

ECOLOGICAL FAUNA AND FLORA HABITAT SURVEY

**Proposed Benicon 2 Industrial, approximately 10 km south of the
centre of Emalahleni, Mpumalanga Province, South Africa**



The widespread butterfly species, *Lampides boeticus* (Pea Blue), feeding on nectar from a flower of *Polydora poskeana* at the site.
Photo: R.F. Terblanche.

MARCH 2020

COMPILED BY:

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(M.Sc, *Cum Laude*; Pr.Sci.Nat, Reg. No. 400244/05)

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I) SPECIALIST EXPERTISE

SYNOPTIC CV: REINIER. F. TERBLANCHE

Reinier is an ecologist and in particular a habitat specialist with an exceptional combination of botanical and zoological expertise which he keeps fostering, updating and improving. He is busy with a PhD for which he registered at the Department of Conservation Ecology at the University of Stellenbosch in July 2013. The PhD research focuses on the landscape ecology of selected terrestrial and wetland butterflies in South Africa. Reinier's experience includes being a lecturer in ecology and zoology at the North West University, Potchefstroom Campus (1998-2008). Reinier collaborates with a number of institutes, organizations and universities on animal, plant and habitat research.

Qualifications:

Qualification	Main subject matter	University
M.Sc Cum Laude, 1998: Botany: Ecology	Quantitative study of invertebrate assemblages and plant assemblages of rangelands in grasslands.	North-West University, Potchefstroom
B.Sc Honns Cum Laude, 1992 Botany: Taxonomy	Distinctions in all subjects: Plant Anatomy, Taxonomy, Modern Systematics, System Modelling, Plant Ecology, Taxonomy Project. Also included: Statistics Attendance Course.	North-West University, Potchefstroom
B.Sc Botany, Zoology	Main subjects: Botany, Zoology.	North-West University, Potchefstroom
Higher Education Diploma, 1990	Numerous subjects aimed at holistic training of teachers.	North-West University, Potchefstroom

In research Reinier specializes in conservation biology, threatened butterfly species, vegetation dynamics and ant assemblages at terrestrial and wetland butterfly habitats as well as enhancing quantitative studies on butterflies of Africa. He has published extensively in the fields of taxonomy, biogeography and ecology in popular journals, peer-reviewed scientific journals and as co-author and co-editor of books (see 10 examples beneath).

Reinier practices as an ecological consultant and has been registered as a Professional Natural Scientist by SACNASP since 2005: Reg. No. 400244/05. His experience in consultation includes: Flora and fauna habitat surveys, Threatened species assessments, Riparian vegetation index surveys, Compilation of Ecological Management Plans, Biodiversity Action Plans and Status quo of biodiversity for Environmental Management Frameworks, Wetland Assessments, Management of Rare Wetland Species.

Recent activities/ awards: Best Poster Award at Oppenheimer De Beers Group Research Conference 2015, Johannesburg. One of the co-authors of Guidelines for Standardised Global Butterfly Monitoring, 2015, Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany (UNEP-WCMC), GEO BON Technical Series 1. Awarded the prestigious Torben Larsen Memorial Tankard in October 2017; one is awarded annually to the person responsible for the most outstanding written account on Afrotropical Lepidoptera. Lectured as Conservationist-in-Residence in the Wildlife Conservation Programme of the African Leadership University, Kigali, Rwanda, 9-23 February 2019. Reinier won a photographic competition which resulted his photograph of the Critically Endangered *Erikssonia edgei* (Waterberg Copper) being on the front cover of the Synthesis Report of the National Biodiversity Assessment (2018) prepared by SANBI. Reinier is a Research Fellow at the University of South Africa (Unisa) from 1 January 2020.

EXPERIENCE

Lecturer: Zoology 1998-2008	Main subject matter and level	Organization
Lectured subjects	- 3 rd year level Ecology, Plantparasitology - 2 nd year level Ethology - <u>Master's degree</u> Evolutionary Ethology, Systematics in Practice, Morphology and Taxonomy of Insect Pests, Wetlands.	North-West University, Potchefstroom and University of South Africa
Co-promoter	PhD: Edge, D.A. 2005. Ecological factors that influence the survival of the Brenton Blue butterfly	North-West University, Potchefstroom
Study leader/ assistant study leader	Six MSc students, One BSc Honn student: Various quantitative biodiversity studies (terrestrial and aquatic).	North-West University, Potchefstroom
Teacher 1994-1998	Biology and Science, Secondary School	Afrikaans Hoër Seunskool, Pretoria
Owned Anthene Ecological CC 2008 – present	- Flora and Fauna habitat surveys - Highly specialized ecological surveys - Riparian vegetation index surveys - Ecological Management Plans - Biodiversity Action Plans - Biodiversity section of Environmental Management Frameworks - Wetland assessments	Private Closed Corporation that has been subcontracted by many companies
Herbarium assistant 1988-1991	- Part-time assistant at the A.P. Goossens herbarium, Botany Department, North-West University, 1988, 1989, 1990 and 1991 (as a student).	North-West University, Potchefstroom

10 EXAMPLES OF PUBLICATIONS OF WHICH R.F. TERBLANCHE IS AUTHOR/ CO-AUTHOR

(Three books, two chapters in books and five articles are listed here as examples)

- HENNING, G.A., **TERBLANCHE, R.F.** & BALL, J.B. (eds) **2009**. *South African Red Data Book: butterflies*. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria. 158p. ISBN 978-1-919976-51-8
- MECENERO, S., BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., **TERBLANCHE, R.F.** & WILLIAMS, M.C. (eds). 2013. *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and atlas*. Safronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
- VAN SWAAY, C., REGAN, E., LING, M., BOZHINOVSKA, E., FERNANDEZ, M., MARINI-FILHO, O.J., HUERTAS, B., PHON, C.-K., KÓRÖSI, A., MEERMAN, J., PE'ER, G., UEHARA-PRADO, M., SÁFIÁN, S., SAM, L., SHUEY, J., TARON, D., **TERBLANCHE, R.F.** & UNDERHILL, L. 2015. Guidelines for Standardised Global Butterfly Monitoring. Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany. GEO BON Technical Series 1.
- TERBLANCHE, R.F.** & HENNING, G.A. **2009**. *A framework for conservation management of South African butterflies in practice*. In: Henning, G.A., Terblanche, R.F. & Ball, J.B. (eds). *South African Red Data Book: Butterflies*. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria. p. 68 – 71.
- EDGE, D.A., **TERBLANCHE, R.F.**, HENNING, G.A., MECENERO, S. & NAVARRO, R.A. 2013. Butterfly conservation in southern Africa: Analysis of the Red List and threats. In: Mecenero, S., Ball, J.B., Edge, D.A., Hamer, M.L., Henning, G.A., Krüger, M., Pringle, E.L., Terblanche, R.F. & Williams, M.C. (eds). *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas*. pp. 13-33. Safronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
- TERBLANCHE, R.F.**, SMITH, G.F. & THEUNISSEN, J.D. **1993**. Did Scott typify names in *Haworthia* (Asphodelaceae: Alooideae)? *Taxon* **42**(1): 91–95. (International Journal of Plant Taxonomy).
- TERBLANCHE, R.F.**, MORGENTHAL, T.L. & CILLIERS, S.S. **2003**. The vegetation of three localities of the threatened butterfly species *Chrysoritis aureus* (Lepidoptera: Lycaenidae). *Koedoe* **46**(1): 73-90.
- EDGE, D.A., CILLIERS, S.S. & **TERBLANCHE, R.F.** **2008**. Vegetation associated with the occurrence of the Brenton blue butterfly. *South African Journal of Science* **104**: 505 - 510.
- GARDINER, A.J. & **TERBLANCHE, R.F.** **2010**. Taxonomy, biology, biogeography, evolution and conservation of the genus *Erikssonia* Trimen (Lepidoptera: Lycaenidae) *African Entomology* **18**(1): 171-191.
- TERBLANCHE, R.F.** 2016. *Acraea trimeni* Aurivillius, [1899], *Acraea stenobea* Wallengren, 1860 and *Acraea neobule* Doubleday, [1847] on host-plant *Adenia repanda* (Burch.) Engl. at Tswalu Kalahari Reserve, South Africa. *Metamorphosis* **27**: 92-102.

* A detailed CV with more complete publication list is available.

II) SPECIALIST DECLARATION

I, Reinier F. Terblanche, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Reinier F. Terblanche



Signature of the specialist

Date: 13 May 2020

1 INTRODUCTION

An ecological habitat survey of flora and fauna was required for the proposed Benicon 2 Industrial development, approximately 10 km south of the centre of Emalahleni, Mpumalanga Province (elsewhere referred to as the site) to determine the likelihood of threatened fauna or flora to reside on the site. The survey focused on the possibility that fauna or flora of conservation concern, which include threatened species, known to occur in Mpumalanga Province are likely to occur within the proposed development and site or not.

1.1 OBJECTIVES OF THE HABITAT STUDY

The objectives of the habitat study are to provide:

- A detailed fauna and flora habitat survey;
- A detailed habitat survey of possible threatened or localised plant species, vertebrates and invertebrates;
- Recording of possible host plants (=foodplants) of fauna such as butterflies.
- Evaluate the conservation importance and significance of the site with special emphasis on the current status of threatened species;
- Literature investigation of possible species that may occur on site;
- Identification of potential ecological impacts on fauna and flora that could occur as a result of the development; and
- Make recommendations to reduce or minimise impacts, should the development be approved.

1.2 SCOPE OF STUDY

- A survey consisting of visits to note key elements of habitats on the site, relevant to the conservation of fauna and flora.
- Recording of any sightings and/or evidence of existing fauna and flora.
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary.
- An evaluation of the conservation importance and significance of the site with special emphasis on the current status of threatened species.
- Recording of possible host plants or foodplants of fauna such as butterflies.
- Literature investigation of possible species that might occur on site.
- Integration of the literature investigation and field observations to identify potential ecological impacts that could occur as a result of the development.
- Integration of literature investigation and field observations to make recommendations to reduce or minimise impacts, should the development be approved.

2 STUDY AREA

The site is located north and south of the R544 road and approximately 10 km south of Emalahleni in the Mpumalanga Province. Site is located in the Grassland Biome which is represented by the Eastern Highveld Grassland vegetation type (Mucina & Rutherford 2006).

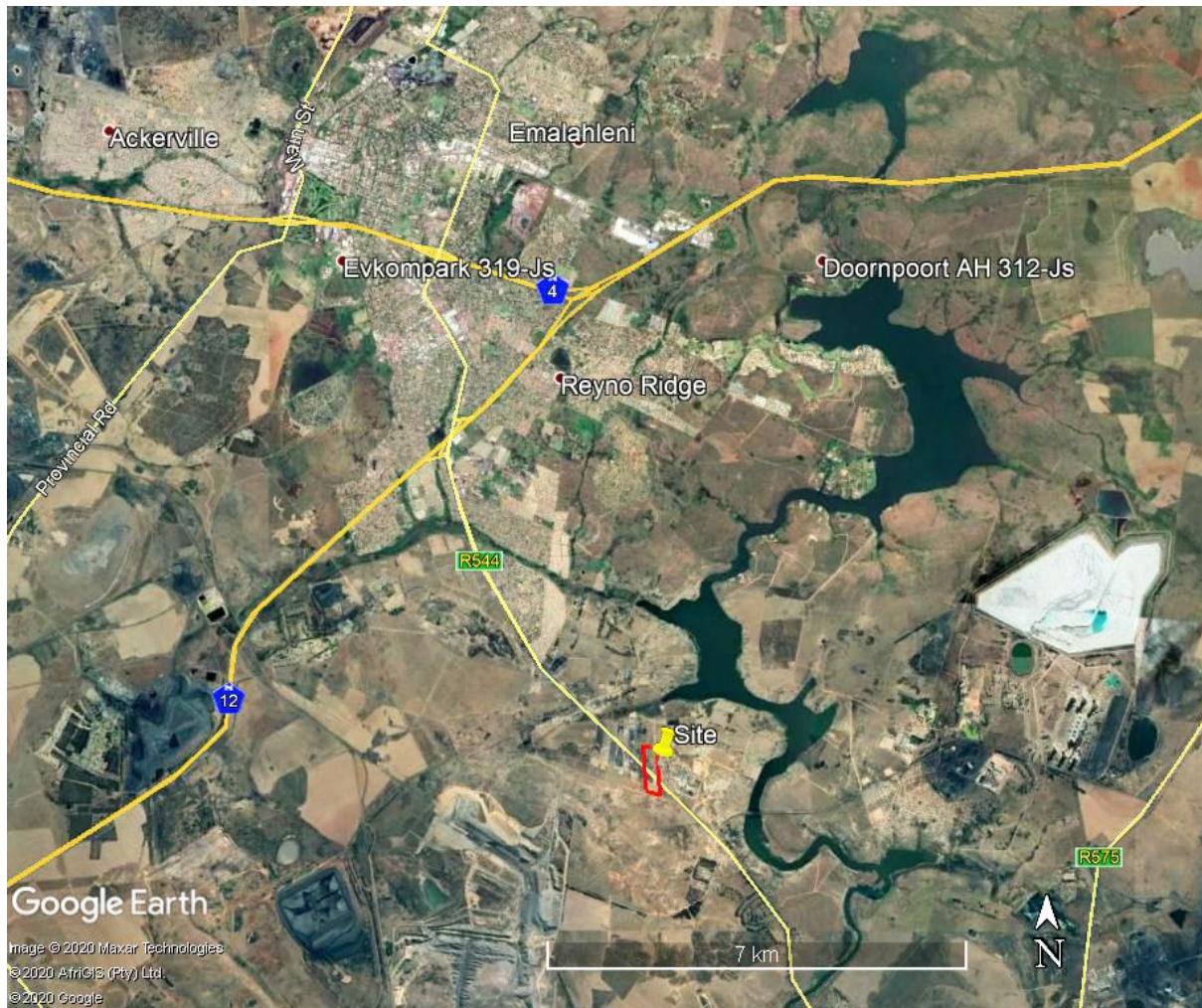


Figure 1 Map with an indication of the location of the site.

Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2019).

Gm 12 Eastern Highveld Grassland

Distribution: In South Africa the Eastern Highveld Grassland (Gm 12) is found in the Mpumalanga and Gauteng Provinces: Plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. Altitude 1520-1780 m, but also as low as 1300 m (Mucina & Rutherford 2006).

Vegetation and landscape features: Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp. *lycioides*, *Parinari capensis*, *Protea caffra*, *Protea welwitschii* and *Searsia magalismsontanum*).

Geology and soils: Red and yellow sandy soils found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup) (Mucina & Rutherford 2006).

Climate: Climate is characterized by strongly seasonal summer-rainfall, with very dry winters. Mean annual precipitation is 650 - 900 mm, (overall average 726 mm). Incidence of frost from 13 – 42 days, but higher at higher elevations (Mucina & Rutherford 2006).

Important taxa of the Eastern Highveld Grassland listed by Mucina & Rutherford (2006):
Graminoids: *Aristida aequiglumis*, *Aristida congesta*, *Aristida junciformis* subsp. *galpinii*, *Brachiaria serrata*, *Cynodon dactylon*, *Digitaria monodactyla*, *Digitaria tricholaenoides*, *Elionurus muticus*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Eragrostis plana*, *Eragrostis racemosa*, *Eragrostis sclerantha*, *Heteropogon contortus*, *Loudetia simplex*, *Michrochloa caffra*, *Monocymbium cerasiiforme*, *Setaria sphacelata*, *Sporobolus africanus*, *Sporobolus pectinatus*, *Themeda triandra*, *Trachypogon spicatus*, *Tristachya leucothrix*, *Tristachya rehmannii*, *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon appendiculatus*, *Andropogon schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplexans*, *Eragrostis capensis*, *Eragrostis gummiflua*, *Eragrostis patentissima*, *Harpochloa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*. Herbs: *Berkheya setifera*, *Haplocarpha scaposa*, *Justicia anagaloides*, *Pelargonium luridum*, *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii*, *Euryops transvaalensis* subsp. *setilobus*, *Helichrysum aureonitens*, *Helichrysum caespitium*, *Helichrysum callicomum*, *Helichrysum oreophilum*, *Helichrysum rugulosum*, *Ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*. Geophytic Herbs: *Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*,

Ledebouria ovatifolia. Succulent Herb: *Aloe ecklonis*. Low Shrubs: *Anthospermum rigidum* subsp. *pumilum*, *Seriphium plumosum*.

Note that many, but *not* all of the above plant species occur at the site.

3 METHODS

A desktop study comprised not only an initial phase, but also it was used throughout the study to accommodate and integrate all the data that become available during the field observations.

Surveys in the larger area and at the site by R.F. Terblanche took place during 10-11 March 2020 to note key elements of habitats on the site, relevant to the conservation of fauna and flora. The main purpose of the site visits was ultimately to serve as a habitat survey that concentrated on the possible presence or not of threatened species and other species of high conservation priority.

The following sections highlight the materials and methods applicable to different aspects that were observed.

3.1 HABITAT CHARACTERISTICS AND VEGETATION

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/physiognomy) as well as floristic composition. Voucher specimens of plant species were only taken where the taxonomy was in doubt and where the plant specimens were of significant relevance for invertebrate conservation. Field guides such as those by Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997) were used to confirm the taxonomy of the species. Works on specific plant groups (often genera) such as those by Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006) and Van Wyk & Smith (2003) were also consulted to confirm the identification of species. In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification. For the most recent treatise of scientific plant names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) were followed to compile the lists of species.

3.2 MAMMALS

Mammals were noted as sight records by day. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner & Chimimba (2005), Cillié, Oberprieler and Joubert (2004) and Apps (2000) are consulted. Sites have been walked, covering as many

habitats as possible. Signs of the presence of mammal species, such as calls of animals, animal tracks (spoor), burrows, runways, nests and faeces were recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) were consulted for additional information and for the identification of spoor and signs. Trapping was not done since it proved not necessary in the case of this study. Habitat characteristics were also surveyed to note potential occurrences of mammals. Many mammals can be identified from field sightings but some bats, rodents and shrews can only be reliably identified in the hand, and even then some species needs examination of skulls, or even chromosomes (Apps, 2000).

3.3 BIRDS

Birds were noted as sight records, mainly with the aid of binoculars (10x30). Nearby bird calls of which the observer was sure of the identity were also recorded. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Ryan (2001) is followed. For information on identification, biogeography and ecology Barnes (2000), Hockey, Dean & Ryan, P.G. (2005), Cillié, Oberprieler & Joubert (2004), Tarboton & Erasmus (1998) and Chittenden (2007) were consulted. Ringing of birds fell beyond the scope of this survey and was not deemed necessary. The site has been walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests have additionally been recorded. Habitat characteristics were surveyed to note potential occurrences of birds.

3.4 REPTILES

Reptiles were noted as sight records in the field. Binoculars (10x30) can also be used for identifying reptiles of which some are wary. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques, Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers (2014), Branch (1998), Marais (2004), Alexander & Marais (2007) and Cillié, Oberprieler and Joubert (2004) were followed. Sites were walked, covering as many habitats as possible. Smaller reptiles are sometimes collected for identification, but this practice was not necessary in the case of this study. Habitat characteristics were surveyed to note potential occurrences of reptiles.

3.5 AMPHIBIANS

Frogs and toads are noted as sight records in the field or by their calls. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Carruthers (2001), Du Preez (1996), Conradie, Du Preez, Smith & Weldon (2006) and the recent complete guide by Du Preez & Carruthers (2009) are consulted. CD's with frog calls by

Carruthers (2001) and Du Preez & Carruthers (2009) are used to identify species by their calls when applicable. Sites are walked, covering as many habitats as possible. Smaller frogs are often collected by pitfall traps put out for epigeal invertebrates (on the soil), but this practice falls beyond the scope of this survey. Habitat characteristics are also surveyed to note potential occurrences of amphibians.

3.6 BUTTERFLIES

Butterflies were noted as sight records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt. Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides*, *Chrysoritis*, *Eriksonia*, *Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deutschländer & Bredenkamp, 1999; Terblanche, Morghental & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies were therefore also recorded. After the visits to the site and the identification of the butterflies found there, a list was also compiled of butterflies that will most probably be found in the area in all the other seasons because of suitable habitat. The emphasis is on a habitat survey.

3.7 FRUIT CHAFER BEETLES

Different habitat types in the areas were explored for any sensitive or special fruit chafer species. Selection of methods to find fruit chafers depends on the different types of habitat present and the species that may be present. Fruit bait traps would probably not be successful for capturing *Ichneustoma* species in a grassland patch (Holm & Marais 1992). Possible chafer beetles of high conservation priority were noted as sight records accompanied by the collecting of voucher specimens with grass nets or containers where deemed necessary.

3.8 MYGALOMORPH SPIDERS AND ROCK SCORPIONS

Relatively homogenous habitat / vegetation areas were identified and explored to identify any sensitive or special species. Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. The area was searched for possible signs of trap door spiders or other mygalomorph spiders (for example traces of wafer-lids, cork-lids or silk-lined burrows). Investigations by brushing the soil surface with a small

broom/paint brush, scraping or digging into the soil with a spade, were made. All the above actions were accompanied by the least disturbance possible.

3.9 LIMITATIONS

For each site visited, it should be emphasized that surveys can by no means result in an exhaustive list of the plants and animals present on the site, because of the time constraint. The site survey was conducted during March 2020 which include an optimal time of the year to find or identify many of the habitat sensitive plant and animal species of high conservation priority. Weather conditions during the survey were favourable for recording fauna and flora. The focus of the survey remains a habitat survey that concentrates on the possibility that species of particular conservation priority occur on the site or not. It is unlikely that more surveys would alter the outcome of this study.

4 RESULTS

4.1 HABITAT AND VEGETATION CHARACTERISTICS

Table 4.1 Outline of main landscape and habitat characteristics of the site.

HABITAT FEATURE	DESCRIPTION
Topography	Moderate slopes, gentle slopes and flat terrain.
Rockiness	Rocky ridges and outcrops are absent at the site.
Presence of wetlands	Wetlands and rivers are absent at the site. Some shallow, narrow small ditches have been dug in the past.
Broad overview of vegetation	<p>Site is characterised by ecologically disturbed vegetation where hitherto scraped areas, areas that were cultivated in the past, footpaths and tracks are found. Patches of mostly secondary grassland with indigenous plant species remain in some areas. An area with with conspicuous high cover of alien invasive Australian <i>Acacia</i> trees is found in the northwestern corner of the site. <i>Eucalyptus</i> species (Gum Trees), <i>Pinus</i> species (Pines) occur at parts of the site.</p> <p>Indigenous grass species at grassland patches include <i>Eragrostis chloromelas</i>, <i>Eragrostis gummiflua</i>, <i>Pogonarthria squarrosa</i>, <i>Cynodon dactylon</i>, <i>Melinis repens</i>, <i>Aristida congesta</i>, <i>Aristida canescens</i>, <i>Urochloa mosambicensis</i>, <i>Urochloa panicoides</i>, <i>Elionurus muticus</i>, <i>Hyparrhenia hirta</i>, <i>Perotis patens</i> and <i>Schizachyrium sanguineum</i>. Indigenous herbaceous plant species such as <i>Polydora poskeana</i>, <i>Helichrysum nudifolium</i>, <i>Helichrysum rugulosum</i>, <i>Pollichia campestris</i>, <i>Chamaecrista mimosoides</i>, <i>Ipomoea crassipes</i>, <i>Kohautia amatymbica</i>, <i>Selago densiflora</i>, <i>Hilliardiella oligocephala</i> and <i>Cleome maculata</i>.</p> <p>Numerous alien invasive weeds are present at the site that include <i>Richardia brasiliensis</i>, <i>Schkuhria pinnata</i>, <i>Tagetes minuta</i>, <i>Bidens</i> species, <i>Conyza</i> species, <i>Datura</i> species, exotic <i>Verbena</i> species, <i>Plantago lanceolata</i> and <i>Solanum sisymbriifolium</i>.</p>
Signs of disturbances	Hitherto cleared areas, previously cultivated areas, footpaths, dirt roads and a tar road are present at the site. A pylon strip runs through the southern part of the site. There are extensively transformed areas at the site. Various alien invasive herbaceous weeds as well as areas with conspicuous cover of alien invasive trees reflect human induced ecological disturbances at the site.
Connectivity of natural vegetation in the site and between the site and surrounding areas	There is little scope for the site to be part of a corridor of particular conservation importance.



Photo 1 View of part of the site north of the R544 road. Trees visible in the picture are alien invasive *Eucalyptus camaldulensis* (Red Gum).
Photo: R.F. Terblanche.



Photo 2 View of part of the site south of the R544 road.
Photo: R.F. Terblanche



Photo 3 View of the site and eastern boundary of the site north of the R544 road.
Photo: R.F. Terblanche.



Photo 4 View of hitherto cleared area at the site north of the R544 road.
Photo: R.F. Terblanche



Photo 5 View from the site towards the eastern boundary of the site and beyond to areas adjacent to the site.

Photo: R.F. Terblanche.



Photo 6 Alien invasive Australian *Acacia* species are present at the northwestern part of the site.

Photo: R.F. Terblanche



Photo 7 Indigenous grass species *Eragrostis gummiiflua*, at the site.
Photo: R.F. Terblanche.



Photo 8 Inflorescence of indigenous grass species, *Pogonarthria squarrosa*, at the site.
Photo: R.F. Terblanche



Photo 9 *Seriphium plumosum* (Bankrupt Bush) at the site.
Photo: R.F. Terblanche.



Photo 10 *Polydora poskeana*, an herbaceous species often found at areas where soil has been disturbed, at the site.
Photo: R.F. Terblanche



Photo 11 Alien invasive *Solanum sisymbriifolium* at the site.
Photo: R.F. Terblanche.



Photo 12 Alien invasive *Richardia brasiliensis*, at the site.
Photo: R.F. Terblanche



Photo 13 Alien invasive *Tagetes minuta*, at the site.
Photo: R.F. Terblanche.



Photo 14 The widespread butterfly species, *Lampides boeticus* (Pea Blue), feeding on nectar from a flower of *Polydora poskeana* at the site.
Photo: R.F. Terblanche

4.2 ASSESSMENT OF PLANT SPECIES OF PARTICULAR CONSERVATION PRIORITY

Plant species of the Mpumalanga Province of high conservation priority which were extracted from Raimondo *et al.* (2009) and updated versions of the Red List of South African Plants (SANBI) are listed in the tables beneath. Many of these plant species could be easily eliminated from occurring in the study area based on habitat type and distributional range by a relatively quick scan to make sure these are not present on the site. For others a habitat surveys during the site visits confirm likely presence or absence.

