THE PROJECTED IMPACT OF 15 CHICKEN FARMS AND TWO ADDITIONAL SITES ON THE VERTEBRATES OF THE RAINBOW ROODEWAL FARMS

Commissioned by Labesh

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Declaration of Professional Standing and Independence

We,

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declare that we:

- hold higher degrees in the biological sciences, which allowed registration by S.A. Council for National Scientific Professions (SACNASP) as Professional Ecologist or Zoologists that sanction us to function independently as specialist scientific consultants;
- declare that as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003 this project was our own work from inception and reflects exclusively our observations and unbiased scientific interpretations, and executed to the best of our abilities;
- abide by the Code of Ethics of the SACNASP;
- are committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas we appreciate opportunities to learn through constructive criticism and debate, we reserve the right to form and hold our own opinions within the constraints of our training, experience and results and therefore will not submit willingly to the interests of other parties or change our statements to appease or unduly benefit them;
- are subcontracted as specialist consultants for the project "The Projected Impact of 16 Chicken Farms on the Vertebrates of the Rainbow Rustenburg Farms" as described in this report;
- have no financial interest in the proposed development other than remuneration for the work performed;
- do not have, and will not have in the future, any vested or conflicting interests in the proposed development;
- undertake to disclose to the consultant and its client(s) as well as to the competent authority any material information that may have the potential to influence any decisions by the competent authority, as required in terms of the Environmental Impact Assessment Regulations 2006;
- reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent from the client will be required for any of us to release of any part of this report to third parties.
- In addition, remuneration for services provided by us is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.



I.L. Rautenbach J.C.P.vanWyk A.E. McKechnie

DISCLAIMER:

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. The vegetation and fauna team can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. Although the authors exercised due care and diligence in rendering services and preparing documents, they accept no liability, and the client, by receiving this document, indemnifies the authors against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document. This report should therefore be viewed and acted upon with these limitations in mind.

EXECUTIVE SUMMARY

The 15 new chicken farms will entirely displace all biota on their footprints. Whereas environmental impacts on these will be Very High, the collective area to be sacrificed for construction will be ca. 0.3% of the total size of Roodewal and Kwa-Mmatau Farms, which are currently managed as a game farm and nine chicken farms. Hard-topped roads will be constructed to service the new farms from a central facility. The surface area of the roads is not known, but together with the chicken farms will probably in the order of 1% of the landmass of the two farms. Chicken farms are sealed units and none of its by-products will leach into the environment. It should also be pointed out that these farms, like all farms, are managed for commercial purposes, quite often at the expense of environmental damage such as tilled fields.

The impact of the construction of the chicken farms on its footprints will be 70%, and impact during the operational phase over a period of >15 years will be 80%, which are deemed to be Very High (See Section 6.5). Add to that the impact of the service roads. This will still be insignificant considering the commercial objective of the properties and the size of the land sacrificed (within a significantly larger conservation area) for this purpose.

Rainbow Chickens manages the areas not utilized for chicken production as a commercial game farm. In terms of environmental conservation it makes thus no sense whatsoever that game are to be relocated and kept on the fallow fields like domestic animals, in order to construct chicken farms on prime veld. It makes more sense to build the chicken farms on the fallow fields and manage the game on it natural habitat.

No sensitive species, sensitive areas, ecological systems or services will be significantly negatively affected by the proposed development. We can therefore not submit reasonable objections to the proposed development, but must point out that should the developments are on fallow fields, the environmental and conservation impact would be virtually nil!

1 INTRODUCTION

Limosella Consulting Pty Ltd was commissioned to qualitatively and quantitatively assess the vertebrate habitats on the Rainbow Chickens properties in the Rustenburg District and to derive lists of mammals, birds, reptiles and amphibian species that could adversely be affected by the construction and operation of 15 additional broiler chicken farms (Two additional sites are defined, but intended for purposes other than building chicken fams. Rainbow has suggested preferred localities pending the results of EIA studies. Suggestions were invited how to mitigate unacceptable plans or intended practices. This assignment is in accordance with the 2014 EIA Regulations (No.982, Department of Environmental Affairs, 4 December 2014) emanating from Chapter 5 of the National Environmental Management Act, 2004 (Act No. 10 of 2004).

