crosses predominantly grassland with scattered shrubs, rocky outcrops, wetlands and moist grassland patches ideal for many Red Data species, the route proposed through the Bronberg crosses sensitive ridge habitat which has previously been highlighted for the possible presence of the critically endangered golden mole species.

4.2 Mammals- Status Quo

From the desktop study, 73 mammal species of small mammal were found to potentially occur on the Bronberg based on habitat requirements and other factors such as levels of disturbance on site. The presence of some species could be confirmed on site based on burrows and droppings (Table 4.2a). At Rietvlei Nature Reserve, 109 species were identified as potentially occurring on site (of which 52 are listed in Tshwane's guide book for the reserve and 18 were confirmed visually).

5. Possible Impacts of the proposed development

In terms of mammals, the proposed project is likely to have a number of direct and indirect impacts on the species occurring in the area. While direct impacts include the death of small mammals (mainly during ground-breaking through vehicle traffic and front-end loaders), resulting in significant effects on the populations currently occurring on the site, these impacts are usually localised and short-term. However, indirect effects such as changes in habitat structure and fragmentation of habitats, while less obvious, may be of higher significance, as their effects can be more widespread and long-term and must be mitigated to lessen their effects.

The proposed pipeline, if not mitigated and rehabilitated adequately, will result in the permanent transformation of the habitat on certain parts of the site. Unfortunately, negative impacts cannot be totally avoided, but must be minimised by keeping the area of transformation to a minimum and rehabilitating the impact sites as best possible to ensure continuity of natural habitats with neighbouring sites.

5.1 Construction Phase

The preconstruction and construction phases will involve the removal of topsoil and vegetation leading to the establishment of access roads and the underground pipeline. This process could possibly lead to:

- A reduction in suitable habitat for many animals through habitat destruction, specifically destruction of the wetlands being crossed, thus directly impacting the population in the demarcated area;
- Habitat fragmentation due to the barrier to movement posed by trenches, underground pipes, roads; this will especially affect small and aquatic mammals;
- Noise pollution and ground vibrations resulting from machinery;
- Intentional killing / hunting of animals by workers;
- Death of a proportion of small mammals by direct physical damage through front-end loaders and other earth moving equipment;
- An increase in runoff and pollution which may adversely affect the down-slope drainage line and wetland, as well as associated small mammals.

5.1.1 Mitigation

The negative effects of this phase can be partially mitigated by:

- Having a designated game ranger accompany the construction crew at Rietvlei Nature Reserve at all times to ensure safety of and prevent harassment of mammals; ensure the presence of an environmental officer at the Bronberg site for the same purpose;
- Selecting Alternative B at Rietvlei Nature Reserve which would lie within the existing fire break; this will significantly decrease disturbance of mammals as well

as practically eliminate the risk of habitat fragmentation as it would run along side an existing main road which marks the border of the reserve;

- Should alternative 2 be chosen, care must be taken not to further collapse existing sinkholes as the caves possibly occurring at the base of these are suitable habitat for bats, many of which are RD listed. Raising of the pipeline above-ground should be considered here;
- Keeping the area of disturbance to a minimum; possibly restricting the area of disturbance to a 20m corridor using at least danger tape to demarcate the corridor;
- Starting with clearing and topsoil removal from one end of the site towards the other to allow small mammals to flee the site;
- Not disturbing the movements of any animals intending to flee the impacted area;
- Prohibiting the intentional killing of mammal species through on-site supervision by an Environmental Officer (EO) or game ranger;
- If any rare or endangered species are located during construction by the EO, an ecologist or specialist must be contacted;
- Educating employees to minimise accidental killing of plant and animal species during construction;
- Relocating, with the assistance of an ecologist, mammals found during ground-breaking;
- Avoid ground clearing during spring/summer as mammals reproduce and disperse during this time; this should be planned for late autumn/early winter.
- Removal of all old materials and remaining soil stockpiles during and after construction. Construction material storage must occur within areas that are considered transformed (e.g. alien bush clumps).
- Access roads to the construction areas should be kept to a minimum, and where possible existing tracks must be used.
- Adequately manage storm water runoff, preferably start with the rehabilitation of the disturbed areas as soon as possible after construction.