Table 4.2 Threatened plant species of the Mpumalanga Province that are listed in the **Critically Endangered** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Adenium swazicum</i>	Critically Endangered	No
<i>Aloe craibii</i>	Critically Endangered	No
<i>Aloe simii</i>	Critically Endangered	No
<i>Dioscorea sp. nov.</i>	Critically Endangered	No
<i>Encephalartos cupidus</i>	Critically Endangered	No
<i>Encephalartos heenanii</i>	Critically Endangered	No
<i>Encephalartos laevifolius</i>	Critically Endangered	No
<i>Encephalartos middelburgensis</i>	Critically Endangered	No
<i>Holothrix culveri</i>	Critically Endangered	No
<i>Oberonia disticha</i>	Critically Endangered	No
<i>Protea roupelliae</i> subsp. <i>hamiltonii</i>	Critically Endangered	No
<i>Siphonochilus aethiopicus</i>	Critically Endangered	No

Table 4.3 Threatened plant species of the Mpumalanga Province that are listed in the **Endangered** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Acacia ebutsiniorum</i>	Endangered	No
<i>Adenia wilmsii</i>	Endangered	No
<i>Alepidea basinuda</i> var. <i>subnuda</i>	Endangered	No
<i>Argyrobium muddii</i>	Endangered	No
<i>Asparagus fractiflexus</i>	Endangered	No
<i>Asparagus sekukuniensis</i>	Endangered	No
<i>Disa clavicornis</i>	Endangered	No
<i>Disa vigilans</i>	Endangered	No
<i>Disa zuluensis</i>	Endangered	No
<i>Encephalartos lebomboensis</i>	Endangered	No
<i>Erica rivularis</i>	Endangered	No
<i>Eriosema naviculare</i>	Endangered	No
<i>Frithia humilis</i>	Endangered	No
<i>Gerbera aurantiaca</i>	Endangered	No
<i>Gladiolus cataractarum</i>	Endangered	No
<i>Haworthia koelmaniorum</i> var. <i>mcmurtryi</i>	Endangered	No
<i>Helichrysum leslei</i>	Endangered	No
<i>Helichrysum summo-montanum</i>	Endangered	No
<i>Ledebouria galpinii</i>	Endangered	No
<i>Leucospermum saxosum</i>	Endangered	No
<i>Morella microbracteata</i>	Endangered	No
<i>Ocotea bullata</i>	Endangered	No
<i>Ophioglossum gracillimum</i>	Endangered	No
<i>Pavetta zeyheri</i> subsp. <i>microlancea</i>	Endangered	No
<i>Platycoryne mediocris</i>	Endangered	No
<i>Plinthus rehmannii</i>	Endangered	No
<i>Streptocarpus</i> sp. nov.	Endangered	No
<i>Syncolostemon incanus</i>	Endangered	No
<i>Warburgia salutaris</i>	Endangered	No

Table 4.4 Threatened (= red listed) plant species of the Mpumalanga Province that are listed in the **Vulnerable** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Alepidea amatymbica</i>	Vulnerable	No
<i>Aloe challsii</i>	Vulnerable	No
<i>Aloe chortolirioides</i> var. <i>chortolirioides</i>	Vulnerable	No
<i>Aloe integra</i>	Vulnerable	No
<i>Aloe kniphofioides</i>	Vulnerable	No
<i>Aloe modesta</i>	Vulnerable	No
<i>Anacampseros subnuda</i> subsp. <i>lubbersii</i>	Vulnerable	No
<i>Asclepias dissona</i>	Vulnerable	No
<i>Asclepias velutina</i>	Vulnerable	No
<i>Asparagus fourei</i>	Vulnerable	No
<i>Aspidoglossum xanthosphaerum</i>	Vulnerable	No
<i>Aspidonepsis shebae</i>	Vulnerable	No
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Vulnerable	No
<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i>	Vulnerable	No
<i>Brachystelma dyeri</i>	Vulnerable	No
<i>Brachystelma longifolium</i>	Vulnerable	No
<i>Caesalpinia rostrata</i>	Vulnerable	No
<i>Clivia miniata</i>	Vulnerable	No
<i>Corpuscularia angustipetala</i>	Vulnerable	No
<i>Crassula setulosa</i> var. <i>deminuta</i>	Vulnerable	No
<i>Crocasmia mathewsiana</i>	Vulnerable	No
<i>Crotalaria monophylla</i>	Vulnerable	No
<i>Cyphia bolusii</i>	Vulnerable	No
<i>Cyrtanthus eucallus</i>	Vulnerable	No
<i>Delosperma deilanthoides</i>	Vulnerable	No
<i>Disa alticola</i>	Vulnerable	No
<i>Disa amoena</i>	Vulnerable	No
<i>Dioscorea sylvatica</i>	Vulnerable	No
<i>Dracosciadium italaе</i>	Vulnerable	No
<i>Drimiopsis davidsoniae</i>	Vulnerable	No
<i>Dyschoriste perrottetii</i>	Vulnerable	No
<i>Encephalartos humilis</i>	Vulnerable	No
<i>Encephalartos lanatus</i>	Vulnerable	No

<i>Encephalartos paucidentatus</i>	Vulnerable	No
<i>Erica subverticillaris</i>	Vulnerable	No
<i>Eucomis vandermerwei</i>	Vulnerable	No
<i>Gladiolus malvinus</i>	Vulnerable	No
<i>Gnidia variabilis</i>	Vulnerable	No
<i>Graderia linearifolia</i>	Vulnerable	No
<i>Haworthia koelmaniorum</i> var. <i>koelmaniorum</i>	Vulnerable	No
<i>Haworthia limifolia</i>	Vulnerable	No
<i>Helichrysum aureum</i> var. <i>argenteum</i>	Vulnerable	No
<i>Hesperantha saxicola</i>	Vulnerable	No
<i>Hypodematium crenatum</i> var. <i>crenatum</i>	Vulnerable	No
<i>Hypoxis patula</i>	Vulnerable	No
<i>Indigofera hybrida</i>	Vulnerable	No
<i>Isoetes aequinoctialis</i>	Vulnerable	No
<i>Khadia carolinensis</i>	Vulnerable	No
<i>Knowltonia transvaalensis</i> var. <i>filifolia</i>	Vulnerable	No
<i>Ledebouria mokobulalensis</i>	Vulnerable	No
<i>Lotononis difformis</i>	Vulnerable	No
<i>Melanospermum italaе</i>	Vulnerable	No
<i>Miraglossum davyi</i>	Vulnerable	No
<i>Monopsis kowynensis</i>	Vulnerable	No
<i>Nerine platypetala</i>	Vulnerable	No
<i>Ocotea kenyensis</i>	Vulnerable	No
<i>Oxalis davvana</i>	Vulnerable	No
<i>Ozoroa barbertonensis</i>	Vulnerable	No
<i>Pachycarpus suaveolens</i>	Vulnerable	No
<i>Paersonia hirsuta</i>	Vulnerable	No
<i>Protea curvata</i>	Vulnerable	No
<i>Protea laetans</i>	Vulnerable	No
<i>Protea subvestita</i>	Vulnerable	No
<i>Prunus africana</i>	Vulnerable	No
<i>Rhyncosia rogersii</i>	Vulnerable	No
<i>Sclerochiton triancanthus</i>	Vulnerable	No
<i>Searsia pygmaea</i>	Vulnerable	No
<i>Senecio triodontiphyllus</i>	Vulnerable	No
<i>Streptocarpus cyaneus</i>	Vulnerable	No
<i>Streptocarpus denticulatus</i>	Vulnerable	No
<i>Streptocarpus fasciatus</i>	Vulnerable	No
<i>Streptocarpus fenestra-dei</i>	Vulnerable	No
<i>Streptocarpus hilburtianus</i>	Vulnerable	No

<i>Streptocarpus occultis</i>	Vulnerable	No
<i>Thorncroftia lotterii</i>	Vulnerable	No
<i>Thorncroftia thorncroftii</i>	Vulnerable	No
<i>Tulbaghia coddii</i>	Vulnerable	No
<i>Zantedeschia pentlandii</i>	Vulnerable	No

Table 4.5 Near Threatened plant species of the Mpumalanga Province. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status:	Resident at the site
	Global status or national status indicated	
<i>Adenia fruticosa</i> subsp. <i>fruticosa</i>	Near Threatened	No
<i>Alepidea attenuata</i>	Near Threatened	No
<i>Aloe albida</i>	Near Threatened	No
<i>Aloe reitzii</i> var. <i>reitzii</i>	Near Threatened	No
<i>Aloe thorncroftii</i>	Near Threatened	No
<i>Argyrobium megarrhizum</i>	Near Threatened	No
<i>Cineraria austrotransvaalensis</i>	Near Threatened	No
<i>Clivia caulescens</i>	Near Threatened	No
<i>Curtisia dentata</i>	Near Threatened	No
<i>Delosperma leendertziae</i>	Near Threatened	No
<i>Disa extingtoria</i>	Near Threatened	No
<i>Disa maculomarronina</i>	Near Threatened	No
<i>Drimia sanguinea</i>	Near Threatened	No
<i>Elaeodendron transvaalense</i>	Near Threatened	No
<i>Erica atherstonei</i>	Near Threatened	No
<i>Eucomis pallidiflora</i> subsp. <i>pole-evansii</i>	Near Threatened	No
<i>Gasteria batesiana</i> var. <i>batesiana</i>	Near Threatened	No
<i>Gladiolus robertsoniae</i>	Near Threatened	No
<i>Habenaria barbertoni</i>	Near Threatened	No
<i>Habenaria bicolor</i>	Near Threatened	No
<i>Habenaria kraenzliniana</i>	Near Threatened	No
<i>Isoetes transvaalensis</i>	Near Threatened	No
<i>Isoetes welwitchii</i>	Near Threatened	No
<i>Jamesbrittenia macrantha</i>	Near Threatened	No
<i>Kniphofia typhoides</i>	Near Threatened	No
<i>Leucospermum gerrardii</i>	Near Threatened	No
<i>Lithops leslei</i> subsp. <i>leslei</i>	Near Threatened	No
<i>Lydenburgia cassinoides</i>	Near threatened	No

<i>Merwillia plumbea</i>	Near Threatened	No
<i>Nerine gracilis</i>	Near Threatened	No
<i>Protea comptonii</i>	Near Threatened	No
<i>Protea parvula</i>	Near Threatened	No
<i>Riocreuxia aberrans</i>	Near Threatened	No
<i>Trachyandra erythrorrhiza</i>	Near Threatened	No
<i>Urginea lydenburgensis</i>	Near Threatened	No

Table 4.6 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Critically Rare** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Blepharis fenestralis</i>	Critically Rare	No
<i>Euclea dewinteri</i>	Critically Rare	No

Table 4.7 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Rare** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Aloe hardyi</i>	Rare	No
<i>Barleria oxyphylla</i>	Rare	No
<i>Berkheya coddii</i>	Rare	No
<i>Bowkeria citrina</i>	Rare	No
<i>Brachystelma remotum</i>	Rare	No
<i>Brachystelma stellatum</i>	Rare	No
<i>Brachystelma villosum</i>	Rare	No
<i>Combretum petrophilum</i>	Rare	No
<i>Dicoma swazilandica</i>	Rare	No
<i>Dracaena transvaalensis</i>	Rare	No
<i>Euphorbia sekukuniensis</i>	Rare	No
<i>Faurea macnaughtonii</i>	Rare	No
<i>Gladiolus pardalinus</i>	Rare	No
<i>Gladiolus pole-evansii</i>	Rare	No
<i>Gladiolus rufomarginatus</i>	Rare	No
<i>Gladiolus saxatilis</i>	Rare	No
<i>Gladiolus serpenticola</i>	Rare	No
<i>Gymnosporia devenishii</i>	Rare	No
<i>Haemanthus pauculifolius</i>	Rare	No

<i>Helichrysum calocephalum</i>	Rare	No
<i>Helichrysum ephelos</i>	Rare	No
<i>Helichrysum homilochrysum</i>	Rare	No
<i>Hesperantha brevicaulis</i>	Rare	No
<i>Indigofera amitina</i>	Rare	No
<i>Khadia alticola</i>	Rare	No
<i>Kniphofia triangularis</i> subsp. <i>obtusiloba</i>	Rare	No
<i>Ledebouria cremnophila</i>	Rare	No
<i>Lobelia trullifolia</i> subsp. <i>delicatula</i>	Rare	No
<i>Lotononis amajubica</i>	Rare	No
<i>Nesaea alata</i>	Rare	No
<i>Pelargonium album</i>	Rare	No
<i>Rhoicissus laetans</i>	Rare	No
<i>Satyrium microrrhynchum</i>	Rare	No
<i>Schizochilus cecilii</i> subsp. <i>culveri</i>	Rare	No
<i>Schizochilus lilacinus</i>	Rare	No
<i>Searsia dracomontana</i>	Rare	No
<i>Selago longicalyx</i>	Rare	No
<i>Senecio hederiformis</i>	Rare	No
<i>Streptocarpus decipiens</i>	Rare	No
<i>Streptocarpus latens</i>	Rare	No
<i>Streptocarpus pogonites</i>	Rare	No
<i>Syncolostemon stalmansii</i>	Rare	No
<i>Thorncroftia longiflora</i>	Rare	No
<i>Woodia singularis</i>	Rare	No