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

1.1 Initial preparations:

Obtain all relevant maps and information on the natural environment of the concerned area. This includes information on Red Data vertebrates that may occur on the properties.

1.2 Fauna assessment

Compile lists of the vertebrates that can be expected in the area.
Identify the Red Data species that occur (or may occur) on the site.
Assess the quantitative and qualitative condition of suitable habitat for the Red-Listed vertebrates that may occur in the area.
Assess the likelihood of Red-Listed fauna being present on the study site.

1.3 General

Identify and describe particular ecologically sensitive areas.
Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, water pollution, degraded areas, reclamation areas.
Make recommendations on aspects that should be monitored during development.
Calculate a significance (impact) rating for the proposed development.

2. RATIONALE

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

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

In South Africa a number of acts and regulations, such as:

The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996),
The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983),
The Environmental Conservation Act, 1989 (Act No. 73 of 1989),
The National Environment Management Act, 1998 (Act No. 107 of 1998) as amended in 2010,
The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004),
The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004), Draft List of Threatened Ecosystems. Government Gazette RSA Vol. 1477, 32689, Cape Town, 6 Nov 2009,
The National Environmental Management: Waste Act [NEM:WA] (Act 59 of 2008),
The National Forests Act, 2006 (Act 84 of 1998 as amended in 2006),
The National Heritage Resources Act, 1999 (Act No. 25 of 1999),
The National Environmental Management: Protected Areas Act (Act 57 0f 2003),
The Mineral and Petroleum Resources Development Act 28 of 2002,
The National Water Act, 1998 (Act No. 36 of 1998), and the
Environmental Impact Assessment Regulations Notice 982 of 2014.

The conduct of natural scientists is directed by The Natural Scientific Professions Act (Act 27 of 2003). Nowadays a development prerogative is to precede new constructions by a multidisciplinary environmental investigation to assess the conservation costs. This is to ensure that best conservation practices are applied during the planning, construction and operational phases of new developments.

3. PROJECT DESCRIPTION

Rainbow Chickens was founded in 1960. Today it is South Africa's largest producer, processor and marketer of fresh and frozen chickens. Amongst others, the company presently operates nine chicken farms on the Farms Roodewal south-west of Rustenburg. It is intended to consolidate regional production by closing other local production units and to significantly increase Roodewal / Kwa-Mmatau output by constructing 15 new chicken farms. The purpose of this study is to ascertain the impact of the new developments (that include 15 sites for chicken farms and two for other plans) on the environment and vertebrates.

4. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the habitat components and current general conservation status of the study site;
- Identify and comment on ecologically sensitive areas or ecological services;
- Comments on connectivity with natural vegetation and habitats on adjacent terrain;
- To provide a list of occurrences and to identify species of conservation importance;

- To highlight potential impacts of the proposed development on the mammals, birds, reptiles and frogs as well as their habitats;
- To investigate the possibility of knock-on effects on the district as result of the development, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.
- Calculate a significance rating for the proposed development.

5. STUDY AREA

The Rainbow Chickens' Rustenburg property consists of the 1600-hectare Roodewal Farm, and the recently acquired 1800-hectare Kwa-Mmatau Farm (collectively the [study] site) (Figure 1). These adjoining farms are ca. 20km southwest of the town of Rustenburg and are located in the Moot Plains Bushveld vegetation unit, and peripherally in the Zeerust Thornveld vegetation unit as defined by Mucina and Rutherford (2006) (Figure 2). The former is regarded as "Vulnerable". In terms of the North-West Province's Critical Biodiversity Sector Plan most of the Rainbow Chicken's farms fall in the Ecological Support Area 1 (Figure 3). The Rainbow farms and the district are grazed and as a consequence it retained its undeveloped natural "bush" ambiance, although some of the farms appear to be overgrazed; this impression may also be the after-effect of the 2015-16 droughts and 2016 winter. Since Rainbow acquired the farms, cattle have been replaced by big game and are hunted by paying guests. There are a number of fallow fields to the west along a seasonal streambed (Kgetleng River); these regenerated into secondary grassland and are visible on the satellite image (Figures 4 and 6).

