ECOLOGICAL FAUNA AND FLORA HABITAT SURVEY

STRAWBERY FARM AREA:

Doornkloof Ptn 107, Doornkloof Ptn 129, Rietvlei 6, Rietvlei 7, Strawberry Farm Phase 1 and Strawberry Farm Phase 2, Gauteng Province

Top left: Succulent, *Lithops leslei* (bottom), Photo: ReinierTerblanche.
Top right: Beetle, *Ichnestoma stobbiai*, Photo: Peter Webb.
Bottom left: Orchid *Habenaria kraenzliniana*, Photo: Reinier Terblanche.
Bottom right: Butterfly, *Kedestes nerva*, Photo Reinier Terblanche.

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1 INTRODUCTION

An ecological habitat survey of flora and fauna was required for the Strawberry Farm Area: Doornkloof Ptn 107, Doornkloof Ptn 129, Rietvlei 6, Rietvlei 7, Strawberry Farm Phase 1 and Strawberry Farm Phase 2, southeast of Irene in the Gauteng Province, at which developments are proposed. This Strawberry Farm area is elsewhere referred to as the study area and the units such as Doornkloof Ptn 107 are referred to as sites. The survey focused on the possibility that fauna or flora of conservation concern, which include threatened species, known to occur in Gauteng Province are likely to occur within the study area or not.

A main purpose of the current habitat survey is to review and consolidate findings on the fauna and flora at the whole area, because of uncertainties that remained and reasons listed beneath. A number of reports have in the past been submitted for some areas overlapping with the present study area, of which the author submitted some. The present survey and integration of findings to existing available knowledge are owing to:

1) Uncertainties in the actual sizes of suitable habitats and actual presence of some species of conservation concern,
2) Extents of potential habitat that in case of doubt are often extensive as a pre-caution,
3) More recent and more objective reviews of the extinction risks of species (according to IUCN categories and criteria). There have for example been significant changes and improvements in the extinction risks of plants (Raimondo *et al*., 2009 and updated versions), butterflies (Mecenero *et al.*, 2013),
4) New taxonomical and biological information on organisms such as *Ichnestoma stobbiai,*
5) Recent improved and updated versions of key biodiversity issues and species of special conservation concern by GDARD (2012),
6) Possible increase in degradation in much of the study area, i.e. the area is not a reserve and management of habitats in the area remains obscure. More consolidated information may address neglect of the area in terms of conservation management and,
7) The area appears to become increasingly isolated and improved information could afford decision making, the latter being overdue.

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;
- Literature surveys that are integrated with the findings of the habitat survey;
- An evaluation of the sensitivity of habitats that in particular relate to current status of threatened species and conspicuous key biodiversity aspects;
- Identification of potential ecological impacts on fauna and flora that could occur as a result of the development; and

1.2 SCOPE OF STUDY

- A survey consisting of several visits to investigate key elements of habitats on the site, relevant to the conservation of fauna and flora;
- Recording of any sightings and signs of existing fauna and flora;
- Recording of possible significant biological interactions of importance to conserve habitats of species;
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary;
- Literature studies and integration of existing knowledge with the findings of the surveys in the field;

2 STUDY AREA

The study area is south-east of Irene in the Gauteng Province. More spefically the site is situated in an area south of Irene Glen Private Estate, west of the M57 and/or R21, east of the M18 route and north of Olifantsfontein.

Study area and sites are situated at the Grassland Biome (Mucina & Rutherford 2006). Grassland Biome at the study area is represented by Carletonville Dolomite Grassland vegetation type (Mucina & Rutherford 2006). Distribution: In South Africa the Carletonville Dolomite Grassland is found in North West, Gauteng and marginally into the Free State Province. The Carletonville Dolomite Grassland ranges from the region of Potchefstroom to Ventersdorp and Carletonville extendting westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in the Gauteng Province. Altitude ranges from 1360-1620 m, but largely 1500-1560 m (Mucina & Rutherford 2006).

Vegetation and landscape features: Slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species (Mucina & Rutherford 2006). Geology and soils: This area occurs almost exclusively on the dolomites of the Malmani Subgroup (Transvaal Supergroup). Climate: Warm-temperate, summer-rainfall region, with overall mean annual precipitation of 560 mm. High summer temperatures. Severe frequent frost occurs in winter (Mucina & Rutherford 2006).

Important taxa of the Carletonville Dolomite Grassland listed by Mucina & Rutherford (2006): Graminoids: *Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides, Diheteropogon amplectens, Eragrostis chloromelas, Eragrostis racemosa, Heteropogon contortus, Loudetia simplex, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra, Alloteropsis semialata* subsp. *eckloniana, Andropogon schirensis, Aristida canescens, Aristida diffusa, Bewsia biflora, Bulbostylis burchellii, Cymbopogon caesius, Cymbopogon pospischilii, Elionurus muticus, Eragrostis curvula, Eragrostis gummiflua, Eragrostis plana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, Melinis repens* subsp. *repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, Tristachya rehmannii.* Herbs: *Acalypha angustata, Barleria macrostegia, Chamaecrista mimosoides, Chamaesyce inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, Helichrysum miconiifolium, Helichrysum nudifolium* var. *nudifolium*, *Ipomoea ommaneyi, Justicia anagalloides, Kohautia amatymbica, Kyphocarpa angustifolia, Ophrestia oblongifolia, Pollichia campestris, Senecio coronatus, Vernonia oligocephala.* Geophytic herbs: *Boophone disticha, Habenaria mossii.* Low Shrubs: *Anthospermum rugidulum* subsp. *pumilum, Indigofera comosa, Pygmaeothamnus zeyheri var. rogersii, Searsia magalismontana, Tylosema esculentum, Ziziphus zeyheriana.* Geoxylic Suffrutices: *Elephantorrhiza elephantina, Parinari capensis* subsp. *capensis.* Endemic taxon: *Delosperma davyi*.

Note: Many, but not all of the above plant species are present at the site and the endemic taxon of the Carletonville Dolomite Grassland *Delosperma davyi* does not appear to be present in the study area.

A tributary of the Hennops River, the Kaalspruit runs through the southern part of the study area and forms the boundaries between Strawberry Farm Phase 2, Strawberry Farm Phase 1 and Rietvlei 6 sites.

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 by R.F. Terblanche took place on 22 October 2013, 25 October 2013, 26 October 2013, October 2013, 1 November 2013, 19 November 2013, 21 December 2013, January 2014, 22 February 2014 and 5 March 2014 to note key elements of habitats on the site, relevant to the conservation of fauna and flora. Numerous surveys in the larger area and on the sites in the past from 2004 – 2011 have also been taken into account. 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/physiognymy) 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, with a few exceptions 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. Sites have 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, 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*, *Erikssonia, 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 *Ichnestoma* 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 constraints and the focus on species of conservation concern. The on site survey was conducted during October 2013, November 2013, December 2013, January 2014, February 2014 and March 2014 which is an optimal time of the year to find many of the habitat sensitive plant and animal species of high conservation priority. Earlier visits to parts of the study area from 2004 – 2011 also covers a range of different seasonal times of the year and as a consequence ideal surveys. Despite this vast range of visits, *Ichnestoma stobbiai* only emerges for very short periods of few days after good rain at the beginning of the summer so that even then full coverage of their habitat range is often limited. However, because of this vast range of visits a good idea at leas the core habitat of *Ichnestoma stobbiai* could be given. 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 study area.

HABITAT FEATURE	DESCRIPTION
Topography	The study area and sites proposed for the developments is in an undulating area with moderate to gentle slopes.
Rockiness	Rocky ridges are present at Doornkloof 107, Doornkloof 129 and Rietvlei 7.
Presence of wetlands	A perennial river (active channel) which is a tributary of the Sesmylspruit and riparian zone are present north eastern boundary of Strawberry Farm Phase 2 and the western boundary of Strawberry Farm Phase 1. A non-perrenial river (streambed) runs from the informal settlement at Strawberry Farm Phase 1 to join the Olifantspruit at Strawberry Farm Phase 2. A quarry surrounded by exotic trees is present at Strawberry Farm Phase 2.
Broad overview of vegetation	As a general trend vegetation ranges from pristine grassland to very disturbed areas in the southern parts of the study area. Few indigenous trees or small clumps of trees are present at the grassland of Doornkloof 107 though a patch of exotic trees are also present at the south western parts of Doornkloof 107. Large patches of exotic trees that interrupt the grassland in many parts of the study area consist mainly of exotic *Eucalyptus camaldulensis* (red gum) and alien invasive Australian *Acacia* species. At the southern parts of the study area these infestation of the riparian zone and many parts of the site by exotic tree species are considerable. Remaining grassland patches at the site are obviously diverse in indigenous grass species and herbaceous species. Vegetation at much the central and southern parts of the study area largely transformed owing to the presence of buildings, clearings, roads, numerous dirt tracks, cultivated fields, informal settlements and informal dumping. These disturbed areas contain, apart from the mentioned exotic patches of trees, numerous alien invasive weeds that include *Campuloclinium* (Pompom Weed), *Schkuhria* (dwarf marigold), *Tagetes* (khaki weed), *Bidens* (black jacks), *Cosmos* (cosmos), *Conyza* (flea banes), *Datura* (thorn-apples), and exotic *Verbena* species (purple tops). Riparian zone (distinct vegetation along the river) is mixed woodland consisting of a mixture of alien plant species at large with some indigenous vegetation remaining. Exotic tree species in the riparian zone include *Populus x canescens* (grey poplar), *Melia azedarach* (Syringa), *Acacia decurrens* (Green Wattle),

	Gleditsia triacanthos (Honey Locust), *Eucalytpus camaldulensis* (red gum) and the naturalised *Salix babylonica* (weeping wilow). Exotic reed species, *Arundo donax*, and exotic grass *Pennisetum clandestinum* are common along the banks of the perennial river at Strawberry Farm Phase 2 and Strawberry Farm Phase 1.
Signs of disturbances	Urban edges, informal settlements, cultivated fields, a large substation, pylons, roads, dirt tracks, patches of exotic trees, alien invasive weeds, informal dumping and excavations are all reflections of human impacts in the area.
Connectivity of natural vegetation in the site and between the site and surrounding areas	The entire study area is isolated by urban and industrial developments and a highway (R21). For much of the study area in particular the central and southern parts a natural continuous conservation corridor is doubtful. There is scope for the riparian zone of the Olifantspruit to be an important link in the area and in particular for some areas to serve as stepping stone corridors at the study area.

Photo 1 Doornkloof 107, view of eastern and north-eastern parts of the site.
Photo: 22 February 2014, R.F. Terblanche

Photo 2 Doornkloof 107, view towards substation (to the south).
Photo: 22 February 2014, R.F. Terblanche.

Photo 3 Doornkloof 129, view towards substation (north).
Photo: February 2014, R.F. Terblanche.

Photo 4 Doornkloof 129 with some recent disturbance visible.
Photo: 22 February 2014 R.F. Terblanche.

Photo 5 Rocky outcrop at Rietvlei 7.
Photo: 22 February 2014, R.F. Terblanche

Photo 6 View of eastern side of Rietvlei 7. Grassland and exotic *Eucalyptus* species are visible in the picture.
Photo: 22 February 2014, R.F. Terblanche.

Photo 7 Disturbed grassland at Rietvlei 6.
Photo: 22 February 2014, R.F. Terblanche.

Photo 8 Disturbed grassland with informal settlement in the background at Strawberry Farm Phase 1.
Photo: 22 February 2014 R.F. Terblanche.

Photo 9 Cultivated fields at Strawberry Farm Phase 2.
Photo: 22 February 2014, R.F. Terblanche

Photo 10 *Phragmites australis*, common reed and exotic trees at and near the riparian zone of Strawberry Farm Phase 2.
Photo: 22 February 2014, R.F. Terblanche.

Photo 11 *Lithops lesliei* at the north-eastern parts of Strawberry Farm Phase 2.
Photo: 22 February 2014, R.F. Terblanche.

Photo 12 Flower of *Cleome conrathii*, a near threatened plant species that sometimes occur with another Near Threatened plant species, *Melolobium subspicatum*, on dolomite banks south of Irene.
Photo: 7 March 2014, R.F. Terblanche.

Photo 13 Another Near Threatened plant species in the study area, the orchid, *Habenaria kraenzliniana*.
Photo: 7 March 2014, R.F. Terblanche.

Photo 14 Summer-flowering *Aloe zebrina* occurs at several rocky patches in the study area.
Photo: 22 February 2014, R.F. Terblanche

Photo 15 *Habenaria nyikana*, yet another grassland orchid species that occurs in the study area.
Photo: February 2014, R.F. Terblanche.

Photo 17 *Cynictis penicillata,* Yellow Mongoose, south of Irene. This widespread species is well-adapted to live at the urban edge.
Photo: 26 October 2013, R.F. Terblanche

Photo 18 *Burhinus capensis*, Spotted Thick-knee, at Irene.
Photo: 26 October 2013, R.F. Terblanche.

Photo 19 *Ichnestoma stobbiai*, at the lower slopes of Smuts Koppie, Irene.
Photo: October 2013, Peter Webb.

Photo 20 *Cigaritis mozambica*, Mozambique Bar butterfly, a widespread species at the north eastern parts of South Africa, at Doornkloof, Irene
Photo: 19 November 2013 R.F. Terblanche.

4.2 ASSESSMENT OF PLANT SPECIES OF CONSERVATION CONCERN

Table 4.2 Threatened plant species of the Gauteng 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 a resident at a site.

Species	Status: Global status or national status indicated	Resident at the site
Encephalartos middelburgensis	Critically Endangered	No

Table 4.3 Threatened plant species of the Gauteng 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 a resident at a site.

Species	Status: Global status or national status indicated	Resident at the site
Aloe peglerae	Endangered	No
Brachystelma discoideum	Endangered	No
Delosperma purpureum	Endangered	No
Frithia humilis	Endangered	No
Habenaria mossii	Endangered	**Yes**
Holothrix micrantha	Endangered	No

Table 4.4 Threatened plant species of the Gauteng 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 a resident at a site.

Species	Status: Global status or national status indicated	Resident at the site
Bowiea volubilis subsp. ***volubilis***	Vulnerable	No
Brachycorythis conica subsp. ***transvaalensis***	Vulnerable	No
Ceropegia decidua subsp. ***pretoriensis***	Vulnerable	No
Cheilanthes deltoidea subsp. ***silicicola***	Vulnerable	**Yes**
Cineraria longipes	Vulnerable	No
Cucumis humifructus	Vulnerable	No
Delosperma gautengense	Vulnerable	No
Dioscorea sylvatica	Vulnerable	No

Encephalartos lanatus	Vulnerable	No
Eulophia coddii	Vulnerable	No
Khadia beswickii	Vulnerable	No
Melolobium subspicatum	Vulnerable	**No***
Prunus africana	Vulnerable	No

* *Melolobium subspicatum* is present in the study area but not at one of the sites.