Table 4.8 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Declining** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009) and updated versions (SANBI). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Acridocarpus natalitius</i>	Declining	No
<i>Adenia gummifera</i> subsp. <i>gummifera</i>	Declining	No
<i>Aloe cooperi</i> subsp. <i>cooperi</i>	Declining	No
<i>Ansellia africana</i>	Declining	No
<i>Balanites maughamii</i>	Declining	No
<i>Boophone disticha</i>	Declining	No
<i>Callilepis leptophylla</i>	Declining	No
<i>Cassipourea malosana</i>	Declining	No
<i>Crinum bulbispermum</i>	Declining	No
<i>Crinum macowanii</i>	Declining	No

<i>Crinum stuhlmanii</i>	Declining	No
<i>Cryptocarya transvaalensis</i>	Declining	No
<i>Cyathea capensis</i> var. <i>capensis</i>	Declining	No
<i>Drimia altissima</i>	Declining	No
<i>Elaeodendron croceum</i>	Declining	No
<i>Eucomis autumnalis</i>	Declining	No
<i>Eucomis montana</i>	Declining	No
<i>Eulophia speciosa</i>	Declining	No
<i>Gunnera perpensa</i>	Declining	No
<i>Hypoxis hemerocallidea</i>	Declining	No
<i>Ilex mitis</i>	Declining	No
<i>Pelargonium sidoides</i>	Declining	No
<i>Pterocelastrus rostratus</i>	Declining	No
<i>Rapanea melanophloeos</i>	Declining	No
<i>Sandersonia aurantiaca</i>	Declining	No

Table 4.9 Plant species of the Mpumalanga Province of which the conservation status is uncertain owing to a lack of information and which are listed in the **Data Deficient** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Aspidoglossum demissum</i>	Data Deficient	No
<i>Ceropegia distincta</i> subsp. <i>verruculosa</i>	Data Deficient	No
<i>Ceropegia scabriflora</i>	Data Deficient	No
<i>Cleome schlechteri</i>	Data Deficient	No
<i>Colchicum swazicum</i>	Data deficient	No
<i>Cephalaria amerioides</i>	Data Deficient	No
<i>Delosperma annulare</i>	Data Deficient	No
<i>Delosperma rileyi</i>	Data Deficient	No
<i>Delosperma zeederbergii</i>	Data Deficient	No
<i>Eulophia chlorantha</i>	Data deficient	No
<i>Euryops discoideus</i>	Data Deficient	No
<i>Hesperantha rupestris</i>	Data Deficient	No
<i>Kalanchoe alticola</i>	Data Deficient	No
<i>Ledebouria parvifolia</i>	Data Deficient	No
<i>Pentatrichia alata</i>	Data Deficient	No
<i>Plectranthus esculentus</i>	Data Deficient	No
<i>Senecio eminens</i>	Data Deficient	No
<i>Senecio latissimifolius</i>	Data Deficient	No
<i>Thesium subsimile</i>	Data Deficient	No

Table 4.10 Tree species of the Mpumalanga Province which are listed as **Protected Species** under the National Forests Act No. 84 of 1998, Section 51(1) and could possibly occur in the area. No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Conservation status	Resident at the site
<i>Boscia albitrunca</i> (Shepherd's tree)	Protected	No
<i>Combretum imberbe</i> (Leadwood)	Protected	No
<i>Sclerocarya birrea</i> (Marula)	Protected	No

4.3 ASSESSMENT OF VERTEBRATE SPECIES OF PARTICULAR CONSERVATION PRIORITY

Table 4.11 Threatened, Endangered mammal species of the Mpumalanga Province. Main source: Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert (2016) with updates by several authors per species. With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status (Regional)	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Cloeotis percivali</i> Short-eared Trident Bat	Endangered	No	No
<i>Diceros bicornis</i> Black Rhinoceros	Endangered	No	No
<i>Lycaon pictus</i> African Wild Dog	Endangered	No	No
<i>Neamblysomus julianae</i> Juliana's Golden Mole	Endangered	No	No
<i>Redunca fulvorufula fulvorufula</i> Southern Mountain Reedbuck	Endangered	No	No

Table 4.12 Threatened, Vulnerable mammal species of the Mpumalanga Province. Main source: Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert (2016) with updates by several authors per species. With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status (Regional)	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Acinonyx jubatus</i> Cheetah	Vulnerable	No	No
<i>Felis nigripes</i> Black-footed Cat	Vulnerable	No	No
<i>Hydrictis maculicollis</i> Spotted-necked Otter	Vulnerable	No	No
<i>Mystromys albicaudatus</i> White-tailed Rat	Vulnerable	No	No
<i>Panthera pardus</i> Leopard	Vulnerable	No	No
<i>Smutsia temminckii</i> Temminck's Ground Pangolin	Vulnerable	No	No

Table 4.13 Near Threatened mammal species of the Mpumalanga Province. Main source: Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert (2016) with updates by several authors per species. With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status (Regional)	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Amblysomus septentrionalis</i> Highveld Golden Mole	Near Threatened	No	No
<i>Aonyx capensis</i> Cape Clawless Otter	Near Threatened	No	No
<i>Atelerix frontalis</i> Southern African Hedgehog	Near Threatened	No	No

<i>Ceratotherium simum simum</i> Southern White Rhinoceros	Near Threatened	No	No
<i>Crocuta crocuta</i> Spotted Hyaena	Near Threatened	No	No
<i>Leptailurus serval</i> Serval	Near Threatened	No	No
<i>Parahyaena brunnea</i> Brown Hyaena	Near Threatened	No	No
<i>Pelea capreolus</i> Grey Rhebok	Near Threatened	No	No
<i>Poecilogale albinucha</i> African Striped Weasel	Near Threatened	No	No

4.2.1 Birds of particular high conservation priority

Table 4.14 Bird species of particular conservation concern in the Mpumalanga Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Bird species is not a resident at the site. Yes = Bird species is a resident at the site.

Species	Common name	Red Listed Status	Recorded at site during survey	Likelihood of residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Aegypius occipitalis</i>	White-headed Vulture	Vulnerable	No	Unlikely, may be visitor
<i>Aegypius tracheliotos</i>	Lappet-faced Vulture	Vulnerable	No	Unlikely, may be visitor
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near-threatened	No	Unlikely
<i>Anastomus lamelligerus</i>	African Openbill	Near-threatened	No	Unlikely
<i>Anthropoides paradiseus</i>	Blue Crane	Vulnerable	No	Highly unlikely
<i>Anthus chloris</i>	Yellow-breasted Pipit	Vulnerable (Globally)	No	Unlikely
<i>Apalis ruddi</i>	Rudd's Apalis	Near-threatened	No	Unlikely
<i>Aquila ayresii</i>	Ayres's Hawk-Eagle	Near-threatened	No	Unlikely

Species	Common name	Red Listed Status	Recorded at site during survey	Likelihood of residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Aquila rapax</i>	Tawny Eagle	Vulnerable	No	Unlikely
<i>Ardeotis kori</i>	Kori Bustard	Vulnerable	No	Highly unlikely
<i>Balearica regulorum</i>	Grey Crowned Crane (Mahem)	Vulnerable	No	Unlikely
<i>Bucorvis leadbeateri</i>	Southern Ground-hornbill	Vulnerable (in South Africa)	No	Unlikely
<i>Bugeranus carunculatus</i>	Wattled Crane	Vulnerable (Globally) Critically Endangered (RSA)	No	Highly unlikely
<i>Buphagus africanus</i>	Yellow-billed Oxpecker	Vulnerable	No	Unlikely
<i>Buphagus erythrorhynchus</i>	Red-Billed Oxpecker	Near-threatened	No	Unlikely
<i>Centropus grillii</i>	Black Coucal	Near-threatened	No	Unlikely
<i>Charadrius pallidus</i>	Chestnut-banded Plover	Near-threatened	No	Unlikely
<i>Ciconia nigra</i>	Black Stork	Near-threatened	No	Unlikely
<i>Circus macrourus</i>	Pallid Harrier	Near-threatened	No	Unlikely
<i>Circus ranivorus</i>	African Marsh- Harrier	Vulnerable	No	Unlikely
<i>Crex crex</i>	Corn Crake	Vulnerable	No	Unlikely
<i>Ephippiorynchus senegalensis</i>	Saddle-billed Stork	Endangered (in RSA)	No	Unlikely
<i>Eupodotis caerulescens</i>	Blue Korhaan	Near-threatened	No	Highly unlikely
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable	No	Highly unlikely
<i>Falco biarmicus</i>	Lanner Falcon	Near-threatened	No	Unlikely
<i>Falco naumanni</i>	Lesser Kestrel	Vulnerable	No	Unlikely

Species	Common name	Red Listed Status	Recorded at site during survey	Likelihood of residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Falco peregrinus</i>	Peregrine Falcon	Near-threatened	No	Unlikely
<i>Geronticus calvus</i>	Southern Bald Ibis	Vulnerable	No	Unlikely
<i>Glareola pranticola</i>	Collared Pranticole	Near-threatened	No	Unlikely
<i>Gorsachius leuconotus</i>	White-backed Night-heron	Vulnerable	No	Unlikely
<i>Gyps africanus</i>	White-backed Vulture	Vulnerable	No	Unlikely
<i>Gyps coprotheres</i>	Cape Vulture	Vulnerable	No	Unlikely
<i>Heteromirafra ruddi</i>	Rudd's Lark	Critically Endangered (Globally)	No	Unlikely
<i>Hirundo atrocaerulea</i>	Blue Swallow	Critically Endangered (in RSA)	No	Unlikely
<i>Hypargos margaritatus</i>	Pink-throated Twinspot	Near-threatened	No	Unlikely
<i>Lioptilus nigricapillus</i>	Bush Blackcap	Near-threatened	No	Unlikely
<i>Lissotis melanogaster</i>	Black-bellied Bustard	Near-threatened	No	Unlikely
<i>Macheiramphus alcinus</i>	Bat Hawk	Near-threatened	No	Unlikely
<i>Mirafra cheniana</i>	Melodious lark	Near-threatened	No	Highly unlikely
<i>Mycteria ibis</i>	Yellow-billed Stork	Near-threatened	No	Unlikely
<i>Neophron percnopterus</i>	Egyptian Vulture	Regionally almost extinct	No	Unlikely
<i>Neotis denhami</i>	Denham's Bustard	Vulnerable	No	Highly unlikely
<i>Nettapus auritus</i>	African Pygmy-goose	Near-threatened	No	Unlikely
<i>Pelecanus onocrotalus</i>	Great White Pelican	Near-threatened	No	Unlikely

Species	Common name	Red Listed Status	Recorded at site during survey	Likelihood of residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Pelecanus rufescens</i>	Pink-backed Pelican	Vulnerable	No	Unlikely
<i>Phoenicopterus minor</i>	Lesser Flamingo	Near-threatened	No	Unlikely
<i>Phoenicopterus ruber</i>	Greater Flamingo	Near-threatened	No	Unlikely
<i>Platysteira peltata</i>	Black-throated Wattle-eye	Near-threatened	No	Unlikely
<i>Polemaetus bellicosus</i>	Martial Eagle	Vulnerable	No	Unlikely
<i>Rostratula benghalensis</i>	Greater Painted-snipe	Near-threatened	No	Unlikely
<i>Rhynchops flavirostris</i>	African Skimmer	Endangered	No	Unlikely
<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	No	Unlikely
<i>Sarothrura affinis</i>	Striped Flufftail	Vulnerable	No	Unlikely
<i>Sarothrura ayresi</i>	White-winged Flufftail	Critically Endangered	No	Highly unlikely
<i>Schoenicola brevirostris</i>	Broad-tailed Warbler	Near-threatened	No	Unlikely
<i>Scotopelia peli</i>	Pel's Fishing-Owl	Vulnerable	No	Unlikely
<i>Spermestes fringilloides</i>	Magpie Mannikin	Near-threatened	No	Unlikely
<i>Spizocorys fringillaris</i>	Botha's Lark	Endangered (Globally)	No	Highly unlikely
<i>Stephanoaetus coronatus</i>	African Crowned Eagle	Near-threatened	No	Unlikely
<i>Sterna caspia</i>	Caspian Tern	Near-threatened	No	Unlikely
<i>Therathopius ecaudatus</i>	Bateleur	Vulnerable (in southern Africa)	No	Unlikely
<i>Turnix nanus</i>	Black-rumped Buttonquail	Endangered	No	Unlikely
<i>Tyto capensis</i>	African Grass-Owl	Vulnerable	No	Unlikely
<i>Vanellus albiceps</i>	White-crowned Lapwing	Near-threatened	No	Unlikely

Species	Common name	Red Listed Status	Recorded at site during survey	Likelihood of residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Vanellus melanopterus</i>	Black-winged lapwing	Near-threatened	No	Unlikely
<i>Zoothera gurneyi</i>	Orange ground-thrush	Near-threatened	No	Unlikely

4.2.2 Assessments of reptiles of particular high conservation concern in Mpumalanga Province

Table 4.15 Threatened reptile species of the Mpumalanga Province that are listed in the vulnerable category. Main source: Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers (2014).

Species	Common name	Conservation status	Recorded at site during survey	Likelihood of being resident at the site
<i>Crocodylus niloticus</i>	Nile Crocodile	Vulnerable	No	Unlikely
<i>Smaug giganteus</i>	Giant Dragon Lizard	Vulnerable	No	Unlikely
<i>Tetradactylus breyeri</i>	Breyer's Long-tailed Seps	Vulnerable	No	Unlikely

Table 4.16 Near Threatened **reptile** species of the Mpumalanga Province. Main source: Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers (2014).