Nine chicken farms are presently functioning on Roodewal and can be discerned in Figures 4, 6 and 7. Seventeen additional facilities are to be constructed on the localities suggested by Rainbow (Figure 6), of which 15 will be for new chicken farms. Their usage will depend on the results of a series of environmental impact assessments.

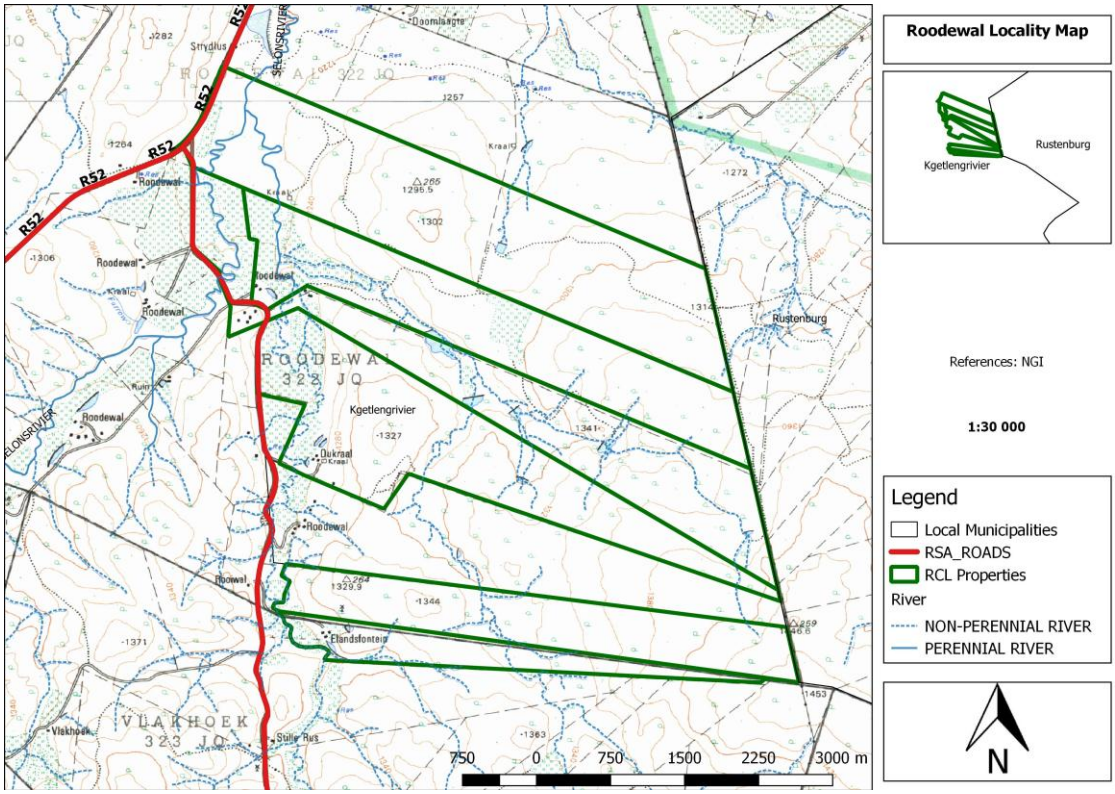

Figure 1: Locality map.

