

**AN ASSESSMENT OF THE VERTEBRATES, VEGETATION, FLORA
AND HABITATS OF A PORTION OF THE REMAINING EXTENT OF
THE FARM BERGENDAL 981 JT & REMAINING PORTION OF THE
FARM WEMMERSHUIS 379 JT (“BELFAST MALL & RESIDENTIAL
DEVELOPMENT”)**

by

G.J. Bredenkamp D.Sc. Pr.Sci.Nat.

A. E. McKechnie Ph.D. Pr.Sci.Nat.

I.L. Rautenbach Ph.D. Pr.Sci.Nat.

J.C.P. Van Wyk M.Sc. Pr.Sci.Nat.

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Declaration of Professional Standing and Independence:

We,

George Johannes Bredenkamp (SACNASP # 400086/83)

Andrew E. McKechnie (SACNASP # 400205/05)

Ignatius Lourens Rautenbach (SACNASP # 400300/05),

Jacobus Casparus Petrus van Wyk (SACNASP # 400062/09)

declare that we:

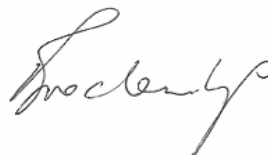
- hold higher degrees in the biological sciences, which allowed registration by S.A. Council for National Scientific Professions (SACNASP) as Professional Zoologists that sanction us to function independently as specialist scientific consultants;
- declare that as per prerequisites of the Natural Scientific 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 or unduly benefit them;
- are subcontracted as specialist consultants for the project “An Assessment of the Vertebrates, Vegetation, Flora and Habitats of a Portion of the Remaining Extent of the Farm Bergendal 981 JT & Remaining Portion of the Farm Wemmershuis 379 JT (“Belfast Mall & Residential Development”)”, 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;
- reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent from the client will be required for any of us to release of any part of this report to third parties.
- In addition, remuneration for services provided by us 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



G.J. Bredenkamp



A.E. McKechnie

ABSTRACT

All three vertebrate habitat types are considered as average and the aquatic/wetland habitat is flagged as sensitive. Ecologically, the terrestrial habitat quality has been disturbed in some areas by livestock grazing, wire fences, a few gravel roads and exotic plants. The study site falls within the Lydenburg Montane Grassland (Gm18) which has a status of *Vulnerable*.

Indigenous grasslands provide important ecological services including water quality, quantity and sustainability, sediment control, and floral (seed, pollination) and faunal support (food, rest, breeding, connectivity).

In terms of the National Water Act, all wetlands in and around the study area must be considered as ecologically sensitive. The study site is part of a water catchment area which, as an ecological mechanism is very important. The drainage lines as well as their buffer zones should thus be considered as ecologically sensitive. The buffer zone as identified in the wetland assessment report should be applied. It will be important to manage storm water to mitigate the effect of runoff water entering the remaining catchment area.

Twenty-nine mammals, 360 birds, 46 reptiles and 20 amphibian species occur in the district and are likely to be occupants or at least vagrants at the site. Note that the numbers of these vertebrates (particularly birds) may be somewhat elevated by considering the adjacent relatively natural grassland in the above estimates.

Should the development go ahead, it is very important that the holes and trenches should be dug and then be refilled as quickly as possible; otherwise the holes may act as death traps for herpetofauna.

As a result of present land-use vertebrate and plant species richness is under pressure and is in fact still in a declining cycle as result of impaired connectivity (the effect of the security fence) and particularly grazing as well as the aggressive invasion of an alien creeper plant.

The conservation status of the partially transformed homestead enclosure is subjectively ranked as **Medium-low** i.e. *Land on which small sections could be considered for conservation but where the area in general has little conservation value*. In view of the Mpumalanga C-plan (Figure 3) the conservation of the grassland portion of the site is regarded as of 'Least Concern' and its conservation status is consequently rated as **Medium-high** i.e. *Land where sections are disturbed but that is still ecologically sensitive to development/disturbance*.

The impact values of the development on the environment will respectively be 'High' (60) for the partially disturbed homestead, and 'Very High' for the range land (see Sections 6-10).

Strictly from a biological perspective, there is no compelling argument to oppose the development, notwithstanding the fact that the property in question will ultimately be transformed. No portion of the property enjoys extraordinary conservation status (Figure 3). Although the site will be entirely altered, faunal species will be displaced to the extensive district, and floral loss will be low relative to the extent of the undisturbed condition of the district.

1. BACKGROUND INFORMATION

Via *Limosella Consulting* for *Labesh Sustainable, Natural Resource Management* we have been tasked with evaluating the vertebrate and plant species richness and conservation ranking of the 117 hectares of a Portion of the Remaining Extent of the Farm Bergendal 981 JT & Remaining Portion of the Farm Wemmershuis 379-JT scheduled for urban development (which in the interim shall be named the “Belfast Mall & Residential Development”).

This report focuses on vegetation and sensitive habitats as well as the current status of vertebrates and threatened plants that occurs or are likely to occur on the proposed development site, and whose conservation status should be considered in the decision-making process. Special attention has been paid to the qualitative and quantitative habitat conditions for Red Data plant and vertebrate species deemed present on the site, and mitigation measures to ameliorate the effect of the proposed development. The secondary objective of the investigation was to gauge which species might persist on the site and to compile a list of mammal, bird and herpetofauna species that may occur in the ecosystems found within the study area.

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

2. 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 life-support products for plants, animals and humans. Environmental degradation ranges from mega-problems such as global warming, demand for power, land-use practices to smaller-scale issues such as 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 and regulations call developers (and by implication consumers), the scientific community and conservation agencies to task to minimise environmental impact. These include:

The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996),

The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983),
 The Environmental Conservation Act, 1989 (Act No. 73 of 1989),
 The National Environment Management Act, 1998 (Act No. 107 of 1998) as amended in 2010,
 The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004),
 The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004), Draft List of Threatened Ecosystems. Government Gazette RSA Vol. 1477, 32689, Cape Town, 6 Nov 2009,
 The National Environmental Management: Waste Act [NEM:WA] (Act 59 of 2008),
 The National Forests Act, 2006 (Act 84 of 1998 as amended in 2006),
 The National Heritage Resources Act, 1999 (Act No. 25 of 1999),
 The National Environmental Management: Protected Areas Act (Act 57 Of 2003),
 The Mineral and Petroleum Resources Development Act 28 of 2002,
 The National Water Act, 1998 (Act No. 36 of 1998), and
 The Environmental Impact Assessment Regulations Notice 982 of 2014.

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.

Worldwide, housing developments are a major source of habitat fragmentation, and have the potential to severely impact the survival and reproductive success of vertebrate populations. In North America, for instance, studies of birds have found that housing developments around forest edges can dramatically reduce the suitability of forest for migrant species (Friesen, Eagles & Mackay 1995; Kluza, Griffin & DeGraaf 2000). In general, housing developments negatively affected avian reproductive success mainly through increased rates of nest predation and/or brood parasitism (Kluza, Griffin & DeGraaf 2000; Phillips *et al.* 2005; Tewksbury *et al.* 2006). However, these negative impacts of housing developments are directly dependent on housing density, with denser developments having more pronounced negative impacts (Kluza, Griffin & DeGraaf 2000; Tewksbury *et al.* 2006). In at least one study, long-distance migrants were more susceptible to the negative impacts of housing developments, with impacts being markedly less severe for resident species and short-distance migrants (Friesen, Eagles & Mackay 1995). In contrast to other human impacts, such as power lines and roads, the effects of housing developments on avian survival and reproductive success have been the subject of few studies.

3.1. STUDY SITE

The 117.5 hectare portions of the Farms Bergendal and Wemmershuis borders on the southern edge of the N4, but are planned as strategically situated extensions of the Town of Belfast located one kilometer to the north of the N4 and railway (Figures 1 and 2). The development will include a shopping mall and businesses, schools, residences, industrial sites, utilities, agricultural outlets, open areas etc. The development is clearly planned to benefit from potential trade from passing traffic on the N4. Spatially, the site is defined by coordinates 25° 42' 58"S; 30° 04' 10"E measured towards its center.



Figure 1: The proposed township layout (Korsman and Associates).

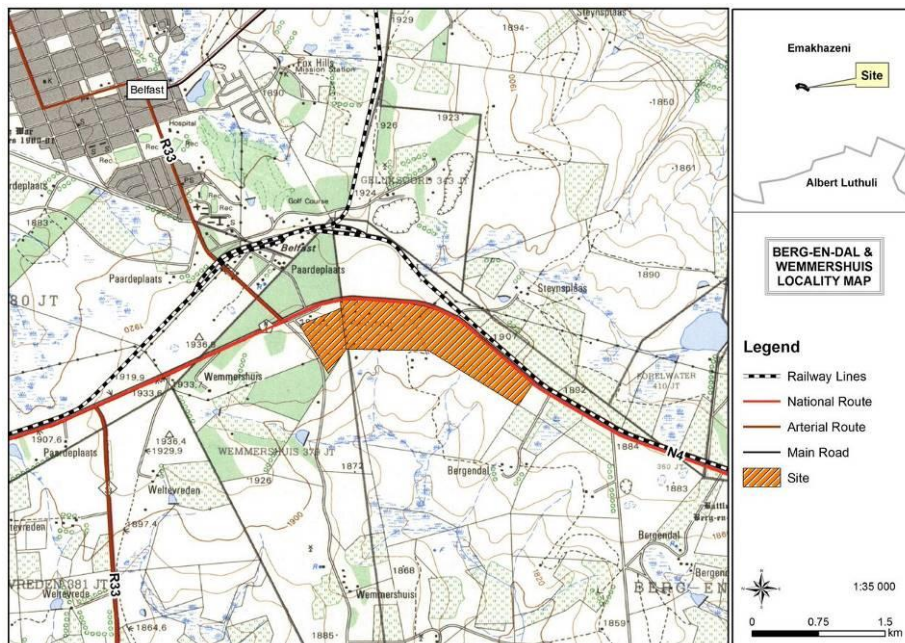


Figure 2: Locality map of the intended development of the Portion of the Remaining Extent of the Farm Bergendal 981 JT & Remaining Portion of the Farm Wemmershuis 379-JT.

3.1.1. Geology and soil

The site is underlain by two geological sequences, namely sandstone, shale, gritstone and coal measures of the Vryheid Formation in the western portion and diabase in the eastern portion of the site. Geomorphologically the site is characterized by a local watershed and divides the terrain into two drainage directions towards the north and south. Some drainage channels were identified on site and run-off will predominantly follow natural topography. The soil is a reddish sandy loam with rocky outcrops along the summits of undulating plains.

3.1.2. Regional Climate

The study area is characterized by summer rainfall but with mist throughout the year. The district experiences mild summers and very cold winters with frost, and a mean annual precipitation of about 858 mm.

3.1.3. Topography and drainage

The site is located on a flat to slightly undulating plain (Figures 5 and 7), at an altitude of over 1925 meters a.s.l. No indigenous wetlands are highlighted on the site (Figure 4), and the higher areas of undulating plains have rocky outcrops approaching weakly developed rupicolous habitat (Figure 10). Typical of Lydenburg Montane Grassland indigenous trees are absent, but a few aliens are present (*Eucalyptus*, wattle, oak), especially just outside the site fence (Figure 9).

3.1.4. Land-use

To date the camps comprising the study area have been rotationally grazed by cattle. Some portions of the site have dense stands of low montane grass, but in other camps the grazing has been heavier, allowing the alien creeper *Richardia brasilensis* to form dense mats choking the regeneration of indigenous grass.

3.1.5. Vegetation Types

The site falls within the Lydenburg Montane Grassland vegetation unit (Gm 18) as defined by Mucina and Rutherford (2006) (Figure 7). The vegetation is typical of an inland high-altitude plateau, with mostly dense and short sour grass. Apart from a farmstead enclosure consisting of houses, sheds, and kraals the site is undeveloped and varies in conservation between lightly and heavily grazed by cattle and equids. Atypically, the entire property is security-fenced with high wire strands and attached razor coils (Figure 6); this represents a connectivity-impairment for medium and larger terrestrial mammals.

3.2. ECOLOGICAL PERSPECTIVE

Although most of the site is largely undeveloped and utilized as grazing in an ecologically unaltered state, no area or ecological system on the site enjoys extraordinary conservation status (Figure 3).

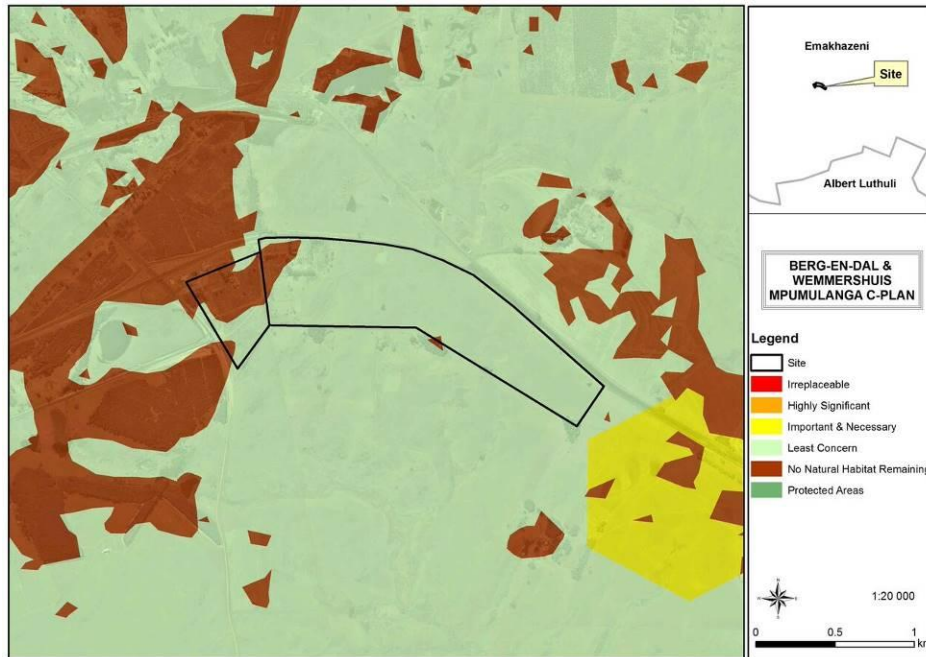


Figure 3: The conservation rating of the site as per the Mpumalanga C-Plan .

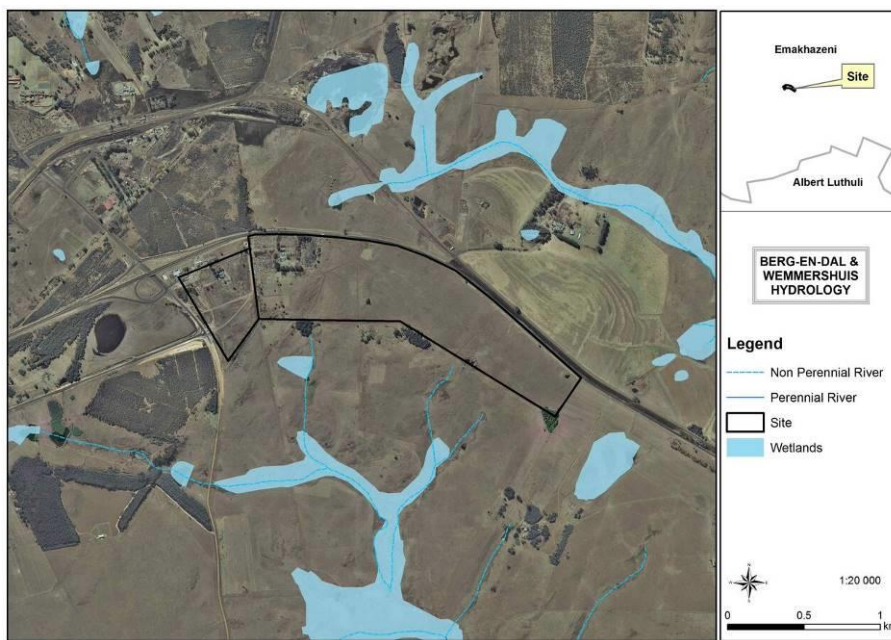


Figure 4: The hydrology of the study site and adjoining properties.



Figure 5: The undulating plains of the high-altitude plateau sour grassland.



Figure 6: The security fence along the southern edge of the N4 motorway, with the remains of the erstwhile two-lane tar road to the Lowveld in the foreground.



Figure 7: Lydenburg Montane Grassland vegetation unit, with protruding rocks along higher aspects of undulating plains.



Figure 8: One of a few drainage lines dammed to provide permanent water for free-ranging domestic stock.



Figure 9: Alien trees are scarce on-site but plantations border onto the site.