Table 4.5 Near Threatened plant species of the Gauteng 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 a resident at the site.

Species	**Status:** Global status or national status indicated	**Resident at the site**
Alepidea attenuata	Near Threatened	No
Adromischus umbraticola subsp. ***umbraticola***	Near Threatened	No
Argyrolobium campicola	Near Threatened	No
Argyrolobium megarrhizum	Near Threatened	No
Ceropegia turricula	Near Threatened	No
Cineraria austrotransvaalensis	Near Threatened	No
Cleome conrathii	Near Threatened	**Yes**
Delosperma leendertziae	Near Threatened	No
Drimia sanguinea	Near Threatened	No
Gladiolus robertsoniae	Near Threatened	No
Habenaria barbertoni	Near Threatened	No
Habenaria bicolor	Near Threatened	No
Habenaria kraenzliniana	Near Threatened	**Yes**
Holothrix randii	Near Threatened	No
Kniphofia typhoides	Near Threatened	No
Lithops leslei subsp. ***leslei***	Near	**Yes**

	Threatened	
Nerine gracilis	Near Threatened	No
Searsia gracillima var. ***gracillima***	Near Threatened	No
Stenostelma umbelluliferum	Near Threatened	No
Trachyandra erythrorrhiza	Near Threatened	No

Table 4.6 Least Concern (= not threatened) plant species of the Gauteng 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 a resident at the site.

Species	**Status:** Global status or national status indicated	**Resident at the site**
Blepharis uniflora	Rare	No
Frithia pulchra	Rare	No
Gladiolus pole-evansii	Rare	No
Gnaphalium nelsonii	Rare	No

Table 4.7 Not threatened plant species of the Gauteng Province which 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). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	**Status:** Global status or national status indicated	**Resident at the site**
Boophone disticha	Declining	**Yes**
Callilepis leptophylla	Declining	**Yes**
Crinum bulbispermum	Declining	No
Crinum macowanii	Declining	No
Drimia altissima	Declining	No
Eucomis autumnalis	Declining	No
Gunnera perpensa	Declining	No
Hypoxis hemerocallidea	Declining	**Yes**
Ilex mitis	Declining	No

Table 4.8 Plant species of the Gauteng 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 a resident at the site.

Species	Status: Global status or national status indicated	Resident at the site
Lepidium mossii	Data Deficient	No

Table 4.9 Some of the tree species of the Gauteng Province which are not threatened but listed as **Protected Species** under the National Forests Act No. 84 of 1998, Section 51(1)**.** 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
Acacia erioloba	Protected	No
Boscia albitrunca	Protected	No
Combretum imberbe	Protected	No
Sclerocarya birrea	Protected	No

4.3 ASSESSMENT OF VERTEBRATE SPECIES OF CONSERVATION CONCERN

4.3.1 Mammals of particular high conservation priority

Table 4.10 Threatened mammal species of the Gauteng Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). Furthermore golden mole species that are rare and being reported from the adjacent Free State and Limpopo Provinces have also been included.

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Chrysospalax villosus Rough-haired golden mole	Vulnerable	No	No
Cloeotis percivali Short-eared Trident Bat	Vulnerable/ Near-threatened	No	No
Diceros bicornis Black rhinoceros	Critically Endangered	No	No
Lycaon pictus African wild dog	Endangered	No	No
Loxodonta africana African elephant	Vulnerable	No	No
Mystromys albicaudatus White-tailed mouse	Endangered	No	No
Neamblysomus julianae Juliana's Golden Mole	Critically Endangered	No	No
Panthera leo Lion	Vulnerable	No	No
Rhinolophus blasii Blasi's Horseshoe Bat	Vulnerable	No	No

Table 4.11 Near threatened mammal species known to occur in the Gauteng Province, Free State Province and North-West Province. Literature sources: Skinner & Chimimba (2005).

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Ceratotherium simum White Rhinoceros	Near-threatened	No	No
Manis temminckii Ground Pangolin	Lower risk/ Near threatened	No	No

4.3.2 Birds of particular high conservation priority

Table 4.12 Threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based on being dependant on site
Aegypius tracheliotos	**Lappet-faced Vulture**	Vulnerable	No	No
Anthropoides paradiseus	**Blue Crane**	Vulnerable	No	No
Aquila rapax	**Tawny Eagle**	Vulnerable	No	No
Ardeotis kori	**Kori Bustard**	Vulnerable	No	No
Botaurus stellaris	**Eurasian Bittern**	Critically Endangered	No	No
Buphagus africanus	**Yellow-billed Oxpecker**	Vulnerable	No	No
Circus ranivorus	**African Marsh-Harrier**	Vulnerable	No	No
Crex crex	**Corn Crake**	Vulnerable	No	No
Eupodotis senegalensis	**White-bellied Korhaan**	Vulnerable	No	No

Gorsachius leuconotus	**White-backed Night-heron**	Vulnerable	No	No
Gyps africanus	**White-backed Vulture**	Vulnerable	No	No
Gyps coprotheres	**Cape Vulture**	Vulnerable	No	No
Neophron percnopterus	**Egyptian Vulture**	Regionally almost extinct	No	No
Neotis denhami	**Denham's Bustard**	Vulnerable	No	No
Pelecanus rufescens	**Pink-backed Pelican**	Vulnerable	No	No
Polemaetus bellicosus	**Martial Eagle**	Vulnerable	No	No
Rhynchops flavirostris	**African Skimmer**	Endangered	No	No
Sarothrura ayresi	**White-winged Flufftail**	Critically Endangered	No	No
Therathopius ecaudatus	**Bateleur**	Vulnerable (in South Africa)	No	No
Tyto capensis	**African Grass-Owl**	Vulnerable	No	No

Table 4.13 Near threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based or being dependant on site
Alcedo semitorquata	**Half-collared Kingfisher**	Near threatened	No	**No***
Anastomus lamelligerus	**African Openbill**	Near threatened	No	No
Aquila ayresii	**Ayres's Hawk-Eagle**	Near threatened	No	No
Buphagus erythrorynchus	**Red-Billed Oxpecker**	Near threatened	No	No
Charadrius pallidus	**Chestnut-banded Plover**	Near threatened	No	No
Ciconia nigra	**Black Stork**	Near threatened	No	No
Circus macrourus	**Pallid Harrier**	Near threatened	No	No
Falco biarmicus	**Lanner Falcon**	Near threatened	No	No
Falco peregrinus	**Peregrine Falcon**	Near threatened	No	No

Glareola nordmanni	**Black-winged Pratincole**	Near threatened	No	No
Leptoptilos crumeniferus	**Marabou Stork**	Near threatened	No	No
Mirafra cheniana	**Melodious lark**	Near threatened	No	No
Mycteria ibis	**Yellow-billed Stork**	Near threatened	No	No
Pelecanus onocrotalus	**Great White Pelican**	Near threatened	No	No
Phoenicopterus minor	**Lesser Flamingo**	Near threatened	No	No
Phoenicopterus ruber	**Greater Flamingo**	Near threatened	No	No
Pterocles gutturalis	**Yellow-throated Sandgrouse**	Near threatened	No	No
Rostratula benghalensis	**Greater Painted-snipe**	Near threatened	No	No
Sagittarius serpentarius	**Secretarybird**	Near threatened	No	No
Sternia caspia	**Caspian Tern**	Near threatened	No	No

* Note that though the Half-Collared Kingfisher, *Alcedo semitorquata*, has been observed in the riparian zone near Irene Market, it has not been found at the riparian zones that runs through the sites in questions.

4.3.3 Reptiles of particular high conservation priority

The following tables list possible presence or absence of threatened reptile or near threatened reptile species in the study area. The Southern African Reptile Conservation Assessment (SARCA) was launched in May 2005 (Branch, Tolley, Cunningham, Bauer, Alexander, Harrison, Turner & Bates, 2006). Its primary aim is to produce a conservation assessment for reptiles of South Africa, Lesotho and Swaziland within the near future (Branch *et al*., 2006). A full up-dated conservation assessment of reptiles, taking into account the recent IUCN (2001) criteria, can only be used once it becomes available. Alexander & Marais (2007) and Tolley & Burger (2007) give useful indications of present conservation statuses as well as possible red listings of reptile species and subspecies in the near future.

Table 4.14 Threatened reptile species in Gauteng Province. Sources: Alexander & Marais (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Python natalensis **Southern African Python**	Vulnerable*	No	No	No

* Unlikely to retain this threat classification when reassessed (Alexander & Marais, 2007).

Table 4.15 Near threatened reptile species in Gauteng Province. Sources: Alexander & Marais (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Homoroselaps dorsalis **Striped Harlequin Snake**	Near threatened	No	No	No

4.4 ASSESSMENT OF INVERTEBRATE SPECIES OF CONSERVATION CONCERN

4.4.1 Butterflies of particular conservation priority

Table 4.16 Threatened (Endangered) butterfly species of the Gauteng Province. 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
Aloeides dentatis dentatis Roodepoort Copper	Endangered	No	Highly unlikely
Chrysoritis aureus Golden Opal/ Heidelberg Opal	Endangered	No	Highly unlikely
Lepidochrysops praeterita Highveld Blue	Endangered	No	Highly unlikely
Orachrysops mijburghi Mijburgh's Blue	Endangered	No	Highly unlikely

Table 4.17 Rare butterfly species of the Gauteng Province. 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
Colotis celimene amina Lilac Tip	Rare (Low density)	No	Highly unlikely
Lepidochrysops procera Grassland Blue	Rare (Habitat specialist)	No	Highly unlikely
Metisella meninx Marsh Sylph	Rare (Habitat specialist)	No	Highly unlikely
Platylesches dolomitica (Hilltop hopper)	Rare (Low density)	No	Unlikely, but possible

4.4.2 Beetles of particular conservation priority

Table 4.18 Fruit chafer species (Coleoptera: Scarabaeidae: Cetoninae) in the Gauteng Province and Gauteng Province which are of known high conservation priority.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Ichnestoma stobbiai	Uncertain (Probably endangered)	**Yes**	**Yes**	**Yes**
Trichocephala brincki	Uncertain	No	No	No

4.4.3 Mygalomorph spiders of particular conservation priority

Table 4.19 Baboon spiders species (Araneae: Teraphosidae) species that are of known high conservation priority in the Gauteng Province and Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Brachionopus pretoriae	Uncertain	No	No	**No**

4.4.4 Scorpions of particular conservation priority

Table 4.20 Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province and Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Hadogenes gracilis	Uncertain	No	No	No
Hadogenes gunningi	Uncertain	No	No	No

5 DISCUSSION

5.1 HABITAT AND VEGETATION CHARACTERISTICS

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

5.2 PLANT SPECIES

Extinct, threatened, near threatened and other plant species of high conservation priority in Gauteng Province are listed in Tables 4.2 – 4.9. The presence or not of all the species listed in the tables were investigated during the survey. A number of Threatened and Near Threatened species of plants have been found in certain habitats in the study area of which some fall outside the present sites. These are listed in the maps, Table 5.2 and the Section 7, the Conclusion.

5.3 VERTEBRATES

5.3.1 Mammals

Table 4.10 and Table 4.11 list the possible presence or absence of threatened mammal species and near threatened mammal species at the site. Literature sources that were used are Friedman & Daly (2004), Skinner & Chimimba (2005) and Wilson & Reeder (2005). Because the site falls outside reserves, threatened species such as the black rhinoceros (*Diceros bicornis*) 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

Table 4.12 and Table 4.13 list the possible presence or absence of threatened bird species and near threatened bird species at the site. Literature sources that were mainly consulted are Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). The site does not appear to form part of any habitat of particular importance for any threatened bird species or any bird

species of particular conservation importance. In the case of this study, the presence or not of *Tyto capensis*, African grass-owl, deserves particular reference.

***Tyto capensis* (African Grass-owl)**

Tyto capensis is listed as regionally vulnerable in South Africa (Hockey, Dean & Ryan 2005). *Tyto capensis* (African Grass-owl) is often found as a resident in treeless areas with damp substrata, mainly marshes and vleis (Hockey, Dean & Ryan 2005). This owl favours patches of tall, rank grass, sedges or weeds (Armstrong, 1991). No *Tyto capensis* was recorded on the site, no particular suitable habitat for this owl species has been found at the site and it is unlikely that the African grass-owl will be present.

5.3.3 Reptiles

Table 4.14 and Table 4.15 list the possible presence or absence of threatened and near threatened reptile species on the site. The Southern African Reptile Conservation Assessment (SARCA) was launched in May 2005 (Branch, Tolley, Cunningham, Bauer, Alexander, Harrison, Turner & Bates, 2006). Its primary aim is to produce a conservation assessment for reptiles of South Africa, Lesotho and Swaziland within the near future (Branch *et al*., 2006). Therefore a full up-dated conservation assessment of reptiles, taking into account the recent IUCN (2001) criteria, will only be available in the near future. While the conservation statuses of reptile species are under revision Alexander & Marais (2007) as well as Tolley & Burger 2007) give useful indications of possible red listings in the near future. There appears to be no threat to any reptile species of particular high conservation importance if the site is developed.

5.3.4 Amphibians

No frog species that occur in the Gauteng are red listed as threatened species or near threatened species at present. There appears to be no threat to any amphibian species of particular high conservation importance if the site is developed.

5.4 INVERTEBRATES

5.4.1 BUTTERFLIES

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; Edge, Cilliers & Terblanche, 2008). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

Because invertebrates are often less well known the expected presence or not of threatened butterfly species in the Endangered category (Table 4.16) and other high conservation priority species such as Rare butterfly species (Table 4.17) follows.

5.4.1.1 Assessment of threatened butterfly species (Endangered) in the Gauteng Province

Aloeides dentatis dentatis (Roodepoort Copper)

The proposed global red list status for *Aloeides dentatis dentatis* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al*. 2013). *Aloeides dentatis dentatis* colonies are found where one of its host plants *Hermannia depressa* or *Lotononis eriantha* is present. Larval ant association is with *Lepisiota capensis* (S.F. Henning 1983; S.F. Henning & G.A. Henning 1989). The habitat requirements of *Aloeides dentatis dentatis* are complex and not fully understood yet. See Deutschländer and Bredenkamp (1999) for the description of the vegetation and habitat characteristics of one locality of *Aloeides dentatis* subsp. *dentatis* at Ruimsig, Roodepoort, Gauteng Province. There is not an ideal habitat of *Aloeides dentatis* subsp. *dentatis* on the site and it is unlikely that the butterfly is present at the site.