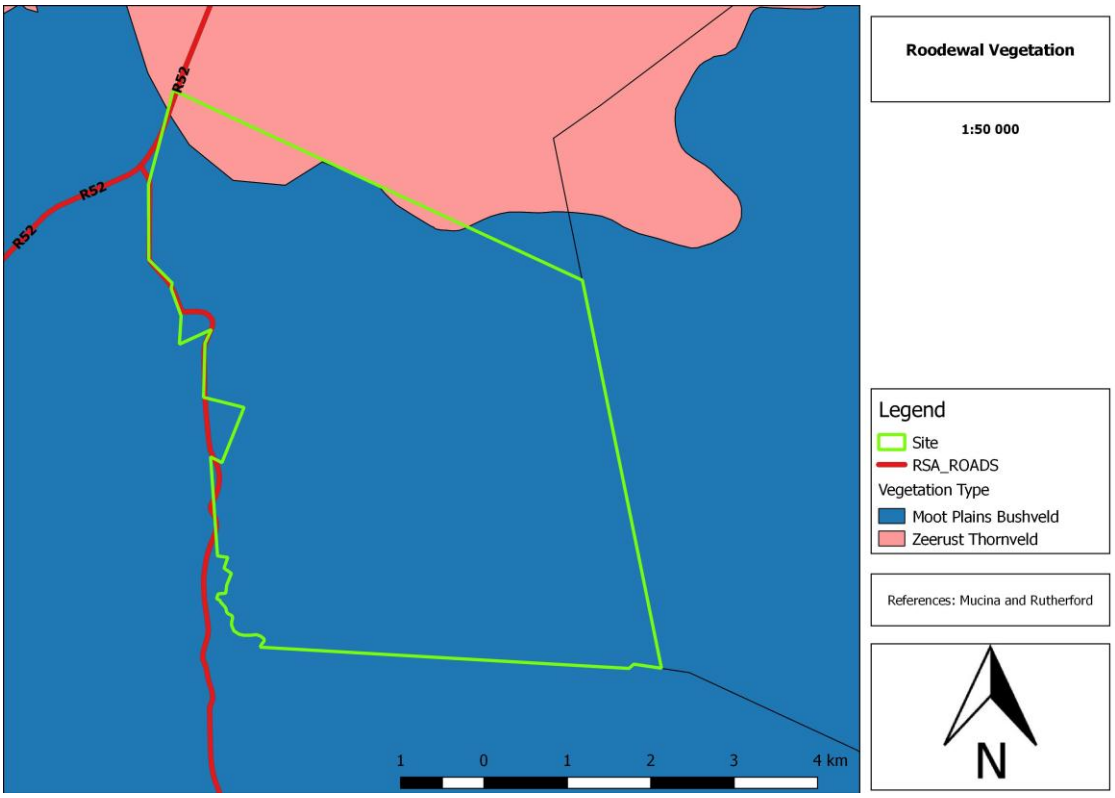

Figure 2: Vegetation map as per Mucina and Rutherford (2006) definitions.