5.1.2 Mitigation specific to the areas suitable for Red Data species

The Rietvlei site has several sensitive habitats that need to be considered. Alternative A (the preferred alternative) may well run parallel to the existing buried pipeline, but will be crossing two drainage lines associated with wetlands. Furthermore it will cross moist grassland where Rough-haired Golden Moles (Red Data listed) are confirmed (see report by S Marais). Creating a disturbance through the centre of the reserve, thereby transecting grassland areas used by large ungulates, will lead to short-term habitat fragmentation and it is essential that the timing of the disturbance does not coincide with breeding season, is short in duration and limited to a 20-30m stretch. It is further essential that rehabilitation of vegetation commences as soon as the pipe is covered with soil.

Where the pipeline crosses the drainage lines and wetlands it is recommended that the pipe runs above-ground with limited disturbance of water flow and mitigation to avoid sediment build-up where supporting structures will be placed into the wetland.

At the Bronberg site, which is highly sensitive due to the presence of Juliana's Golden Mole as well as several burrowing and rock-dwelling rodent species, a pipe below ground would result in significant damage to the rocky outcrop through which it is meant to run. It is suggested that an above-ground mounting of the pipeline be considered as this will cause less disturbance to burrowing rodents in the suitable sandy substrate, as well as the rocky ridge which provides good habitat not only for rodents but also for bats. Should a second alternative be possible, it would be suggested to run the pipeline along the existing tracks leading around the ridge (see section 6).

5.2 Operational Phase

The only impacts from the proposed pipeline during the operational phase may be posed during routine checks (vehicle and human movement, impact is less significant) and a possible pipeline failure, which may release many liters of water into the drainage line and onto dry grassland. This impact will however be of less significance as long as repairs are done as soon as possible.

5.2.1 Mitigation

Most mitigation measures for impacts encountered during this phase need to be implemented during construction and should form part of the design and planning phase. Should Alternative A be accepted, regular monitoring of culverts and flow passages under the pipeline must be done to avoid build-up of organic litter, plastic litter and sediment.

6. Recommendations and Conclusion

Planning to run a water pipeline through a protected area is never an easy task, and it must be noted that, while the original pipeline runs through the same area, our legislation has changed to a point of recognising an area such as Rietvlei Nature Reserve and the Bronberg as worthy of protection. Both sites showed clear evidence of the presence of Red Data mammals, and especially Rietvlei Nature Reserve has a range of Red Data species on their list.

It is strongly suggested that, due to the nature of the sensitive areas within the reserve, the sinkhole and possible cave along the eastern border is of less significance to Red Data mammals, and Alternative B should be the preferred alternative as it reduces the impact on mammal populations due to disturbance, isolation and habitat fragmentation due to its

position within an already graded area (fire break) along the eastern boundary of the reserve.

With regards to the Bronberg, this site overall is not preferable for the routing of this pipeline. However, should it be positioned across this protected area, and above-ground construction would be most suitable to limit destruction of the rocky habitat and to allow passage for burrowing species to both sides of the pipeline.

7. References

City of Tshwane: Rietvlei Nature Reserve (Booklet issued to visitors at the reserve)

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Appendix 1: Mammal species likely to occur at Bronberg and Rietvlei

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Afrosoricidea								
Chrysospalax villosus	Rough-haired Golden Mole	vulnerable	X		obs		confirmed (tunnels)	may occur
Amblysomus septentrionalis	Highveld Golden Mole	near threatened	X		ext	montane grassland and vleis	may occur	may occur
Neamblysomus julianae	Juliana's Golden Mole	vulnerable	X		obs	savanna biome, sandy soils with rocky outcrops	may occur	confirmed at Bronberg (tunnels)
Macroscelidae								
Elephantulus myurus	Eastern Rock Elephant-Shrew	least concern	X		ext	common; rock crevices	likely adjacent to both routes	very likely to occur
Tubulidentata								
Orycteropus afer	Aardvark	least concern	X		ext	associated with termitaria and ant hills	confirmed*	unlikely to occur
Hyracoidea								
Procavia capensis	Rock Hyrax	least concern	X		obs	common; rocky barren areas; rock outcrops and koppies	confirmed*	likely to occur
Lagomorpha								