Species	Common name	Conservation status	Recorded at site during survey	Likelihood to be resident at the site
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	Near Threatened	No	Unlikely
<i>Chamaesaura macrolepis</i>	Large-scaled Grass Lizard	Near Threatened	No	Unlikely
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	Near Threatened	No	Unlikely
<i>Platysaurus orientalis</i> subsp. <i>fitzsimonsi</i>	Fitzsimon's Flat Lizard	Near Threatened	No	Unlikely

4.2.3 Amphibian species of particular high conservation priority

Table 4.17 Threatened amphibian species of the Mpumalanga Province which are listed in the Vulnerable category. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009), Carruthers & Du Preez (2011). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likelihood to be resident at the site
<i>Hemisus guttatus</i>	Spotted Shovel-nosed Frog	Vulnerable	No	Unlikely to be resident.

Table 4.18: Near Threatened **amphibian** species in Mpumalanga Province. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009) and Carruthers & Du Preez (2011). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likelihood to be resident at the site
<i>Strongylopus wageri</i>	Plain Stream Frog	Near Threatened	No	Unlikely to be resident

Table 4.19: Amphibian species of the Mpumalanga Province of which the conservation status is uncertain owing to a lack of information and which are listed in the Data Deficient category. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009) and Carruthers & Du Preez (2011). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likelihood to be resident at the site
<i>Breviceps sopranus</i>	Whistling Rain Frog	Data Deficient	No	Unlikely to be resident

4.3 INVERTEBRATE SPECIES OF PARTICULAR CONSERVATION PRIORITY

4.3.1 Butterflies of particular conservation priority

Table 4.20 Threatened: Globally Critically Endangered butterfly species of the Limpopo and Mpumalanga Provinces combined. Sources: Mecenero *et al.* (2013), Henning, Terblanche & Ball (2009). Invertebrates such as threatened butterfly species are often very habitat specific and residential status implies a unique ecosystem that is at stake.

Species	Red List Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Alaena margaritacea</i> Wolkberg Zulu	Critically Endangered	No	Highly unlikely
<i>Anthene crawshayi juanitae</i> Juanita's Hairtail	Critically Endangered	No	Highly unlikely
<i>Dingana fraterna</i> Stoffberg Widow	Critically Endangered	No	Highly unlikely
<i>Erikssonia edgei</i> * Waterberg Copper	Critically Endangered	No	Highly unlikely

* Formerly this butterfly species has been known as the Waterberg population of *Erikssonia acraeina*. The Waterberg population of *Erikssonia*, known from only one locality, has recently been described as a new species, *Erikssonia edgei* by Gardiner & Terblanche (2010).

Table 4.21 Threatened: Regionally Critically Endangered butterfly species of the Limpopo and Mpumalanga Provinces combined. Sources: Mecenero *et al.* (2013), Henning, Terblanche & Ball (2009).

Species	Red List Status (Global unless stated otherwise)	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Acada biseriata</i> Axehead Orange	Regionally Critically Endangered	No	Highly unlikely
<i>Charaxes guderiana guderiana</i> Blue-spangled Charaxes	Regionally Critically Endangered	No	Highly unlikely

Table 4.22 Threatened: Endangered butterfly species of the Limpopo and Mpumalanga Provinces combined. Sources: Mecenero *et al.* (2013), Henning, Terblanche & Ball (2009).

Species	Red List Status (Global status)	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Aloeides stevensoni</i> Stevenson's Copper	Endangered	No	Highly unlikely
<i>Aloeides barbarae</i> Barbara's Copper	Endangered	No	Highly unlikely
<i>Aloeides nubilus</i> Cloud Copper	Endangered	No	Highly unlikely
<i>Aloeides rossouwi</i> Rossouw's Copper	Endangered	No	Highly unlikely
<i>Chrysoritis aureus</i> Golden Opal/ Heidelberg Opal	Endangered	No	Highly unlikely
<i>Dingana clara</i> Wolkberg Widow	Endangered	No	Highly unlikely
<i>Lepidochrysops irvingi</i> Irving's Blue	Endangered	No	Highly unlikely
<i>Lepidochrysops jefferyi</i> Jeffery's Blue	Endangered	No	Highly unlikely
<i>Lepidochrysops lotana</i> Lotana Blue	Endangered	No	Highly unlikely
<i>Lepidochrysops swanepoeli</i> (Swanepoel's Blue)	Endangered	No	Highly unlikely
<i>Telchinia induna salmontana</i> Soutpansberg Acraea	Endangered	No	Highly unlikely

Table 4.23 Threatened: Vulnerable butterfly species of of the Limpopo and Mpumalanga Provinces combined. Source: Mecenero *et al.* (2013).

Species	Red List Status (Global status)	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Orachrysops violescens</i> Violescent Blue	Vulnerable	No	Highly unlikely

Table 4.24 Near Threatened butterfly species of the Limpopo Province and Mpumalanga Province combined. Source: Mecenero *et al.* (2013).

Species	Red List Status (Global unless stated otherwise)	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility,
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			Unlikely, Highly unlikely
<i>Dingana alaedeus</i> Wakkerstroom Widow	Near Threatened	No	Highly unlikely

Table 4.25 Extremely Rare or Rare butterfly species of the Limpopo and Mpumalanga Provinces combined. Source: Mecenero *et al.* (2013).

Species	Red List Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Anthene minima minima</i> Little Ciliated Blue/ Little Hairtail	Rare (Low density)	No	Unlikely
<i>Charaxes druceanus solitarius</i> Blouberg Silver-barred Charaxes	Rare (Restricted range)	No	Highly unlikely
<i>Charaxes marieps</i> Marieps Charaxes	Rare (Restricted range)	No	Highly unlikely
<i>Charaxes xiphares stauderi</i> Blouberg Forest-king Charaxes	Rare (Restricted range)	No	Highly unlikely
<i>Colotis celimene amina</i> Lilac Tip	Rare (Low density)	No	Unlikely
<i>Dingana jerinae</i> (Kransberg Widow)	Rare (Restricted range)	No	Highly unlikely
<i>Dira swanepoeli isolata</i> Blouberg Widow	Rare (Restricted range)	No	Highly unlikely
<i>Lepidochrysops procera</i> Potchefstroom Blue	Rare (Habitat specialist)	No	Highly unlikely
<i>Metisella meninx</i> Marsh Sylph	Rare (Habitat specialist)	No	Unlikely
<i>Orachrysops regalis</i> Royal Blue	Rare (Habitat specialist)	No	Highly unlikely
<i>Orachrysops warreni</i> Warren's Blue	Extremely Rare	No	Highly unlikely
<i>Papilio ophidicephalus entabeni</i> Entabeni Emperor Swallowtail	Rare (Habitat specialist)	No	Highly unlikely
<i>Papilio ophidicephalus transvaalensis</i> Woodbush Emperor Swallowtail	Rare (Habitat specialist)	No	Highly unlikely
<i>Platylesches dolomitica</i> (Hilltop hopper)	Rare (Low density)	No	Highly unlikely
<i>Serradinga clarki amissivallis</i>	Rare (Restricted range, Habitat specialist)	No	Highly unlikely

Table 4.26 Data deficient butterfly species of the Limpopo and Mpumalanga Provinces combined. Source: Mecenero *et al.* (2013).

Species	Red Listed Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Coenyropsis natalii poetulodes</i>	Data Deficient	No	Highly unlikely
<i>Pseudonympha swanepoeli</i> *	Data Deficient	No	Highly unlikely

* See discussion about taxonomic impediments surrounding *Pseudonympha swanepoeli* in the text. If the Wolkberg population is proved to be a unique taxon it is already Critically Endangered such as assessed by Henning, Terblanche & Ball (2009).

4.3.2 Damselflies of particular conservation priority

Table 4.27 Threatened damselfly species (Odonata: Zygoptera) of Mpumalanga Province (Samways 2006, Samways, Taylor & Tarboton 2005). Invertebrates such as threatened damselfly species are often very habitat specific and residential status implies a unique ecosystem that is at stake.

Species	Common name	Conservation Status	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Pseudagrion newtoni</i>	Harlequin Sprite	Vulnerable	Highly unlikely

4.3.3 Cicadas of particular conservation priority

Table 4.28 Data deficient but possibly highly localised cicada species of the Limpopo Province which is of conservation priority.

Species	Red Listed Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Pycna sylvia</i> Giant Cicada	Data Deficient but possibly has restricted distribution in Sekhukhuneland.	No	Highly unlikely

4.3.4 Beetles of particular conservation priority

Table 4.29 Fruit chafer species (Coleoptera: Scarabaeidae: Cetoninae) in the Limpopo Province which are of known high conservation priority.

Species	Red Listed Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Ichneostoma stobbiai</i>	Uncertain (Some populations maybe endangered: taxonomic difficulties)	No	Highly unlikely
<i>Tmesorhina viridicyanea</i>	Uncertain/ rare	No	Highly unlikely
<i>Trichocephala brincki</i>	Uncertain	No	Highly unlikely

4.3.5 Scorpions of particular conservation importance

Table 4.30 Highly endemic and/ or habitat specific rock scorpion species of Limpopo and Mpumalanga Provinces combined. Main source: Prendini (2001)

Species	Distribution	Conservation Status	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Hadogenes bicolor</i>	Endemic to South Africa (Mpumalanga and Limpopo)	Uncertain. Habitat specialist.	Highly unlikely
<i>Hadogenes longimanus</i>	Endemic to South Africa (Mpumalanga)	Uncertain. Habitat specialist	Highly unlikely
<i>Hadogenes longimanus</i> "Steelpoort specimens"	Specimens from Steelpoort have some different characteristics and may be a different taxon pending further investigations (See Prendini 2001).	Data deficient. Habitat specialist	Highly unlikely

Species	Distribution	Conservation Status	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Hadogenes newlandsi</i>	Conservation status uncertain but species has restricted distribution in Limpopo Province (See Prendini 2001).	Uncertain. Habitat specialist with restricted distribution.	Highly unlikely
<i>Hadogenes troglodytes</i>	Not threatened but regarded as sensitive species with high habitat specificity.	Not threatened (pers. obs.) but clearly lithophilous (rocky habitat specialist)	Highly unlikely

5 DISCUSSION

5.1 HABITAT AND VEGETATION CHARACTERISTICS

An outline of the overall habitat and vegetation characteristics is given in Table 4.1.

5.2 PLANT SPECIES

Assessment of threatened or other high conservation priority plant species

Threatened (critically endangered, endangered and vulnerable), near threatened, critically rare, rare and data deficient plant species in the Mpumalanga Province are listed in Tables 4.2 to 4.9 (extracted from Raimondo *et al.* 2009). None of the above plant species of particular conservation priority have been found at the site.

Protected tree species that could possibly occur in the area are listed in Table 4.10. None of these protected tree species appears to be present at the proposed footprint.

5.3 VERTEBRATES

5.3.1 Mammals

Assessment of threatened or other high conservation priority mammal species

Tables 4.11, 4.12 and 4.13 list the possible presence or absence of threatened, near threatened and data deficient mammal species respectively. Literature sources used are Skinner & Chimimba (2005) and Friedman & Daly (2004). With mammal species which normally needs a large range their residential status does always not imply that they are exclusively dependent on the site or use the site as important shelter or for reproduction. Because the site falls outside large reserves or national parks threatened mammal species such as the black rhinoceros (*Diceros bicornis*), African elephant (*Loxodonta africana*) and the African wild dog (*Lycaon pictus*) are obviously not present. No smaller mammals of particular high conservation significance are likely to be found on the site as well.

5.3.2 Birds

Assessment of threatened or other high conservation priority bird species

Table 4.14 lists the anticipated presence or absence of threatened and near threatened bird species at the site. With bird species which often have a large distributional range, their presence does not imply that they are particularly dependent on a site as breeding location. Literature sources used include Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). For the threatened (vulnerable, endangered, critically endangered) bird species or any other bird species of particular conservation priority (near threatened, data deficient) the site does not appear to form part of any habitat of particular importance.

5.3.3 Reptiles

Assessment of threatened or other high conservation priority reptile species

Table 4.15 and Table 4.16 list the reptile species of conservation concern in the Mpumalanga Province that has been compiled mainly from the Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers (2014). No reptile species that are threatened or any other reptile species of particular conservation priority appear to be present at the site.

5.3.4 Amphibians

Assessment of threatened or other high conservation priority reptile species

Table 4.17, Table 4.18 and Table 4.19 list the frog species of conservation concern from the Mpumalanga Province compiled mainly from Minter, Burger, Harrison, Braack, Bishop and Kloepfer (2004), Du Preez and Carruthers (2009) and Carruthers and Du Preez (2011). Two subspecies of *Breviceps sylvestris* are recognised and both occur in afro-montane forest or northeastern mountain grassland (Du Preez & Carruthers, 2009). Bull Frog (*Pyxicephalus adspersus*) has hitherto been listed as Near Threatened. According to the present IUCN red list *Pyxicephalus adspersus* is listed as Least Concern (IUCN SSC Amphibian Specialist Group, 2013). *Pyxicephalus adspersus* remains a species to be regarded as sensitive. *Pyxicephalus adspersus* could be present at a pan outside the site but within 500 m from the site. The site proposed for the development is unlikely to be a sustainable foraging area for bullfrogs of the pan.