Chrysoritis aureus (Golden Opal/ Heidelberg Copper)

The proposed global red list status for *Chrysoritis aureus* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.* 2013) *Chrysoritis aureus* (Golden Opal/ Heidelberg Copper) is a resident where the larval host plant, *Clutia pulchella* is present. However, the distribution of the butterfly is much more restricted than that of the larval host plant (S.F. Henning 1983; Terblanche, Morgenthal & Cilliers 2003). One of the reasons for the localised

distribution of *Chrysoritis aureus* is that a specific host ant *Crematogaster liengmei* must also be present at the habitat. Fire appears to be an essential factor for the maintenance of suitable habitat (Terblanche, Morgenthal & Cilliers 2003). Research revealed that *Chrysorits aureus* (Golden Opal/ Heidelberg Copper) has very specific habitat requirements, which include rocky ridges with a steep slope and a southern aspect (Terblanche, Morgenthal & Cilliers 2003). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon is highly unlikely.

Lepidochrysops praeterita (Highveld Blue)

The proposed global red list status for *Lepidochrysops praeterita* according to the most recent IUCN criteria and categories is Endangered (G.A. Henning, Terblanche & Ball, 2009; Mecenero *et al.* 2013). *Lepidochrysops praeterita* is a butterfly that occurs where the larval host plant *Ocimum obovatum* (= *Becium obovatum*) is present (Pringle, G.A. Henning & Ball, 1994), but the distribution of the butterfly is much more restricted than the distribution of the host plant. *Lepidochrysops praeterita* is found on selected rocky ridges and rocky hillsides in parts of Gauteng, the extreme northern Free State and the south-eastern Gauteng Province. No ideal habitat appears to be present for the butterfly on the site. It is unlikely that *Lepidochrysops praeterita* would be present on the site and at the footprint proposed for the development.

Orachrysops mijburghi (Mijburgh's Blue)

The proposed global red status for *Orachrysops mijburghi* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.* 2013). *Orachrysops mijburghi* favours grassland depressions where specific *Indigofera* plant species occur (Terblanche & Edge 2007). The Heilbron population of *Orachrysops mijburghi* in the Free State uses *Indigofera evansiana* as a larval host plant (Edge, 2005) while the Suikerbosrand population in Gauteng uses *Indigofera dimidiata* as a larval host plant (Terblanche & Edge 2007). There is no suitable habitat for *Orachrysops mijburghi* on the site and it is unlikely that *Orachrysops mijburghi* would be present on the site.

Conclusion on threatened butterfly species

There appears to be no threat to any red listed butterfly species if the site is developed.

5.4.1.2 Butterfly species that are not threatened but also of high conservation priority

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*. 2013). Reasons for its rarity are poorly understood. It is highly unlikely that *Colotis celimene amina* would be present at the site.

Lepidochrysops procera (Savanna Blue)

Lepidochrysops procera is listed as Rare (Habitat specialist) by Mecenero *et al.* (2013). *Lepidochrysops procera* is endemic to South Africa and found in Gauteng, KwaZulu-Natal, Mpumalanga and North West (Mecenero *et al.* 2013). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon at the site is highly unlikely.

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 atlassing project the Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas (Mecenero *et al.* 2013) 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* is now regarded as Rare (Habitat specialist) (Mecenero *et al.* 2013). 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 a 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). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon at the site is highly unlikely that the marsh sylph butterfly would be present at the site.

Platylesches dolomitica (Hilltop Hopper)

Platylesches dolomitica is listed as Rare (Low density) by Mecenero et al. (2013). Historically the conservation status of *Platylesches dolomitica* was proposed to be Vulnerable (Henning, Terblanche & Ball 2009). However, this butterfly which is easily overlooked has a wider distribution thant percieved before. *Platylesches dolomitica* has a patchy distribution and is found on rocky ledges where *Parinari capensis* occurs, between 1300 m and 1800m (Mecenero *et al.* 2013, Dobson Pers comm.). At the study area, though not totally impossible, it is unlikely that *Platylesches dolomitica* would be present.

5.4.2 FRUIT CHAFER BEETLES

Table 4.18 lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoninae) that are of known high conservation priority in the Gauteng Province. At most of the study area no *Ichnestoma stobbiai* or *Trichocephala brincki* were found during the surveys. At most of the study area there appears to be no threat to any of the fruit chafer beetles of particular high conservation priority if the site is developed. At Doornkloof Ptn 107 there is an extant population of *Ichnestoma stobbiai* and outside the sites in question a strong population of *Ichnestoma stobbiai* is found on the lower slopes east of the Irene Market Parking Area.

Ichnestoma stobbiai is an endangered fruit chafer (Scarabaeidae: Cetoniinae) that occurs in small habitat fragments of South Africa (Kryger & Scholtz, 2008). The adults of this species are short-lived and the females are flightless. Thus, the vagility of these beetles is extremely low (Kryger & Scholtz, 2008). The Cetoniinae (Coleoptera: Scarabaeidae) genus *Ichnestoma* Gory & Percheron, 1833 currently comprises 13 described species and is endemic to South Africa. The species *I. stobbiai* Holm, 1992 is thought to occur in a very restricted area in and around Gauteng Province and all habitat patches should be protected (Kryger & Scholtz, 2008; Deschodt, Scholtz & Kryger, 2009). Unlike most cetoniine larvae, the larvae of this species usually occur in dolomitic to cherty, well-drained soils (Deschodt, Scholtz & Kryger, 2009). *Ichnestoma* larvae feed under the soil surface and also pupate under the soil surface in specific grassland areas (Perissinotto, Smith &

Stobbiai, 1999). All the habitat requirements of *Ichnestoma stobbiai* in these grassland patches are not fully understood yet, but it is normally a rocky area (dolomite to chert: see Deschodt, Scholtz & Kryger, 2009), consisting of grassland with a variety of indigenous grass species. From personal experience few trees occur in such patches, with species diverse grassland that are well developed in terms of succession. Rocks, often well-embedded in the soil, are scattered throughout such areas. There would be a threat to the rare and localised fruit chafer beetle, *Ichnestoma stobbiai* if the development at northern parts of the study area destroys its habitat.

5.4.3 MYGALOMOPH SPIDERS

Table 4.19 lists the baboon spider species (Araneae: Teraphosidae) that are of known high conservation priority in the Gauteng Province. The assessment of the conservation status of baboon spiders in South Africa is in process but as a pre-caution the species listed in Table 4.18 has been included. None of the above baboon spider species were found on the site, or are likely to be resident at the site. There appears to be no threat to the baboon spider species of high conservation significance if the study site is developed.

5.4.4 SCORPIONS

Table 4.20 lists the rock scorpion species (Scorpiones: Ischnuridae) that are of known high conservation priority in the Gauteng Province. There appears to be no threat to the rock scorpion species of high conservation priority if the study site is developed.

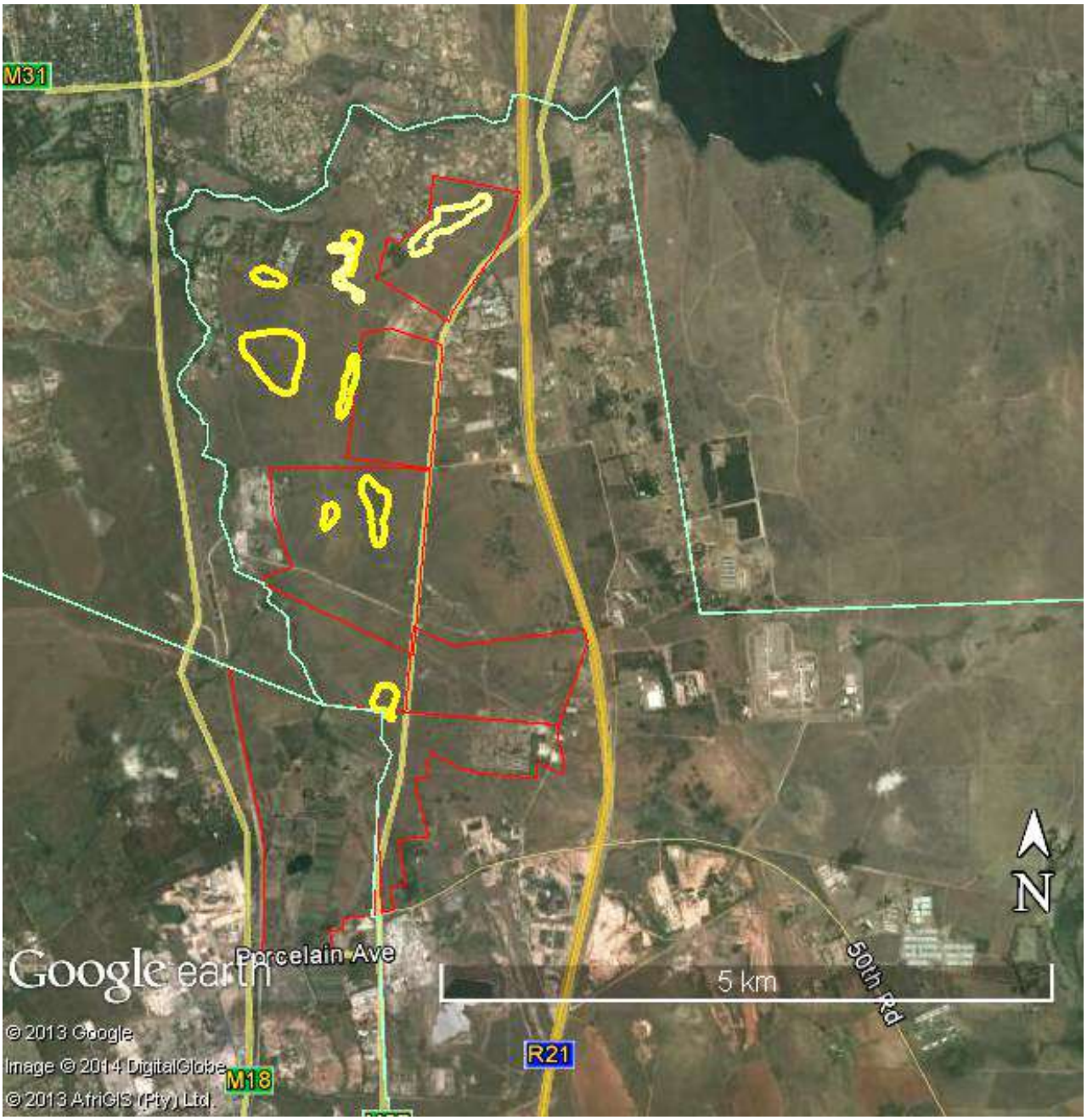

Figure 1 Map of sites in the study area (outlined in red) and core areas that are highly sensitive (outlined in yellow). These highly sensitive areas contain significant populations of Threatened or Near Threatened plant or animal species.

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, 2013, licenced software bought by the author).

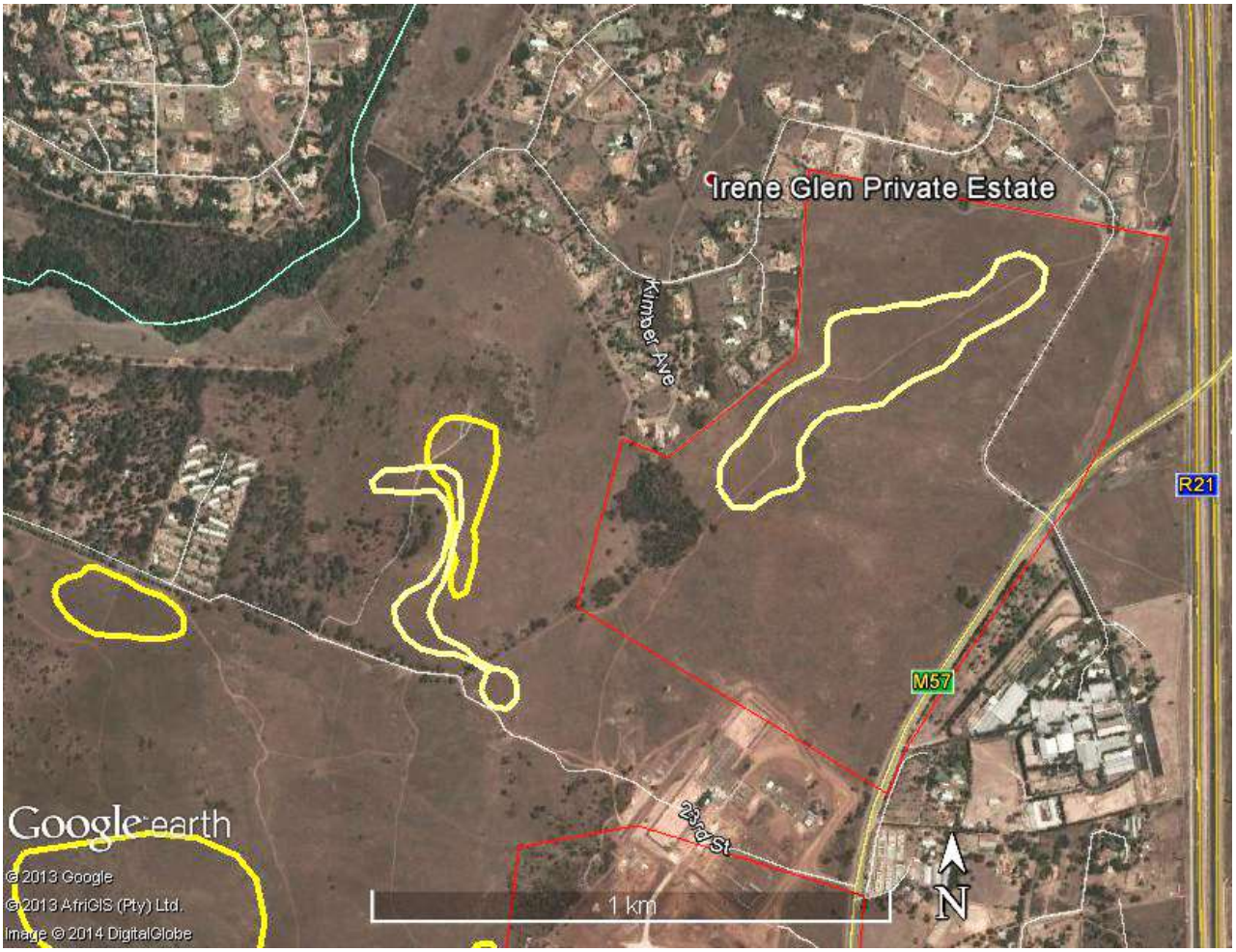

Figure 2 Map of Doornkloof Ptn 107 (outlined in red) and core areas that are highly sensitive (outlined in yellow). These highly sensitive areas contain significant populations of Near Threatened or Threatened plant or animal species. The light yellow outline at Doornkloof Ptn 107 indicates a confirmed habitat of the beetle *Ichnestoma stobbiai* but which does not appear to be as strong as the population east of Irene Market Parking Area (oultined in bright central left).

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, 2013, licenced software bought by the author).