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Lepus saxatilis	Scrub Hare	least concern	X		obs	widespread; savanna and grassland (shrubs, tall grass); agricultural land;	confirmed throughout the reserve (droppings)	likely to occur
Pronolagus radensis	Jameson's Red Rock Rabbit	least concern	X		obs	only found around rocky outcrops	likely to occur in parts of the reserve	confirmed (droppings)
Lepus capensis	Cape Hare	least concern				dry open grassland	confirmed*	unlikely to occur
Rodentia								
Aethomys ineptus	Tete Veld Rat	least concern	X		obs	peripheral; rocky crevices, piles of boulders	may occur in pars of the reserve	likely to occur
Cryptomys hottentotus	African Molerat	least concern	X		obs	common; wide range of habitats	confirmed in parts of the reserve (tunnels)	likely to occur
Dendromus melanotis	Grey Climbing Mouse	least concern	X		obs	common; tall coarse grass, bushes	confirmed*	may occur
Dendromus mesomelas	Brants' Climbing Mouse	least concern	X			tall grass, near water	likely to occur	unlikely to occur
Dendromus mystacalis	Lesser/chestnut Climbing Mouse	least concern	X		obs	peripheral; tall coarse grass; grassland	confirmed*	may occur
Graphiurus murinus	Woodland Dormouse	least concern	X		obs	common; woodland	may occur in pars of the reserve	likely to occur

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Graphiurus platyops	Rock Dormouse	data deficient	X		obs	rocky areas	may occur in pars of the reserve	likely to occur
Xerus inauris	Ground Squirrel	least concern	X		ext	open terraine, sparse bush,	may occur	unlikely to occur
Hystrix africaeaustralis	Cape Porcupine	least concern	X		obs	common; wide range of habitats	confirmed (quills)	may occur
Lemniscomys rosalia	Single-striped Grass Mouse	data deficient	X		obs	peripheral; savanna and grassland; good cover	likely to occur	mayoccur
Mastomys coucha	Southern Multimammate Mouse	least concern	X		obs	common; wide habitat tolerance	confirmed*	likely to occur
Mastomys natalensis	Natal multimammate Mouse	least concern	X			peripheral; wide habitat tolerance; arid scrub savanna and woodland	likely to occur	may occur
Micaelamys namaquensis	Namaqua Rock Mouse	least concern	X		obs	common rocky crevices, outcrops	may occur in pars of the reserve	likely to occur
Mus indutus	Desert Pygmy Mouse	least concern	X			common; moist to arid shrub savanna	confirmed*	may occur
Otomys angoniensis	Angoni Vlei Rat	least concern	X		obs	common; mesic grassland with good cover	likely to occur	may occur
Otomys irroratus	Vlei Rat	least concern	X		obs	common; grassland with good cover, bogs, marshes, swamps	confirmed (droppings)	may occur

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Pedetes capensis	Springhare	least concern	X		obs	common; sandy hard soils, cultivated areas or open shrublands	confirmed*	may occur
Rhabdomys pumilio	Four-striped Grass Mouse	least concern	X		obs	common; grassland with good cover	confirmed (droppings ad burrows)	may occur
Tatera brantsii	Highveld Gerbil	least concern	X		obs	common; grassland and shrub on sandy soil	confirmed*	may occur
Tatera leucogaster	Bushveld Gerbil	data deficient	X		obs	common; sandy soils	likely to occur	likely to occur
Dasymys incomtus	Water Rat	near threatened	X		ext	peripheral; swamps and wet areas along rivers and streams	may occur near dams and wetland	unlikely to occur
Steatomys pratensis	Fat Mouse	least concern			obs	peripheral; wide habitat tolerance	likely to occur	likely to occur
Thallomys nigricauda	Black-tailed Tree Rat	least concern				common; acacia woodlands and tree savanna; in shrubs in grassy areas	may occur	may occur
Thallomys paedulcus	Acacia Rat	least concern			ext	common; woodlands and tree savanna; in shrubs in grassy areas	may occur	may occur