5.4 INVERTEBRATES

5.4.1 Butterflies

Assessment of threatened butterfly species

In terms of conservation status of invertebrates in South Africa butterflies represents the most well studied group and many of the present extinction risk assessments are relatively well refined. Three “red data assessments” have already been conducted on South African butterflies notably that of Henning & Henning (1989), Henning, Terblanche & Ball (2009) and the most recent assessment Mecenero *et al.* (2013), the latter also comprising a butterfly atlas. Studies about the vegetation and habitat of threatened butterfly species in South Africa showed that ecosystems with a unique combination of features are selected by these often localised threatened butterfly species (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

Because the habitat specificity of invertebrates are often less well known and because of recent updates of information, the expected presence or absence of butterfly species of high conservation priority that are listed in Tables 4.20 – 4.26 is outlined beneath.

Threatened: Critically Endangered (global)

Alaena margaritacea (Wolkberg Zulu)

The proposed global red list status for *Alaena margaritacea* according to the most recent IUCN criteria and categories is Critically Endangered (Mecenero *et. al.* 2013). *Alaena margaritacea* is only known from one restricted area in the vicinity of Haenertsburg in the Wolkberg. The secluded colony is found on steep grassy slopes in the Wolkberg with where lichen covered rocks are a crucial part of the habitat (Henning, Terblanche & Ball 2009). Recently a second locality of this butterfly species has been found, also at high altitude at the Wolkberg mountains (A. Coetzer pers. comm.). Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Anthene crawshayi juanitae (Juanita’s Ciliated Blue)

The proposed global red list status for *Anthene crawshayi juanitae* according to the most recent IUCN criteria and categories is Critically Endangered (Mecenero *et al.*, 2013). *Anthene*

juanitae has only recently been rediscovered after for two decades being known from only six specimens from riverine vegetation on the banks of the Olifants River at Manoutsa Park where the butterfly was discovered in 1990 (Henning, Terblanche & Ball 2009). Recently in 2011 and 2012 the butterfly was rediscovered at Manoutsa Park and also at a new locality at the Lekgalameetse Nature Reserve. Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Erikssonina edgei (Waterberg Copper)

Erikssonina edgei was previously referred to as the Waterberg population of *Erikssonina acraeina* before it was described as a new species from South Africa by Gardiner & Terblanche (2010). The proposed global red list status for *Erikssonina edgei* (hitherto known as the South African population of *Erikssonina acraeina*) according to the most recent IUCN criteria and categories is Critically Endangered (Possibly extinct) (Mecenero *et al.*, 2013). *Erikssonina edgei* is only known from one restricted area in the vicinity of Rankin's Pass on deep sands of the Waterberg (Gardiner & Terblanche, 2010). Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Threatened: Critically Endangered (regionally: South Africa)

Acada biseriata (Axehead Orange)

Acada biseriata is listed as regionally Critically Endangered in South Africa (Mecenero *et al.*, 2013). In South Africa *Acada biseriata* is only recorded from Gundani northeast of Thohoyandou in the Limpopo Province (Mecenero *et al.* In press.). *Acada biseriata* only occurs at the VhaVenda Miombo vegetation type (Mucina & Rutherford 2006) in South Africa. Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Charaxes guderiana guderiana (Blue-spangled Charaxes)

Charaxes guderiana guderiana is listed as regionally Critically Endangered in South Africa (Mecenero *et al.*, 2013). Only one population of this butterfly is known in South Africa in the Soutpansberg near Thohoyandou which is removed from the nearest main population in Zimbabwe by more than 500 km (Mecenero *et al.*, 2013). *Charaxes guderiana guderiana* only occurs at the VhaVenda Miombo vegetation type (Mucina & Rutherford 2006) in South Africa. Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Threatened: Endangered (global)

Aloeides stevensoni (Stevenson's Copper)

The proposed global red list status for *Aloeides stevensoni* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). *Aloeides stevensoni* colonies are found on south facing, high-altitude grassy slopes of the Wolkberg (Henning, Terblanche & Ball 2009). *Aloeides stevensoni* is endemic to the Limpopo Province near Serala and Haenertsburg and up to date only found in the Woodbush Granite Grassland vegetation type (Mecenero *et al.*, 2013, Mucina & Rutherford 2006). Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Dingana clara (Wolkberg Widow)

The proposed global red list status for *Dingana clara* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). Historically *Dingana clara* has been listed as Vulnerable by Henning, Terblanche & Ball (2009) so that the most recent assessment reflects an increase in the extinction risk. *Dingana clara* is endemic to South Africa and confined to the Wolkberg at Lekgalameetse Nature Reserve near Tzaneen in the south to just south of Haenertsburg in the north (Mecenero *et al.*, 2013). Adults are found on steep, rock-strewn, grassy slopes at high elevations among proteas (Henning, Ball & Terblanche, 2009). Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Lepidochrysops lotana (Lotana Blue)

The proposed global red list status for *Lepidochrysops lotana* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). The type locality where the butterfly was first discovered is on the farm Rietvlei 30km south of Polokwane. Another locality is known on the Wolkberg east of Polokwane and very recently the butterfly was found in the Legalemeetse Nature Reserve (Mecenero *et al.*, 2013). The butterfly is present where the larval host plant *Ocimum obovatum* occurs on grassy slopes (Henning, Terblanche & Ball, 2009). Note that the distribution of the butterfly is much more restricted than the distribution of the host plant. Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Telchinia induna salmontana (Soutpansberg Acraea)

The proposed global red list status for *Telchinia induna salmontana* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). Historically *Telchinia induna salmontana* has been listed as Vulnerable by Henning, Terblanche & Ball (2009) so that the most recent assessment reflects an increase in the extinction risk. *Telchinia induna salmontana* is found in Soutpansberg Summit Sourveld (Mucina & Rutherford 2006) on the higher peaks in the Soutpansberg Mountains. Adults fly along exposed high rocky

ridges where the food plant of the larva, *Aeschynomene nodulosa*, grows (Henning, Ball & Terblanche 2009). Presence of this species at site is highly unlikely owing to lack of habitat requirements.

Extremely Rare or Rare species (National categories)

Anthene minima minima (Little Cilated Blue/ Little Hairtail)

Anthene minima minima is listed as Rare (Low density) by Mecenero *et al.* (2013). *Anthene minima minima* is found in a few selected spots in South Africa in KwaZulu-Natal, Limpopo, and Mpumalanga and also Botswana and Swaziland. *Anthene minima minima* has been recorded from relatively dry savanna but its habitat requirements are still poorly understood. It is unlikely that this taxon is present at the site.

Charaxes druceanus solitarius (Blouberg Silver-barred Charaxes)

Charaxes druceanus solitarius is listed as Rare (Restricted Range) by Mecenero *et al.* (2013). *Charaxes druceanus solitarius* is endemic to South Africa and limited to the Blouberg inselberg near Poleni in the Limpopo Province (Mecenero *et al.* In press.). *Charaxes druceanus solitarius* has only been found at the Northern Mistbelt Forest vegetation type (Mucina & Rutherford 2006). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Charaxes xiphares staudei (Blouberg Forest-king Charaxes)

Charaxes xiphares staudei is listed as Rare (Restricted Range) by Mecenero *et al.* (2013). *Charaxes xiphares staudei* is endemic to South Africa and limited to the Blouberg inselberg near Poleni in the Limpopo Province (Mecenero *et al.*, 2013). *Charaxes xiphares staudei* has only been found at the Northern Mistbelt Forest vegetation type (Mucina & Rutherford 2006). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Colotis celimene amina (Lilac tip)

Colotis celimene amina is listed as Rare (Low density) by Mecenero *et al.* (2013). In South Africa *Colotis celimene amina* is present from Pietermaritzburg in the south and northwards into parts of Kwa-Zulu Natal, Gauteng, Limpopo, Mpumalanga and the North West Provinces (Mecenero *et al.* In press.). Reasons for its rarity are poorly understood. Presence of *Colotis celimene amina* as a resident at the site is unlikely.

Dingana jerinae (Kransberg Widow)

Dingana jerinae is listed as Rare (Range Restricted) by Mecenero *et al.* (2013). Historically the conservation status of *Dingana jerinae* was proposed to be Vulnerable (Henning, Terblanche & Ball 2009), however during the most recent assessment it was concluded that the habitat is currently under no immediate threat. *Dingana jerinae* is only known from the Kransberg part of the Waterberg where one of its localities extends into the Marekele National Park. Adults fly on steep slopes, below high cliffs, among fallen rocks as well as in rocky terrain on the summits (Henning, Terblanche & Ball 2009). *Dingana jerinae* is endemic to South Africa and limited to the Waterberg near Thabazimbi in the Limpopo Province (Mecenero *et al.*, 2013). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Dira swanepoeli isolata (Blouberg Widow)

Dira swanepoeli isolata is listed as Rare (Restricted Range) by Mecenero *et al.* (2013). *Dira swanepoeli isolata* is endemic to South Africa and is only found at the southern slopes of the Blouberg in the Limpopo Province (Mecenero *et al.*, 2013). *Dira swanepoeli isolata* has only been found at montane grassy slopes of its single known locality (Mecenero *et al.*, 2013). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Metisella meninx (Marsh Sylph)

Henning and Henning (1989) in the first South African Red Data Book of butterflies listed *Metisella meninx* as threatened under the former IUCN category Indeterminate. Even earlier in the 20th century Swanepoel (1953) raised concern about vanishing wetlands leading to habitat loss and loss of populations of *Metisella meninx*. According to the second South African Red Data Book of butterflies (Henning, Terblanche & Ball, 2009) the proposed global red list status of *Metisella meninx* has been Vulnerable. During a recent large scale atlasing project the *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas* (Mecenero *et al.*, In press.) it was found that more *Metisella meninx* populations are present than thought before. Based on this valid new information, the conservation status of *Metisella meninx* has been changed to least concern Rare (Habitat specialist) (Mecenero *et al.*, 2103). Though *Metisella meninx* is more widespread and less threatened than perceived before, it should be regarded as a localised rare habitat specialist of conservation priority, which is dependent on wetlands with suitable patches of grass at wetlands (Terblanche *In prep.*). Another important factor to keep in mind for the conservation of *Metisella meninx* is that based on very recent discoveries of new taxa in the group the present *Metisella meninx* is species complex consisting of at least three taxa (Terblanche *In prep.*, Terblanche & Henning *In prep.*). The ideal habitat of *Metisella meninx* is treeless marshy areas where *Leersia*

hexandra (rice grass) is abundant (Terblanche In prep.). The larval host plant of *Metisella meninx* is wild rice grass, *Leersia hexandra* (G.A. Henning & Roos, 2001). Presence of this species as resident at site is unlikely owing to the absence of *Leersia hexandra* (Wild Rice Grass) at the watercourse at the site.

Orachrysops regalis (Royal Blue)

Orachrysops regalis is listed as Rare (Habitat specialist) (Mecenero *et al.*, 2013). *Orachrysops regalis* is endemic to the Limpopo Province and found from the Strydpoortberg mountain range near Haenertsburg in the south to Soutpansberg in the north (Mecenero *et al.*, 2013). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Papilio ophidicephalus entabeni (Entabeni Emperor Swallowtail)

Papilio ophidicephalus entabeni is listed as Rare (Habitat specialist) by Mecenero *et al.* (2013). *Papilio ophidicephalus entabeni* is endemic to the Limpopo Province and limited to the forests of the Blouberg and Soutpansberg. *Papilio ophidicephalus entabeni* has only been found at the Northern Mistbelt Forest vegetation type (Mucina & Rutherford 2006). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Papilio ophidicephalus transvaalensis (Woodbush Emperor Swallowtail)

Papilio ophidicephalus transvaalensis is listed as Rare (Habitat specialist) by Mecenero *et al.* (In press.). *Papilio ophidicephalus transvaalensis* is endemic to the Limpopo Province and limited to the forests from near Polokwane in the west to Ofcolaco in the east (Mecenero *et al.*, 2013). *Papilio ophidicephalus transvaalensis* has only been found at the Northern Mistbelt Forest vegetation type (Mucina & Rutherford 2006). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements and distributional barriers.

Data deficient

Coenyropsis natalii poetulodes

Coenyropsis natalii poetulodes is listed as Data Deficient by Mecenero *et al.* (2013). *Coenyropsis natalii poetulodes* is endemic to South Africa and limited to the western Wolkberg near Chuniespoort (Mecenero *et al.*, 2013). *Coenyropsis natalii poetulodes* has only been found at rank grassy slopes at an altitude of 1000 m to 1500 m in mixed savanna/ grassland of the western parts of the Wolkberg (Mecenero *et al.*, 2013). Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

Pseudonympha swanepoeli

Pseudonympha swanepoeli is listed as Data Deficient by Mecenero *et al.* (2013). The population at the type locality near Houtbosdorp (“Woodbush Village”) where the butterfly was originally found may be extinct. If this population at high elevation in the Wolkberg is unique then the red list status would be Critically Endangered (Henning, Terblanche & Ball 2009). *Pseudonympha swanepoeli* is only known from one restricted marshy area near Houtbosdorp in the Wolkberg mountains. Previously known localities of the butterfly in the vicinity of Houtbosdorp have been destroyed (Henning, Terblanche & Ball 2009). Taxonomic uncertainty is a real problem for conservation in this case because all the *Pseudonympha swanepoeli* populations known today are clearly part of more than one taxon. Some of these taxa which are obscured by the present taxonomic predicament may be under a very high extinction risk. All *Pseudonympha swanepoeli* populations should be regarded as sensitive as a precautionary principle. Presence of this species as resident at site is highly unlikely owing to lack of habitat requirements.