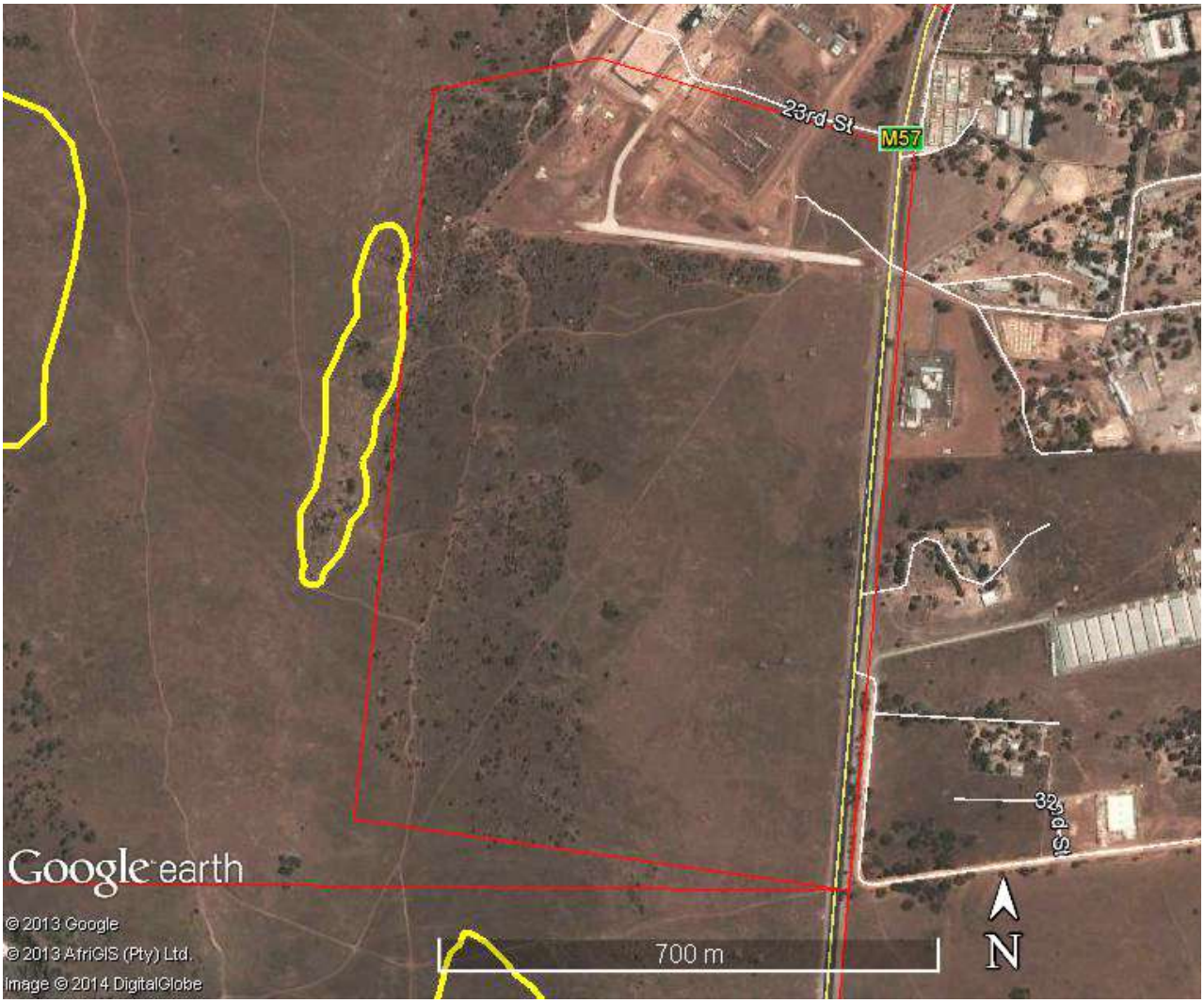

Figure 3 Map of Doornkloof Ptn 129 (outlined in red) and core areas that are highly sensitive (outlined in yellow). These highly sensitive areas contain significant populations of Near Threatened or Threatened plant or animal species. These areas of particular high sensitivity fall outside Doornkloof Ptn 129 but near its western boundary such as indicated.

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, 2013, licenced software bought by the author).

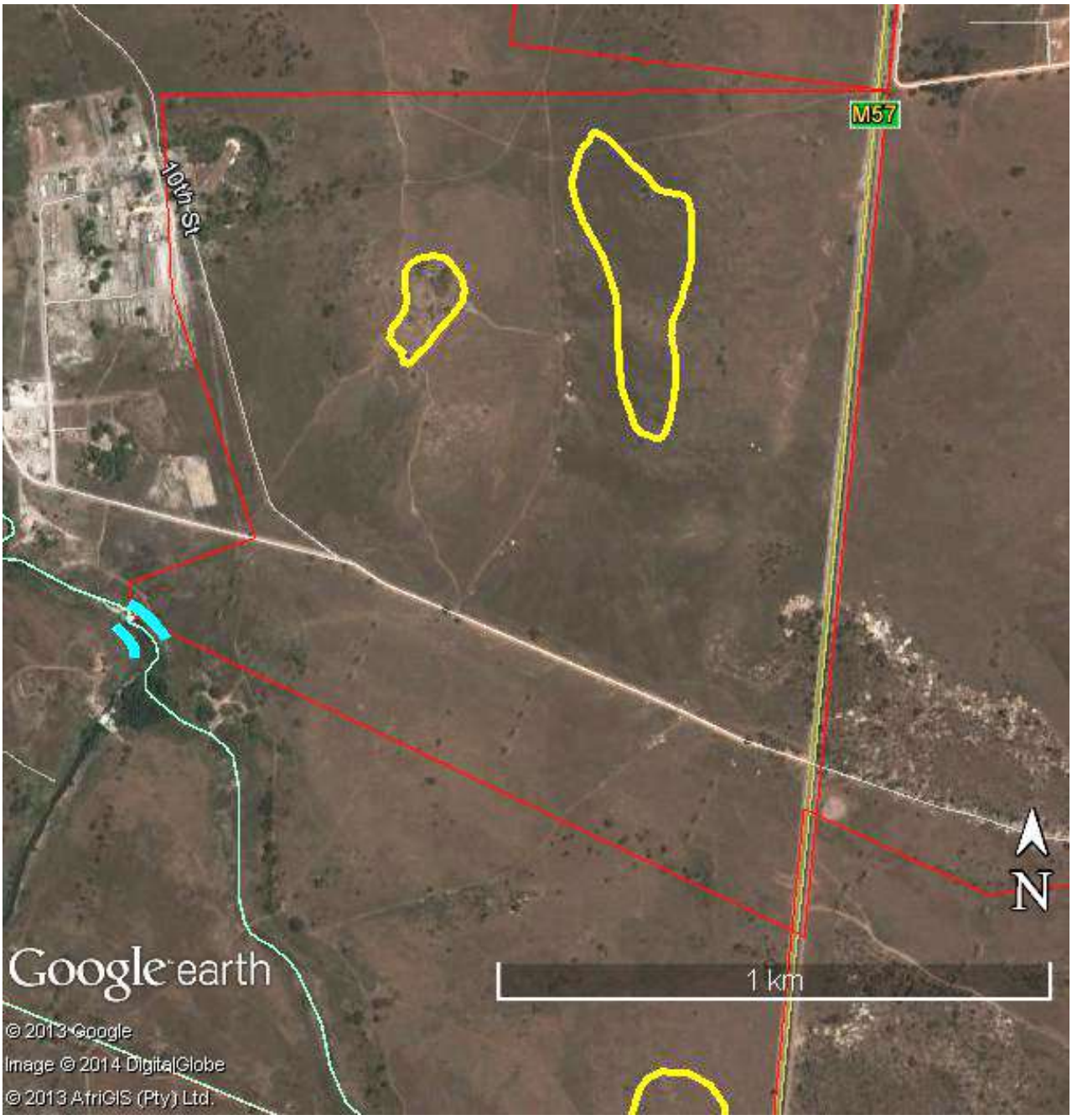

Figure 4 Map of Rietvlei 7 (outlined in red) and core areas that are highly sensitive (outlined in yellow). Area outlined in yellow at north-eastern (right) part indicates a habitat that contains the ENDANGERED orchid, *Habenaria mossii,* a Near Threatened orchid *Habenaria kraenzliniana* and a Near Threatened herbaceous plant species, *Cleome conrathii*. Area oultined in yellow at north-western part (left) indicates a rocky outcrop with the VULNERABLE fern *Cheilanthes deltoidea* subsp. *silicicola*.

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, 2013, licenced software bought by the author).

Figure 5 Map of Rietvlei 6 (outlined in red). Rietvlei 6 is increasingly degraded and considered to be of low sensitivity. Vast majority of trees that either occur in clumps or dot the landscape are exotic species, of which *Eucalyptus camaldulensis* (red gum) was visibly abundant during the site surveys.

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, 2013, licenced software bought by the author).

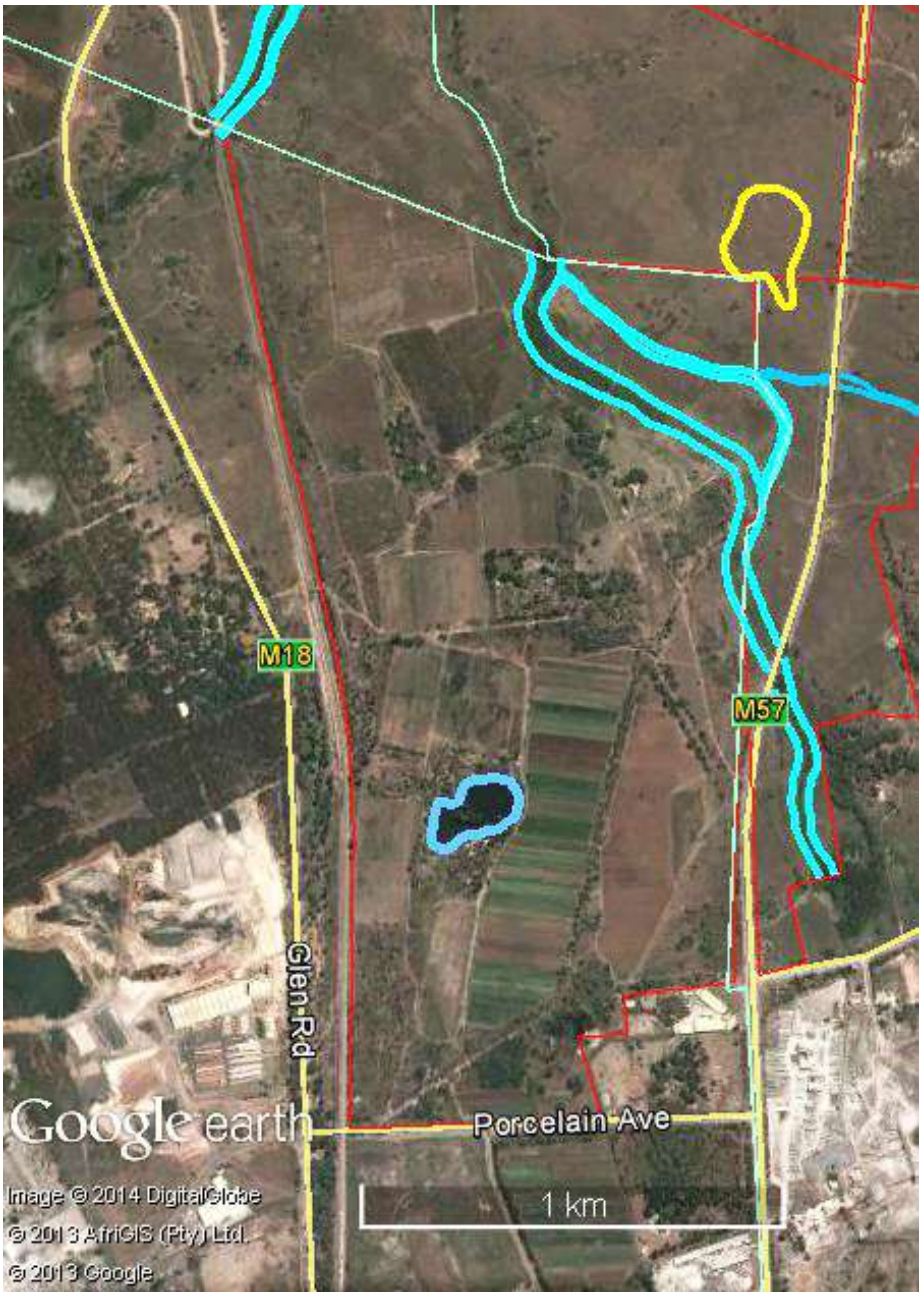

Figure 6 Map of Strawberry Farm Phase 2 (outlined in red). Aquatic ecosystems such as a quarry (central-southern part) and a perennial active channel (north-eastern parts) are outlined in blue. Area outlined in yellow that enters the north-eastern extreme of the site contains the Near Threatened succulent *Lithops leslei* and a Near Threatened herbaceous species *Cloeme conrathii*.

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, 2013, licenced software bought by the author).