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Thryonomys swinderianus	Greater Cane Rat	least concern	X		ext	common; seldom found far from water; moist swampy areas	may occur near dams and wetland	unlikely to occur
Saccostomus campestris	Pouched Mouse	least concern	X		obs	common; savanna and grassland, seed-eater	likely to occur	may occur
Steatomys krebsii	Krebs' Fat Mouse	least concern	X		obs	peripheral; wide habitat tolerance	may occur	may occur
Mystromys albicaudatus	White-tailed mouse	endangered	X		obs	grassland biome, good grass cover, rocky areas with good cover	confirmed*	may occur
Primates								
Papio ursinus	Chacma Baboon	least concern	X		obs	widespread; savanna and grassland, inhabits woodland edges	confirmed in the reserve	unlikely to occur
Cercopithecus pygerythrus	Vervet Monkey	least concern			ext	woody areas, riparian savanna , woodlands	confirmed*	unlikely to occur
Galago moholi	South African Galago	least concern	X		obs	arboreal; savanna and savanna woodland	confirmed*	may occur
Eulipothyphla								

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Atelerix frontalis	Southern African Hedgehog	near threatened	X		obs	common; requires dry habitat with ground cover for nesting	confirmed*	may occur
Crocidura cyanea	Reddish-grey Musk Shrew	data deficient	X		obs	common; wide habitat tolerance	confirmed*	may occur
Crocidura mariquensis	Swamp Musk Shrew	data deficient	X		obs	common; damp areas, river banks, swamps/marshes	confirmed*	unlikely to occur
Crocidura silacea	Lesser Grey-brown Musk Shrew	data deficient	X		ext	common; wide habitat tolerance	confirmed*	may occur
Crocidura fuscomurina	Tiny Musk Shrew	data deficient	X		ext	common; wide habitat tolerance	likely to occur	may occur
Suncus infinitesimus	Least Dwarf Shrew	data deficient	X		obs	forest and grassland, savanna, mixed bushveld, termitaria	confirmed*	may occur
Suncus varilla	Lesser Dwarf Shrew	data deficient	X		obs	termite mounds; gardens, open savanna	confirmed*	may occur
Crocidura hirta	Lesser Red Musk Shrew	data deficient	X		obs	requires cover in form of logs or rock; prefers damp areas	confirmed*	may occur
Crocidura maquassiensis	Maquassie Musk Shrew	vulnerable	X				may occur	may occur

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Myosorex varius	Forest Shrew	data deficient	X		obs	common; forest/dense vegetation; damp habitats; grasslands; burrows or uses rodent burrows	confirmed*	likely ot occur
Chiroptera								
Miniopterus schreibersii	Schreiber's Long-fingered Bat	near threatened	X	X	obs	common; prefers moister regions; roosts in caves, disused tunnels, mine shafts, under bridges and in trees, outbuildings and under roofs	may occur	may occur
Neoromicia capensis	Cape Serotine Bat	least concern	X	X	obs	widespread; urban areas; roosts in man-made structures, rock crevices, tree bark	confirmed*	may occur

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Epomophorus wahlbergi	Wahlberg's Epauletted Fruit Bat	least concern	X	X	ext	peripheral; urban areas, roosts in eaves of houses/under bridges; savanna, roosts in tall trees with good cover	may occur	may occur
Nycteris thebaica	Egyptian/Common Slit-faced Bat	least concern	X	X	ext	widespread; open savanna woodland and coastal and riverine forest; roosts in caves, man-made structures, aardvark holes	confirmed*	may occur
Rhinolophus blasii	Blasius' Horseshoe Bat	vulnerable	X	X	obs	savanna habitats, roosts in caves; aerial insectivore	confirmed*	may occur
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	near threatened	X	X	obs	peripheral; savanna woodlands and grassland; cave-dwellings, subterrainean habitats, trees and eaves	confirmed*	may occur