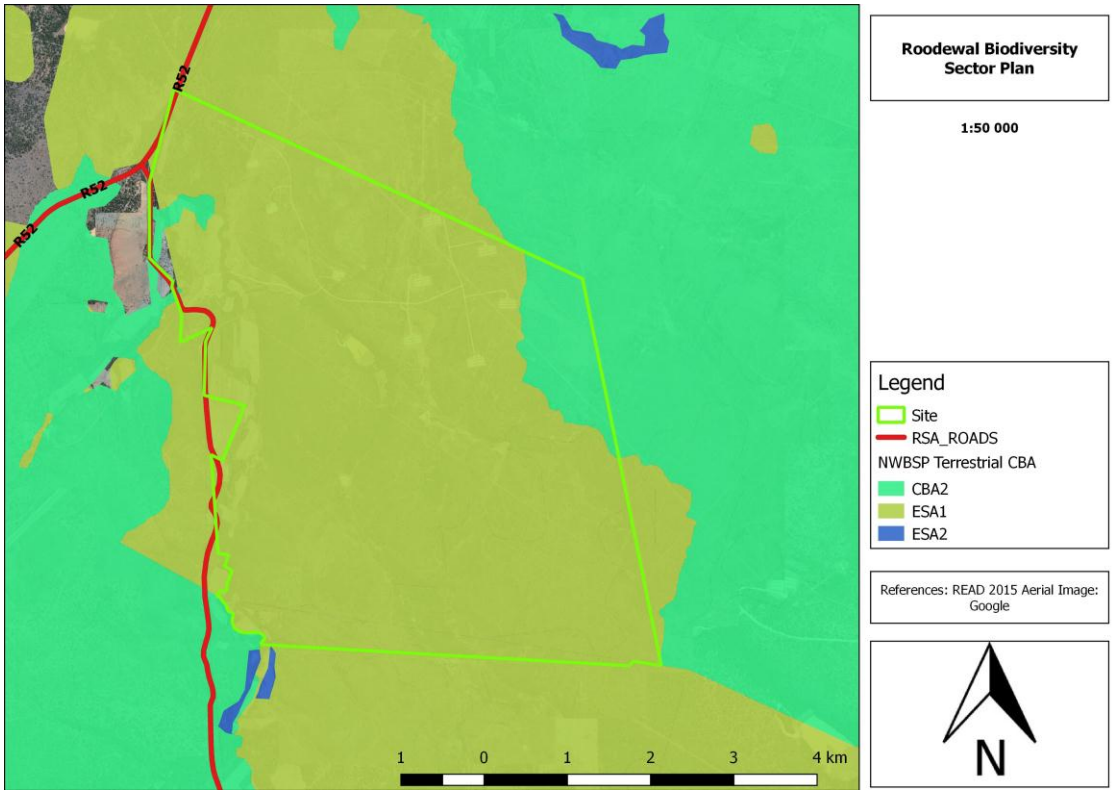

Figure 3: Critical Biodiversity and Ecological Support Areas (CBA and ESA) of the site

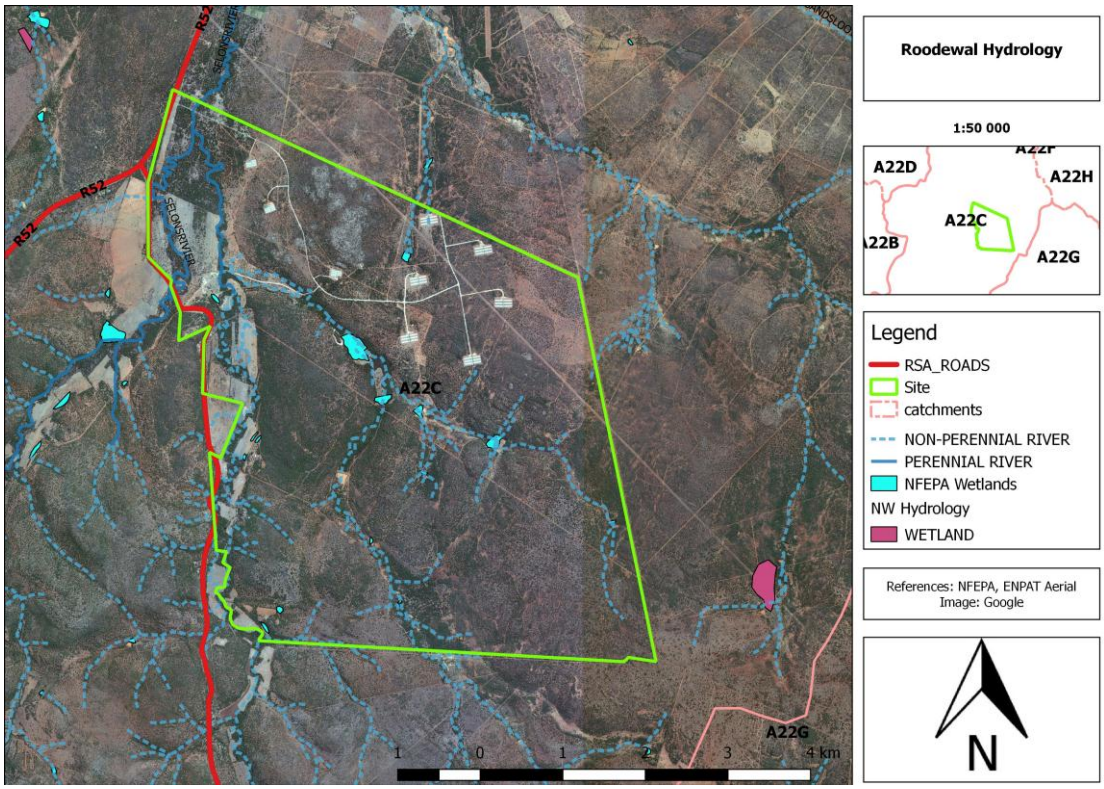

Figure 4: The site's seasonal drainage decanting storm water in the Selons River.