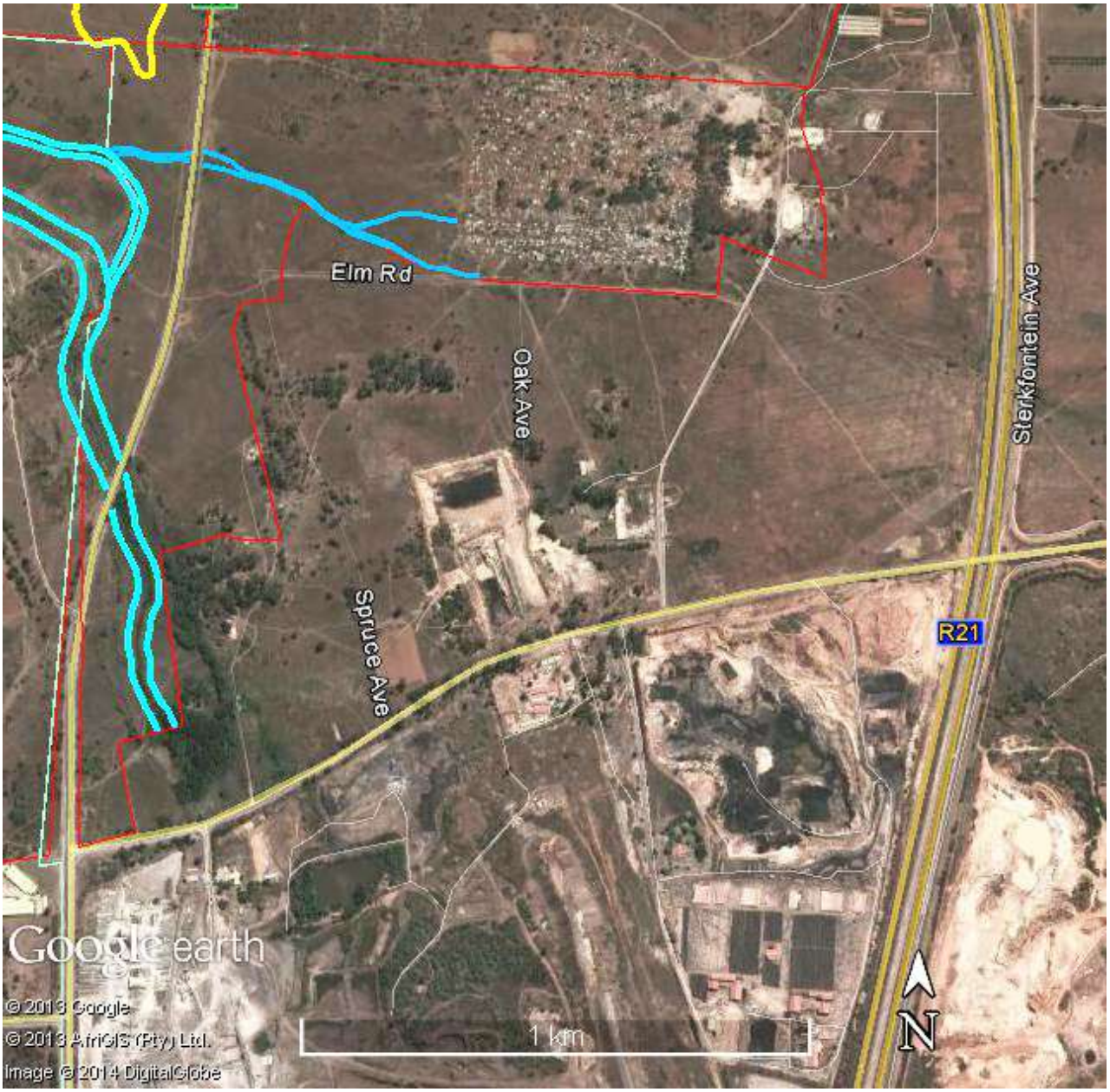

Figure 7 Map of Strawberry Farm Phase 1 (outlined in red). Aquatic ecosystems such as a perennial active channel (north-western parts) and a non-perennial small water course are outlined in blue. Area outlined in yellow that enters the north-western extreme of the site contains the Near Threatened succulent species *Lithops leslei* and a Near Threatened herbaceous species *Cloeme conrathii*.

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, 2013, licenced software bought by the author).

Table 1.1: Outline of topography, rockiness vegetation, disturbances and aquatic aspects of the sites at the studya area.

		DOORNKLOOF PTN 107	DOORNKLOOF PTN 129	RIETVLEI 7	RIETVLEI 6	STRAWBERRY FARM PHASE 1	STRAWBERRY FARM PHASE 2
Topography		Summit with gentle to moderate slopes.	Gentle to moderate slopes.	Rocky ridge in the west, flats in the southern parts and shallow valley in eastern parts.	Gentle to moderate slopes.	Flat/ gentle slopes.	Flat/ Gentle slopes.
Rockiness		Chert rocks occur in patches near summit and some slopes. Pebbles in soil.	Chert rocks surface but not highly concentrated and not as large as that of adjacent areas.	Rocky outcrop as extension of north-south ridge. Few rocks in eastern and southern parts of site.	Few rocks and small rocky patches.	Rocks few and sparse. No rocky ridges of note.	Rocks sparse and very few rocky patches. No rocky ridges of note.
Note: Vegetation		Indigenous and diverse grassland with few trees and patch of exotic trees in the south-western part.	Grassland patches. Western and north-western parts of site contain many exotic trees.	Mostly grassland with few trees. Bushclump of indigenous trees at upper northern slope of rocky outcrop. Exotic trees at eastern parts.	Large tracks of grassland invaded by dense patches of mainly exotic *Eucalyptus* trees.	Few natural grassland patches remain. Degraded or modified grassland with high infestation of alien invasive tree species.	Few natural grassland patches remain. Degraded or modified grassland with high infestation of alien invasive tree species.
Note: Disturbances		Disturbance low but large patch of exotic trees, mainly alien invasive Australian *Acacia* species.	Increasing disturbances recognised over recent years. Substation enters site. Pylons and excavations. Band of alien invasive trees.	Many tracks and invasion by *Eucalyptus* in the eastern parts.	Becoming increasingly disturbed and degraded.	Highly disturbed and degraded or modifiied area.	Highly disturbed and degraded or modified area.
Aquatic	**Presence of active channels and riparian zones**	No riparian zones or active channels of any note.	No riparian zones or active channels of any note.	Riparian zone of tributary of Olifantspruit crosses south-western extreme.	No riparian zones or active channels of any note.	Perennial active channel runs across southern extreme of site and a non-perennial active channel run through central-northern parts of the site.	Perennial active channel and non-perennial active channel run through north-eastern part of the site.
	Presence of wetlands	No wetlands of any note.	No wetlands of any note.	No wetlands of any note.	No wetlands of any note.	No wetlands of any note.	Artificial wetland: Quarry filled with water and surrounded by exotic trees at central-western part of the site. A weakly developed wetland occurs south of the quarry.

Table 2.2: Outline of key fauna and flora considerations stemming from the habitat assessment and surveys. Categories of presence or degree: Very low, Low, Moderate, High, Very high, Confirmed.

	DOORNKLOOF PTN 107	DOORNKLOOF PTN 129	RIETVLEI 7	RIETVLEI 6	STRAWBERRY FARM PHASE 1	STRAWBERRY FARM PHASE 2
Unique habitat of Threatened Plant Species	**Low**	**Low**	**Confirmed** *Habenaria mossii* **ENDANGERED,** *Cheilanthes deltoidea* subsp. *silicicola* **VULNERABLE**	**Low**	**Low**	**Low**
Unique habitat other plant species of conservation concern: Near Threatened Plant Species	**Low**	**Low**	**Confirmed** *Habenaria kraenzliniana* NEAR THREATNED *Cleome conrathii* NEAR THREATNED	**Low**	**Confirmed** *Cleome conrathii* NEAR THREATNED *Lithops lesliei* subsp. *lesliei* NEAR THREATENED	**Confirmed** *Cleome conrathii* NEAR THREATNED *Lithops lesliei* subsp. *lesliei* NEAR THREATENED
Unique habitat other plant species of conservation concern: Declining / Rare/ Plant Species	**Confirmed** *Boophone disticha* Declining *Hypoxis hemerocallidea* Declining	**Confirmed** *Boophone disticha* Declining *Hypoxis hemerocallidea* Declining	**Confirmed** *Hypoxis hemerocallidea* Declining *Eucomis autumnalis* subsp. *clavata* Declining	**Confirmed** *Boophone disticha* Declining *Hypoxis hemerocallidea* Declining	**Low**	**Low**
Unique habitat of Threatened Fauna	**Confirmed** *Ichnestoma stobbiai* (Beetle) **VULNERABLE**	**Low** Historically some records of *Ichnestoma stobbiai* but no recent observations. Viable sub-population unlikely.	**Low**	**Low**	**Low**	**Low**
Unique habitat of Near Threatened Fauna	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**
General cover of indigenous plant species	**High**	**High**	**High**	**Medium**	**Low**	**Very Low**
Grazing importance* (of entire area including the sites)	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**
Connectivity, intactness (of entire area including the sites)	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**

6 TOWARDS ENVIRONMENTAL MANAGEMENT AND PLANNING OF THE STUDY AREA

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 2002, 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 Gauteng the pressure to develop areas are high since its infrastructure allows for improvement of human well-being in some way. 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 red listed 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 resent 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 residential developments are concerned, the key would be to prioritise and plan according to sensitive species and special ecosystems.

In the case of this study study area the vegetation ranges from pristine patches that are mostly present in the northern pars to extensively transformed at most of the southern parts of the study area. With careful planning unique ecosystems and sensitive species could be conserved if the development is approved. If some areas such as the core sensitive habitats are developed there would be a significant loss of unique local ecosystems and in particular loss of species of conservation concern of which some are in reality threatened species. In other areas there appear to be no loss of any particular sensitive species or particular unique ecosystems. A challenge in the area is that a trend of increasing degradation has been observed and decisions have to be made on the future of the study area south of Irene.

Riparian zone at the site is a very important conservation corridor and a 50 m buffer zone from the edge of the river is thought to be sufficient to conserve the riparian zone.

7 CONCLUSION

A holistic approach was deliberately followed during this study to address present limitations in the consolidation and confirmation of key biodiversity information and consequently biodiversity priorities of the study area.

The study area is a mosaic of which the vegetation and habitat ranges from extensively degraded in most of the southern parts to pristine patches of grassland in the northern parts. Some of the remaining patches of grassland and rocky outcrops in the study area contain not only Near Threatened species but also threatened plant and animal species. In other parts of the study area large areas are unfortunately covered by alien invasive Australian *Acacia* species and exotic *Eucalyptu*s species (gum trees). Though some of these exotic trees harbour some raptor bird species, these are not threatened and can in the case of this study, not weigh up against loss of indigenous grassland patches which serve as habitat for a number of localised plant and animal species.

A key issue at the study area is the apparent continuous ecological degradation of indigenous grassland and unique indigenous bushclumps in the area, witnessed for one, by the author of this document, in the past decade. If this trend of habitat degradation continues, habitat loss and loss of plant and animal species of particular conservation are most likely scenarios.

Another critical issue is that the entire study area is increasingly isolated and that corridors and buffer zones should be viewed in that context. Grassland and bushclump patches as well as sensitive species to be conserved in the area are unlikely to be linked to the Rietvlei Reserve as a continuous corridor, i.e. any conserved areas are more likely to be viewed in terms of stepping stone corridor models. Buffer zones such as required for species of particular conservation concern is impractical in this case and have already been compromised by extant developments, if not entirely. It may, however, and is then vital to have as great as possible connectivity of conserved areas in the study area itself, south of Irene. Such planning of the entire area falls beyond the scope of this study but should be conducted as soon as possible.

A summary of important considerations at each site follows (see Table 5.1 and Table 5.2 for an outline):

Doornkloof Ptn 107

- Doornkloof Ptn 107 is situated north of a large substation but contains large patches of pristine and diverse grassland.
- Northern and north western parts of the site contain an extant habitat of the VULNERABLE beetle species *Ichnestoma stobbiai*. Population of the beetle *Ichnestoma stobbiai* in this area does not appear to be as strong as the population east of Irene Market Parking Area but could with careful planning and eradication of exotic tree species be connected to the core population lower down.
- A large patch of alien invasive trees (mainly Australian *Acacia* species) is present at the south-western parts of the site. Eradication of this patch will benefit conservation of indigenous grassland and associated fauna in the area.

Doornkloof Ptn 129

- Doornkloof Ptn 129 is ecologically increasingly degraded in terms of available quality indigenous grassland habitats.
- Areas of particular high sensitivity fall outside Doornkloof Ptn 129 but near its western boundary such as indicated (Figure 3).
- There are numerous exotic tree species, especially at the western and north western parts of the site. These exotic trees at the western boundary of the site where have already started to encroach on unique localised ecosystems of chert rock and bushclumps next and west of Doornkloof Ptn 129.

Rietvlei 7

- Numerous tracks, pylons, excavations and some exotic tree species reflect disturbances in the area. A rocky outcrop is present but also appears to be increasingly degraded.
- Despite these disturbances a VULNERABLE fern species, *Cheilanthes deltoidea* subsp. *silicicola* is found on chert rock at the rocky outcrop east of the cement factory.
- An area of very high sensitivity occurs in the shallow valley east of the rocky outcrop at the site. This area includes habitat and a significant population of the ENDANGERED orchid, *Habenaria mossii,* a Near Threatened orchid *Habenaria kraenzliniana* and a Near Threatened herbaceous plant species, *Cleome conrathii*.

Rietvlei 6

- Rietvlei 6 is increasingly degraded and considered to be of low sensitivity.
- Informal settlements in the area have expanded to the south-eastern parts of the site and are further cause for ecological degradation in the area.
- Vast majority of trees that either occur in clumps or dot the landscape are exotic species, of which *Eucalyptus camaldulensis* (red gum) was visibly abundant during the site surveys.

Strawberry Farm Phase 2

- Degradation and transformation of indigenous grassland are severe at most of Strawberry Farm Phase 2.
- A patch of indigenous grassland containing the Near Threatened succulent *Lithops leslei* and a Near Threatened herbaceous species *Cloeme conrathii* enters the north-eastern extreme of the site. These are very important to set aside from any developments.

- Aquatic ecosystems such as a quarry (central-southern part) and a perennial active channel (north-eastern parts) are present at the site. The quarry is surrounded by exotic *Eucalyptus* (gum trees). Riparian zone of the active channel is highly transformed and exotic plant species are visibly abundant.

Strawberry Farm Phase 1

- Strawberry Farm Phase 1 is another site in the area that is of which the indigenous grassland is highly degraded or transformed.
- A large informal settlement is spreading at the site, resulting in an increase of tracks and poorly managed human impacts such as informal dumping and pollution.
- An area outlined in yellow that enters the north-western extreme of the site contains the Near Threatened succulent species *Lithops leslei* and a Near Threatened herbaceous species *Cloeme conrathii.* Owing to an apparent increase of tracks, trampling and informal dumping the future of the *Lithops lesliei* population is precarious given the status quo.
- Aquatic ecosystems such as a perennial active channel (north-western parts) and a non-perennial small water course are present.
- Vegetation of riparian zones and vegetation associated with the non-perennial narrow water course are in an obvious degraded state and visibly infested by exotic trees and weeds.

An opportunity presents itself to secure some diverse and highly sensitive grassland south of Irene through carefull planning and eradication of large patches of exotic trees. This report removes some uncertainties and gives an indication of areas of particular high sensitivity and suggests some indicators of the conservation of these. The planning and management of the study area falls beyond the scope of this report, however, decisions cannot be postponed any longer, because the area is in a constant state of degradation.

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ANNEXURE 1: Plants

List of plant species that have been recorded or are likely to occur in the study area

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

Sources: Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998), Van Wyk & Van Wyk (1997), Crouch, Klopper, Burrows & Burrows (2011), Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Ginkel *et al*. (2011), Van Jaarsveld (2006), Van Wyk & Smith (2003).