Figure 10: Weakly rocky outcrops on higher aspects of the rolling plains represent rupicolous habitat

4. METHODS: VERTEBRATES

4.1. Field Survey - Mammals and Herpetofauna

The site was visited on 11 March 2016. During this study, mammals, reptiles and frogs were identified by 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 mammals and herpetofauna species on the study site. These include known distribution ranges, habitat preferences and the qualitative and quantitative presences of suitable habitats.

Birds occurring on the site were assessed in several steps, as detailed below.

4.2. Desktop Survey - Mammals and Herpetofauna

As many mammals and herpetofauna are either secretive, nocturnal, hibernators and/or seasonal, 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 probabilities of occurrence of mammals and herpetofauna species were 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.

4.3. Field and Desktop Survey - Birds

Birds occurring at the site of the proposed development were assessed in several steps, as detailed below. Red-listed species were identified using the recent (2015) Red Data Book for South Africa, Lesotho and Swaziland (Taylor *et al.* 2015).

Prior to the site visit, a desktop study was undertaken in which bird species that potentially occur at the site and in the surrounding areas were identified using data from the first and second South African Bird Atlas Projects (SABAP 1 and 2). SABAP 2 data are based on records for pentads (i.e., 5' X 5'), where SABAP 1 data were based on quarter-degree grid cells (i.e., 15' X 15'). A list of species potentially occurring at the site was developed for the SABAP 2 pentad within which the site

falls (2540_3000), as well as all eight adjacent pentads (i.e., nine pentads in total). This species list is thus based on an area much larger than the actual development site – approximately 700 square kilometers (28 km north-south X 25 km east-west, Figure 1). This approach is adopted to ensure that all species potentially occurring at the site, whether resident, nomadic, or migratory, are identified.

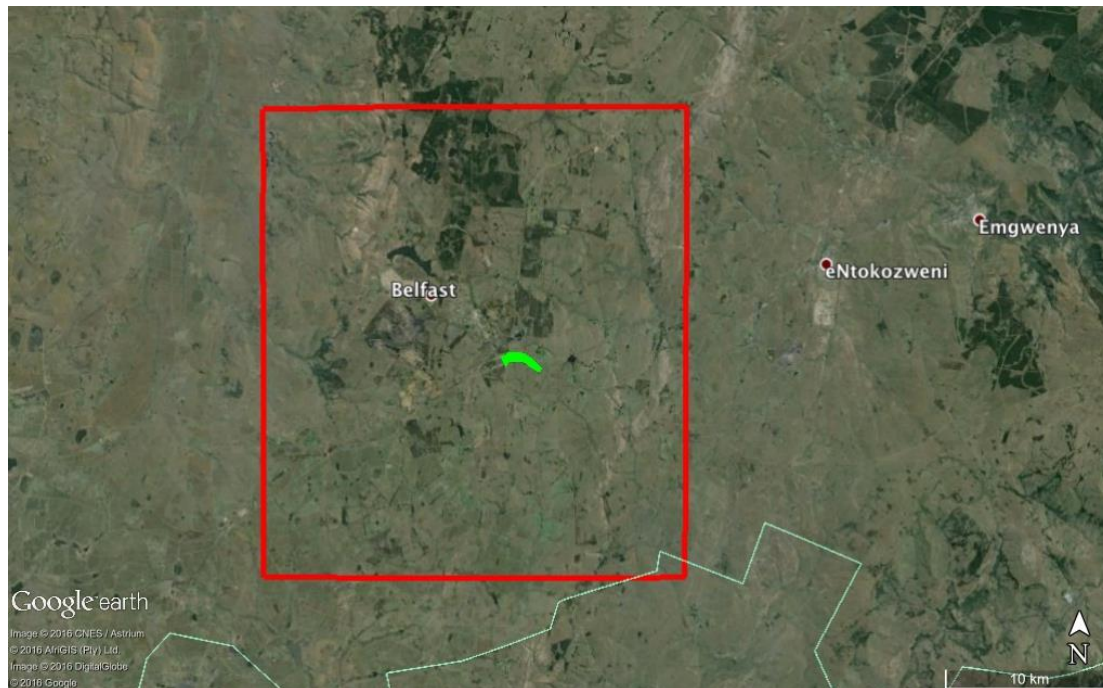


Figure 11. Approximate extent of area included (red square) when generating the list of birds potentially occurring at the site (indicated in light green). Image courtesy of Google Earth.

A site visit took place on 12 March 2016, with a total of approximately 4 hours spent on site. The weather during the visit was warm, partly cloudy and with little wind. During the site visit, birds occurring at the site were identified by walking transects, and driving transects in surrounding areas. During walking transects, an observer with binoculars walked slowly through the site, identifying all birds encountered (seen or heard), identifying nests observed, and assessing the avian habitats present.

4.4. 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 (*Neamblysomus 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 member 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 (*Clootis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc. (Friedman and Daly (editors), 2004).

Herpetofauna: During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data species in Mpumalanga (Minter, *et al*, 2004; Alexander & Marais, 2007; Du Preez & Carruthers, 2009 and Bates, *et al*, 2014), such as: Nile Crocodile (*Crocodylus niloticus*); Giant Bullfrog (*Pyxicephalus adspersus*); Plain Stream Frog (*Strongylopus wageri*); Spotted Shovel-Nosed Frog (*Hemisus guttatus*); Whistling Rain Frog (*Breviceps sopranus*); Coppery Grass Lizard (*Chamaejasura aenea*); Large-Scaled Grass Lizard (*Chamaejasura macrolepis*); Giant Dragon Lizard / Sungazer (*Smaug giganteus*); Fitzsimons' Flat Lizard (*Platysaurus orientalis fitzimonsi*); Breyer's Long-Tailed Seps (*Tetradactylus breyeri*); Striped Harlequin Snake (*Homoroselaps dorsalis*); and Southern African Python (*Python natalensis*).

4.5. Assessment criteria

The conservation status of habitats within the study site can subjectively be assigned to one of five levels of sensitivity, i.e.

High: Ecologically sensitive and valuable land, with high species richness, sensitive ecosystems or Red Data species, that should be conserved and no development allowed.

Medium-high: Land where sections are disturbed but that is still ecologically sensitive to development/disturbance.

Medium: Land on which low-impact development with limited impact on the ecosystem could be considered, but where it is still recommended that certain portions of the natural habitat be maintained as open spaces.

Medium-low: Land on which small sections could be considered for conservation but where the area in general has little conservation value.

Low: Land that has little conservation value and that could be considered for developed with little to no impact on the habitats or avifauna.

4.5. Impact Assessment Criteria

In order to quantitatively express the projected impact of a development, somewhat subjective weighted values of 0-5 are deployed, as tabulated below. This technique is a useful tool to compare impacts on locations under consideration for development. The environmental significance of a development is then calculated using the following formula, which allows the development to be assessed more objectively:

Significance (Consequence) = (Magnitude + Reversibility + Extent + Duration) X Probability.

Significance values depicting reigning environmental conditions at proposed development sites.

SIGNIFICANCE RANKING MATRIX

RANKING	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact ceases after operational life of asset)	Almost certain
3	Moderate	Reversibility with	Provincial	Medium term (6-15)	Can occur

		human intervention		years)	
2	Low		Local	Short term (0 - 5 years)	Unusual but possible
1	Minor	Completely reversible	Site bound	Immediate	Extremely remote
0	None		None		None

- The **Magnitude** of the impact: This will be quantified as either:
 - Low: Will cause a low impact on the environment;
 - Moderate: Will result in the process continuing but in a controllable manner;
 - High: Will alter processes to the extent that they temporarily cease; and
 - Very High: Will result in complete destruction and permanent cessation of processes.
- **Reversibility/ Replaceability:** The degree at which the impact can be **reversible** or **the lost resource replaced**.
- **The Extent of the impact:** This criterion expresses the spatial impact of the impact.
- **The Duration (or Exposure):** wherein it will be indicated whether:
 - The impact will be immediate;
 - The impact will be of a short term (Between 0-5 years);
 - The impact will be of medium term (between 5-15 years);
 - The impact will be long term (15 and more years); and
 - The impact will be permanent.
- **The Probability:** which shall describe the likelihood of impact occurring and will be rated as follows:
 - Extremely remote: Which indicates that the impact will probably not happen;
 - Unusual but Possible: Distinct possibility of occurrence;
 - Can Occur: there is a possibility of occurrence;
 - Almost Certain: Most likely to occur; and
 - Certain/ Inevitable: Impact will occur despite any preventative measures put in place.

Derived values are then translated as being in the significance range of from Very High to Minor.

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

- Very high environmental significance 65-100 points
- High environmental significance 64-36 points
- Moderate environmental significance 35-16 points
- Low environmental significance 15-5 points
- Minor environmental significance 4-1 points

Depending on the nature of the proposed development, significance rankings may be calculated Without Mitigation Measures (WOMM) and With Mitigation Measures (WMM) to illustrate the predicted effectiveness of proposed mitigation measures.

5. METHODS: VEGETATION AND FLORA

5.1. Initial preparations:

For background information, the relevant maps, aerial photographs and other information on the natural environment of the concerned area were obtained.

5.2. Site visit

The vegetation/habitats were stratified into relatively homogeneous units on recent Google Earth images of the area. At several sites within each relatively homogeneous unit, a description of the dominant and characteristic species found in transects was recorded. These descriptions were based on total floristic composition, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). Data recorded were a list of the plant species present, including trees, shrubs, grasses and forbs. Comprehensive species lists were therefore derived for each plant community/ecosystem present on the site. These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina *et al.* 2000) and are considered to be an efficient method of describing vegetation and capturing species information. Additional notes were made of any other features that might have an ecological influence.

The identified systems are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for Red Data plant species.

Critically Endangered, Endangered, Vulnerable and Protected Species (NEMBA species, TOPS species) are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007 (National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)).

Protected trees are identified in accordance with the list of nationally protected trees published in Government Notice No. 29062 3 (2006) (National Forests Act, 1998 (Act No. 84 Of 1998), as Amended (Department of Water Affairs Notice No 897, 2006).

Lists of Red Data plant species for the area were obtained from the SANBI databases, with updated threatened status, (Raimondo *et al* 2009) for the map grid 3530CA. These lists were then evaluated in terms of habitat available on the site, and also in terms of the present development and presence of Man in the area.

Alien invasive species, according to the Conservation of Agricultural Resources Act (Act No.43 of 1983) as listed in Henderson (2001) and other weeds Bromilov (2010) are indicated.

Medicinal plants are indicated according to Van Wyk, Van Oudthoorn & Gericke (1997).

5.3. Conservation Value

The following **conservation value** categories were used for each site:

High: Ecologically sensitive and valuable land with high species richness and/or sensitive ecosystems or red data species that should be conserved and no developed allowed.

Medium-high: Land where sections are disturbed but which is in general ecologically sensitive to development/disturbances.

Medium: Land on which low impact development with limited impact on the vegetation / ecosystem could be considered for development. It is recommended that certain portions of the natural vegetation be maintained as open space.

Medium-low: Land of which small sections could be considered to conserve but where the area in general has little conservation value.

Low: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation.

Sensitivity High and Low sensitivity is indicated as follows:

High: High and Medium-High conservation priority categories mentioned above are considered to have a High sensitivity and development should not be supported. Portions of vegetation with a Medium conservation priority should be conserved.

Low: Medium, Medium-Low and Low conservation priority categories mentioned above are considered to have a Low sensitivity and development may be supported.

5.4. Plant Species Status

Plant species recorded in each plant community with an indication of the status of the species by using the following symbols:

A = Alien woody species; D = Dominant; d = subdominant; G = Garden or Garden Escape; M = Medicinal plant species; P = Protected trees species; p = provincially protected species; RD = Red data listed plant; W = weed.

Species Richness

Species Richness is interpreted as follows: Number of indigenous species recorded in the sample plots representing the plant community. Alien woody species and weeds are not included.

No of species	Category
1-24	Low
25-39	Medium
40-59	High
60+	Very High

6. RESULTS: 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), but the same cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant associations. For instance, Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006) 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 vertebrates, on the other hand, 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 vertebrate species by evaluating the habitat types within the context of global distribution ranges.

Only two main habitat type are present, predominantly terrestrial and to a lesser extent rupicolous. Most of the arboreal habitat consists of exotics, or to a lesser degree of planted endemics established outside their natural distributional ranges. However, it can be expected that, irrespective of its origin, alien trees serve as perches and nesting sites for birds. Common reptiles most likely invaded established homesteads.

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 presence and extent of suitable habitats on site:

- *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.

The data used to extract information come from a variety of specialized resources and are based on integration using our specialist knowledge and experience, assessment of whatever habitats remains, and impressions received during the site visit on 11 March 2016.

6.1. Mammal Habitat Assessment

The site is used for raising livestock. Consequently, the ecology of the area has not been transformed by intrusive practices such as ploughing, although grazing has partially over-utilized rangeland.

Only two main habitat types are present on the site. Terrestrial habitat predominates in the form of high altitude sour grassland. The quality of ground cover varies between dense stands of sour grass, and areas where the grass has been overgrazed and/or displaced by the dense and vigorous alien creeper *Richardia braziliensis*. Most terrestrial small mammals select for good cover providing both refuge and nourishment. Scrub hares have a predilection for short grass cover and are assumed to favour areas dominated by the creeper.

No termitaria were recorded, and this could be the reason why aardvarks were not noted as present. The coiled razor fence is regarded as impairment to connectivity for medium-sized mammals such as black-backed jackal, duiker and steenbok (but these are still regarded as occupants given access under the fence).

The rocky outcrops at the upper reaches of undulating plains do not provide prime rupicolous habitat, but applying the precautionary principle robust rupicolous species such as Namaqua rock rats, rock rabbits and rock elephant shrews are presumed to be residents; discerning species such as dassies are definitely absent.

The artificial ponds made in seasonal drainage courses are not recognized as wetland habitat for mammals since these are artificial, recently constructed and too isolated to allow immigration of species such as vleis rats. Functional indigenous arboreal habitat is absent. The alien trees are not utilized by arboreal mammals, apart from being too isolated for occupancy by arboreal species is impossible.

6.2. Observed and Expected Mammal Species Richness

The study site and the district are pastoral in characteristic. However, it has been farmed for decades by raising stock. As the intensity of farming increased large mammals (viz. elephants, rhinos, buffalo, lion, leopard, spotted hyenas, zebra and most plains antelopes) were progressively displaced. Later medium-sized mammals were hunted out (or displaced) such as aardvark, porcupine, springhare, baboons, monkeys and aardwolf. The coiled razor wire along the fence is a decided hindrance to immigration for medium-sized animals such as oribi, duiker and steenbok. Reticent but widespread species such as caracal has also succumbed to pressures such as the fence and persecution.

Mammal species reliant on arboreal and wetland habitat have *a priori* been omitted from the list of potential occurrences in the district (Table 2). Aardvark and dwarf shrew species are also absent since (for some reason or other) termitaria are absent; the termites are the main source of nourishment for aardvark whereas dwarf shrews (and often also pygmy mice) use moribund termitaria as refuges.

It is concluded that 29 mammal species are still part of the present-day mammal species assemblage. The presence of rodent moles and scrub hares has been confirmed (Table 3).

The species of the resident diversity (Table 1) are common and widespread (viz. genets, mongooses and others). Many of the species listed in Table 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 constraining effect of unyielding substrates.

The listed free-tailed bat and the three vespertilionid 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

buildings in the vicinity. Vesper bats are more tolerant towards roost opportunities and it is more than likely that small colonies found roosting opportunities in the roofs of buildings 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 possible that they have roosts elsewhere and at times commute to the site to hawk for invertebrates rising over the ponds and dams during summer sunsets. However, the likelihood of their occurrence on the site is so remote that they are not listed as potential vagrants.

The species richness is very low for such an extensive area. That is ascribed to the fact that Highveld grasslands do not have the species richness of savannahs, and also since only two habitats are present (terrestrial and a weakly developed rupicolous habitat). The overall quality of conservation is ranked as varying between poor and fairly good.

Table 1: Mammal diversity. The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Bronner et.al [2003], Skinner & Chimimba [2005], Apps [2012] and Stuart & Stuart [2015]).