5.4.2 Damselflies

Assessment of high conservation priority damselfly species

In general extraordinary progress has been made recently in South Africa to improve the taxonomy and ecological knowledge of damselflies. However, in terms of conservation status many species and subspecies are still poorly known and extinction risk assessments are limited, though this situation is currently addressed by an Odonata atlas and red list project. Here only one species which are better known to the extent that some indication of their conservation priority could be listed (Table 4.27) and presence of this species at the site is unlikely.

5.4.3 Cicadas

Assessment of high conservation priority cicada species

In general much progress has been made recently in South Africa to improve the taxonomy and ecological knowledge of cicadas in South Africa. However, in terms of conservation status many species and subspecies are still poorly known and extinction risk assessments are

limited. Here only one species which are better known to the extent that some indication of their conservation priority could be listed (Table 4.28).

***Pycna (Platypleura) sylvia* (Giant cicada)**

Pycna sylvia, the largest endemic cicada species in South Africa, was recorded from the Mpumalanga Province in South Africa at Sekhukhuneland. *Pycna sylvia*, hitherto thought to be extinct, was rediscovered in 2001 after 95 years in the Groot Dwars River Valley, Mpumalanga during a faunal survey for Anglo Platinum (Malherbe, Burger & Stephen, 2004). The only known host plant of *Pycna sylvia* is the tree *Vitex obovata* subsp. *wilmsii*. Apparently *Pycna sylvia* is mostly found at or in the vicinity of dense stands of the host plant (Malherbe, Burger & Stephen, 2004). Presence of this species as resident at site is highly unlikely.

5.4.4 Fruit chafer beetles

Assessment of threatened or other high conservation priority fruit chafer beetle species

Table 4.29 lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoniinae) that are of known high conservation priority in the Limpopo Province. Some of the rare Cetoniinae is rather data deficient and more information is necessary for the extinction risk assessments. No fruit chafer beetles of particular conservation priority are expected to be resident at the site.

5.4.5 Scorpions

Table 4.30 lists rock scorpion species (Scorpiones: Ischnuridae) that are of known high conservation priority in the Limpopo and Mpumalanga Provinces combined. It is highly unlikely that any of these sensitive rock scorpions are present at the site.

5.4.6 Baboon spiders

In the South African context baboon spider species belonging to the genus *Ceratogyrus* has a particular presence in the Limpopo Province. *Ceratogyrus* (“horned baboon spiders”) is also of importance to the pet trade and appears on the TOPS list with other baboon spider genera *Harpactira* and *Pterinochilus*.

Ceratogyrus bechuanicus and *Ceratogyrus brachycephalus* appear to be only found to occur in small colonies of a few burrows scattered over wide area at each locality (De Wet & Dippenaar-Schoeman 1991). This is in contrast to other baboon spider species such as

Pterinochilus which is found in much larger colonies. Distribution of *Ceratogyrus bechuanicus* ranges from Botswana, Central Namibia, Zimbabwe (widespread), Mozambique to the northern parts of South Africa (Limpopo Province) (Dippenaar-Schoeman 2002). *Ceratogyrus bechuanicus* has also been recorded from the western Soutpansberg (Foord, Dippenaar-Schoeman & Van der Merwe 2002). In contrast to the more widespread species mentioned above, *Ceratogyrus brachycephalus* has a much more restricted distribution, being confined to localities in central Botswana, southern Zimbabwe and the extreme northern Limpopo (De Wet & Dippenaar-Schoeman 1991; Dippenaar-Schoeman 2002).

Burrows of *Ceratogyrus* can be found in different types of soils, ranging from sandy to very hard, compacted soils in areas sparsely covered with grass (De Wet & Dippenaar-Schoeman 1991). Most burrows are J-shaped (De Wet & Dippenaar-Schoeman 1991). In arid regions the burrow of baboon spiders (Theraphosidae) are usually deep to provide protection from high temperatures (Smith 1990). Adult males are usually not found in burrows and actively seeking females, freely wandering at night, and may also be shorter-lived than the females (De Wet & Dippenaar-Schoeman 1991; De Wet & Schoonbee 1991). Pitfall traps are found to be unsuccessful, as the males of *Ceratogyrus* are not easily captured in this manner (De Wet & Schoonbee 1991).

Ceratogyrus bechuanicus is well-represented in the Kruger National Park, Musina, D'nyala and Atherstone Nature Reserves as well as in the Klaserie and Sabi Sand private nature reserves (De Wet & Schoonbee 1991). *Ceratogyrus brachycephala* has only been found in the Messina Provincial Nature Reserve whilst its historic distribution includes the Langjan Nature Reserve (De Wet & Schoonbee 1991). *Ceratogyrus brachycephala* with its much smaller distribution has a higher conservation priority than *Ceratogyrus bechuanicus*. Since *Ceratogyrus* species are found in areas sparsely covered with grass, a balanced utilisation of habitat must be prescribed, and for management purposes the complete ecosystem must thus be taken into account (De Wet & Schoonbee 1991). Though De Wet & Schoonbee (1991) recommended determination of veld condition boundaries of habitats where colonies of *Ceratogyrus* occur, no detailed habitat study could be tracked in an extensive literature survey for this study. *Ceratogyrus bechuanicus* is likely to be present at or near the site. Occurrence of baboon spiders of particular conservation concern at the site is unlikely.

5.5 Ecological Sensitivity at the site

Ecological sensitivity at most of the site is low and at some areas where secondary grassland has established, medium (Figure 2).

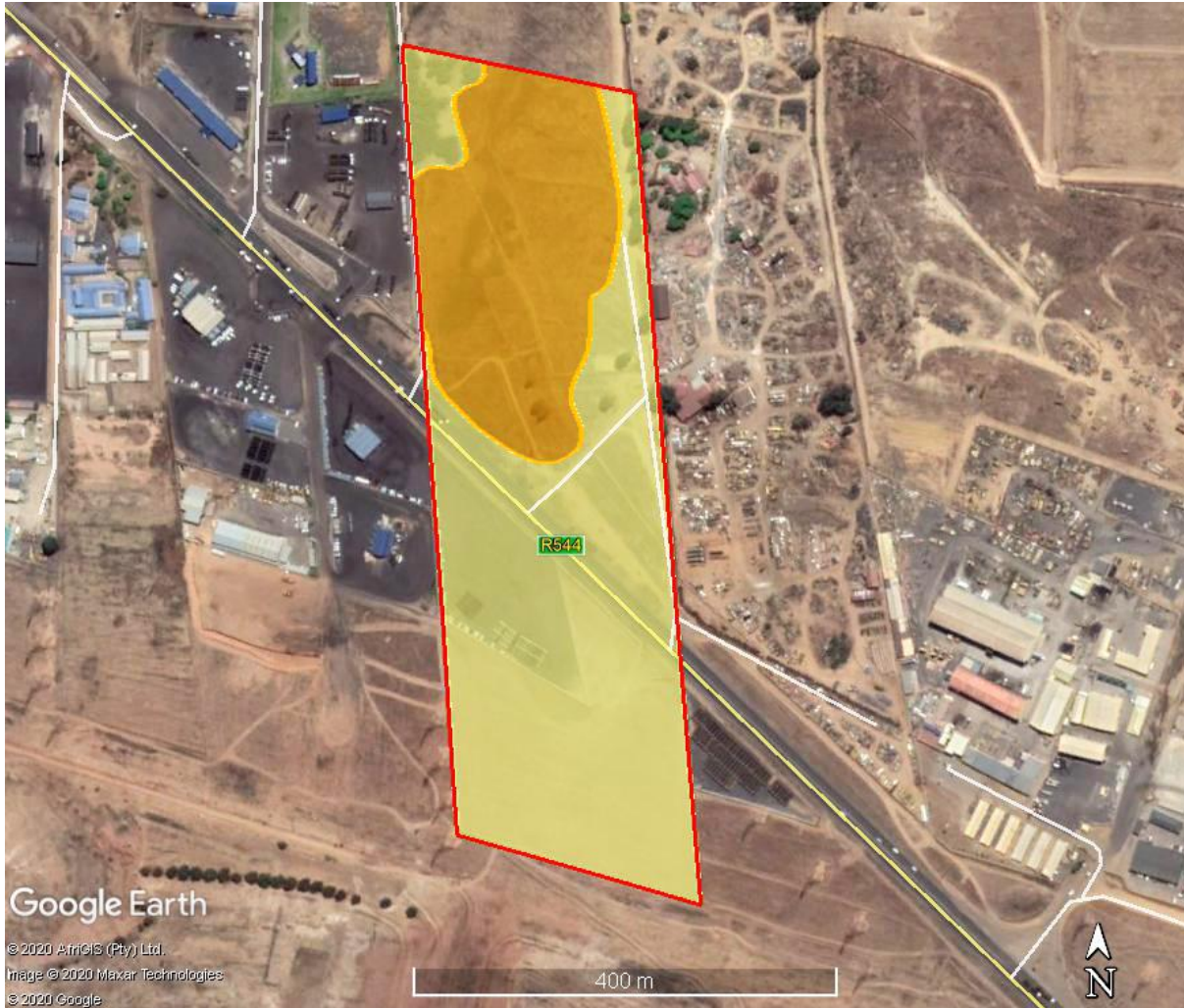


Figure 2 Indications of ecological sensitivity at the site.

- | | | |
|---|----------------------------------|------------------------|
| — | Black outline | Boundaries of the site |
| — | Orange outline and shading | Medium sensitivity |
| — | Light yellow outline and shading | Low Sensitivity |

Grid references and altitudes were taken at site with a GPS Garmin E-trex 20 ® instrument. Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2019).

6 RISKS, IMPACTS AND MITIGATION

Background:

Habitats of threatened plants are in danger most often due to urban developments such as is the case for the Gauteng Province (Pfab & Victor, 2002). Habitat conservation is the key to the conservation of invertebrates such as threatened butterflies (Deutschländer and Bredenkamp 1999; Edge 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Furthermore corridors and linkages may play a significant role in insect conservation (Pryke & Samways, 2003, Samways, 2005).

Urbanisation is a major additional influence on the loss of natural areas (Rutherford & Westfall 1994). In the South Africa the pressure to develop areas are high since its infrastructure allows for improvement of human well-being. Urban nature conservation issues in South Africa are overshadowed by the goal to improve human well-being, which focuses on aspects such as poverty, equity, redistribution of wealth and wealth creation (Cilliers, Müller & Drewes 2004). Nevertheless the conservation of habitats is the key to invertebrate conservation, especially for those threatened species that are very habitat specific. This is also true for any detailed planning of corridors and buffer zones for invertebrates. Though proper management plans for habitats are not in place, setting aside special ecosystems is in line with the recent Biodiversity Act (2004) of the Republic of South Africa.

Corridors are important to link ecosystems of high conservation priority. Such corridors or linkages are there to improve the chances of survival of otherwise isolated populations (Samways, 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways, 2005). For an African butterfly assemblage this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005). Much more research remains to be done to find refined answers to the width of grassland corridors in South Africa. The width of corridors will also depend on the type of development, for instance the effects of the shade of multiple story buildings will be quite different from that of small houses.

To summarise: In practice, as far as developments are concerned, the key would be to prioritise and plan according to sensitive species and special ecosystems.

In the case of this study:

Site is characterised by ecologically disturbed vegetation where hitherto scraped areas, areas that were cultivated in the past, a tar road, footpaths and tracks are found. Patches of secondary grassland with indigenous plant species remain in some areas. An area with with conspicuous high cover of alien invasive Australian *Acacia* trees is found in the northwestern corner of the site. *Eucalyptus* species (Gum Trees), *Pinus* species (Pines) occur at parts of the site.

Indigenous grass- and forb species are found at the remaining grassland patches at the site. Numerous alien invasive weeds are present at the site.

Wetlands and rocky ridges are absent at the site.

No Threatened or Near Threatened or any other plant or animal species of particular conservation concern appear to be present at the site.

Grassland at the site is represented by the Eastern Highveld Grassland (Gm 12) vegetation type which is listed as a Threatened Ecosystem, Vulnerable, according to the National List of Threatened Ecosystems (2011). The vegetation at the site has been modified in the past and is currently considerably degraded. There is little scope for the restoration and sustainable conservation of a natural grassland area at the site.

The scope for the site to be part of a corridor of particular conservation importance is small.

The following potential risks, impacts and mitigation measures apply to the proposed development:

6.1 Identification of potential impacts and risks

The potential impacts identified are:

Construction Phase

- Potential impact 1: Loss of habitat owing to the removal of vegetation at the proposed footprint for development.

- Potential impact 2: Loss of sensitive species (Threatened, Near-Threatened, Rare, Declining or Protected species) during the construction phase.
- Potential impact 3: Loss of connectivity and conservation corridor networks in the landscape.
- Potential impact 4: Contamination of soil during construction in particular by hydrocarbon spills.
- Potential impact 5: Killing of vertebrate fauna during the construction phase.

Operational Phase

- Potential impact 6: An increased infestation of exotic or alien invasive plant species owing to disturbance.