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Tadarida aegyptiaca	Egyptian Free-tailed Bat	least concern	X	X	obs	widespread; roosts in rock fissures and man-made structures; aerial insectivore	confirmed*	may occur
Taphozous mauritanus	Mauritian Tomb Bat	least concern	X	X	ext	peripheral; roosts on bark of trees under covering vegetation, under eaves of houses	confirmed*	may occur
Myotis welwitschii	Welwitsch's Hairy Bat	near threatened	X	X	ext		may occur	may occur
Rhinolophus darlingi	Darling's Horseshoe Bat	near threatened	X	X	obs		confirmed*	may occur
Sauromys petrophilus	Flatheaded free-tailed bat	least concern	X	X	ext	patchy distribution; savanna, roosts in rock fissures; aerial insectivore	may occur	may occur
Scotophilus viridis	Greenish Yellow House Bat	least concern	X		ext	peripheral; savanna; roosts in tree hollows and man-made structures; aerial insectivore	confirmed*	may occur

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Scotophilus dinganii	African Yellow Bat	least concern	X		obs	common; savanna and mixed bushveld; aerial insectivore, roosts in crevices	confirmed*	may occur
Mycotis tricolor	Temminck's Hairy Bat	near threatened	X	X	obs	savanna woodlands, drier areas, roots in caves or tunnels	may occur	may occur
Pipistrellus rusticus	Rusty Pipistrelle	near threatened	X	X	obs	peripheral savanna; riparian forest; aerial insectivore, roosts in tree crevices	may occur	may occur
Rhinolophus simulator	Bushveld Horseshoe Bat	least concern	X	X	obs	peripheral; savanna and riverine savanna; aerial insectivore; cave-dwelling	confirmed*	may occur
Pholidota								
Manis temminckii	Ground Pangolin	vulnerable	X		obs	common in savanna areas; shrub, woodlands,	confirmed*	unlikely to occur
Carnivora								

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Aonyx capensis	African Clawless Otter	least concern	X		obs	common; freshwater and marine; rivers/streams/creeks; ponds, agriculture ponds	confirmed*	unlikely to occur
Civettictis civetta	African Civet	least concern	X		ext		confirmed*	may occur
Atilax paludinosus	Marsh Mongoose	least concern	X		obs	common; freshwater and marine; permanent/seasonal freshwater lakes, and pools	confirmed*	unlikely to occur
Canis mesomelas	Black-backed Jackal	least concern	X		obs	common; savanna, grasaland	confirmed*	unlikely to occur
Panthera pardus	Leopard	least concern	X		obs	peripheral; savanna, grassland; usually associated with woodland	confirmed*	unlikely to occur
Caracal caracal	Caracal	least concern	X		obs	common; open shrubland and woodland; savanna and grassland	confirmed*	may occur
Cynictis penicillata	Yellow Mongoose	least concern	X		obs	common; savanna, shrubland, grassland	confirmed (visual)	unlikely to occur

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Felis nigripes	Black-footed Cat	least concern			ext	common; grassland, shrubland	likely to occur	may occur
Felis silvestris	African Wild Cat	least concern	X		obs	common; broad habitat tolerance	likely to occur	may occur
Galerella sanguinea	Slender Mongoose	least concern	X		obs	common; savanna, grassland, urban areas	confirmed*	unlikely to occur
Genetta genetta	Small-spotted Genet	least concern	X		obs	common; open scrub and woodland; ; savanna, grassland, urban areas	confirmed*	may occur
Genetta tigrina	Large-spotted Genet	least concern	X		obs	common; open scrub and woodland; ; savanna, grassland, urban areas	confirmed*	may occur
Helogale parvula	Dwarf Mongoose	least concern	X		obs	common; prefers savannas	likely to occur	may occur
Hyaena brunnea	Brown Hyaena	near threatened	X		obs	common; dry habitats, shrublands, grasslands, urban areas	confirmed*	unlikely to occur