TAXON	COMMON NAMES	FAMILY	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
PTERIDOPHYTA (MONILOPHYTA)	PTERIDOPHYTES/ TRUE FERNS							
Cheilanthes hirta		SINOPTERIDACEAE	Dn 107	Dn 129	Rv 7			
Cheilanthes *viridis* (cf. subsp. glauca)		SINOPTERIDACEAE	Dn 107	Dn 129	Rv 7			
Pellaea calomelanos		SINOPTERIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Pleopeltis macrocarpa		POLYPODIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Pteridium aquilinum	Bracken fern	DENNSTAEDTIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
GYMNOSPERMAE	GYMNOSPERMS							
**** Pinus*** species	Pine species	PINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
ANGIOSPERMAE: MONOCOTYLEDONS								
Albuca setosa	Fibrous Slime Lily	HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Aloe greatheadii var. ***davyana***	Kgopane	ASPHODELACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Aloe zebrina		ASPHODELACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Alloteropsis semialata	Black-seed Grass	POACEAE	Dn 107	Dn 129	Rv 7			
Andropogon schirensis	Hairy Blue Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Andropogon schirensis	Stab Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Aristida adscensionis	Annual Three-awn	POACEAE	Dn	Dn	Rv	Rv	Sf	Sf

			107	129	7	6	2	1
Aristida canescens	Pale Three-awn	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Aristida congesta subsp. ***congesta***	Tassel Three-awn	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Aristida diffusa	Iron Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Aristida scabrivalvis/ transvaalensis	Purple Three-awn	POACEAE	Dn 107	Dn 129	Rv 7			
Asparagus flavicaulis* subsp. *flavicaulis		ASPARAGACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Asparagus laricinus	Common Wild Asparagus	ASPARAGACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Asparagus suaveolens	Wild Asparagus	ASPARAGACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Arundo donax***	Spanish Reed	POACEAE					Sf 2	Sf 1
Bewsia biflora	False Love Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Boophone disticha	Poison Bulb	AMARYLLIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Brachiaria serrata	Velvet Signal Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Bromus catharticus***	Rescue Grass	POACEAE					Sf 2	Sf 1
Bulbine capitata		ASPHODELACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Bulbine narcissifolia		ASPHODELACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Bulbostylis burchellii		CYPERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Chloris virgata	Feather-top Chloris	POACEAE					Sf 2	
Chlorophytum fasciculatum		ANTHERICAECEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Commelina africana		COMMELINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Commelina benghalensis	Wanderinh Jew	COMMELINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Crinum graminicola	Grass Lily	AMARYLLIDACEAE					Sf 2	Sf 1
Cyanotis speciosa	Doll's Powderpuff	COMMELINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Cymbopogon caesius	Broad-leaved Turpentine Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Cymbopogon pospischilii	Narrow-leaved Turpentine Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Cynodon dactylon	Couch Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Cyperus esculentus***	Yellow nutsedge	CYPERACEAE	Dn	Dn	Rv	Rv	Sf	Sf

			107	129	7	6	2	1
***Cyperus* species**		CYPERACEAE					Sf 2	Sf 1
Cyperus obtusiflorus		CYPERACEAE					Sf 2	Sf 1
Digitaria eriantha	Common Finger Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Digitaria monodactyla	Common Finger Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Digitaria tricholaenoides	Purple Finger Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Diheteropogon amplectens	Broad-leaved Bluestem	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Dipcadi viride		LILIACEAE					Sf 2	Sf 1
Drimia calcarata		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Drimia depressa		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Drimia sanguinea		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Eleusine coracana	Goose Grass	POACEAE				Rv 6	Sf 2	Sf 1
Elionurus muticus	Wire Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eragrostis capensis	Heart-seed Love Grass	POACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Eragrostis chloromelas	Narrow Curly Leaf	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eragrostis curvula	Weeping Love Grass	POACEAE					Sf 2	Sf 1
Eragrostis gummiflua	Gum Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Eragrostis nindensis	Wether Love Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eragrostis micrantha		POACEAE	Dn 107	Dn 129	Rv 7			
Eragrostis racemosa	Narrow Heart Love Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eragrostis superba	Saw-toothed Love Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eriospermum flagelliforme		ASPARAGACEAE					Sf 2	
Eucomis autumnalis subsp. ***clavata***	Common Pineapple Lily	HYACINTHACEAE			Rv 7			
Eulophia hians		ORCHIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Eulophia welwitschii		ORCHIDACEAE			Rv 7			
Eustachys paspaloides	Brown Rhodes	POACEAE	Dn	Dn	Rv	Rv	Sf	Sf

	Grass		107	129	7	6	2	1
Gladiolus crassifolius	Thick-leaved Gladiolus	IRIDACEAE			Rv 7			
Gladiolus permeabilis		IRIDACEAE	Dn 107		Rv 7		Sf 2	
Habenaria epipactidea		ORCHIDACEAE			Rv 7			
Habenaria kraenzliniana		ORCHIDACEAE			Rv 7			
Habenaria mossii		ORCHIDACEAE			Rv 7			
Habenaria nyikana		ORCHIDACEAE			Rv 7			
Heteropogon contortus	Spear Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hyparrhenia hirta	Common Thatching Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hypoxis argentea		HYPOXIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Hypoxis hemerocallidea	Star Flower	HYPOXIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hypoxis obtusa		HYPOXIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hypoxis rigidula		HYPOXIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Imperata cylindrica	Cotton Wool Grass	POACEAE					Sf 2	Sf 1
Kyllinga alba		CYPERACEAE					Sf 2	Sf 1
Ledebouria ovatifolia		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ledebouria revoluta		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Loudetia simplex	Common Russet Grass	POACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Melinis nerviglumis	Bristle-leaved Red Top	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Melinis repens	Natal Red Top	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Michrochloa caffra	Pincushion Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Monocymbium ceresiiforme	Boat Grass	POACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Ornithogalum tenuifolium		HYACINTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Panicum maximum	Guinea Grass	POACEAE					Sf 2	Sf 1
**** Paspalum dilatatum***	Dallis Grass	POACEAE			Rv 7	Rv 6	Sf 2	Sf 1
**** Pennisetum clandestinum***	Kikuyu Grass	POACEAE			Rv	Rv	Sf	Sf

					7	6	2	1
Phragmites australis	Common Reed	POACEAE					Sf 2	Sf 6
Pogonarthria squarrosa	Herringbone Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Scadoxus puniceus	Red Blood Lily	AMARYLLIDACEAE			Rv 7			
Schizachyrium sanguineum	Red Autumn Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Schizocarpus nervosus	Wild Squill	HYACINTHACEAE					Sf 2	
Scheonoplectus brachyceras		CYPERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Setaria incrassata	Vlei Bristle Grass	POACEAE				Rv 6	Sf 2	Sf 1
Setaria megaphylla	Broad-leaved Bristle Grass	POACEAE		Dn 129				
Setaria nigrirostris		POACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Setaria sphacelata *var.* ***sphacelata***	Common Bristle Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Setaria sphacelata *var.* ***torta***	Creeping Bristle Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Sorghum halepense***	Johnson Grass	POACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Sporobolus africanus	Ratstail Dropseed	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Sporobolus festivus	Red Dropseed	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Sporobolus fimbriatus	Dropseed Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Sporobolus stapfianus	Fibrous Dropseed	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Themeda triandra	Red Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Trachyandra saltii		ASPHODELACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Trachypogon spicatus	Giant Spear Grass	POACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Tricholaena monachne	Blue-seed Grass	POACEAE	Dn 107	Dn 129	Rv 7			
Trichoneura grandiglumis	Small Rolling Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Triraphis andropogonoides	Broom Needle Grass	POACEAE	Dn 107	Dn 129	Rv 7			
Tristachya biseriata		POACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Tristachya leucothrix	Hairy Trident Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	

Tristachya rehmannii		POACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Tulbaghia leucantha		ALLIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Typha capensis	Bulrush	TYPHACEAE					Sf 2	Sf 1
Urelytrum agropyroides	Quinine Grass	POACEAE	Dn 107		Rv 7			
Urochloa mosambicensis	Bushveld Signal Grass	POACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Xerophyta retinervis	Black-stick Lily/ Monkey's Tail	VELLOZIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
ANGIOSPERMS: DICOTYLEDONS			Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Acacia baileyana***	Bailey's Wattle	MIMOSACEAE					Sf 2	Sf 1
Acacia caffra	Common Hook-thorn	MIMOSACEAE	Dn 107		Rv 7			
**** Acacia dealbata***	Silver Wattle	MIMOSACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Acacia decurrens***	Green Wattle	MIMOSACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Acacia karroo	Sweet Thorn	MIMOSACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Acacia mearnsii***	Black Wattle	MIMOSACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Acalypha angustata	Copper leaf	EUPHORBIACEAE	Dn 107	Dn 129	Rv 7			
Acalypha caperonioides		EUPHORBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Acalypha villicaulis	Heart-leaved Brooms and Brushes	EUPHORBIACEAE	Dn 107	Dn 129	Rv 7			
**** Acanthospermum australe***	Prostrate Starbur	ASTERACEAE	Dn 107	Dn 129				
**** Achyranthes aspera***	Chaff Flower	AMARANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Alternanthera pungens***	Duwweltjie	AMARANTHACEAE					Sf 2	Sf 1
Alysicarpus rugosus subsp. **perrennirufus**		FABACEAE	Dn 107	Dn 129	Rv 7			
**** Amaranthus hybridus***	Pigweed	AMARANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ancylobotrys capensis	Rock Wild Apricot	APOCYNACEAE			Rv 7			
**** Araujia sericifera***	Moth catcher	ASCLEPIADACEAE			Rv 7	Rv 6		
Anthospermum rigidum subsp. ***rigidum***		RUBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Argemone ochroleuca***	White-flowered	PAPAVERACEAE	Dn	Dn	Rv	Rv	Sf	Sf

	Mexican poppy		107	129	7	6	2	1
Asclepias adscendens		APOCYNACEAE		Dn 129	Rv 7			
Aster harveyanus		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Barleria macrostegia		ACANTHACEAE	Dn 107	Dn 129	Rv 7			
Berkheya radula		ASTERACEAE					Sf 2	Sf 1
**** Bidens bipinnata***	Spanish blackjack	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Bidens pilosa***	Common blackjack	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Campuloclinium macrocephalum***	Pom Pom Weed	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Canthium gilfillanii	Velvet Rock Alder	RUBIACEAE	Dn 107	Dn 129	Rv 7			
Celtis africana	White Stinkwood	CELTIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
**** Celtis australis/ Celtis occidentalis/ Celtis sinensis***	Exotic Stinkwoods	CELTIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Chaetacanthus costatus		ACANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Chamaecrista capensis/ comosa		CAESALPINIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Chamaesyce inaequilatera	Smooth Creeping Milkweed	EUPHORBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Chenopodium album***	White Goosefoot	CHENOPODIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Cirsium vulgare***	Scotch Thistle	ASTERACEAE					Sf 2	Sf 1
Clematis brachiata	Traveller's Joy	RANUNCULACEAE	Dn 107	Dn 129	Rv 7	Rv 6		Sf 1
Cleome conrathii		CAPPARACEAE			Rv 7			
Cleome monophylla	Single-leaved Spindle Pod	BRASSICACEAE (or Capparaceae)	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Combretum erythrophyllum	River Bushwillow	COMBRETACEAE					Sf 2	Sf 1
Combretum molle	Velvet Bushwillow	COMBRETACEAE	Dn 107	Dn 129	Rv 7			
Convolvulus sagittatus		CONVOLVULACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Conyza albida/ bonariensis/ canadensis***	Tall Fleabane	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Conyza podocephala		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Corchorus asplenifolius		MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Crabbea angustifolia		ACANTHACEAE	Dn	Dn	Rv	Rv	Sf	Sf

			107	129	7	6	2	1
Crabbea hirsuta		ACANTHACEAE					Sf 2	Sf 1
Crassula capitella		CRASSULACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Crassula setulosa		CRASSULACEAE	Dn 107	Dn 129	Rv 7			
Cryptolepis oblongifolia		PERIPLOCACEAE	Dn 107					
Cucumus hirsutus		CUCURBITACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Cucumus zeyheri		CUCURBITACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Cussiona paniculata	Highveld Cabbage Tree	ARALIACEAE	Dn 107	Dn 129	Rv 7			
Cynoglossum lanceolatum		BORAGINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Datura ferox***	Large Thorn-apple	SOLANACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Datura stramonium***	Common Thorn-apple	SOLANACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Dianthus mooiensis	Wild Pink	CARYOPHYLLACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Dicoma anomala		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Dichrostachys cinerea	Sickle Bush	MIMOSACEAE (or Fabaceae)	Dn 107	Dn 129	Rv 7			
Dimorphotheca spectabilis	Blou Bietou	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Diospyros lycioides var. ***guerkei***	Bluebush	EBENACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Dombeya rotundifolia	Common Wild Pear	STERCULIACEAE			Rv 7			
Elephantorrhiza elephantina		MIMOSACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Englerophytum magalismontanum	Transvaal Milkplum	SAPOTACEAE		Dn 129	Rv 7			
Eriosema burkei		FABACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Eriosema cordatum		FABACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
**** Eucalyptus camaldulensis***	Red Gum	MYRTACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Euclea crispa	Blue Guarri	EBENACEAE	Dn 107	Dn 129	Rv 7			
Euphorbia trichadenia	Melkbol	EUPHORBIACEAE			Rv 7			
Felicia muricata		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Ficus carica***	Fig	MORACEAE			Rv			

					7			
Ficus ingens	Red-leaved Fig	MORACEAE			Rv 7			
**** Flaveria bidentis***	Smelter's bush	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Gazania krebsiana subsp. ***serrulata***		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Geigeria burkei		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6		
Gerbera piloselloides	Swarteebossie	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Gerbera viridifolia subsp. ***viridifolia***		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Gleditsia triacanthos***	Honey Locust	CAESALPINIACEAE					Sf 2	Sf 1
Gnidia capitata		THYMELAEACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Gnidia kraussiana var. ***kraussiana***		THYMELAEACEAE	Dn 107	Dn 129	Rv 7			
Gnidia microcephala		THYMELAEACEAE	Dn 107	Dn 129	Rv 7			
Gnidia sericocephala		THYMELAEACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Gomphocarpus fruticosus	Milkweed	APOCYNACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Gomphrena celosioides***	Bachelor's Button	AMARANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Graderia subintegra	Wild Penstemon	OROBANCHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Gymnosporia buxifolia	Common Spike-thorn	CELASTRACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Haplocarpha lyrata		ASTERACEAE					Sf 2	Sf 1
Helichrysum acutatum		ASTERACEAE			Rv 7			
Helichrysum cerastioides		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Helichrysum nudifolium	Hottentot's tea	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Helichrysum rugulosum		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Helichrysum setosum	Yellow Everlasting	ASTERACEAE	Dn 107		Rv 7			
Hemizygia pretoriae		LAMIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hermannia cordata		MALVACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Hermannia depressa	Creeping Red Hermannia	MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1