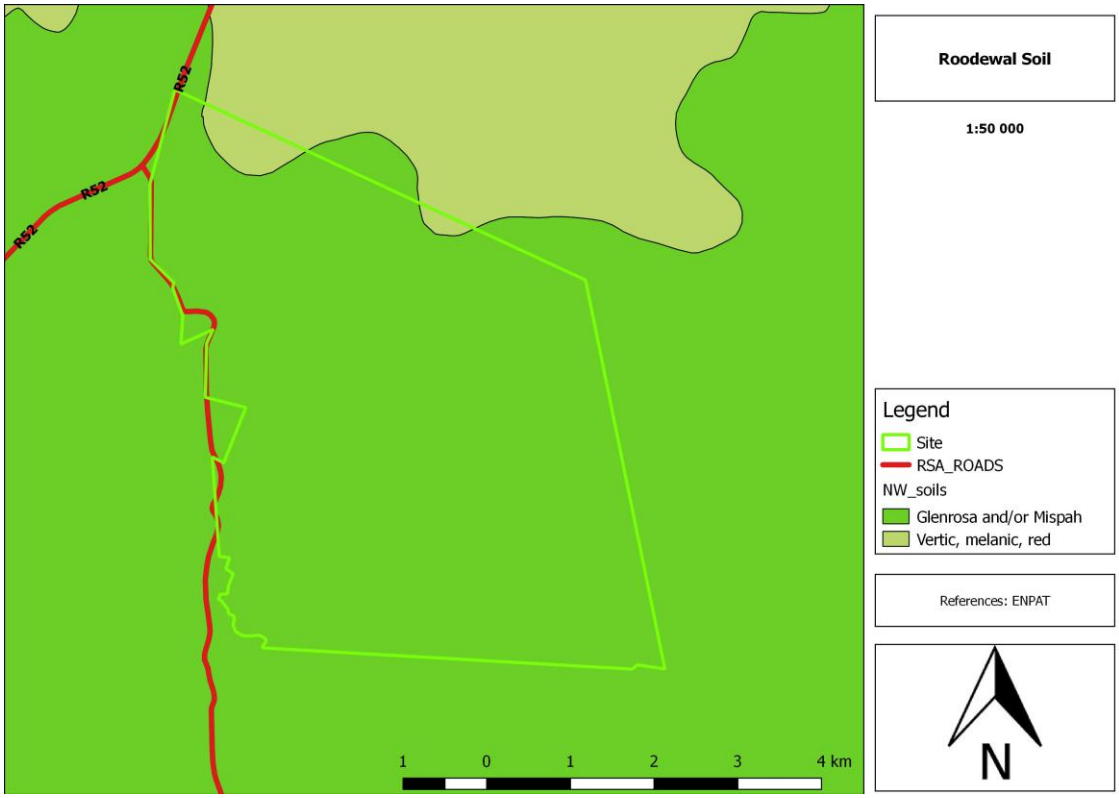

Figure 5: Soil map.

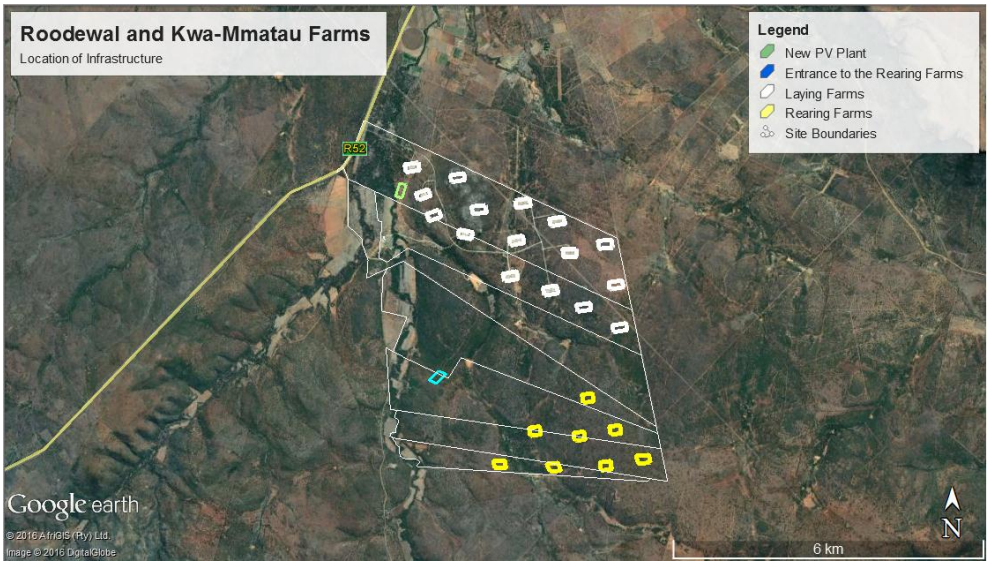

Figure 6: The approximate localities of the final facilities, including the 17 new facilities (i.e. 15 new rearing and laying farms + 2 facilities for other purposes) to be constructed on Roodewaal and Kwa-Mmatau Farms.