Species (and Order)	Common Name	Conservation Status	Skinner & Chimimba, 2005	Taylor, 2000	Friedman & Daly, 2004	Habitat Requirements	Likelihood of occurrence Rietvlei	Likelihood of occurrence Bronberg
Ichneumia albicauda	White-tailed Mongoose	least concern	X		obs	common; savanna, grasslands, urban areas and rural gardens	confirmed*	may occur
Ictonyx striatus	Striped Polecat	least concern	X		obs		confirmed*	may occur
Lutra maculicollis	Spotted-necked Otter	near threatened	X		ext	fresh deep water, dense cover	may occur	unlikely to occur
Mellivora capensis	Honey Badger	near threatened	X		ext	common; savanna and grassland; commensural with humans	likely to occur	may occur
Mungos mungo	Banded Mongoose	least concern	X		obs	common, savanna; feeds on termite and beetle larvae	likely to occur	may occur
Poecilogale albinucha	African Striped Weasel	data deficient	X		obs	common; grassland, savanna; predator of rodents; burrowing	confirmed*	may occur
Proteles cristatus	Aardwolf	least concern	X		obs	common; pastureland; open savanna, grassland; associated with termites; burrowing	confirmed*	unlikely to occur

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Suricata suricata	Suricate	least concern			obs	common; Savanna; Grassland	confirmed*	unlikely to occur
Vulpes chama	Cape Fox	least concern	X		obs	common; grassland, however more common in dry grassland and desert	confirmed*	unlikely to occur
Perissodactyla								
Ceratotherium simum	White Rhinoceros	least concern	X		ext	short garss, water, bush cover, flat terrain	confirmed (visual)	unlikely to occur
Equus burchellii	Zebra	least concern				savanna, open areas	confirmed (visual)	unlikely to occur
Whippomorpha								
Hippopotamus amphibius	Hippopotamus	least concern				water bodies	confirmed (visual)	unlikely to occur
Ruminantia								
Andidorcas marsupiallis	Springbok	least concern	X		obs	widespread; arid regions, dry open grassland savanna	confirmed (visual)	unlikely to occur
Connochaetes gnou	Black Wildebeest	least concern	X		obs	common; graslands, open areas with short grass; open plains	confirmed (visual)	unlikely to occur

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Ourebia ourebi	Oribi	endangered	X		obs	peripheral; open grassland;	confirmed*	unlikely to occur
Pelea capreolus	Grey Rhebok	least concern	X		ext	peripheral; rocky/mountainous terrain; ecotones	may occur	may occur
Raphicerus campestris	Steenbok	least concern	X		obs	widespread; savanna, shrubland, open grassland with some cover (high grass, shrubs)	confirmed (visual)	may occur
Sylvicapra grimmia	Common Duiker	least concern	X		obs	common; thickets, savanna, forest, grassland	confirmed (visual)	may occur
Taurotragus oryx	Eland	least concern	X		ext	common; prefers woodlands/woodland mosaics; also in arid grasslands/thickets and savannas	confirmed (visual)	unlikely to occur
Alcelaphus buselaphus	Red Hartebeest	least concern	X		obs	widespread; open grassland, arid shrub and savanna	confirmed (visual)	unlikely to occur

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Connochaetes taurinus taurinus	Blue Wildebeest	least concern	X		ext	common; open savanna woodlands, short grass	may occur	unlikely to occur
Equus burchellii	Plains Zebra	least concern			obs			
Oreotragus oreotragus	Klipspringer	least concern	X		ext	widespread; rocky outcrops, mountainous areas	likely to occur	may occur
Redunca fulvorufula	Mountain Reedbuck	least concern	X		ext	common; mountainous terrain, rocks/boulders for cover; grasslands	confirmed*	unlikely to occur
Syncerus caffer	African Buffalo	least concern	X			savanna, abundant grass and water	confirmed (visual)	unlikely to occur
Redunca arundinum	Reedbuck	least concern	X		ext	peripheral; tall grass savannas with herbaceous cover and woody plants; reedbeds; near water supply	confirmed*	unlikely to occur
Damaliscus pygargus phillipsi	Blesbok	least concern	X		obs	common; grasslands, short grass	confirmed*	unlikely to occur
Kobus ellipsiprymnus	Waterbuck	least concern					confirmed*	unlikely to occur
Suiformes								

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Potamochoerus larvatus	Bushpig	least concern				tall grass, thickets, forest	confirmed*	unlikely to occur

* confirmed in Rietvlei visitor's Guide; Ext = extent of range; Obs = observed