Hermannia transvaalensis		MALVACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Hibiscus microcarpus		MALVACEAE			Rv 7			
Hibiscus pusillus		MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Hibiscus trionum***	Bladder hibiscus	MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hilliardiella aristata (= *Vernonia natalensis*)		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Hilliardiella oligocephala (= *Vernonia oligocephala*)		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Indigastrum burkeanum			Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Indigofera hedyantha	Black-bud Indigo	FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Indigofera heterotricha		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6		Sf 1
Indigofera hilaris	Red Indigo Bush	FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Indigofera melanadenia		FABACEAE	Dn 107	Dn 129	Rv 7			
**** Indigofera suffruticosis***			Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ipomoea bolusiana		CONVOLVULACEAE			Rv 7			
Ipomoea crassipes		CONVOLVULACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ipomoea oblongata		CONVOLVULACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ipomoea ommaneyi	Beespatat	CONVOLVULACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Ipomoea purpurea***	Common Morning Glory	CONVOLVULACEAE		Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Justicia anagalloides		ACANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Kalanchoe thyrsiflora		CRASSULACEAE	Dn 107	Dn 129	Rv 7			
Kiggelaria africana	Wild Peach	KIGGELARIACEAE (or Flacourtiaceae)			Rv 7			
Kohautia amatymbica		RUBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Kyphocarpa angustifolia		AMARANTHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lactuca inermis		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lannea edulis		ANACARDIACEAE			Rv 7			
Lantana rugosa		VERBENACEAE	Dn	Dn	Rv			

			107	129	7			
**** Lepidium bonariense***	Pepperweed	BRASSICACEAE					Sf 2	Sf 1
**** Ligustrum*** species	Privets	OLEACEAE					Sf 2	Sf 1
Lippia javanica	Fever Tea	VERBENACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lithops lesliei subsp. ***lesliei***		MESEMBRYANTHEMACEAE					Sf 2	
Lotononis calycina		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lotononis foliosa		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lotononis laxa		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Macledium zeyheri		ASTERACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
**** Malva parviflora***	Small Mallow	MALVACEAE				Rv 6	Sf 2	Sf 1
**** Malvastrum coromandelianum***	Malvastrum	MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Medicago sativa***	Lucerne	FABACEAE				Rv 6	Sf 2	Sf 1
**** Melia azedarach***	Seringa	MELIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Melilotus alba***	Bokhara Clover	FABACEAE			Rv 7	Rv 6	Sf 2	Sf 1
**** Mirabilis jalapa***	Four O'clock	NYCTAGINACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Monsonia angustifolia	Crane's Bill	GERANIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Morea stricta	Bloutulp	IRIDACEAE				Rv 6	Sf 2	Sf 1
**** Morus alba***	Common Mulberry	MORACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Nemesia fruticans		SROPHULARIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Neorautanenia fivifolius		FABACEAE	Dn 107	Dn 129	Rv 7			
**** Nicotiana glauca***	Wild Tobacco	SOLANACEAE	Dn 107	Dn 129				Sf 1
Nidorella anomala		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Nidorella hottentotica		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ocimum obovatum	Cat's whiskers	LAMIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Oenothera rosea***	Rose Evening Primrose	ONAGRACEAE				Rv 6	Sf 2	Sf 1
**** Oenothera stricta***	Yellow Evening	ONAGRACEAE	Dn	Dn	Rv	Rv	Sf	Sf

	Primrose		107	129	7	6	2	1
Oldenlandia herbacea		RUBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Opuntia ficus-indica***	Sweet Prickly Pear	CACTACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Osteospermum muricatum		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Oxalis corniculata***	Creeping Sorrel	OXALIDACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Oxalis obliquifolia	Oblique-leaved Sorrel	OXALIDACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Ozoroa paniculosa	Bushveld Ozoroa	ANACARDIACEAE	Dn 107		Rv 7			
Pachycarpus schinzianus	Dark-eyed Bell	APOCYNACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Parapodium costatum		APOCYNACEAE					Sf 2	
Parinari capensis subsp. ***capensis***	Dwarf Mobolo Plum	CHRYSOBALANACEAE	Dn 107	Dn 129	Rv 7			
Pearsonia cajanifolia		FABACEAE	Dn 107	Dn 129	Rv 7			
Pearsonia sessillifolia		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Pelargonium luridum		GERANIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Pentanisia angustifolia		RUBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Pentarrhinum insipidum	African Heartvine	APOCYNACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Persicaria lapathifolia		POLYGONACEAE				Rv 6	Sf 2	Sf 1
Peucedanum magalismontanum	Wild Parsley	APIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Phyllanthus incurvus		EUPHORBIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Plantago lanceolata***	Narrow-leaved plantain	PLANTAGINACEAE					Sf 2	Sf 1
Pollichia campestris	Waxberry	ILLECEBRACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Polygala amatymbica		POLYGALACEAE	Dn 107	Dn 129	Rv 7		Sf 2	SF 1
Polygala hottentotta		POLYGALACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Polygala rehmnannii		POLYGALACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Populus x canescens***	Grey Poplar	SALICACEAE					Sf 2	Sf 1
**** Populus deltoides***	Match Poplar	SALICACEAE					Sf 2	Sf 1

Protea welwitschii	Cluster-head Sugarbush	PROTEACEAE	Dn 107	Dn 129	Rv 7			
**** Prunus persica***	Peach	ROSACEAE				Rv 6	Sf 2	Sf 1
Psammotropha myriantha		AIZOACEAE	Dn 107	Dn 129	Rv 7			
Pygmaeothamnus zeyheri	Sand Apple	RUBIACEAE	Dn 107	Dn 129	Rv 7			
**** Pyracantha angustifolia***	Yellow Firethorn	ROSACEAE			Rv 7	RV 6	Sf 2	Sf 1
**** Raphanus raphanistrum***	Wild Radish	BRASSICACEAE					Sf 2	Sf 1
Raphionacme galpinii		APOCYNACEAE	Dn 107	Dn 129	Rv 7		Sf 2	Sf 1
Raphionacme hirsuta	Khadi Root	APOCYNACEAE	Dn 107	Dn 129	Rv 7		Sf 2	Sf 1
Rhamnus prinioides		RHAMNACEAE			Rv 7			
Rhyncosia monophylla		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
Rhynchosia totta		FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Robinia pseudoacacia***	Black Locust	FABACEAE					Sf 2	
Rorippa nudiuscula		BRASSICACEAE						Sf 1
Rotheca hirsuta	Bush Violet	LAMIACEAE	Dn 107	Dn 129	Rv 7			
Rubia horrida	Kleefgras	RUBIACEAE			Rv 7			
Ruellia cordata	Veld Violet	ACANTHACEAE	Dn 107	Dn 129	Rv 7			
**** Rumex crispus***	Curly Dock	POLYGONACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Salix babylonica***	Weeping Willow	SALICACEAE					Sf 2	Sf 1
Salvia runcinata		LAMIACEAE					Sf 2	
Scabiosa columbaria	Wild Scabious	DIPSACACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Schkuhria pinnata***	Dwarf Marigold	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Searsia discolor		ANACARDIACEAE	Dn 107	Dn 129	Rv 7			
Searsia lancea	Karree	ANACARDIACEAE	Dn 107	Dn 129			Sf 2	Sf 1
Searsia leptodictya	Mountain Karree	ANACARDIACEAE	Dn 107					
Searsia pyroides	Common Wild Currant	ANACARDIACEAE	Dn	Dn	Rv	Rv	Sf	Sf

			107	129	7	6	2	1
Searsia rigida		ANACARDIACEAE	Dn 107		Rv 7			
Searsia zeyheri		ANACARDIACEAE	Dn 107		Rv 7			
Senecio affinis		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Senecio coronatus	Sybossie	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Senecio inaequidens	Canary Weed	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Senecio inornatus		ASTERACEAE					Sf 2	Sf 1
Senecio oxyriifolius	False Nasturtium	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Senecio venosus		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Seriphium plumosum	Bankrupt Bush	ASTERACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Sida dregei		MALVACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Silene burchellii	Gunpowder Plant	CARYOPHYLLACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	
**** Solanum mauritianum***	Bugweed	SOLANACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Solanum panduriforme	Poison Apple	SOLANACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Solanum sisymbrifolium***	Dense-thorned Bitter Apple	SOLANACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Sonchus oleraceus***	Sowthistle	ASTERACEAE		Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Sphenostylis angustifolia	Wild Sweetpea	FABACEAE	Dn 107	Dn 129	Rv 7		Sf 2	Sf 1
Striga asiatica	Witchweed	OROBANCHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Striga elegans	Large Witchweed	OROBANCHACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Tagetes minuta***	Khakiweed	ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Tephrosia capensis var. ***capensis***		FABACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Tephrosia longipes		FABACEAE	Dn 107	Dn 129	Rv 7		Sf 2	
Tephrosia semiglabra		FABACEAE			Rv 7	Rv 6	Sf 2	Sf 1
Teucrium trifidum		LAMIACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Thesium sp.		SANTALACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Thesium utile		SANTALACEAE	Dn	Dn	Rv	Rv	Sf	

			107	129	7	6	2	
**** Tipuana tipu***	Tipu Tree	FABACEAE					Sf 2	Sf 1
**** Tragopogon dubius***	Yellow Goat's Beard	ASTERACEAE					Sf 2	Sf 1
Triaspis hypericoides		MALPIGHIACEAE	Dn 107		Rv 7			
Ursinia nana		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Vangueria infausta	Wild Medlar	RUBIACEAE	Dn 107		Rv 7			
**** Verbena aristigera***	Fine-leaved Verbena	VERBENACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Verbena bonariensis***	Purple top	VERBENACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
**** Verbena brasiliensis***		VERBENACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Vernonia galpinii		ASTERACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Vernonia staehelinoides		ASTERACEAE	Dn 107	Dn 129	Rv 7			
Vigna vexillata	Narrow-leaved Sweetpea	FABACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Wahlenbergia denticulata	Bellflower	CAMPANULACEAE	Dn 107		Rv 7			
Xysmalobium undulatum		APOCYNACEAE					Sf 2	Sf 1
Zanthoxylum capense	Small Knobwood	RUTACEAE			Rv 7			
Ziziphus zeyheriana	Dwarf Buffalo-thorn	RHAMNACEAE	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	

ANNEXURE 2: Mammals

List of mammals species that have been or could possibly be recorded at the study area.

Compiled by R.F. Terblanche

Sources: Apps (2012); Skinner & Chimimba (2005); Rautenbach (1982); Stuart & Stuart (2000)

Note that the species are listed alphabetically under the distinctive orders for easy reference.

ORDERS AND SPECIES	COMMON NAMES ENGLISH/ AFRIKAANS	LOCAL STATUS
ORDER CHIROPTERA	BAT ORDER	
Neoromicia capensis (A. Smith, 1829)	Cape Serotine Bat	**Likely, forager:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Nycteris thebaica E. Geoffroy Saint-Hilaire, 1813	Egyptian Slit-faced Bat	**Likely, forager:** Dn107, Dn129
Scotophilus dinganii (A. Smith, 1833)	African Yellow Bat	**Moderate:** Sf2, Sf1
Tadarida aegyptiaca (E. Geoffroy Saint-Hilaire, 1818)	Egyptian Free-tailed Bat	**Likely, forager:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
ORDER MACROSCELIDEA	SENGI ORDER	
Elephantulus myurus Thomas & Schwann, 1906	Eastern Rock Elephant- Sengi	**Suitable rocky habitat, but presence needs confirmation**
ORDER EULIPOTYPHLA	SHREW AND HEDGEHOG FAMILY	
Crocidura cyanea (Duvernoy, 1838)	Reddish-grey Musk Shrew	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Crocidura hirta (Peters, 1852)	Lesser Red Musk Shrew	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
ORDER RODENTIA	RODENT ORDER	
Aethomys ineptus (Thomas & Wroughton, 1908)	Tete Veld Rat	**Likely** Dn107, Dn129, Rv7

Cryptomys hottentotus (Lesson, 1826)	African Mole-rat	**Confirmed:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Hystrix africaeaustralis Peters, 1852	Cape Porcupine	**Likely** Dn107, Dn129, Rv7
Lemniscomys rosalia (Thomas, 1904)	Single-striped Grass Mouse	**Localised**
Mastomys coucha/ natalensis*	Multimammate Mouse Species Complex	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Rhabdomys pumilio (Spearman, 1784)	Four-striped Grass Mouse	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Tatera brantsii (A. Smith, 1836)	Highveld Gerbil	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Tatera leucogaster (Peters, 1852)	Bushveld Gerbil	**Likely:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
ORDER LAGOMORPHA	HARES AND RABBITS ORDER	
Lepus saxatilis F. Cuvier, 1823	Scrub Hare	**Confirmed:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
ORDER RUMINANTIA	RUMINANTS	
Sylvicapra grimmia (Linnaeus, 1758)	Common Duiker	**Confirmed (but rare in the area)**
ORDER CARNIVORA	CARNIVORE ORDER	
Cynictis penicillata (G. Cuvier, 1829)	Yellow Mongoose	**Confirmed:** Dn107, Dn129, Rv7, Rv6, Sf2, Sf1
Galerella sanguinea (Rüppell, 1836)	Slender Mongoose	**Confirmed:** Rv7, Sf2; **Likely:** Dn107, Dn129, Rv6, Sf1

* Species complexes are under revision or else species could not reliably be identifiied by using external characters.

ANNEXURE 3: Birds

List of bird species that have been recorded at the study area

Compiled by R.F. Terblanche

Sources: Chittenden (2007), Hockey, Dean & Ryan (2005), Peacock (2006).

Note that the species are listed according to their Roberts Bird numbers for easy reference.