6.2 Potential impacts and risks during the construction phase

Classes of impacts for this study: Very High, High, Moderate, Low, Very Low

Aspect/Activity	Clearance of vegetation at part of the site for the development
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of vegetation at the proposed development. This will entail the destruction of habitat of medium and low ecological sensitivity.
Status	Negative
Mitigation Required	Planting of indigenous plant species at the proposed footprint is of considerable importance for improved urban biodiversity conservation efforts in an increasingly urbanised and industrialised area.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISK	Following the mitigation measures a moderate risk of impact is expected.

Aspect/Activity	Removal of sensitive species
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Sensitive species: Loss of Threatened or Near-Threatened Plants, Mammals, Reptiles, Amphibians and Invertebrates at the proposed footprint appears to be unlikely. Loss of any protected trees or other species of particular conservation, owing to the proposed development at the site, appears unlikely.
Status	Neutral.
Mitigation Required	No mitigation measures specific to sensitive species apply.
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
RISK	No risks particular to sensitive species at the site, apply.

Aspect/Activity	Fragmentation of corridors of particular conservation concern
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	The scope for the site to be part of a corridor of particular conservation importance in the local increasingly urbanised and industrialised surroundings, is small.
Status	Negative
Mitigation Required	Planting of indigenous plant species at the proposed footprint is of considerable importance for improved urban biodiversity conservation efforts in the area.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISK	Following mitigation, a low impact risk is expected.

Aspect/Activity	Contamination of soil by leaving rubble/ waste or spilling petroleum fuels or any pollutants on soil which could infiltrate the soil
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Rubble or waste could lead to infiltration of unwanted pollutants into the soil. Spilling of petroleum fuels and unwanted chemicals onto the soils that infiltrate these soils could lead to pollution of soils.
Status	Negative
Mitigation Required	Rubble or waste that could accompany the construction effort, if the development is approved, should be removed during and after construction. Measures should be taken to avoid any spills and infiltration of petroleum fuels or any chemical pollutants into the soil during construction phase.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISKS	A low risk is expected following mitigation.

Aspect/Activity	Possible disturbance, trapping, hunting and killing of vertebrates during construction phase
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	During the construction phase animal species could be disturbed, trapped, hunted or killed.
Status	Negative
Mitigation Required	If the development is approved, contractors must ensure that no animal species are disturbed, trapped, hunted or killed during the construction phase.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISKS	Following mitigation, a low risk of impact is anticipated.

5.3 Potential impacts during the operational phase

Aspect/Activity	An increased infestation of exotic or alien invasive plant species owing to clearance or disturbance where the footprint took place.
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Infestation by alien invasive species could replace indigenous vegetation or potential areas where indigenous vegetation could recover. Once established combatting these alien invasive plant species may become very expensive in the long term.
Status	Negative
Mitigation Required	Continued monitoring and eradication of alien invasive plant species are imperative.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISKS	Following mitigation, a low risk is anticipated.

5.4 Risk and impact assessment summary for the Construction Phase

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)	
Clearing of vegetation	Habitat loss, loss of indigenous species	Negative	Part of site	Long-Term	Substantial	Very likely	Low	Low	Planting of indigenous plant species at the proposed footprint is of considerable importance for improved urban biodiversity conservation efforts in the area.	Moderate	Low	High
Loss of sensitive species	Loss of sensitive species	Neutral	Site	Long-Term	Low (No Threatened species anticipated)	Unlikely	Not applicable	Not applicable	Loss of Threatened or Near-Threatened Plants, Mammals, Reptiles, Amphibians and Invertebrates at the proposed footprint appears to be unlikely. Loss of any other plant or animal species of particular conservation concern at the site appears unlikely.	Low	Low	High
Loss of corridors of particular conservation concern	Fragmentation of landscape and loss of connectivity	Negative	Site	Long-Term	Moderate	Unlikely	Moderate	Moderate	Planting of indigenous plant species at the proposed footprint is of considerable importance for improved urban conservation efforts in the area.	Moderate	Low	High

Contamination of soil by spilling pollutants on soil which could infiltrate the soil	Soil contamination	Negative	Site	Long-Term	Moderate	Unlikely	Moderate	Moderate	Rubble and waste removal. Measures that avoid hydrocarbon (petroleum) spills to get into contact with the soil.	Moderate	Low	High
Disturbance or killing of vertebrates	Disturbance or killing of species	Negative	Site	Long-Term	Moderate	Unlikely	Moderate	Moderate	If the development is approved, contractors must ensure that no animal species are disturbed, trapped, hunted or killed during the construction phase.	Moderate	Low	High

5.5 Risk/ Impact assessment summary for the Operational Phase

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)	
Increased infestation of exotic or alien invasive plant species	Loss of habitat quality	Negative	Site	Long-Term	Substantial	Likely	Moderate	Moderate	Monitoring and eradication of alien invasive plant species. Cultivation of indigenous plant species.	Moderate	Low	High

5.6 Summary of risks and impacts

Site is characterised by ecologically disturbed and modified vegetation in an urbanised and industrialized area. Presence of wetlands and rocky ridges at the site is unlikely. No wetlands appear to be present within 500 m of the boundary of the site. No Threatened or Near Threatened or any other plant or animal species of particular conservation concern appear to be present at the proposed footprints for development.

Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate or low.

7 CONCLUSIONS

- Site is characterised by ecologically disturbed vegetation where hitherto cleared areas, areas that were cultivated in the past, a tar road, footpaths and tracks are found. Patches of secondary grassland with indigenous plant species remain in some areas. An area with with conspicuous high cover of alien invasive Australian *Acacia* trees is found in the northwestern corner of the site. *Eucalyptus* species (Gum Trees), *Pinus* species (Pines) occur at parts of the site. Numerous alien invasive weeds are present at the site.
- Wetlands and rocky ridges appear to be absent at the site.
- No wetlands appear to be present withing 500 m from the boundary of the site.
- No Threatened or Near Threatened or any other plant or animal species of particular conservation concern appear to be present at the site.
- Grassland at the site is represented by the Eastern Highveld Grassland (Gm 12) vegetation type which is listed as a Threatened Ecosystem, Vulnerable, according to the National List of Threatened Ecosystems (2011). The vegetation at the site has been modified in the past and is currently considerably degraded. There is little scope for the restoration and sustainable conservation of a natural grassland area at the site.
- The scope for the site to be part of a corridor of particular conservation importance is small.
- Ecological sensitivity at the site is indicated as medium at some part and for the larger part of the site, low.
- Following the mitigations which will be upheld and planned, the footprint for development all the impact risks listed above are moderate or low.
- By no means should exotic declared invaders such as *Melia azedarach* (Syringa) the green wattle, *Acacia decurrens* or the black wattle, *Acacia mearnsii*, be planted or allowed to establish.
- If the development is approved an opportunity exists to cultivate indigenous vegetation at the site which could benefit urban biodiversity conservation efforts.

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APPENDIX 1

List of plant species recorded at the site.

Compiled by R.F. Terblanche

Main sources used for names, identification, distribution and biology of species: Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (2012), Van Wyk (2000), Van Wyk & Malan (1998), Van Wyk & Van Wyk (2013), Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006), Van Wyk & Smith (2014), Germishuizen, Meyer & Steenkamp (2006), Raimondo, Von Staden, Foden, Victor, Helme, Turner, Kamundi and Manyama (2009).

Plant species are listed alphabetically under life forms that are generally recognizable.
Plant species marked with an asterisk (*) are exotic.

TAXON	COMMON NAMES	FAMILY
ANGIOSPERMS: MONOCOTYLEDONS ("MONOCOTS")	GRASSES, SEDGES, RUSHES, LILIES, ALOES, ORCHIDS, ASPARAGUSES, PALMS	
<i>Aristida adscensionis</i>	Annual Three-awn	POACEAE
<i>Aristida canescens</i>	Pale Three-awn	POACEAE
<i>Aristida congesta</i> subsp. <i>congesta</i>	Tassel Three-awn	POACEAE
<i>Cymbopogon caesius</i>	Broad-leaved Turpentine Grass	POACEAE
<i>Cymbopogon pospischilii</i>	Narrow-leaved Turpentine Grass	POACEAE
<i>Cynodon dactylon</i>	Couch Grass	POACEAE
<i>Digitaria eriantha</i>	Common Finger Grass	POACEAE
<i>Eleusine coracana</i>	Goose Grass	POACEAE
<i>Elionurus muticus</i>	Wire Grass	POACEAE
<i>Eragrostis chloromelas</i>	Narrow Curly Leaf	POACEAE
<i>Eragrostis curvula</i>	Weeping Love Grass	POACEAE
<i>Eragrostis gummiflua</i>	Gum Grass	POACEAE
<i>Heteropogon contortus</i>	Spear Grass	POACEAE
<i>Hyparrhenia hirta</i>	Common Thatching Grass	POACEAE
<i>Hypoxis rigidula</i>		HYPOXIDACEAE
<i>Melinis repens</i>	Natal Red Top	POACEAE
<i>Perotis patens</i>	Cat's Tail	POACEAE

<i>Pogonarthria squarrosa</i>	Herringbone Grass	POACEAE
<i>Setaria sphacelata</i> var. <i>sphacelata</i>	Common Bristle Grass	POACEAE
* <i>Sorghum halepense</i>	Johnson Grass	POACEAE
<i>Sporobolus africanus</i>	Ratstail Dropseed	POACEAE
<i>Themeda triandra</i>	Red Grass	POACEAE
ANGIOSPERMS: DICOTYLEDONS		
* <i>Acacia dealbata</i>	Silver Wattle	FABACEAE
* <i>Acacia decurrens</i>	Green Wattle	FABACEAE
* <i>Acacia mearnsii</i>	Black Wattle	FABACEAE
* <i>Alternanthera pungens</i>	Duwweltjie	AMARANTHACEAE
* <i>Amaranthus hybridus</i>	Pigweed	AMARANTHACEAE
* <i>Argemone ochroleuca</i>	White-flowered Mexican poppy	PAPAVERACEAE
* <i>Bidens bipinnata</i>	Spanish blackjack	ASTERACEAE
* <i>Bidens pilosa</i>	Common blackjack	ASTERACEAE
<i>Chamaecrista mimosoides</i>		FABACEAE
<i>Chamaesyce inaequilatera</i>	Smooth Creeping Milkweed	EUPHORBIACEAE
* <i>Chenopodium album</i>	White Goosefoot	CHENOPODIACEAE
<i>Cleome maculata</i>		CAPPARACEAE
<i>Convolvulus sagittatus</i>		CONVOLVULACEAE
* <i>Conyza bonariensis</i>	Fleabane	ASTERACEAE
<i>Conyza podocephala</i>		ASTERACEAE
* <i>Cosmos bipinnatus</i>	Cosmos	ASTERACEAE
* <i>Datura ferox</i>	Large Thorn-apple	SOLANACEAE
* <i>Datura stramonium</i>	Common Thorn-apple	SOLANACEAE
* <i>Eucalyptus camaldulensis</i>	Red River Gum	MYRTACEAE
<i>Felicia muricata</i>		ASTERACEAE
<i>Gazania krebsiana</i> subsp. <i>serrulata</i>		ASTERACEAE
<i>Geigeria burkei</i>		ASTERACEAE
<i>Gerbera viridifolia</i> subsp. <i>viridifolia</i>		ASTERACEAE
<i>Gomphocarpus fruticosus</i>	Milkweed	APOCYNACEAE
* <i>Gomphrena celosioides</i>	Bachelor's Button	AMARANTHACEAE
<i>Helichrysum nudifolium</i>	Hottentot's tea	ASTERACEAE
<i>Helichrysum rugulosum</i>		ASTERACEAE

* <i>Hibiscus trionum</i>	Bladder hibiscus	MALVACEAE
<i>Hilliardiella oligocephala</i> (= <i>Vernonia oligocephala</i>)		ASTERACEAE
* <i>Hypochaeris radicata</i>	Hairy Wild Lettuce	ASTERACEAE
* <i>Lepidium bonariense</i>	Pepperweed	BRASSICACEAE
* <i>Malva parviflora</i>	Small Mallow	MALVACEAE
* <i>Melia azedarach</i>	Seringa	MELIACEAE
<i>Monsonia angustifolia</i>	Crane's Bill	GERANIACEAE
<i>Nemesia fruticans</i>		SROPHULARIACEAE
* <i>Oenothera stricta</i>	Yellow Evening Primrose	ONAGRACEAE
* <i>Physalis viscosa</i>	Sticky Gooseberry	SOLANACEAE
* <i>Plantago lanceolata</i>	Narrow-leaved plantain	PLANTAGINACEAE
<i>Pollichia campestris</i>	Waxberry	ILLECEBRACEAE
<i>Polydora poskeana</i>		ASTERACEAE
* <i>Richardia brasiliensis</i>	Mexican Richardia	RUBIACEAE
* <i>Schkuhria pinnata</i>	Dwarf Marigold	ASTERACEAE
<i>Senecio coronatus</i>	Sybossie	ASTERACEAE
<i>Senecio inaequidens</i>	Canary Weed	ASTERACEAE
<i>Seriphium plumosum</i>	Bankrupt Bush	ASTERACEAE
* <i>Solanum sisymbriifolium</i>	Dense-thorned Bitter Apple	SOLANACEAE
* <i>Sonchus oleraceus</i>	Sowthistle	ASTERACEAE
* <i>Tagetes minuta</i>	Khakiweed	ASTERACEAE
* <i>Verbena aristigera</i>	Fine-leaved Verbena	VERBENACEAE
* <i>Verbena bonariensis</i>	Purple top	VERBENACEAE