	SCIENTIFIC NAME	ENGLISH NAME
	Order Macroscelididae	
	Family Macroscelididae	
?	<i>Elephantulus myurus</i>	Eastern rock elephant shrew
	Order Lagomorpha	
	Family Leporidae	
√	<i>Lepus saxatilis</i>	Scrub hare
?	<i>Pronologus randensis</i>	Jameson's red rock rabbit
	Order Rodentia	
	Family Bathyergidae	
√	<i>Cryptomys hottentotus</i>	African mole rat
	Family Muridae	
*	<i>Rhabdomys pumilio</i>	Four-striped grass mouse
*	<i>Mus minutoides</i>	Pygmy mouse
*	<i>Mastomys natalensis</i>	Natal multimammate mouse
*	<i>Mastomys coucha</i>	Southern multimammate mouse
*	<i>Aethomys ineptus</i>	Tete veld rat
?	<i>Aethomys namaquensis</i>	Namaqua rock mouse
*	<i>Gerbilliscus brantsii</i>	Highveld gerbil
?	<i>Dendromus melanotis</i>	Grey pygmy climbing mouse
?	<i>Dendromus mesomelas</i>	Brants' climbing mouse
?	<i>Dendromus mystacalis</i>	Chestnut climbing mouse
	Order Eulipotypha	
	Family Soricidae	
DD*	<i>Crocidura cyanea</i>	Reddish-grey musk shrew
DD*	<i>Crocidura hirta</i>	Lesser red musk shrew
	Order Chiroptera	

	Family Molossidae	
*	<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat
	Family Vespertilionidae	
√	<i>Neoromicia capensis</i>	Cape serotine bat
√	<i>Scotophilus dinganii</i>	African yellow house bat
√	<i>Scotophilus viridis</i>	Greenish yellow house bat
	Order Carnivora	
	Family Viverridae	
?	<i>Genetta genetta</i>	Small-spotted genet
?	<i>Genetta tigrina</i>	SA large-spotted genet
	Family Herpestidae	
*	<i>Cynictis penicillata</i>	Yellow mongoose
*	<i>Galerella sanguinea</i>	Slender mongoose
	Family Canidae	
?	<i>Canis mesomelas</i>	Black-backed jackal
	Family Mustelidae	
DD*	<i>Poecilogale albinucha</i>	African weasel
*	<i>Ictonyx striatus</i>	Striped polecat
	Order Ruminanta	
	Family Bovidae	
?	<i>Sylvicapra grimmia</i>	Common duiker
?	<i>Raphicerus campestris</i>	Steenbok

√ Definitely present or has a *high* probability of occurrence;

* *Medium* probability of occurrence based on ecological and distributional parameters;

? *Low* probability of occurrence to occur based on ecological and distributional parameters.

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

Table 2: Mammal species positively confirmed from the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
<i>L. saxatilis</i>	Scrub hare	Faecal pellets	Short grassveld
<i>C. hottentotus</i>	African mole rat	Tunnel systems	Universal
<i>G. brantsii</i>	Highveld gerbil	Tunnel systems	Sandy grassland

Scrub hares and the mole rats are outstandingly widespread in the Subcontinent and common within their distribution ranges. Both are reproductively fecund. The scrub hare thrive on short grass (which is normally the result of overgrazing or environmental manipulation, and in this instance the invasion of an alien creeper plant that inhibits the growth of natural grass tussocks), and is rarely seen since they are nocturnal and are

exceptionally cryptic during day where they lie up in forms constructed at the base of grass clumps or shrubs. The subterranean life-style of rodent moles renders them virtually untouchable by humans unless specialised traps are deployed. Highveld gerbils are fairly common in sandy veld where they can excavate colonial tunnel systems; they are often encountered at the edges of tilled fields. In this instance the sandy nature of the substrate is sufficient to support this species.

6.3. Red-listed Mammal Species Identified:

-By the Scientific Community

The two shrew species and the African weasel cited as 'DD' in Table 1 are not necessarily endangered. These diminutive insectivores and carnivore 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'. Both shrews and the weasel exist at the apex of their respective food pyramids, 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 ferocious little insectivores/carnivores, they are furthermore not readily trapped with conventional bait or traps which may mean that their numbers are under-estimated. Good capture results for shrews obtained with drift fences and pitfalls support the latter statement.

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).

-By the Biodiversity Act No 10 of 2004

Protected Species: Nil

-By the Gauteng Guidelines for Biodiversity Assessments, 2014

Protected Species: Nil

7. RESULTS: BIRDS

The site of the proposed development falls within the Steenkampsberg Important Bird and Biodiversity Area (IBA) (Marnewick *et al.* 2015). This IBA includes a number of highly significant sites for avian conservation, such as the Middelpunt wetland between Belfast and Dullstroom (Marnewick *et al.* 2015).

7.1. Avian habitats

Avian habitats at the site of the proposed development can be categorized as follows:

- Short grassland on rocky substrate – the eastern portion of the site consists predominantly of short grassland with extensive rocky outcrops (Figure 12). These grasslands are being used for grazing
- Highly disturbed grasslands interspersed with stands of alien trees, buildings and livestock paddocks (Figure 13). This habitat type is characteristic of the western portion of the site.

- Small dams – there are a number of small dams on the property. One of these (located along the southern edge of the site at 25°24'15.5" S 30°04'29" E) differs from the others by being lined with reeds and other aquatic vegetation (Figure 14).

The areas surrounding the site are characterized by similar grassland habitats also used for grazing, and plantations.



Figure 12: Rocky grassland in the eastern portion of the site



Figure 13: Disturbed grassland and stands of alien trees in the eastern parts of the site



Figure 14: Small dam lined with vegetation along the southern border of the property.

7.2. Avifauna

The avian community at the site is typical of mid- to high-altitude grasslands in Mpumalanga in transformed rural landscapes. The disturbed grasslands in the western parts of the property hold species such as Zitting Cisticola, Bokmakierie, Amur Falcon, and Malachite Sunbird. The area around the buildings and stands of alien trees hold species like Dark-capped Bulbul, Speckled Pigeon, Common Fiscal, Hadeda Ibis and Laughing Dove. The rocky grassland areas in the central and eastern sections of the property hold a more diverse community, which in addition to the species listed above includes Ant-eating Chat, Buff-streaked Chat, African Stonechat, Cloud Cisticola, Cape Longclaw and Black-shouldered Kite. Few birds were present at the dams, with the exception of the vegetation-lined dam (Figure 4); Reed Cormorant and Levillant's Cisticola were both present here but not elsewhere on the site. This dam likely also hosts species such as Red-knobbed Coot and Yellow-billed Duck from time to time.

A total of 32 species were confirmed to be present at the site, and the occurrence of an additional 38 species is considered likely (Table 1).

Table 3: Bird species recorded in the area considered for the desktop survey (SABAP 2 pentad 2540_3000 plus eight adjacent pentads – see Figure 1). The current (2015) status of each red-listed species is provided (NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered), and the likelihood of each species occurring at the site is rated as confirmed, high, medium or low.

English name	Scientific name	Red Data Status	Likelihood of occurrence
Apalis, Bar-throated	<i>Apalis thoracica</i>		Low
Avocet, Pied	<i>Recurvirostra avosetta</i>		Low
Babbler, Arrow-marked	<i>Turdoides jardineii</i>		Low
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>		Low
Barbet, Black-collared	<i>Lybius torquatus</i>		Confirmed
Barbet, Crested	<i>Trachyphonus vaillantii</i>		High
Batis, Cape	<i>Batis capensis</i>		Low
Batis, Chinspot	<i>Batis molitor</i>		Low
Bee-eater, European	<i>Merops apiaster</i>		High
Bee-eater, Little	<i>Merops pusillus</i>		Low
Bee-eater, White-fronted	<i>Merops bullockoides</i>		Low
Bishop, Southern Red	<i>Euplectes orix</i>		High
Bishop, Yellow	<i>Euplectes capensis</i>		Low
Bishop, Yellow-crowned	<i>Euplectes afer</i>		Medium
Bittern, Little	<i>Ixobrychus minutus</i>		Low
Blackcap, Bush	<i>Lioptilus nigricapillus</i>	VU	Low
Bokmakierie, Bokmakierie	<i>Telophorus zeylonus</i>		Confirmed
Boubou, Southern	<i>Laniarius ferrugineus</i>		Low
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>		Confirmed
Bunting, Cape	<i>Emberiza capensis</i>		Medium
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>		Low
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>		Low
Bush-shrike, Olive	<i>Telophorus olivaceus</i>		Low
Bustard, Black-bellied	<i>Lissotis melanogaster</i>		Low
Bustard, Denham's	<i>Neotis denhami</i>	VU	Medium
Buttonquail, Black-rumped	<i>Turnix nanus</i>	EN	Low
Buttonquail, Kurrichane	<i>Turnix sylvaticus</i>		Low
Buzzard, Jackal	<i>Buteo rufofuscus</i>		Medium
Buzzard, Lizard	<i>Kaupifalco monogrammicus</i>		Low
Buzzard, Steppe	<i>Buteo vulpinus</i>		High
Camaropectera, Green-backed	<i>Camaropectera brachyura</i>		Low
Canary, Black-throated	<i>Crithagra atrogularis</i>		Low
Canary, Cape	<i>Serinus canicollis</i>		Low
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>		Low
Chat, Anteating	<i>Myrmecocichla formicivora</i>		Confirmed

Chat, Buff-streaked	<i>Oenanthe bifasciata</i>		Confirmed
Chat, Familiar	<i>Cercomela familiaris</i>		Medium
Cisticola, Cloud	<i>Cisticola textrix</i>		Confirmed
Cisticola, Desert	<i>Cisticola aridulus</i>		Low
Cisticola, Lazy	<i>Cisticola aberrans</i>		Medium
Cisticola, Levillant's	<i>Cisticola tinniens</i>		Confirmed
Cisticola, Pale-crowned	<i>Cisticola cinnamomeus</i>		Low
Cisticola, Rattling	<i>Cisticola chiniana</i>		Low
Cisticola, Wailing	<i>Cisticola lais</i>		Low
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>		Medium
Cisticola, Zitting	<i>Cisticola juncidis</i>		Confirmed
Cliff-chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>		Low
Cliff-swallow, South African	<i>Hirundo spilodera</i>		Low
Coot, Red-knobbed	<i>Fulica cristata</i>		High
Cormorant, Reed	<i>Phalacrocorax africanus</i>		Confirmed
Cormorant, White-breasted	<i>Phalacrocorax carbo</i>		Medium
Coucal, Burchell's	<i>Centropus burchellii</i>		Low
Courser, Temminck's	<i>Cursorius temminckii</i>		Low
Crake, Black	<i>Amaurornis flavirostris</i>		Medium
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	Low
Crane, Grey Crowned	<i>Balearica regulorum</i>	EN	Low
Crane, Wattled	<i>Bugeranus carunculatus</i>	CR	Low
Crombec, Long-billed	<i>Sylvietta rufescens</i>		Low
Crow, Cape	<i>Corvus capensis</i>		Medium
Crow, Pied	<i>Corvus albus</i>		Medium
Cuckoo, Black	<i>Cuculus clamosus</i>		Low
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>		High
Cuckoo, Klaas's	<i>Chrysococcyx klaas</i>		Low
Cuckoo, Red-chested	<i>Cuculus solitarius</i>		Medium
Darter, African	<i>Anhinga rufa</i>		Low
Dove, Laughing	<i>Streptopelia senegalensis</i>		Confirmed
Dove, Namaqua	<i>Oena capensis</i>		Low
Dove, Red-eyed	<i>Streptopelia semitorquata</i>		Confirmed
Dove, Rock	<i>Columba livia</i>		Medium
Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>		High
Duck, African Black	<i>Anas sparsa</i>		Low
Duck, Comb	<i>Sarkidiornis melanotos</i>		Low
Duck, Fulvous	<i>Dendrocygna bicolor</i>		Low
Duck, Maccoa	<i>Oxyura maccoa</i>	NT	Low
Duck, White-backed	<i>Thalassornis leuconotus</i>		Low

Duck, White-faced	<i>Dendrocygna viduata</i>		Low
Duck, Yellow-billed	<i>Anas undulata</i>		Low
Eagle, Long-crested	<i>Lophaetus occipitalis</i>		Medium
Eagle, Martial	<i>Polemaetus bellicosus</i>	EN	Low
Eagle, Verreaux's	<i>Aquila verreauxii</i>	VU	Low
Eagle-owl, Cape	<i>Bubo capensis</i>		Low
Eagle-owl, Spotted	<i>Bubo africanus</i>		High
Egret, Cattle	<i>Bubulcus ibis</i>		Confirmed
Egret, Great	<i>Egretta alba</i>		Low
Egret, Little	<i>Egretta garzetta</i>		Low
Egret, Yellow-billed	<i>Egretta intermedia</i>		Low
Falcon, Amur	<i>Falco amurensis</i>		Confirmed
Falcon, Lanner	<i>Falco biarmicus</i>	VU	Medium
Falcon, Peregrine	<i>Falco peregrinus</i>		Medium
Falcon, Red-footed	<i>Falco vespertinus</i>	NT	Medium
Finch, Cuckoo	<i>Anomalospiza imberbis</i>		Low
Finch, Cut-throat	<i>Amadina fasciata</i>		Low
Finch, Red-headed	<i>Amadina erythrocephala</i>		Low
Finfoot, African	<i>Podica senegalensis</i>	VU	Low
Firefinch, African	<i>Lagonosticta rubricata</i>		Low
Firefinch, Red-billed	<i>Lagonosticta senegala</i>		Low
Fiscal, Common (Southern)	<i>Lanius collaris</i>		Confirmed
Fish-eagle, African	<i>Haliaeetus vocifer</i>		Low
Flamingo, Greater	<i>Phoenicopterus ruber</i>	NT	Low
Flamingo, Lesser	<i>Phoenicopterus minor</i>	NT	Low
Flufftail, Red-chested	<i>Sarothrura rufa</i>		Low
Flufftail, White-winged	<i>Sarothrura ayresi</i>	CR	Low
Flycatcher, African Dusky	<i>Muscicapa adusta</i>		Low
Flycatcher, Fairy	<i>Stenostira scita</i>		Low
Flycatcher, Fiscal	<i>Sigelus silens</i>		Medium
Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>		Low
Flycatcher, Spotted	<i>Muscicapa striata</i>		Low
Francolin, Coqui	<i>Peliperdix coqui</i>		Low
Francolin, Grey-winged	<i>Scleroptila africanus</i>		Low
Francolin, Red-winged	<i>Scleroptila levaillantii</i>		Medium
Goose, Egyptian	<i>Alopochen aegyptiacus</i>		High
Goose, Spur-winged	<i>Plectropterus gambensis</i>		Low
Goshawk, African	<i>Accipiter tachiro</i>		Low
Grass-owl, African	<i>Tyto capensis</i>	VU	Low
Grassbird, Cape	<i>Sphenoeacus afer</i>		Medium

Grebe, Black-necked	<i>Podiceps nigricollis</i>		Low
Grebe, Great Crested	<i>Podiceps cristatus</i>		Low
Grebe, Little	<i>Tachybaptus ruficollis</i>		Low
Greenbul, Sombre	<i>Andropadus importunus</i>		Low
Greenshank, Common	<i>Tringa nebularia</i>		Low
Guineafowl, Helmeted	<i>Numida meleagris</i>		High
Gull, Grey-headed	<i>Larus cirrocephalus</i>		Low
Hamerkop, Hamerkop	<i>Scopus umbretta</i>		Low
Harrier, Montagu's	<i>Circus pygargus</i>		Low
Harrier-Hawk, African	<i>Polyboroides typus</i>		Low
Helmet-shrike, White-crested	<i>Prionops plumatus</i>		Low
Heron, Black	<i>Egretta ardesiaca</i>		Low
Heron, Black-headed	<i>Ardea melanocephala</i>		Confirmed
Heron, Goliath	<i>Ardea goliath</i>		Low
Heron, Green-backed	<i>Butorides striata</i>		Low
Heron, Grey	<i>Ardea cinerea</i>		High
Heron, Purple	<i>Ardea purpurea</i>		Low
Heron, Squacco	<i>Ardeola ralloides</i>		Low
Hobby, Eurasian	<i>Falco subbuteo</i>		Low
Honeybird, Brown-backed	<i>Prodotiscus regulus</i>		Low
Honeyguide, Greater	<i>Indicator indicator</i>		Low
Honeyguide, Lesser	<i>Indicator minor</i>		Low
Hoopoe, African	<i>Upupa africana</i>		High
Hornbill, African Grey	<i>Tockus nasutus</i>		Low
House-martin, Common	<i>Delichon urbicum</i>		Medium
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>		High
Ibis, Glossy	<i>Plegadis falcinellus</i>		Medium
Ibis, Hadedda	<i>Bostrychia hagedash</i>		Confirmed
Ibis, Southern Bald	<i>Geronticus calvus</i>	VU	Confirmed
Indigobird, Dusky	<i>Vidua funerea</i>		Low
Jacana, African	<i>Actophilornis africanus</i>		Low
Kestrel, Greater	<i>Falco rupicoloides</i>		Medium
Kestrel, Lesser	<i>Falco naumanni</i>		Medium
Kestrel, Rock	<i>Falco rupicolus</i>		Medium
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>		Low
Kingfisher, Giant	<i>Megaceryle maximus</i>		Low
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>	NT	Low
Kingfisher, Malachite	<i>Alcedo cristata</i>		Low
Kingfisher, Pied	<i>Ceryle rudis</i>		Low
Kingfisher, Woodland	<i>Halcyon senegalensis</i>		Low