	SPECIES	COMMON NAMES ENGLISH	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Roberts Bird No.								
8	***Tachybaptus ruficollis***	**Little Grebe**					Sf 2	Sf 1
63	***Ardea melanocephala***	**Black-headed Heron**				Rv 6	Sf 2	Sf 1
71	***Bubulcus ibis***	**Cattle Egret**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
91	***Threskiornis aethiopicus***	**African Sacred Ibis**					Sf 2	Sf 1
94	***Bostrychia hagedash***	**Hadeda Ibis**				Rv 6	Sf 2	Sf 1
102	***Alopochen aegyptiaca***	**Egyptian Goose**					Sf 2	Sf 1
104	***Anas undulata***	**Yellow-billed Duck**					Sf 2	Sf 1
105	***Anas sparsa***	**African Black Duck**					Sf 2	Sf 1
127	***Elanus caeruleus***	**Black-shouldered Kite**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
199	***Pternistis swainsonii***	**Swainson's Spurfowl**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
203	***Numida meleagris***	**Helmeted Guineafowl**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
228	***Fulica cristata***	**Red-knobbed Coot**					Sf 2	Sf 1
255	***Vanellus coronatus***	**Crowned Lapwing**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
258	***Vanellus armatus***	**Blacksmith Lapwing**					Sf 2	Sf 1
260	***Vanellus senegallus***	**African Wattled Lapwing**					Sf 2	
297	***Burhinus capensis***	**Spotted Thick-knee**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
304	***Afrotis afraoides***	**Northern Black Korhaan**			Rv 7			
348	***Columba livia***	**Rock Dove**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
352	***Streptopelia semitorquata***	**Red-eyed Dove**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
354	***Streptopelia capicola***	**Cape Turtle-dove**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
355	***Streptopelia senegalensis***	**Laughing Dove**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1

417	***Apus affinis***	**Little Swift**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
424	***Colius striatus***	**Speckled Mousebird**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
426	***Urocolius indicus***	**Red-faced Mousebird**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
443	***Merops bullockoides***	**White-fronted Bee-eater**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
473	***Trachyphonus vaillantii***	**Crested Barbet**			Rv 7	Rv 6	Sf 2	Sf 1
494	***Mirafra africana***	**Rufous-naped Lark**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
518	***Hirundo rustica***	**Barn Swallow**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
520	***Hirundo albigularis***	**White-throated Swallow**					Sf 2	Sf 1
526	***Hirundo cucullata***	**Greater Striped Swallow**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
527	***Hirundo abyssinica***	**Lesser Striped Swallow**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
568	***Pycnonotus tricolor***	**Dark-capped Bulbul**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
-	***Turdus smithi***	**Karoo Thrush**					Sf 2	Sf 1
601	***Cossypha caffra***	**Cape Robin-Chat**					Sf 2	Sf 1
664	***Cisticola juncidis***	**Zitting Cisticola**	Dn 107	Dn 129			Sf 2	
713	***Motacilla capensis***	**Cape Wagtail**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
732	***Lanius collaris***	**Common Fiscal**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
758	***Acridotheres tristis***	**Common Myna**					Sf 2	
787	***Cinnyris talatala***	**White-bellied Sunbird**			Rv 7			
796	***Zosterops virens***	**Cape White-eye**					Sf 2	Sf 1
803	***Passer melanurus***	**Cape Sparrow**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
804	***Passer diffusus***	**Southern Grey-headed Sparrow**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
814	***Ploceus velatus***	**Southern Masked-weaver**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
824	***Euplectes orix***	**Southern Red Bishop**					Sf 2	Sf 1
852	***Ortygospiza atricollis***	**African Quailfinch**					Sf 2	Sf 1
854	***Sporaeginthus subflavus***	**Orange-Breasted Waxbill**					Sf 2	Sf 1
870	***Crithagra atrogularis***	**Black-throated Canary**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
878	***Crithagra flaviventris***	**Yellow Canary**					Sf 2	Sf 1
881	***Crithagra gularis***	**Streaky-headed Seedeater**			Rv 7	Rv 6	Sf 2	Sf 1

ANNEXURE 4: Reptiles

List of reptile species that have been recorded or are likely to occur at the study area

Compiled by R.F. Terblanche

Sources of names and identifications:

Alexander & Marais (2007), Branch (1998), Branch (2008), Marais (2004).

Reptile species are listed alphabetically.

SPECIES	COMMON NAMES ENGLISH	SITES					
Agama aculeata subsp. ***distanti***	**Ground Agama**	?		?			
Aparallactus capensis	**Cape Centipede Eater**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Crotaphopeltis hotamboeia	**Herald Red-lipped Snake**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Dasypeltis scabra	**Common Egg Eater**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Lamprophis capensis	**Brown House Snake**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Pachydactylus capensis	**Cape Thick-toed Gecko**	Dn 107		Rv 7			
Trachylepis capensis	**Cape Skink**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1
Trachylepis striata subsp. ***punctatissima***	**Striped Skink**	Dn 107	Dn 129	Rv 7	Rv 6	Sf 2	Sf 1

ANNEXURE 5: Amphibians

List of frog species that have been recorded at study area

Compiled by R.F. Terblanche

Sources of names, distributions and habitats:

[1]Conradie, Du Preez, Smith & Weldon, [2]Carruthers & Du Preez (2011), [3]Du Preez (1996), [4]Du Preez & Carruthers (2009)

Note that the species are listed alphabetically for easy reference.

SPECIES	COMMON NAMES ENGLISH/ AFRIKAANS	STATUS
Amietia angolensis (Bocage, 1866)	**Common River Frog**	Grassland streams and other permanent water bodies[2,4]
Amietophrynus gutturalis (Power, 1927)	**Guttaral Toad**	Grassland and savanna, Breeds in permanent waterholes, streams and garden ponds[2,4]
Schismaderma carens (Smith, 1848)	**Red Toad**	Breeds in deep pools, farm dams and swimming pools. Forages widely and then retreats into holes in trees[2,4]

ANNEXURE 6: Butterflies

List of butterfly species at the study area

Compiled by R.F. Terblanche

FAMILIES, SUBFAMILIES AND SPECIES	COMMON NAMES ENGLISH/ AFRIKAANS
FAMILY: PAPILIONIDAE	SWALLOWTAIL FAMILY SWAELSTERTFAMILIE
SUBFAMILY PAPILIONINAE	SWALLOWTAILS AND SWORDTAILS SWAELSTERTE EN SWAARDSTERTE
Papilio demodocus (Esper, 1798)	**Citrus Swallowtail** Lemoenswaelstert
FAMILY PIERIDAE	WHITES, YELLOWS AND TIPS WITJIES, GELETJIES EN PUNTJIES
SUBFAMILY COLIADINAE	YELLOWS AND CLOUDED YELLOWS GELETJIES EN WOLK-ORANJES
Catopsilia florella (Fabricius, 1775)	**African Migrant** Afrikaanse Migreerder
Colias electo electo (Linnaeus, 1763)	**African Clouded Yellow** Afrikaanse Wolk-oranje
Eurema brigitta brigitta (Stoll, 1780)	**Broad-bordered Grass Yellow** Grasveldgeletjie
SUBFAMILY PIERINAE	WHITES AND TIPS SUBFAMILY WITJIES EN PUNTJIES SUBFAMILIE
Belenois aurota aurota (Fabricius, 1793)	**Brown-veined White** Grasveldwitjie
Belenois creona severina (Stoll, 1781)	**African Common White** Afrikaanse Gewone Witjie
Colotis evinina evinina (Wallengren, 1857)	**Common Orange Tip** Gewone Oranjepuntjie
Colotis subfasciatus subfasciatus (Swainson, 1833)	**Lemon Traveller Tip** Suurlemoensmous
Mylothris agathina agathina (Cramer, 1779)	**Common Dotted Border** Gewone Spikkelrandjie/ Voëlentwitjie
Pinacopteryx eriphia eriphia (Godart, 1819)	**Zebra White** Kwagga
Pontia helice helice (Linnaeus, 1764)	**African Meadow White** Bontrokkie
FAMILY NYMPHALIDAE	BRUSH-FOOTED BUTTERFLIES BORSELPOOTSKOENLAPPERS
SUBFAMILY DANAINAE	MONARCH SUBFAMILY MONARG-SUBFAMILIE
Danaus chrysippus chrysippus (Linnaeus, 1758)	**African Monarch** Afrikaanse Melkbosskoenlapper
SUBFAMILY CHARAXINAE	CHARAXES SUBFAMILY DUBBELSTERT SUBFAMILIE
Charaxes jasius saturnus Butler, 1866	**Saturn Foxy Charaxes** Saturnus-koppiedubbelstert
SUBFAMILY SATYRINAE	BROWNS SUBFAMILY BRUINTJIES-SUBFAMILIE

Paternympha narycia (Wallengren, 1857)	**Spotted-eye Brown** Koloogbruintjie
Stygionympha wichgrafi wichgrafi Van Son, 1955	**Wichgraf's Hillside Brown** Wichgraf-rantbruintjie
SUBFAMILY BIBLIDINAE	BYBLIA SUBFAMILY BIBLIA SUBFAMILIE
Byblia ilithyia (Drury, 1773)	**Spotted Joker** Leliegrasvegter
SUBFAMILY NYMPHALINAE	PANSY SUBFAMILY GESIGGIE SUBFAMILIE
Catacroptera cloanthe cloanthe (Stoll, 1781)	**Pirate** Seerower
Hypolimnas misippus (Linnaeus, 1764)	**Common Diadem** Gewone Na-aper/ Blouglans
Junonia hierta cebrene Trimen, 1870	**Yellow Pansy** Geelgesiggie
Junonia oenone oenone (Linneaus, 1758)	**Blue Pansy** Blougesiggie
Junonia orithya madagascariensis Guenée, 1865	**Eyed Pansy** Padwagtertjie
Precis archesia archesia (Cramer, 1779)	**Garden Commodore** Rots-blaarvlerk
Vanessa cardui (Linnaeus, 1758)	**Painted Lady** Sondagsrokkie
SUBFAMILY HELICONIINAE	ACRAEA SUBFAMILY ACRAEA SUBFAMILIE
Acraea natalica natalica De Boisduval, 1847	**Natal Acraea** Natal-se-rooitjie
Acraea neobule neobule Doubleday, 1847	**Wandering Donkey Acraea** Dwaalesel-rooitjie
Acraea rahira rahira De Boisduval, 1833	**Marsh Acraea** Moerasrooitjie
Acraea serena *(=Acraea eponina)* Fabricius, 1775	**Small Orange Acraea** Klein-oranjerooitjie
Phalanta phalantha aethiopica (Rothschild & Jordan, 1903)	**African Leopard Butterfly** Afrikaanse Luiperdskoenlapper
FAMILY LYCAENIDAE	BLUES AND COPPERS BLOUTJIES EN KOPERVLERKIES
SUBFAMILY THECLINAE	HAIRSTREAKS AND COPPERS LANGSTERTE EN KOPERVLERKIES
Aloeides aranda (Wallengren, 1857)	**Aranda Copper** Aranda-kopervlerkie
Aloeides henningi Tite & Dickson, 1973	**Henning's Copper** Henning-se-kopervlerkie
Aloeides molomo molomo (Trimen, 1870)	**Grassland Molomo Copper** Grasveld-molomokopervlerkie
Cigaritis mozambica (Bertoloni, 1850)	**Mozambique Bar** Mosambiek-se-streepvlerkie
Cigaritis natalensis (Westwood, 1852)	**Natal Bar** Natal-se-streepvlerkie
Leptomyrina henningi Dickson, 1976	**Henning's Black-eye** Henning-se-swartogie
SUBFAMILY POLYOMMATINAE	BLOUTJIES AND CILIATED BLUES

	BLOUTJIES EN KORTSTERTJIES
Actizera lucida (Trimen, 1883)	**Rayed Blue** Witstreepbloutjie
Anthene amarah amarah (Guérin-Méneville, 1849)	**Black-striped Hairtail** Swartstreep-kortstertjie
Anthene definita definita (Butler, 1899)	**Common Hairtail** Donkerkortstertjie
Azanus jesous jesous (Guérin-Méneville, 1849)	**Topaz-spotted Blue** Hemels-kolbloutjie
Azanus moriqua (Wallengren, 1857)	**Thorn-tree Blue** Doringboombloutjie
Azanus ubaldus (Stoll, 1782)	**Velvet-spotted Blue** Fluweel-kolbloutjie
Cacyreus marshalli Butler, 1898	**Geranium Bronze** Pelargoniumbrons
Chilades trochylus (Freyer, 1843)	**Grass Jewel Blue** Grasjuweeltjie
Cupidopsis cissus cissus (Godart, 1824)	**Common Meadow Blue** Vleibloutjie
Cupidopsis jobates jobates (Hopffer, 1855)	**Tailed Meadow Blue** Aasbloutjie
Eicochrysops messapus mahallakoaena (Wallengren, 1857)	**Grassland Cupreous Copper** Grasveldkoperbloutjie
Euchrysops osiris (Hopffer, 1885)	**Osiris Smokey Blue** Osiris Dowwebloutjie
Lampides boeticus (Linneaus, 1767)	**Longtailed Pea Blue** Langstert-ertjiebloutjie
Lepidochrysops patricia (Trimen, 1887)	**Patricia Blue** Patricia-bloutjie
Lepidochrysops plebeia plebeia (Butler, 1898)	**Twin-spot Blue** Dubbelkolbloutjie
Leptotes brevidentatus (Tite, 1958)	**Short-toothed Blue** Korttandbloutjie
Leptotes species	**Common Blue** Gewone bloutjie
Tarucus sybaris sybaris (Hopffer, 1855)	**Dotted Blue** Spikkelbloutjie
Tuxentius melaena melaena (Trimen, 1887)	**Black Pie** Swartbontetjie
Zintha hintza hintza (Trimen, 1864)	**Hintza Pie** Hintza-bontetjie
Zizeeria knysna (Trimen, 1862)	**Sooty Blue** Duwweltjiebloutjie
Zizula hylax (Fabricius, 1775)	**Gaika Blue** Gaika-bloutjie
FAMILY HESPERIIDAE	SKIPPERS DARTELAARS
SUBFAMILY COELIADINAE	POLICEMEN KONSTABELS
Coeliades forestan forestan (Stoll, 1782)	**Striped Policeman** Witbroekkonstabel
Coeliades pisistratus (Fabricius, 1793)	**Two-pip Policeman** Dubbelkolkonstabel

SUBFAMILY PYRGINAE	SANDMEN AND ELFINS SANDMANNETJIES EN ELWE
Eretis umbra umbra (Trimen, 1862)	**Small Marbled Elf** Umbra-kabouter
Spialia diomus ferax (Wallengren, 1863)	**Common Sandman** Kwagga-sandmannetjie
Spialia mafa mafa (Trimen, 1870)	**Mafa Sandman** Mafa-sandmannetjie
Spialia spio (Linnaeus, 1764)	**Mountain Sandman** Bergsandmannetjie
SUBFAMILY HETEROPTERINAE	SYLPHS WALSERTJIES
Tsitana tsita (Trimen, 1870)	**Grassland Dismal Sylph** Grasveld Donkerwalsertjie
SUBFAMILY HESPERIINAE	RANGERS AND SWIFTS WAGTERTJIES EN RATSVLIEËRS
Gegenes niso niso (Linneaus, 1764)	**Common Gold Skipper** Gewone Goud
Gegenes pumilio gambica (Mabille, 1878)	**Dark Gold Skipper** Donker Goud
Kedestes barberae barberae (Trimen, 1873)	**Barber's Ranger** Barber-se-wagtertjie
Kedestes nerva nerva (Fabricius, 1793)	**Scarce Ranger** Seldsame wagtertjie
Pelopidas mathias (Fabricius, 1798)	**Black-banded Swift** Swartmerk-ratsvlieër
Pelopidas thrax inconspicua (Bertoloni, 1850)	**White-branded Swift** Witmerk-ratsvlieër
Platylesches ayresii (Trimen, 1889)	**Peppered Hopper** Ayres-se-hoppertjie