Kite, Black-shouldered	<i>Elanus caeruleus</i>		Confirmed
Kite, Yellow-billed	<i>Milvus aegyptius</i>		Low
Korhaan, Blue	<i>Eupodotis caerulescens</i>		Low
Korhaan, Northern Black	<i>Afrotis afroides</i>		Low
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	VU	Medium
Lapwing, African Wattled	<i>Vanellus senegallus</i>		High
Lapwing, Black-winged	<i>Vanellus melanopterus</i>		Low
Lapwing, Blacksmith	<i>Vanellus armatus</i>		High
Lapwing, Crowned	<i>Vanellus coronatus</i>		High
Lark, Eastern Clapper	<i>Mirafra fasciolata</i>		Medium
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>		Medium
Lark, Pink-billed	<i>Spizocorys conirostris</i>		Low
Lark, Red-capped	<i>Calandrella cinerea</i>		Medium
Lark, Rufous-naped	<i>Mirafra africana</i>		Medium
Lark, Sabota	<i>Calendulauda sabota</i>		Low
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>		Low
Longclaw, Cape	<i>Macronyx capensis</i>		Confirmed
Mannikin, Bronze	<i>Spermestes cucullatus</i>		Low
Marsh-harrier, African	<i>Circus ranivorus</i>		Low
Marsh-harrier, Western	<i>Circus aeruginosus</i>		Low
Martin, Banded	<i>Riparia cincta</i>		Confirmed
Martin, Brown-throated	<i>Riparia paludicola</i>		High
Martin, Rock	<i>Hirundo fuligula</i>		High
Martin, Sand	<i>Riparia riparia</i>		Medium
Masked-weaver, Southern	<i>Ploceus velatus</i>		High
Moorhen, Common	<i>Gallinula chloropus</i>		Low
Mousebird, Red-faced	<i>Urocolius indicus</i>		Low
Mousebird, Speckled	<i>Colius striatus</i>		High
Myna, Common	<i>Acridotheres tristis</i>		Confirmed
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>		Medium
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>		Low
Nightjar, European	<i>Caprimulgus europaeus</i>		Low
Nightjar, Fiery-necked	<i>Caprimulgus pectoralis</i>		Low
Nightjar, Freckled	<i>Caprimulgus tristigma</i>		Low
Olive-pigeon, African	<i>Columba arquatrix</i>		Low
Oriole, Black-headed	<i>Oriolus larvatus</i>		Low
Ostrich, Common(domestic)	<i>Struthio camelus</i>		Confirmed
Owl, Barn	<i>Tyto alba</i>		High
Owl, Marsh	<i>Asio capensis</i>		Low
Painted-snipe, Greater	<i>Rostratula benghalensis</i>	NT	Low

Palm-swift, African	<i>Cypsiurus parvus</i>		Low
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>		Low
Petronia, Yellow-throated	<i>Petronia superciliaris</i>		Low
Pigeon, Speckled	<i>Columba guinea</i>		Confirmed
Pipit, African	<i>Anthus cinnamomeus</i>		Confirmed
Pipit, Buffy	<i>Anthus vaalensis</i>		Low
Pipit, Long-billed	<i>Anthus similis</i>		Medium
Pipit, Plain-backed	<i>Anthus leucophrys</i>		Medium
Pipit, Striped	<i>Anthus lineiventris</i>		Low
Pipit, Yellow-breasted	<i>Anthus chloris</i>	VU	Low
Plover, Common Ringed	<i>Charadrius hiaticula</i>		Low
Plover, Kittlitz's	<i>Charadrius pecuarius</i>		Low
Plover, Three-banded	<i>Charadrius tricollaris</i>		Low
Pochard, Southern	<i>Netta erythrophthalma</i>		Low
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT	Low
Prinia, Black-chested	<i>Prinia flavicans</i>		Medium
Prinia, Drakensberg	<i>Prinia hypoxantha</i>		Low
Prinia, Karoo	<i>Prinia maculosa</i>		Low
Prinia, Tawny-flanked	<i>Prinia subflava</i>		Medium
Puffback, Black-backed	<i>Dryoscopus cubla</i>		Low
Pygmy-Goose, African	<i>Nettapus auritus</i>	VU	Low
Pygmy-Kingfisher, African	<i>Ispidina picta</i>		Low
Pytilia, Green-winged	<i>Pytilia melba</i>		Low
Quail, Common	<i>Coturnix coturnix</i>		Medium
Quailfinch, African	<i>Ortygospiza atricollis</i>		High
Quelea, Red-billed	<i>Quelea quelea</i>		High
Rail, African	<i>Rallus caerulescens</i>		Low
Reed-warbler, African	<i>Acrocephalus baeticatus</i>		Medium
Reed-warbler, Great	<i>Acrocephalus arundinaceus</i>		Low
Robin-chat, Cape	<i>Cossypha caffra</i>		Confirmed
Robin-chat, Chorister	<i>Cossypha dichroa</i>		Low
Rock-thrush, Cape	<i>Monticola rupestris</i>		Medium
Rock-thrush, Sentinel	<i>Monticola explorator</i>		Low
Roller, European	<i>Coracias garrulus</i>	NT	Low
Ruff, Ruff	<i>Philomachus pugnax</i>		Low
Rush-warbler, Little	<i>Bradypterus baboecala</i>		Medium
Sandpiper, Common	<i>Actitis hypoleucos</i>		Low
Sandpiper, Curlew	<i>Calidris ferruginea</i>		Low
Sandpiper, Marsh	<i>Tringa stagnatilis</i>		Low
Sandpiper, Wood	<i>Tringa glareola</i>		Low

Saw-wing, Black	<i>Psalidoprocne holomelaena</i>		Low
Secretarybird	<i>Sagittarius serpentarius</i>	VU	Medium
Seedeater, Streaky-headed	<i>Crithagra gularis</i>		Medium
Shelduck, South African	<i>Tadorna cana</i>		Low
Shoveler, Cape	<i>Anas smithii</i>		Low
Shrike, Lesser Grey	<i>Lanius minor</i>		Medium
Shrike, Red-backed	<i>Lanius collurio</i>		Confirmed
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>		Low
Snake-eagle, Brown	<i>Circaetus cinereus</i>		Low
Snipe, African	<i>Gallinago nigripennis</i>		Low
Sparrow, Cape	<i>Passer melanurus</i>		High
Sparrow, House	<i>Passer domesticus</i>		High
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>		Low
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>		Low
Sparrowhawk, Black	<i>Accipiter melanoleucus</i>		High
Sparrowhawk, Little	<i>Accipiter minullus</i>		Low
Sparrowhawk, Rufous-chested	<i>Accipiter rufiventris</i>		Low
Sparrowlark, Chestnut-backed	<i>Eremopterix leucotis</i>		Low
Spoonbill, African	<i>Platalea alba</i>		Low
Spurfowl, Natal	<i>Pternistis natalensis</i>		Low
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>		Medium
Starling, Cape Glossy	<i>Lamprotornis nitens</i>		Medium
Starling, Pied	<i>Spreo bicolor</i>		High
Starling, Red-winged	<i>Onychognathus morio</i>		High
Starling, Violet-backed	<i>Cinnyricinclus leucogaster</i>		Low
Starling, Wattled	<i>Creatophora cinerea</i>		Medium
Stilt, Black-winged	<i>Himantopus himantopus</i>		Low
Stint, Little	<i>Calidris minuta</i>		Low
Stonechat, African	<i>Saxicola torquatus</i>		Confirmed
Stork, Abdim's	<i>Ciconia abdimii</i>	NT	Low
Stork, Black	<i>Ciconia nigra</i>	VU	Low
Stork, Saddle-billed	<i>Ephippiorhynchus senegalensis</i>	EN	Low
Stork, White	<i>Ciconia ciconia</i>		High
Stork, Yellow-billed	<i>Mycteria ibis</i>	EN	Low
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>		Medium
Sunbird, Greater Double-	<i>Cinnyris afer</i>		Medium

collared			
Sunbird, Malachite	<i>Nectarinia famosa</i>		Confirmed
Sunbird, Southern Double-collared	<i>Cinnyris chalybeus</i>		Low
Sunbird, White-bellied	<i>Cinnyris talatala</i>		Low
Swallow, Barn	<i>Hirundo rustica</i>		Confirmed
Swallow, Greater Striped	<i>Hirundo cucullata</i>		Confirmed
Swallow, Lesser Striped	<i>Hirundo abyssinica</i>		High
Swallow, Red-breasted	<i>Hirundo semirufa</i>		Low
Swallow, White-throated	<i>Hirundo albigularis</i>		Medium
Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>		Medium
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>		Low
Swift, African Black	<i>Apus barbatus</i>		High
Swift, Alpine	<i>Tachymarptis melba</i>		Low
Swift, Common	<i>Apus apus</i>		High
Swift, Horus	<i>Apus horus</i>		Low
Swift, Little	<i>Apus affinis</i>		Medium
Swift, White-rumped	<i>Apus caffer</i>		Confirmed
Tchagra, Black-crowned	<i>Tchagra senegalus</i>		Low
Teal, Cape	<i>Anas capensis</i>		Low
Teal, Hottentot	<i>Anas hottentota</i>		Low
Teal, Red-billed	<i>Anas erythrorhyncha</i>		Low
Tern, Caspian	<i>Sterna caspia</i>		Low
Tern, Whiskered	<i>Chlidonias hybrida</i>		Low
Tern, White-winged	<i>Chlidonias leucopterus</i>		Low
Thick-knee, Spotted	<i>Burhinus capensis</i>		Medium
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>		Medium
Thrush, Karoo	<i>Turdus smithi</i>		Medium
Thrush, Kurrichane	<i>Turdus libonyanus</i>		High
Thrush, Olive	<i>Turdus olivaceus</i>		Low
Tit, Southern Black	<i>Parus niger</i>		Low
Turtle-dove, Cape	<i>Streptopelia capicola</i>		Confirmed
Vulture, Cape	<i>Gyps coprotheres</i>	EN	Low
Wagtail, African Pied	<i>Motacilla aguimp</i>		Low
Wagtail, Cape	<i>Motacilla capensis</i>		High
Warbler, Broad-tailed	<i>Schoenicola brevirostris</i>		Low
Warbler, Dark-capped Yellow	<i>Chloropeta natalensis</i>		Low
Warbler, Marsh	<i>Acrocephalus palustris</i>		Low
Warbler, Willow	<i>Phylloscopus trochilus</i>		Medium
Waxbill, Blue	<i>Uraeginthus angolensis</i>		Low
Waxbill, Common	<i>Estrilda astrild</i>		Medium

Waxbill, Orange-breasted	<i>Amandava subflava</i>	Low
Waxbill, Sweet	<i>Coccyzygia melanotis</i>	Low
Weaver, Cape	<i>Ploceus capensis</i>	Medium
Weaver, Golden	<i>Ploceus xanthops</i>	Low
Weaver, Red-headed	<i>Anaplectes rubriceps</i>	Low
Weaver, Spectacled	<i>Ploceus ocularis</i>	Low
Weaver, Thick-billed	<i>Amblyospiza albifrons</i>	Low
Weaver, Village	<i>Ploceus cucullatus</i>	Low
Wheatear, Capped	<i>Oenanthe pileata</i>	Low
Wheatear, Mountain	<i>Oenanthe monticola</i>	Medium
White-eye, Cape	<i>Zosterops virens</i>	Medium
Whydah, Pin-tailed	<i>Vidua macroura</i>	High
Widowbird, Fan-tailed	<i>Euplectes axillaris</i>	High
Widowbird, Long-tailed	<i>Euplectes progne</i>	Medium
Widowbird, Red-collared	<i>Euplectes ardens</i>	Medium
Widowbird, White-winged	<i>Euplectes albonotatus</i>	Medium
Wood-dove, Emerald-spotted	<i>Turtur chalcospilos</i>	Low
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>	Low
Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>	Medium
Woodpecker, Golden-tailed	<i>Campethera abingoni</i>	Low
Woodpecker, Ground	<i>Geocolaptes olivaceus</i>	Medium
Woodpecker, Olive	<i>Dendropicos griseocephalus</i>	Low
Wryneck, Red-throated	<i>Jynx ruficollis</i>	High

7.3. Threatened Species

No less than 30 Near Threatened or Threatened bird species have been recorded in the area considered during the desktop survey (Table 2). The potential presence of such a large number of species of conservation concern (including two *Critically Endangered* species) is highly pertinent, and calls for very careful evaluation of whether any of these species are likely to be present at the site, even if their presence is occasional.

One red-listed species, the *Vulnerable* Southern Bald Ibis, was recorded at the site during the survey. This southern African endemic occurs in mid- to high-altitude grasslands and breeds colonially on cliffs (Henderson 2015). The species is threatened by theft of eggs and young, poisoning and habitat destruction and transformation (Henderson 2015). The individuals seen at the site were foraging, and in view of the specialized cliff-nesting habits of the species, there is virtually zero likelihood that these birds breed at the site.

Besides the Southern Bald Ibis, several other red-listed species may be expected to occur at the site from time to time, although it is doubtful that it represents critical breeding habitat for any of them. Secretarybird and Denham's Bustard are both *Vulnerable* grassland specialists

that have been recorded in the area considered for the desktop survey, and could occur at the site. Lanner Falcon (also *Vulnerable*) generally avoids transformed rural landscapes, but could conceivably occur here occasionally. The *Near Threatened* Red-footed Falcon may also occur here from time to time, but the site is outside the usual range for this species.

Finally, two *Critically Endangered* species have been recorded in the area considered for the desktop survey, specifically Wattled Crane and White-winged Flufftail. Both are unlikely to occur at this site. White-winged Flufftails are restricted to permanently flooded marshes, such as those at Middelpunt between Belfast and Dullstroom (Evans, Smit-Robinson & Tarboton 2015), and are hence extremely unlikely to ever occur at this site. Wattled Cranes breed in permanently inundated wetlands, but may venture into drier grasslands (Smith 2015); there is a small chance birds could visit the area periodically.

Table 4. Red-listed species whose possible presence at the site of the proposed Bergendal development was evaluated during the assessment process.

Species	Scientific name	Red Data ¹	NEMBA ²	Assessment of likelihood of presence at site
Stork, Saddle-billed	<i>Ephippiorhynchus senegalensis</i>	EN	EN	Extremely unlikely. No suitable habitat – occurs in rivers, lakes and wetlands.
Stork, Yellow-billed	<i>Mycteria ibis</i>	EN		Unlikely. No suitable habitat – occurs in inland water bodies.
Stork, Abdim's	<i>Ciconia abdimii</i>	NT		Unlikely. Occurs in grasslands, woodlands and cultivated fields in rural areas, but not recorded in this area during SABAP 2.
Stork, Black	<i>Ciconia nigra</i>	VU	VU	Unlikely. No suitable habitat – usually associated with mountainous regions.
Ibis, Southern Bald	<i>Geronticus calvus</i>	VU	VU	Present at site. See text for discussion.
Flamingo, Greater	<i>Phoenicopterus ruber</i>	NT		Extremely unlikely. No suitable habitat – occurs in lakes and pans.
Flamingo, Lesser	<i>Phoenicopterus minor</i>	NT		Extremely unlikely. No suitable habitat – occurs in lakes and pans.
Pygmy-Goose, African	<i>Nettapus auritus</i>	VU		Unlikely. Occurs in permanent wetlands, usually with water lilies present.
Duck, Maccoa	<i>Oxyura maccoa</i>	NT		Unlikely. Occurs in permanent standing water bodies such as large dams.
Buttonquail, Black-rumped	<i>Turnix nanus</i>	EN		Unlikely. Very specific habitat requirements, and no suitable habitat at site.
Secretarybird	<i>Sagittarius serpentarius</i>	VU		Possible. Occurs in undisturbed grasslands and savannas.
Vulture, Cape	<i>Gyps coprotheres</i>	EN	EN	Unlikely. Could traverse the area occasionally, but usually avoids transformed rural landscapes.
Falcon, Lanner	<i>Falco biarmicus</i>	VU		Possible. Sometimes breeds on electricity pylons, but unlikely to occur in heavily transformed landscapes.
Falcon, Red-footed	<i>Falco vespertinus</i>	NT		Possible – outside usual range, but birds may occasionally move through area.
Eagle, Verreaux's	<i>Aquila verreauxii</i>	VU		Unlikely – no suitable habitat. Occurs in mountainous areas.
Eagle, Martial	<i>Polemaetus bellicosus</i>	EN	VU	Unlikely - requires huge areas of suitable habitat and avoids transformed landscapes.
Flufftail, White-winged	<i>Sarothrura ayresi</i>	CR		Extremely unlikely. Restricted to dense stands of vegetation in permanent

				marshes.
Finfoot, African	<i>Podica senegalensis</i>	VU		Extremely unlikely – requires slow-flowing water in large river systems.
Crane, Grey Crowned	<i>Balearica regulorum</i>	EN	EN	Unlikely. No suitable habitat – undisturbed grassland and wetlands, cultivated fields
Crane, Wattled	<i>Bugeranus carunculatus</i>	CR	CR	Unlikely. Occurs primarily in wetlands and sometimes in undisturbed natural grasslands.
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	EN	Unlikely. No suitable habitat – undisturbed grassland and wetlands, cultivated fields.
Bustard, Denham's	<i>Neotis denhami</i>	VU	PR	Possible – occurs in grassland, often in rocky areas.
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	VU		Unlikely. No suitable habitat at site – requires large areas of tall grassland or savannah.
Painted-snipe, Greater	<i>Rostratula benghalensis</i>	NT		Extremely unlikely. Occurs in thick vegetation along the edges of water bodies.
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT		Unlikely. Occurs in open grassland, edges of pans and cultivated fields, but not recorded in area during SABAP 2.
Grass Owl, African	<i>Tyto capensis</i>	VU	VU	Unlikely – unsuitable habitat. Requires large areas of tall, rank wetland or short natural grassland.
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>	NT		Unlikely. No suitable habitat – clear, vegetated fast-flowing streams.
Roller, European	<i>Coracias garrulus</i>	NT		Unlikely. No suitable habitat – open woodlands.
Blackcap, Bush	<i>Lioptilus nigricapillus</i>	VU		Extremely unlikely – occurs in afro-montane and mistbelt forest and adjacent thickets.
Pipit, Yellow-breasted	<i>Anthus chloris</i>	VU		Unlikely – restricted to high-altitude lush montane grasslands. Not recorded in area during SABAP 2.

¹Current (2015) IUCN Red List Status for South Africa, Lesotho and Swaziland (Taylor, Peacock & Wanless 2015). NT = *Near Threatened*; VU = *Vulnerable*; EN = *Endangered*; CR = *Critically Endangered*;²Indicates species listed as Protected (“PR”), Vulnerable (“VU”), Endangered (“EN”) or Critically Endangered (“CR”) in the National Environmental Management: Biodiversity Act, 2004 list of Threatened or Protected Species (2007 version)

7.4. Overall avifaunal sensitivity

From an avifaunal perspective, most of the site can be considered of medium-high sensitivity, on account of the remaining natural grassland vegetation in the eastern portion of the site, the confirmed presence of one red-listed species, and the possible presence from time to time of several others. Designation of the site as being of medium-high sensitivity is further justified by its location within the Steenkampsberg Important Bird and Biodiversity Area (IBA) (Marnewick *et al.* 2015). The contribution of proposed development to cumulative avian habitat loss in the Steenkampsberg IBA also cannot be ignored. The loss of habitat will be mitigated to some extent by the zoning of several parts of the site for open space and agriculture, as per the layout plan provided. In the area surrounding the buildings, the degree of human disturbance is far greater than in the remainder of the site, is of lower sensitivity than the rocky grassland areas further east. Another factor that should be considered is the potential for negative impacts over a larger area of the IBA through pollution associated with construction and/or agricultural activities; the possibility exists, for instance, that injudicious use of toxic chemicals at the site could reach areas of major conservation significance (e.g., Middelpunt wetland) via run-off and/or groundwater. For this reason, the location of this site within the IBA must be borne in mind throughout the construction and operational phases of this project.

8. HERPETOFAUNA

8.1. Herpetological Habitat Assessment

From a herpetological habitat perspective, it was established that three of the four major habitats are naturally present on the study site, namely terrestrial, rupicolous and wetland-associated vegetation cover.

Most of the study site consists of plateau and moist grassland. The natural grassland has been transformed in some parts for agricultural purposes like grazing and by anthropogenic influences such as buildings, roads, fences and invasive plants. The study site is thus ecologically disturbed in places. No moribund termitaria were recorded on the study site. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for the study site is lower. At the time of the site visit the basal cover was good in many places, despite grazing by cattle, horses and donkeys, and would provide adequate cover for small terrestrial herpetofauna. The grasslands on the study site have not been severely transformed and prey is probably widely distributed, so foraging grounds would not need to be so extensive to support the different populations of herpetofauna.

On the central part of the study site there are many small rocky outcrops in the grassveld, which provide excellent rupicolous habitat. Due to the presence of natural rupicolous habitat, some species like common girdled lizard, common crag lizard and rock agama were added to the species list. There are several artificial surrogates for rupicolous habitat, such

as buildings. Only common reptiles like the speckled rock skink will benefit from these structures.

There are a few manmade dams/burrow pits on the study site. Some of the dams are in drainage lines and hold water either temporarily or permanently. These water sources would provide habitat for common water-dependent herpetofauna. All wetlands are protected in Mpumalanga and are regarded as sensitive.

Noticeable absentees from the study site are indigenous trees. Arboreal habitat is therefore absent in a functional sense. Due to the absence of natural arboreal habitat, some species such as tree agamas and flap-neck chameleons were omitted from the species list. Most of the trees present on the study site are exotics. There are several dead logs, which provide shelter and food for some herpetofauna.

8.2. Observed and Expected Herpetofauna Species Richness

Of the 46 reptile species that may occur on the study site (Table 5), four were confirmed during the site visit (Table 6) and of the possible 20 amphibian species that may occur on the study site (Table 5), two were confirmed during the site visit (Table 6).

A total of 66 herpetofauna species are recorded as potential occupants of the study site. Many 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 4) are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, rinkhals, speckled rock skink, common platanna, common river frog, Boettger's caco, bubbling kassina, guttural toad and common river frog).

Table 5: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Minter, *et.al* (2004), Alexander & Marais (2007), Du Preez & Carruthers (2009) and Bates *et.al* (2014)

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	REPTILES
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder: LACERTILIA	LIZARDS
	Family: Gekkonidae	Geckos
√	<i>Lygodactylus ocellatus ocellatus</i>	Spotted Dwarf Gecko
?	<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko

[Type text]

	SCIENTIFIC NAME	ENGLISH NAME
√	<i>Pachydactylus vansonii</i>	Van Son's Gecko
	Family: Lacertidae	Old World Lizards or Lacertids
?	<i>Nucras lalandii</i>	Delalande's Sandveld Lizard
?	<i>Nucras ornata</i>	Ornate Sandveld Lizard
?	<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard
	Family: Cordylidae	
*NT	<i>Chamaesaura aenea</i>	Coppery Grass Lizard
? NT	<i>Chamaesaura macrolepis</i>	Large-Scaled Grass Lizard
√	<i>Cordylus vittifer</i>	Common Girdled Lizard
√	<i>Pseudocordylus melanotus melanotus</i>	Common Crag Lizard
	Family: Gerrhosauridae	Plated Lizards
√	<i>Gerhosaurus flavigularis</i>	Yellow-Throated Plated Lizard
	Family: Scincidae	Skinks
?	<i>Acontias breviceps</i>	Short-Headed Legless Skink
?	<i>Acontias plumbeus</i>	Giant Legless Skink
?	<i>Acontias gracilicauda</i>	Thin-Tailed Legless Skink
√	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-Eyed Skink
√	<i>Trachylepis capensis</i>	Cape Skink
√	<i>Trachylepis punctatissima</i>	Speckled Rock Skink
√	<i>Trachylepis varia</i>	Variable Skink
√	<i>Scelotes mirus</i>	Montane Dwarf Burrowing Skink
	Family: Agamidae	Agamas
√	<i>Agama aculeata distanti</i>	Eastern Ground Agama
*	<i>Agama atra</i>	Southern Rock Agama
	Suborder: SERPENTES	SNAKES
	Family: Typhlopidae	Blind Snakes
*	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake
?	<i>Megatyphlops schlegelii</i>	Schlegel's Giant Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
?	<i>Leptotyphlops scutifrons</i>	Peter's Thread Snake
	Family: Viperidae	Adders
√	<i>Bitis arietans arietans</i>	Puff Adder
?	<i>Bitis atropos</i>	Berg Adder
√	<i>Causus rhombeatus</i>	Rhombic Night Adder
	Family: Lamprophiidae	
?	<i>Amblyodipsas concolor</i>	KwaZulu-Natal Purple-Glossed Snake
√	<i>Aparallactus capensis</i>	Black-headed Centipede Eater
?	<i>Homoroselaps lacteus</i>	Spotted Harlequin Snake
√	<i>Boaedon capensis</i>	Common House Snake
?	<i>Inyoka swazicus</i>	Swazi Rock Snake
?	<i>Lycodonomorphus inornatus</i>	Olive Ground Snake
√	<i>Lycodonomorphus rufulus</i>	Brown Water Snake
*	<i>Lycophidion capense capense</i>	Cape Wolf Snake

[Type text]

	SCIENTIFIC NAME	ENGLISH NAME
√	<i>Psammophis brevirostris</i>	Short-snouted Grass Snake
√	<i>Psammophis crucifer</i>	Cross-Marked Grass Snake
*	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake
?	<i>Amplorhinus multimaculatus</i>	Many-Spotted Snake
√	<i>Duberria lutrix lutrix</i>	South African Slug-Eater
√	<i>Pseudaspis cana</i>	Mole Snake
	Family: Elapidae	Cobras, Mambas and Others
√	<i>Hemachatus haemachatus</i>	Rinkhals
?	<i>Elapsoidea sundevallii</i>	Sundevall's Garter Snake
	Family: Colubridae	
√	<i>Crotaphopeltis hotamboeia</i>	Red-Lipped Snake
√	<i>Dasypeltis scabra</i>	Rhombic Egg Eater
?	<i>Philothamnus natalensis occidentalis</i>	Western Natal Green Snake
	CLASS: AMPHIBIA	AMPHIBIANS
	Order: ANURA	FROGS
	Family: Pipidae	Clawed Frogs
√	<i>Xenopus laevis</i>	Common Platanna
	Family: Bufonidae	Toads
√	<i>Amietaophrynus gutturalis</i>	Guttural Toad
*	<i>Amietaophrynus rangeri</i>	Raucous Toad
?	<i>Vandijkophrynus gariiepensis</i>	Karoo Toad
?	<i>Schismaderma carens</i>	Red Toad
	Family: Hyperoliidae	Reed Frogs
?	<i>Hyperolius marmoratus taeniatus</i>	Painted Reed Frog
√	<i>Kassina senegalesis</i>	Bubbling Kassina
√	<i>Semnodactylus wealii</i>	Rattling Frog
	Family: Brevipectidae	Rain Frogs
?	<i>Breviceps adspersus</i>	Bushveld Rain Frog
√	<i>Breviceps mossambicus</i>	Mozambique Rain frog
	Family: Phrynobatrachidae	Puddle Frog
?	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog
	Family: Ptychadenidae	Grass Frogs
*	<i>Ptychadena porosissima</i>	Striped Grass Frog
	Family: Pyxicephalidae	
√	<i>Amietia angolensis</i>	Common River Frog
*	<i>Amietia fuscigula</i>	Cape River Frog
√	<i>Strongylopus fasciatus</i>	Striped Stream Frog
*	<i>Strongylopus grayii</i>	Clicking Stream Frog
√	<i>Cocosternum boettgeri</i>	Boettger's Caco or Common Caco
√	<i>Cocosternum nanum nanum</i>	Bronze Caco
?	<i>Tomopterna cryptotis</i>	Tremolo Sand Frog
√	<i>Tomopterna natalensis</i>	Natal Sand Frog

[Type text]

√ 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), Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) and Bates, *et.al*, Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (2014) 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 6: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Sight record of several adults	Natural rupicolous habitat
<i>Trachylepis varia</i>	Variable Skink	Sight record of a few adults	Natural rupicolous habitat
<i>Pseudocordylus melanotus melanotus</i>	Common Crag Lizard	Sight record of single juvenile	Natural rupicolous habitat
<i>Pachydactylus vansoni</i>	Van Son's Gecko	Sight record of single juvenile	Natural rupicolous habitat
<i>Amietaophrynus gutturalis</i>	Guttural Toad	Sight record of a juvenile	Under a rock
<i>Amietia angolensis</i>	Common River Frog	Sight record of several adults and sub-adults	Along the water edge of a manmade dam

The speckled rock skink, variable skink, common crag lizard, Van Son's gecko, guttural toad and common river frog, listed in Table 5, should be abundant or common on the study site and elsewhere in its range.

8.3. Red-listed Herpetofauna identified

-By the Scientific Community

The study site falls outside the natural range of giant bullfrog, plain stream frog, spotted shovel-nosed frog, whistling rain frog, giant dragon lizard (sungazer), Fitzsimons' flat lizard,

[Type text]

Breyer's long-tailed seps, striped harlequin snake, Southern African python and the Nile crocodile. None of these species should occur on the study site.

The coppery grass lizard has been recorded on this quarter degree square 2530CA (Belfast) [Transvaal or Ditsong Museum of Natural History records], and large parts of the study site consist of fairly pristine grassveld. Therefore there is a good possibility that this species may occur on the study site.

The study site has suitable habitat for the large-scaled grass lizard (*Chamaeasaura macrolepis*) and there is a small possibility that this species may occur on the site.

9. RESULTS: VEGETATION

9.1. Vegetation (mapping units) Classification

Six mapping units were identified along on the site (Figure 15, Table 7). The largest part of the site is covered with natural primary grassland, though grazed. Rocky areas with boulders occur scattered throughout the area. Two small drainage areas with moist grassland are present on the southern boundary. In the south western corner is degraded grassland and the farmstead development covers the north western corner.

Table 7: List of mapping units presented in this report, with ecological sensitivity:

Mapping unit	Ecological Sensitivity
1. Grassland	High
2. Moist Grassland	High
3. Rocky Outcrops	High
4. Degraded Grassland	Low
5. Highly Disturbed Areas	Low
6. Developed Area	Low

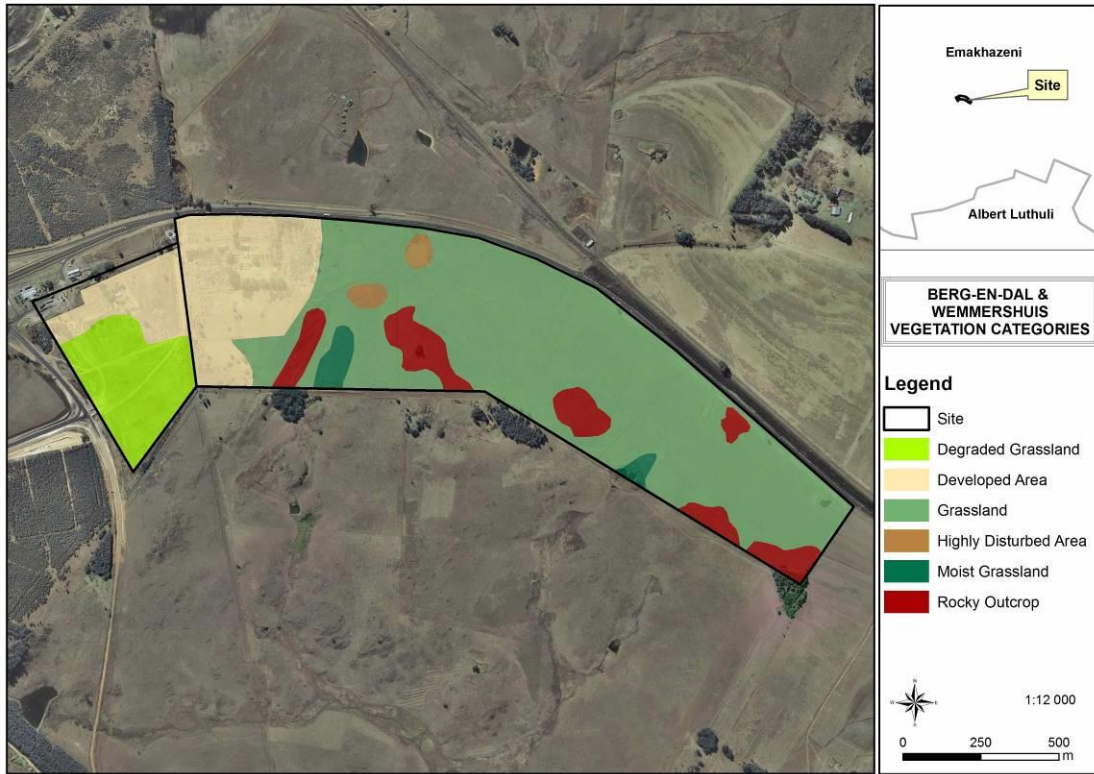


Figure 15: Mapping units on the Bergendal own development area

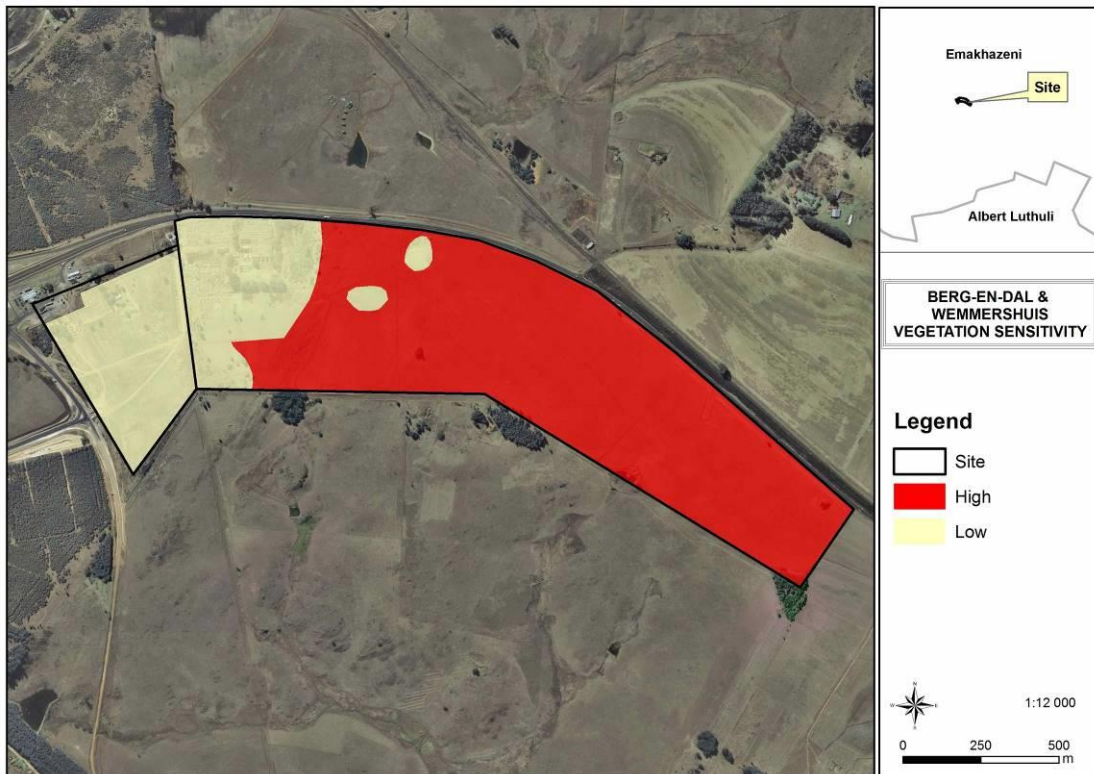


Figure 16: Ecological sensitivity map on the Bergendal development area

9.2. Description of the vegetation of the mapping units

A vegetation map (Figure 15) indicates the distribution of the plant communities (mapping units) on the site, while the ecological sensitivity is indicated in Figure 16. In general, almost [Type text]

the entire area represents primary grassland vegetation, with limited areas developed or degraded.

9.2.1. Grassland

Primary grassland occurs on the slightly undulating terrain on the larger eastern part of the site (Figure 17). Although grazed, the grass layer has a high cover and is in a good condition, often with *Eragrostis curvula* dominant. Although never dominant, several forb species occur scattered within this grassland.



Figure 17: Typical grassland on the site

1. Grassland summary			
Status	Primary grassland vegetation		
Soil	Reddish brown loam	Rockiness	0-5%
Conservation value:	High	Ecological sensitivity	High
Agricultural potential:	Medium	Need for rehabilitation	Low
Dominant spp.	<i>Eragrostis plana</i> , <i>Eragrostis curvula</i>		

The following plant species were recorded in this plant community:

Trees and shrubs, dwarf shrubs

Eucalyptus sp A

Grasses and sedges

[Type text]

Andropogon schirensis
Brachiaria serrata
Cymbopogon caesius
Elionurus muticus
Eragrostis plana d
Eragrostis curvula D

Eragrostis racemosa
Heteropogon contortus
Themeda triandra
Trachypogon spicatus
Tristachya leucothrix

Forbs

Acalypha angustata
Anthospermum hispidulum
Disa aconitoides p
Gladiolus crassifolius p
Helichrysum aureonitens
Helichrysum pilosellum
Helichrysum rugulosum
Helichrysum sp
Hilliardiella oligocephala
Hypochoeris radicata W
Justicia anagaloides
Khadia carolinensis RD
Lactuca serriola
Lobelia erinus
Lotononis sp

Menodora africana
Monopsis decipiens
Oxalis obliquifolia
Pearsonia sessilifolia
Pelargonium luridum
Polygala hottentotta
Richardia braziliensis W
Scabiosa columbaria
Sebaea grandis
Sebaea sedoides
Selago densiflora
Striga bilabiata
Thunbergia atriplicifolia
Wahlenbergia huttonii
Watsonia latifolia pM

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	0	1	1	0	0	0
Grasses	11	0	11	0	0	0
Forbs	28	2	30	1	3	1
Total	42	3	45	1	3	1

Conclusion

This is primary grassland and is therefore considered to have a high ecological sensitivity. The conservation status is considered to be vulnerable, mainly due to expansion of alien plantations. Red data and protected plant species were recorded.

The proposed development can be supported in the western area but the veld earmarked for agriculture should be carefully managed.

9.2.2. Moist Grassland and dams

Moist primary grassland has a very limited distribution within the study area, and is restricted to the small catchments of the two small dams on the southern boundary of the site. Although grazed, the grass layer has a high cover and is in a fair to good condition, often with *Eragrostis curvula* and *Eragrostis plana* dominant. The grassland vegetation is not

much different from the surrounding grassland (1. above), but a few hygrophilous plant species occur at the dams (Figure 18).



Figure 18: Dams and Moist Grassland grassland on the site

2. Moist Grassland summary			
Status	Primary grassland vegetation, with dams		
Soil	Reddish brown loam	Rockiness	0%
Conservation value:	High	Ecological sensitivity	High
Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	<i>Eragrostis plana</i> , <i>Eragrostis curvula</i>		

The following plant species were recorded in this plant community:

Trees and shrubs, dwarf shrubs

nil

Grasses and sedges

Andropogon schirensis
Eragrostis plana d
Eragrostis curvula D
Fuirena pubescens
Heteropogon contortus
Isolepis fluitans

Pennisetum clandestinum
Schoenoplectus corymbosus
Themeda triandra
Tristachya leucothrix
Typha capensis

Forbs

Centella asiatica M
Haplocarpha lyrata
Hibiscus trionum
Hypochoeris radicata W
Lactuca serriola
Limosella major M
Lobelia erinus
Monopsis decipiens

Oxalis obliquifolia
Pelargonium luridum
Ranunculus multifidus
Richardia braziliensis W
Sebaea sedoides
Selago densiflora
Striga bilabiata
Thunbergia atriplicifolia

*Wahelenbergia huttonii**Watsonia latifolia*

pM

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	0	0	0	0	0	0
Grasses	11	0	11	0	0	0
Forbs	16	2	18	0	1	2
Total	27	2	29	0	1	2

Conclusion

This is primary grassland that feeds into a shallow drainage valley and is therefore considered to have a high ecological sensitivity. No red data or protected plant species were recorded.

It is suggested that the drainage areas be kept as natural open space.

9.2.3. Rocky Outcrops

Rocky outcrops occur scattered within the undulating grassland (Figure 19). These rocky areas provide special habitat to a great number of plant species, including rare and threatened species of conservation concern.

3. Rocky Outcrops summary			
Status	Primary grassland vegetation		
Soil	Reddish brown loam	Rockiness	0-5%
Conservation value:	High	Ecological sensitivity	High
Agricultural potential:	Medium	Need for rehabilitation	Low
Dominant spp.	<i>Eragrostis plana</i> , <i>Eragrostis curvula</i>		



Figure 19: A typical Rocky Outcrop (above) with Red Data listed *Eucomis montana* (below, left) and *Boophone disticha* (below, right).

The following plant species were recorded in this plant community:

Trees and shrubs, dwarf shrubs

Diospyros lycioides

Searsia discolor

Myrothamnus flabellifolius

Grasses and sedges

Andropogon schirensis

Eragrostis racemosa

Aristida transvaalensis

Heteropogon contortus

Brachiaria serrata

Sporobolus pectinatus

Cymbopogon caesius

Themeda triandra

Elionurus muticus

Trachypogon spicatus

Eragrostis plana d

Tristachya leucothrix

Eragrostis curvula D

Forbs

Acalypha angustata

Berkheya setifera

Aloe ecklonis p

Dicoma anomala

Aloe graciliflora p

Eucomis montanus RD

Asparagus sp

Gladiolus crassifolius p

<i>Hibiscus trionum</i>		<i>Oxalis obliquifolia</i>
<i>Helichrysum aureonitens</i>		<i>Pearsonia sessilifolia</i>
<i>Helichrysum dasymallum</i>		<i>Pellaea viridis</i>
<i>Helichrysum pilosellum</i>		<i>Pelargonium luridum</i>
<i>Helichrysum rugulosum</i>		<i>Psammotropha myriantha</i>
<i>Hypochoeris radicata</i>		<i>Polygala hottentotta</i>
<i>Indigofera</i> sp		<i>Rhabdosiella calycina</i>
<i>Justicia anagalloides</i>		<i>Selago densiflora</i>
<i>Khadia carolinensis</i>	RD	<i>Silene burchellii</i>
<i>Lactuca inermis</i>		<i>Sutera caerulea</i>
<i>Leonotis ocymifolius</i>		<i>Thunbergia atriplicifolia</i>
<i>Lobelia erinus</i>		<i>Wahlenbergia huttonii</i>
<i>Lotononis</i> sp		<i>Zantedeschia rehmannii</i>
<i>Oldenlandia herbacea</i>		p

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	3	0	3	0	0	0
Grasses	13	0	13	0	0	0
Forbs	35	0	35	2	4	0
Total	51	3	51	1	2	0

3. Rocky Outcrops summary			
Status	Primary grassland vegetation		
Soil	Reddish brown loam	Rockiness	0-5%
Conservation value:	High	Ecological sensitivity	High
Agricultural potential:	Medium	Need for rehabilitation	Low
Dominant spp.	<i>Eragrostis plana</i> , <i>Eragrostis curvula</i>		

Conclusion

This is special habitat in the primary grassland and is therefore considered to have a high ecological sensitivity. Red data and protected plant species were recorded.

It is suggested that the rocky areas be protected as natural habitats in open space areas and that they not be destroyed by the development.

9.2.4. Degraded Grassland

The area in the south-western corner at the current entrance gate of the site has been highly disturbed and transformed (Figure 20). Some *Eucalyptus* and *Acacia mearnsii* occur here. The area is quite weedy while the tall-growing grasses *Hyparrhenia hirta*, *Hyparrhenia dregeana*, *Eragrostis curvula* and also *Eragrostis plana* are locally prominent.

These are patches within the grassland that have been highly disturbed and transformed, e.g. the borrow pit area on the northern boundary of the site. These areas have no plant species of any concern and low sensitivity.

The following plant species were recorded in this plant community:

Trees and shrubs, dwarf shrubs

<i>Acacia mearnsii</i>	A	<i>Eucalyptus</i> sp	A
<i>Acacia dealbata</i>	A		

Grasses and sedges

<i>Cyperus esculentus</i>		<i>Hyparrhenia hirta</i>	
<i>Eragrostis curvula</i>	D	<i>Paspalum dilatatum</i>	
<i>Eragrostis plana</i>	d	<i>Pennisetum clandestinum</i>	A
<i>Hyparrhenia dregeana</i>		<i>Setaria pumila</i>	

Forbs

<i>Sonchus oleraceus</i>	W
<i>Verbena bonariensis</i>	W
<i>Selago densiflora</i>	
<i>Helichrysum nudifolium</i>	
<i>Senecio inaequilatera</i>	W
<i>Bidens bipinnata</i>	W
<i>Achillea millefolium</i>	W

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	0	3	3	0	0	0
Grasses	7	1	8	0	0	0
Forbs	2	5	7	0	0	0
Total	9	9	18	0	0	0

4. Degraded Grassland summary			
Status	Transformed vegetation		
Soil	Reddish brown loam	Rockiness	0%
Conservation value:	Low	Ecological sensitivity	Low
Agricultural potential:	Medium	Need for rehabilitation	Medium
Dominant spp.	<i>Eragrostis plana</i> , <i>Eragrostis curvula</i>		



Figure 20: An example of the Degraded Grassland

Conclusion

This area is highly disturbed and no species of conservation concern occur here. Development in this area can be supported.

9.2.5. Highly Disturbed Areas

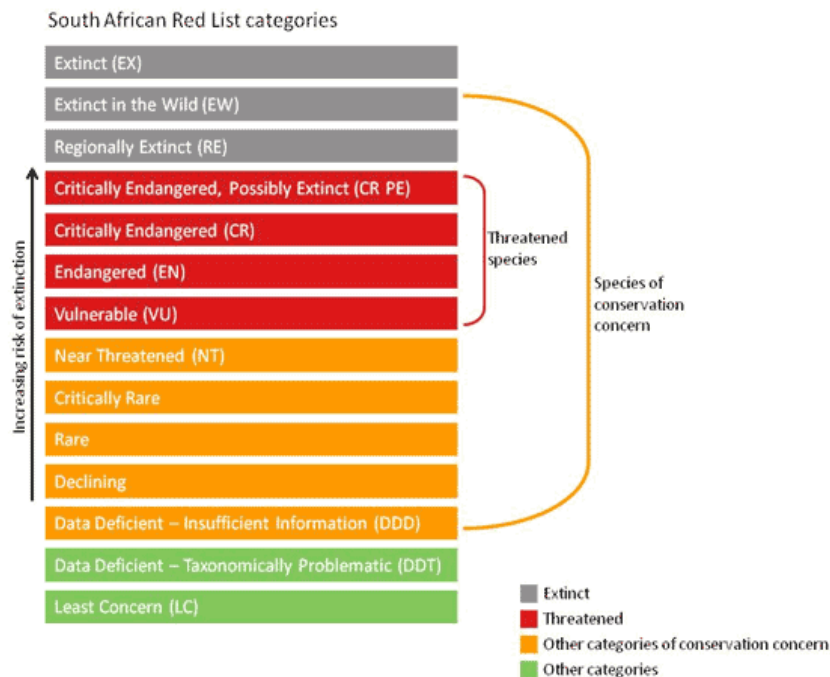
Highly disturbed and transformed areas occur in the western part of the study site, e.g. the borrow pit on the northern boundary. These areas have no plant species of concern and have low conservation value and low sensitivity.

9.2.6. Developed Area

This area covers the farmstead and associated infrastructure in the north-western corner of the study site. Alien trees e.g. *Pinus*, *Eucalyptus* and *Quercus* were planted in this area, Old field and planted pastures are also present. These areas have no plant species of concern and have low conservation value and low sensitivity.

9.3. Plants of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining (Figure 21). These plants are nationally protected by the National Environmental Management: Biodiversity Act (Raimondo *et al*, 2009).



(Source: <http://redlist.sanbi.org/redcat.php>)

Figure 21: Threatened species and species of conservation concern

A list of Species of Conservation Concern for the Grid 3530CA was obtained from the database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened (NT), Data Deficient (DD), (DDT = lack of taxonomic data), Critically Rare (CR), Rare (R) and Declining (D). This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

Table 8: List of red Data listed species from Grid 3530CA (Precis 2016)

Family	Species	Status	Habitat
Amaryllidaceae	<i>Crinum bulbispermum</i> (Burm.f.) Milne-Redh. & Schweick.	Declining	Suitable
Apiaceae	<i>Alepidea peduncularis</i> A.Rich.	DDT	Suitable
Apocynaceae	<i>Riocreuxia aberrans</i> R.A.Dyer	NT	No
Aquifoliaceae	<i>Ilex mitis</i> (L.) Radlk. var. <i>mitis</i>	Declining	No
Asphodelaceae	<i>Aloe reitzii</i> Reynolds var. <i>reitzii</i>	NT	No
Asteraceae	<i>Helichrysum homilochrysum</i> S.Moore	Rare	No
Asteraceae	<i>Cymbopappus piliferus</i> (Thell.) B.Nord.	Threatened	?
Asteraceae	<i>Callilepis leptophylla</i> Harv.	Declining	Suitable
Gesneriaceae	<i>Streptocarpus latens</i> Hilliard & B.L.Burt	Rare	No
Gesneriaceae	<i>Streptocarpus denticulatus</i> Turrill	VU	No
Gunneraceae	<i>Gunnera perpensa</i> L.	Declining	No
Hyacinthaceae	<i>Eucomis montana</i> Compton	Declining	Present
Iridaceae	<i>Gladiolus malvinus</i> Goldblatt & J.C.Manning	VU	Suitable
Mesembryanthemaceae	<i>Khadia alticola</i> Chess. & H.E.K.Hartmann	Rare	No
Mesembryanthemaceae	<i>Khadia carolinensis</i> (L.Bolus) L.Bolus	VU	Present
Proteaceae	<i>Protea parvula</i> Beard	NT	No
Rosaceae	<i>Prunus africana</i> (Hook.f.) Kalkman	VU	No
SANTALACEAE	<i>Thesium subsimile</i> N.E.Br.	DDD	?

Of the above plant species *Eucomis montana* Compton (Declining) and *Khadia carolinensis* (L.Bolus) L.Bolus (Vulnerable) was found on the rocky outcrops A further species namely *Boophone disticha* (L.f.) Herb. (Declining) is also present on the rocky outcrops

The localities of the plant populations of the Red Data listed species observed during the field survey are indicated in the Table 9 below.

Table 9: Approximate localities of Red-listed plant species

Plant species	Latitude	Longitude
<i>Eucomis montana</i>	25°43'08"S	30° 04'22"E
<i>Boophone distica</i>	25°43'10"S	30° 04'27"E
	25°43'20"S	30° 04'37"E
<i>Khadia carolinensis</i>	25°43'11"S	30° 04'39"E
	25°42'59"S	30° 04'04"E

9.4. Provincially Protected Plants

Apart from the Red Data species listed above, a number of provincially protected plants are listed in the Mpumalanga Conservation Act 10 of 1998. These plants are not to be removed, damaged, or destroyed without permit authorization from MTPA. (Table 10 below).

Table 10: Provincially protected plants that was confirmed to occur

Plant species	Habitat
<i>Aloe ecklonis</i>	Rocky outcrops
<i>Aloe graciliflora</i>	Rocky outcrops
<i>Gladiolus crassifolius</i>	Grassland
<i>Watsonia latifolia</i>	Grassland
<i>Zanthesdeschia rehmannii</i>	Rocky outcrops

9.5. Alien Invasive Plant Species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring program. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

The amended Regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) identifies three categories of problem plants:

Category 1 (Declared weeds): plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish plant, maintain, propagate or sell/import any category 1 plant species;

Category 2 (Declared invaders): plants are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and

Category 3 (Declared invaders): plants are ornamentally used and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30 m of a 1:50 year flood line and must be prevented from spreading.

In addition, a second draft of the Alien and Invasive Species Regulations, as well as a new draft list of categories of invasive species in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) was published in the Government Gazette No. 32090, in April 2009. Any species designated under section 70 cannot be propagated, grown, bought or sold by the industry without a permit. Whereas CARA previously classified problem plants into two groups - declared weeds and plant invaders - the amended regulations make provision for four groups: declared weeds (Category 1 plants), plant invaders (Category 2 and Category 3 plants) and indicators of bush encroachment. The first three groups consist of undesirable alien plants and are covered by Regulation 15.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

Category 1b: Invasive species requiring compulsory control as part of an invasive species control program. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management program. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

In terms of the amendments to the regulations under the Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983) and Regulation 598, Government Gazette 37885, August 2014 (Alien and Invasive Species Regulations), landowners are legally responsible for the control of alien species on their properties.

Alien invader species present on the site include:

<i>Eucalyptus</i> sp	Category 2
<i>Acacia mearnsii</i> / <i>Acacia dealbata</i>	Category 2

The normally present *Tagetes minuta*, *Bidens bipinnata* and a few other weeds were recorded from the site.

9.6. Vegetation Importance and Sensitivity

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

The vegetation sensitivity assessment aims to identify whether the vegetation within the study area is of conservation concern and thus sensitive to development as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Habitat or potential habitat to plants species of conservation concern, protected plants or protected trees;
- Situated within ecologically sensitive features such as wetlands or riparian areas;
- Natural, untransformed and un-fragmented natural vegetation.

9.7. Sensitivity ratings and sensitivity analysis

In order to determine the sensitivity of the vegetation on the site, weighting scores (as listed below) were applied. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity.

The sensitivity analysis results of the above assessment were classified as per Table 7 below:

Table 11: Weighting scores

Scoring	13-18	7-12	0-6
Sensitivity	High	Medium	Low

As per Table 12 below, the result of the assessment indicates that the moist grasslands are of high vegetation sensitivity, while the secondary grasslands are classified as being of medium sensitivity. The riparian area and ridge vegetation scored higher than the secondary grassland albeit also of medium sensitivity (Figure 36). The sensitivity classes are discussed below.

Table 12: Scoring of vegetation that occurs within the study area.

Vegetation	Conservation Status of regional Vegetation unit	Listed Ecosystem	Legislated Protection	Plants of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18
Transformed areas, mapping units 5&6	Not applicable No natural vegetation		0	0	1	0	1
Degraded Grassland, mapping unit 4	2	0	0	0	1	0	3
Grassland & Moist Grassland mapping units 1 & 2	3	2	2	3	3	3	16
Rocky outcrops mapping unit 3	3	3	3	3	3	3	18

The Primary grassland and Rocky Outcrops (mapping units 1-3), is considered to be sensitive (MTPA minimum requirements).

9.8. Impact Assessment: Vegetation and Flora

9.8.1. Methods

The following generic criteria drawn from published literature and general South African practise will be used to describe magnitude and significance of impacts in an objective, systematic manner.

These criteria are:

- Extent or scale of the impact (what size of the area will be affected?)
- Duration (how long will the impact last?)
- Intensity (the intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself.
- Probability (how likely is it that the impact will occur?)
- Significance (how severe will the impact be?)
- Mitigatory potential and mitigation measures

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

The impacts are given in table form. Conventions and definitions used in these tables are described below:

Extent of impact

Site: Effect confined to the development area
 Local: Effect limited to within 3-5km of the development area
 Regional: Effect extends beyond the borders of the development area to influence the area as a whole.

Duration of impact

Short: Effect last for a period up to five years
 Medium: Effect continues for a period of between five and ten years
 Long: Effect continues for a period in excess of 10 years
 Permanent: Effect lasts permanently

Intensity

Low: Will have no or little effect on the vegetation and fauna
 Medium: Will have some effect but parts of vegetation will remain in tact
 High: Will destroy the vegetation or habitat for fauna completely

Probability of occurrence

Low: Less than 33% chance of occurrence
 Medium: Between 33 and 66% chance of occurrence

High: Greater than 66% chance of occurrence

Significance

Low: Where the impact will have a relatively small effect on the vegetation which does not need to be accommodated

Medium: Where the impact can have an influence on the vegetation that might require mitigation

High: Where the impact definitely has an impact on the vegetation and may need modification of the project

Status

Positive: Impact will be beneficial to the environment

Negative: Impact will not be beneficial to the environment

Neutral: No positive or negative impact

Confidence

Low: It is uncertain whether the impact will occur

Medium: It is likely that the impact will occur

High: It is relatively certain that the impact will occur

Table 13: Impact table

Impact on	Extent	Duration	Intensity	Probability	Significance	Status	Confidence
Vegetation/Ecosystem							
Transformed vegetation Mapping units 4, 5 & 6	Site western part	Permanent	Low	High	Low ¹	Slightly negative	High
Primary Grassland west	Site western part	Permanent	High	High	High ²	Negative	High
Primary grassland east	Site Eastern part	Permanent	Low	High	Low ³	Negative	High
Rocky Outcrops	Site	Permanent	Low	High	Low ⁴	Neutral	Medium
Plant species							
Indigenous species	Site	Permanent	High	High	High	Negative	High
Alien plant species	Site	Permanent	Low	High	Low	Positive	High

1. Transformed areas are already highly disturbed, therefore the significance of the impact on vegetation and flora is considered to be low.

2. The Primary Grassland west will be destroyed by the planned development.

3. The Primary Grassland east will be used for agricultural purposes – should this be mainly grazing in accordance to an ecologically based management plan, the significance of the impact should be relatively low.

4. The major rocky area sites should be kept in a natural protected condition in open space areas.

5. Removal of alien woody species is of advantage to the environment.

10. FAUNAL IMPACT ASSESSMENT

The impact assessment for the two proposals as follows (see Section 4.5):

SIGNIFICANCE RANKING MATRIX

DEVELOPMENT	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY	
Homestead	4	5	1	5	4	60
The grassland	5	5	2	5	4	68

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

The calculated 'High' impact value of the proposed development on the homestead area is lower since a noticeable degree of environmental disturbance has been affected by former low-key developments. The impact on the grassland portion of the site is calculated to be Very High; although a degree of ecological disturbance has been recorded it could be restored by directed range management. The environmental loss caused by the proposed development will be irrevocable.

11. RECOMMENDED MITIGATION MEASURES

11.1. Avifaunal impacts

The avifaunal impacts of the proposed development can be broadly divided into those associated with the construction and operational phases of the project. A quantitative assessment of avifaunal impacts is presented in Table 3.

Construction phase impacts

Impact 1: Avian habitat loss associated with construction activities

- Avian habitats will be lost in the areas cleared for buildings, roads and other infrastructure associated with the proposed project. This impact will mainly affect the western portion of the site, which is of lower sensitivity than the rocky grasslands to the east. The footprint of this impact will presumably be greater than the area occupied by the development itself, on account of additional areas cleared for access, vehicle parking, construction activities and housing construction workers.
- Mitigation 1: The spatial extent of construction activities must be minimized, and as far as possible must be restricted to the areas on which buildings, roads etc will actually be located. Particular care must be taken to minimize activities in the areas of natural grasslands in the eastern half of the site.

Impact 2: Disturbance associated with construction activities

- The presence of vehicles and construction workers will cause disturbance to avifauna, with the movement and activities of personnel on site and the associated noise, pollution and litter all having a negative effect on birds. In addition, the presence of construction workers will increase the probability of activities such as illegal hunting of birds.

- Mitigation 2: Movement of construction vehicles and workers in the natural grasslands in the eastern part of the site must be minimized. In addition, workers must be instructed to minimize disturbance of birds at all times, and steps must be taken to ensure that no illegal hunting occurs.

Impact 3: Pollution associated with construction activities

- Pollution associated with construction activities (e.g., fuel spills, use of cleaning chemicals) could have serious negative impacts on avifauna if such chemicals were to enter the dams on the site, and/or make their way into the drainage lines and wetlands located immediately to the north or south of the site. Given the importance of this area for threatened birds associated with wetland habitats, this impact needs to be taken very seriously, and carefully mitigated.
- Mitigation 3: Great care must be taken that no pollutants enter local water systems during the construction phase. Measures to rapidly deal with spills of fuel, cleaning chemicals or any other potential pollutants must be put in place before construction commences. Construction workers must be suitably trained to deal with any such spills.

Operational phase impacts

Impact 4: Habitat loss

- Avian habitats in the areas where buildings, roads and other infrastructure, as well as agricultural activities are located will be permanently lost.
- Mitigation 4: The area cleared for the proposed project must be kept to a minimum. The eastern portion of the site is currently zoned for agriculture. However, given the presence of the natural grasslands and the obstacles to agriculture posed by the rocky nature of this area, it is recommended that it be left in its current state. As noted elsewhere, the cumulative impact of avian habitat losses in this Important Bird and Biodiversity Area must be borne in mind.

Impact 5: Disturbance associated with increased human presence in the area

- The permanent presence of a much larger number of people than presently occur at the site will result in greater disturbance of birds that use the area for foraging and breeding. This impact will be manifested, for example, by residents and their pets walking in the area.
- Mitigation 5: Disturbance of birds breeding and foraging in the area should be minimized. For instance, residents walking in the area should be required to keep dogs on leashes at all times. The use of noisy vehicles (e.g., offroad motorcycles) should be prohibited. Given the current trend for so-called “eco-estates”, one possibility worth considering is designating the eastern portion of the site as a green zone, and emphasizing its ecological and conservation value to residents. Activities such as illegal hunting must be strictly prohibited.

Impact 6: Electrocution and collision hazards

- Electrical infrastructure such as transmission lines, as well as electric fences, pose a potential collision risk to flying birds, and a potential electrocution risk to perching birds. The magnitudes of these risks are much lower than the corresponding risks associated with large

overhead transmission lines. Assuming that the electrical infrastructure comprising part of the proposed development is typical of residential estates and business parks, no specific mitigation measures are required.

Impact 7: Collision risk associated with vehicular traffic

- Higher numbers of vehicles driving on the site, together with an increase in their average speed on account of the presence of surfaced roads, will lead to an increase in the risk of birds being killed or injured via collisions. However, this impact will remain very minor compared to the mortality risk associated with vehicles travelling at high speed on the adjacent N4 highway. No specific mitigation measures are required, beyond enforcement of speed limits appropriate for residential areas.

Table 13. Quantitative assessment of avifaunal impacts of proposed Bergendal Residential Development, evaluated as per criteria listed in footnotes

Impact	Extent ^a	Duration ^b	Magnitude ^c	Probability ^d	Significance ^e	Status	Reversi-bility	Irreversible loss of resources?	Mitigation required?
Habitat loss associated with construction activities	1	2	2	5	25	Negative	Low	No	Yes (1)
Disturbance associated with construction activities	1	2	2	4	20	Negative	High	No	Yes (2)
Pollution associated with construction activities	3	2	5	3	30	Negative	Low	No	Yes (3)
Habitat loss	1	5	1	5	35	Negative	Low	No	Yes (4)
Disturbance associated with increased human presence	1	4	2	3	21	Negative	High	No	Yes (5)
Electrocution and collision hazards	1	4	1	2	12	Negative	High	No	No
Collision risk associated with vehicular traffic	1	4	1	1	6	Negative	High	No	Yes

^a1 – 5, where 1 = local and 5 = regional

^b1 – 5, where 1 = 0-1 years, 2 = 2-5 years, 3 = 5-15 years, 4 = >15 years, 5 = permanent

^c0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes

^d1-5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures)

^eSignificance calculated as (Extent+Duration+Magnitude)*Probability. Weighting: < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area), 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated), > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

11.2. Recommended Mitigation Measures, Herpetofauna

Protection of the Drainage lines and Dams:

- Every effort should be made to retain the linear integrity, flow dynamics and water quality of the drainage lines and dams.
- Storm water from the new township must be managed in such a way that it simulate natural flow patterns.

The following mitigation measures are proposed by the specialist:

- If the coppery grass lizard, large-scaled grass lizard, or any herpetological species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. This remediation requires the employment of a herpetologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment). The contractor must ensure that no herpetofauna species are disturbed, trapped, hunted or killed during the construction phase. Any herpetofauna that are inadvertently killed during earthmoving operations should be preserved as museum voucher specimens. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed.
- When holes or trenches are dug, construction must be completed as quickly as possible, otherwise such holes may act as death traps for herpetofauna.
- During the construction phase there will be increased surface water runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate the environmental impact.

11.3. Recommended Mitigation Measures: Vegetation and Flora:

- Restrict the planned agricultural practice in the eastern grassland to grazing, based on an ecologically based management plan
- Keep the major rocky outcrops natural and protected in open space areas
- Avoid any form of erosion, rehabilitate where needed
- Use only indigenous plant species for gardens and rehabilitation
- Remove all alien woody species
- If needed, rescue red data listed and protected species, and replant at suitable places (e.g. gardens) within the development

12. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The team has extensive practical experience as well as access to wide-ranging data bases (such as published records as well as unpublished data in museum archives) to consider the derived species lists with high limits of accuracy. In this instance the biodiversity of the site has *a priori* been jeopardized, which renders the need for intensive field surveys unnecessary. In instances where uncertainty exists regarding the presence of a species it is taken under consideration, which renders the suggested mitigation measures and conclusions more robust.

Bird species occurring at the site of the proposed project were intensively assessed during two days, and the possibility exists that rare species in the area were not encountered due to the short time spent on site. This constraint is partly offset by the incorporation of data from SABAP 2 and SABAP 1. The behaviour and ecology of birds, like that of other organisms, is not completely predictable. The overall impacts of the proposed project can reliably be predicted on the basis of impacts observed elsewhere, but it is important to appreciate that specific, and sometimes subtle, local factors can modify interactions between birds and human activities.

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

13. CONCLUSIONS

All three vertebrate habitat types are considered as average and the aquatic/wetland habitat is flagged as sensitive. Ecologically, the terrestrial habitat quality has been disturbed in some areas by livestock grazing, wire fences, a few gravel roads and exotic plants. The study site falls inside the Lydenburg Montane Grassland (Gm18) which has *Vulnerable* status.

Indigenous grasslands provide important ecological services like water quality, quantity and sustainability, sediment control, and floral (seed, pollination) and faunal support (food, rest, breeding, connectivity).

In terms of the National Water Act, all wetlands in and around the study area must be considered as ecologically sensitive. The study site is part of a water catchment area which, as an ecological mechanism, is very important. The drainage lines as well as their buffer

zones should thus be considered as ecologically sensitive. Buffer zones as identified in the wetland assessment report should be implemented. It will be important to manage storm water to mitigate the effect of runoff water entering the remaining catchment area.

Twenty-nine mammals, 360 birds, 46 reptile and 20 amphibian species occur in the district and are likely to be occupants or at least be vagrants onto the site. Note that the numbers of these vertebrates may be somewhat elevated by considering the adjacent relatively natural grassland in estimates.

If the development should go ahead, it is very important that the holes and trenches should be dug and then be refilled as quickly as possible; otherwise the holes may act as death traps for herpetofauna.

As result of present land-use vertebrate and plant species richness is under pressure and is in fact still in a declining cycle as result of impaired connectivity (the effect of the security fence) and particularly grazing as well as the aggressive invasion of an alien creeper plant.

The conservation status of the partially transformed homestead enclosure is subjectively ranked as **Medium-low** i.e. *Land on which small sections could be considered for conservation but where the area in general has little conservation value.* In view of the Mpumalanga C-plan (Figure 3) the conservation of the grassland portion of the site is regarded as of 'Least Concern' and its conservation status is consequently rated as **Medium-high** i.e. *Land where sections are disturbed but that is still ecologically sensitive to development/disturbance.*

The impact values of the development on the environment will respectively be 'High' (60) for the partially disturbed homestead, and 'Very High' for the range land (see Sections.

Strictly from a biological perspective, there is no compelling argument to oppose the development in spite of the fact that the property in question will ultimately be transformed. No portion of the property enjoys extraordinary conservation status (Figure 3). Although the site will be entirely altered, faunal species will be displaced to the extensive district, and floral loss will be low relative to the extent of the undisturbed condition of the district.

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- NEMBA, National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004). Draft List of Threatened Ecosystems. Government Gazette RSA Vol. 1477, 32689, Cape Town, 6 Nov 2009.
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- The National Environment Management Act, 1998 (Act No. 107 of 1998)
- The National Environmental Management Biodiversity Act, 2004. (Act 10 Of 2004). Government Gazette RSA Vol. 467, 26436, Cape Town, June 2004.
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- van Rooyen, C.S. (2003) *Eskom EWT partnership - annual report 2002/2003*. Vulture Study Group Workshop Aandster, Namibrand Nature Reserve, Namibia.
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15. DETAILS OF SPECIALIST CONSULTANTS

GEORGE JOHANNES BREDEKAMP

Born: 10 February 1946 in Johannesburg, South Africa.

Citizenship: South African

Marital status: Married, 1 son, 2 daughters

Present work address

Extra-ordinary Professor

Department of Plant Science, University of Pretoria, Pretoria, 0002, South Africa

Tel:(27)(12)420-3121 Fax: (27)(12)362 5099

E-Mail: george.bredenkamp@up.ac.za

or

EcoAgent CC, or Ecotrust Environmental Services CC

PO Box 25533, Monument Park, 0105, South Africa

Tel and Fax: (27)(12) 460 2525

Cell 082 5767046

E-Mail: ecoagent@mweb.co.za or ecoagent@mile.co.za

Qualifications:

1963 Matriculation Certificate, Kemptonpark High School

1967 B.Sc. University of Pretoria, Botany and Zoology as majors,

1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.

1969 T.H.E.D. (cum laude) Pretoria Teachers Training College.

1975 M.Sc. University of Pretoria, Plant Ecology .

1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:

- MSAIE&ES South African Institute of Ecologists and Environmental Scientists
 - 1989-1990 Council member
- MGSSA Grassland Society of Southern Africa
 - 1986 Elected as Sub-editor for the Journal
 - 1986-1989 Serve on the Editorial Board of the Journal
 - 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
 - 1993 Elected as professional member
- Pr.Sci.Nat. South African Council for Natural Scientific Professions **Reg No 400086/83**

- 1993-1997 **Chairman** of the Professional Advisory Committee:
Botanical Sciences
- 1993-1997: **Council** Member
- 1992-1994: Publicity Committee
- 1994-1997: Professional Registration Committee

Professional career:

- Teacher in Biology 1970-1973 in Transvaal Schools
- Lecturer and senior lecturer in Botany 1974-1983 at University of the North
- Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
- Professor in Plant Ecology 1988-2008 at University of Pretoria.
- Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

Academic career:

- Students:
 - Completed post graduate students: M.Sc. 53; Ph.D. 14.
 - Presently enrolled post-graduate students: M.Sc. 4; Ph.D. 1.
- Author of:
 - 175 scientific papers in refereed journals
 - >150 papers at national and international congresses
 - >300 scientific (unpublished) reports on environment and natural resources
 - 17 popular scientific papers.
 - 39 contributions in books
- Editorial Committee of
 - South African Journal of Botany,
 - Journal Grassland Society of Southern Africa,
 - Bulletin of the South African Institute of Ecologists.
 - Journal of Applied Vegetation Science.(Sweden)
 - Phytocoenologia (Germany)
- FRD evaluation category: C1 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

Membership:

- International Association of Vegetation Science.
- International Society for Ecology (Intecol)
- Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).
- South African Association of Botanists (SAAB)
 - 1988-1993 Elected to the **Council** of SAAB.
 - 1989-1990 Elected as **Chairman** of the Northern Transvaal Branch
 - 1990 Elected to the Executive Council as **Vice-President**
 - 1990- Sub-editor Editorial Board of the Journal
 - 1991-1992 Elected as **President** (2-year period)

- 1993 **Vice-President** and Outgoing President
- Wildlife Management Society of Southern Africa
 - Suid-Afrikaanse Akademie vir Wetenskap en Kuns
(=South African Academy for Science and Art).
 - Wildlife Society of Southern Africa
 - 1975 - 1988: Member
 - 1975 - 1983: Committee member, Pietersburg Centre
 - 1981 - 1982: **Chairman**, Pietersburg Centre
 - Dendrological Society of Southern Africa
 - 1984 - present: Member
 - 1984 - 1988: Committee member, Western Transvaal Branch
 - 1986 - 1988: **Chairman**, Western Transvaal Branch
 - 1987 - 1989: Member, Central Committee (National level)
 - 1990 - 2000: Examination Committee
 - Succulent Society of South Africa
 - 1987 - present: Member
 - Botanical Society of South Africa
 - 2000 – present: Member
 - 2001- 2008: Chairman, Pretoria Branch
 - 2009-present Committee member Pretoria Branch
 - 2002 – present: Chairman, Northern Region Conservation Committee
 - 2002- 2007: Member of Council

Special committees:

- Member or past member of 10 special committees re ecology, botany, rangeland science in South Africa.
- Member of the International Code for Syntaxonomical Nomenclature 1993-1996.

Merit awards and research grants:

- 1968 Post graduate merit bursary, CSIR, Pretoria.
- 1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.
- 1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.
- 1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.
- 1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.
- 1991-present Research Grant, National Research Foundation , Pretoria.
- Research Grant, Water Research Commission.
- 1999-2003 Research Grant, Water Research Commission.
- 2006 South African Association of Botanists Silver Medal for outstanding contributions to South African Botany

Abroad:

- 1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom Visits to Israel, Italy, Germany, United Kingdom, Portugal.
- 1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.

- Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.
- 1990 Travel Grant, FRD.
Visit to Japan, Taiwan, Hong-Kong.
- 1991 Travel Grant, FRD.
Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.
- 1993 Travel Grant, University of Pretoria.
Visits to the USA, Costa Rica, Czech Republic, Austria.
- 1994 Travel Grant FRD.
Visits to Switzerland, The Netherlands, Germany, Czech Republic.
- 1995 Travel Grant FRD, University of Pretoria
Visits to the USA
Travel Grant, University of Pretoria
Visit to the UK.
Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria
Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden
Travel Grant, University of Pretoria, Visit Hungary, Spain, USA
Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.
Travel Grant, NRF, Visit Brazil
- 2006 German Grant Invited lecture in Rinteln, Germany

Consultant

Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC
Since 1988 >300 reports as consultant on environmental matters, including:
Game Farm and Nature Reserve planning,
Environmental Impact Assessments,
Environmental Management Programme Reports,
Vegetation Surveys,
Wildlife Management,
Veld Condition and Grazing Capacity Assessments,
Red data analysis (plants and animals).

ANDREW E. MCKECHNIE**ABRIDGED CURRICULUM VITAE**

Professor
Department of Zoology and Entomology
University of Pretoria

Email: aemckechnie@zoology.up.ac.za
Tel: +27-(0)12-423232
Cell: +27-(0)72-7777572

ACADEMIC QUALIFICATIONS

Ph.D. (Zoology), University of Natal, April 2002
M.Sc. *cum laude* (Zoology), University of Natal, April 1999
B.Sc. (Honours) *cum laude* (Zoology), University of Natal, April 1997
B.Sc. (Majors: Zoology and Botany), University of Natal, April 1996

PROFESSIONAL QUALIFICATIONS

Professional Natural Scientist (*Pr. Sci. Nat.*; Registration number: 400205/05), South African Council for Natural Scientific Professions

TECHNICAL REPORTS [31 in total, only 10 most recent shown]

- McKechnie, A.E.** 2013. *Specialist avifaunal assessment: proposed Frankfort Power Station.*
Prepared for Rural Maintenance.
- McKechnie, A.E.** 2013. *Specialist avifaunal assessment: proposed MOGS oil storage facility, Saldanha Bay.* Prepared for Enviro-Insight.
- McKechnie, A.E.** 2012. *Specialist winter avifaunal assessment: proposed Prieska Photovoltaic Plant.* Prepared for Enviro-Insight.
- McKechnie, A.E.,** Verburgt, L., Chimimba, C.T., Orban, B. and Niemand, L.J. 2011. *Initial environmental assessment report: proposed Chisanga Falls Hydroelectric Generation Facility.* Prepared for Rural Maintenance.
- McKechnie, A.E.,** Verburgt, L., Chimimba, C.T., Orban, B. and Niemand, L.J. 2011. *Initial environmental Assessment report: proposed expansion to the Kayelekera Coal Mine, northern Malawi.* Prepared for Rural Maintenance.
- McKechnie, A.E.,** Verburgt, L., Chimimba, C.T., Orban, B. and Niemand, L.J. 2010. *Malawi Mini Grids Ecological Assessment Report.* Prepared for Rural Maintenance and Millennium Challenge Corporation.
- McKechnie, A.E.** 2010. *Specialist survey report: assessment of impacts on birds, with particular reference to threatened and near threatened species: proposed subdivision of portion 39, Olifantsvlei 327 IQ, Gauteng.* Prepared for Prism EMS.
- McKechnie, A.E.** 2009. *Specialist survey report: assessment of impacts on birds, with particular reference to African Grass-owls, White-bellied Korhaans, African Finfoots and Half-collared Kingfishers: proposed residential development on portion 63, Rietvallei 180 IQ, Roodepoort, Gauteng.* Prepared for Prism EMS.
- McKechnie, A.E.** 2009. *Specialist survey report: Assessment of impacts on birds: proposed wind farm development on Burgershoop 107 and Elandspoort 99 HS, Mpumalanga.* Prepared for K2M Environmental.
- Schwaibold, U., Alexander, G.J., **McKechnie, A.E.**, et al. 2009. *Monitoring recommendations for fauna: AngloGold Ashanti Vaal Reef and West Wits.* Prepared for AngloGold.

PEER-REVIEWED SCIENTIFIC PUBLICATIONS [71 in total, only three most recent shown]

Pietersen, D.W., Symes, C.T., Woodborne, S.W., **McKechnie, A.E.** and Jansen, R. (in press)

Diet and prey selectivity of the specialist myrmecophage, Temminck's ground pangolin (*Smutsia temminckii*). *Journal of Zoology*

Smit, B. and **McKechnie, A.E.** 2015. Water and energy fluxes during summer in an arid-zone passerine bird. *Ibis* 157(4): 774-786.

Whitfield, M.C., Smit, B., **McKechnie, A.E.** and Wolf, B.O. 2015. Avian thermoregulation in the heat: scaling of heat tolerance and evaporative cooling capacity in three southern African arid-zone passerines. *Journal of Experimental Biology* 218: 1705-1714.

ARTICLES IN SEMI-POPULAR MAGAZINES [73 in total, only three most recent shown]

McKechnie, A.E. 2016. Mercury rising - South Africa's national parks are getting warmer. *African Birdlife* in press.

McKechnie, A.E. 2016. Enormous, enigmatic, extinct – the elephant birds of Madagascar. *African Birdlife* in press.

Noakes, M.J. and **McKechnie, A.E.** 2015 Hot or not? Physiological variation in white-browed sparrow-weavers. *African Birdlife* September/October 2015: 12-13.

CONFERENCE PRESENTATIONS [110 in total, only plenary lectures shown]

McKechnie, A.E., Smit, B., Hockey, P.A.R. and Wolf, B.O. Taking the heat: climate change and desert birds. *At: Frontiers in South African Ornithology*, 15-16 March 2012, Port Elizabeth, South Africa.

McKechnie, A.E., Smit, B., Cory Toussaint, D., Boyles, J.G. and Wolf, B.O. Hot birds and bats: physiological approaches to predicting climate change impacts in small endotherms. *At: Joint ZSSA and PARSAs Conference*, 10-13 July 2011, Stellenbosch, South Africa.

SCIENTIFIC AWARDS AND RECOGNITION [only last five years shown]

2013	Finalist: 2012/2013 NSTF/BHP Billiton Awards
2013	Exceptional Academic Achiever, University of Pretoria
2011	Founding Member, South Africa Young Academy of Science
2008-2012	Exceptional Young Researcher Award, University of Pretoria

STUDENT SUPERVISION

Current supervision: 4 PhD, 1 BSc(Hons); Current co-supervision: 3 PhD

Past supervision: 1 PhD, 10 MSc, 9 BSc (Hons); Past co-supervision: 1 PhD, 2 MSc, 3 BSc (Hons)

EDITORSHIP

Associate Editor: *Climate Change Responses*

Associate Editor: *Emu – Austral Ornithology*

Editorial Board: *Journal of Comparative Physiology B*

INVITED SEMINARS AND LECTURES [23 in total, only 3 most recent shown]

Mitrani Department for Desert Ecology, Ben-Gurion University of the Negev, Israel, August 2015.

School of Biological Sciences, University of Queensland, July 2015

Hawkesbury Institute for the Environment, University of Western Sydney, July 2015.

OTHER CONTRIBUTIONS

Scientific Advisor, *African Birdlife* magazine

Expert reviewer - South African National Standard SANS 10386 Annex C

Member, Research Ethics and Scientific Committee, National Zoological Gardens

Member, Steering Committee, Endangered Wildlife Trust Threatened Grassland Species Program

Council Member, Zoological Society of Southern Africa [2009-2013]

SOCIETY MEMBERSHIP

American Ornithologists' Union

Australia and New Zealand Society for Comparative Physiology and Biochemistry

Cooper Ornithological Society

International Ornithologists' Union

Society for Integrative and Comparative Biology

Zoological Society of Southern Africa

IGNATIUS LOURENS RAUTENBACH

Independent Environmental Consultant – MAMMALOGY; Ph.D., Prof. Nat. Sci. .

Identity Number 421201 5012 00 5

Gender Male

Date of Birth 1 December 1942; born Germiston, RSA

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) 1966, **T.H.E.D** (Pta TTC) 1967, **M.Sc.** (UP) 1971, **Ph.D.** (Un. Natal) 1971

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 1966 - 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, co-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”.

JACOBUS CASPARUS PETRUS (JACO)

Identity number 680804 5041 08 4

Gender Male

Date of birth 4 August 1968

Nationality South African

Home languages Afrikaans, fluent in English

Postal address P.O. Box 25085, Monument Park, Pretoria, 0105.

Tel no +27 12 347 6502, Cell +27 82 410 8871

E-mail jcpvanwyk@absamail.co.za

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, censusing 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 >60 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.