A so-called chicken farm is a complex consisting of six or seven chicken houses (depending on its purpose, i.e. laying or rearing) and each house accommodates ca. 5500 chickens (Figure 7). Farm complexes are fenced and managed as a sealed unit. A network of hard-topped roads will connect the farms and the central complex. After chickens are harvested

and processed, the houses are cleaned, the manure is sold and the facility is steam-sterilised. No side-product of this form of farming is allowed in the environment.

Figure 7: A chicken farm, secured with an electrical security fence. The building in the foreground is a chicken house designed to house 5500 chickens at a time.

The topography of the farms consists of “randjie veld”, i.e. rocky undulating woodlands. The North West Environmental Management Plan consider a slope of >5º as a ridge, and Classical Environmental Fauna Opinion (2015) report ridges as a prominent environmental element on the study site. Rocky ridges typically present rupiculous habitat that provide nooks and crannies for rock-living creatures. Rupiculous habitat on the study site is undeveloped since its “ridges” lack large(ish) rock faces and boulder accumulations to form crevices for dedicated rock-living species such as dassies (Figure 8). However, less-discerning rupiculous vertebrates are present such as Namaqua rock rats and red rock rabbits.

The dense stand of trees is dominated by olienhout trees (*Olea europaea*) (Figure 9). However, thorn trees are present in numbers. A well-developed understory is formed by shrubs and young trees.

The terrestrial habitat type is spatially predominant. It is rocky and in fact functionally overlaps with many areas regarded as “randjieveld” (Figure 8). The soil is a reddish soil with low clay content (Figure 5), and is heavily imbedded with gravel and rocks (Figure 8). During the visit the terrestrial habitat displayed the effect of a long dry period during the winter and the preceding summer drought by being over-utilized by browsing; quantitatively it is thus offers poor refuge and nourishment for terrestrial vertebrates. Termitaria are present: these

structures are indicative of the presence of dwarf shrews and pygmy mice which have a predilection for moribund termite mounds as refuge.

Although there are drainage lines, they are seasonal. A number of sizeable manmade dams were constructed in the drainage lines and decant overflow rain water from the upstream undulating terrain (Figures 1, 4 and 6) into the Selons River further downstream outside the study site. Most of these are water bodies (some dry up towards the end of winter [Figure 11]), but fluctuations of water levels result in poorly developed wetland along their banks. Further downstream riparian zones woodlands are better developed (Figures 4 and 6) and suitable habitat for wetland-reliant vertebrates is available.

All 15 chicken farms plus two others will be connected to the central facility with hard-top roads.

The sister report deals with the floral characteristics of the site, *inter alia* with trees and scrub that collectively form an arboreal habitat. It is, however, clear that olienhout trees are extraordinary common over the entire property (Figure 9).

Figure 8: A typical habitat on Roodewaal and Kwa-Mmatau. Note the red soil imbedded with gravel and rocks, an abundance of surface rocks of various sizes and shapes, and a variety of scrub and tree species.

Figure 9: Olienhout trees predominate in the woodland.

6. METHODS

6.1 Field Survey

Two botanists, a mammologist and an ornithologist assessed the site on 8 November 2016. The botanists continued their survey the days thereafter. The herpetologist conducted desktop studies and relied on the data sets compiled by the field workers and extensive data-bases for the district. During the field work mammals, birds, reptiles and frogs were identified by visual sightings through random transect walks and patrolling with a vehicle. No trapping or mist netting was conducted as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites, birds by their calls, old nests, moulted feathers, spoor, droppings and food remains, and herpetofauna by their calls.

The weather during the visit was pleasantly warm, clear and with little wind. The owners advised the field workers re the presence of vertebrates.

6.2 Desktop Survey

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

6.3 Taxon-specific Requirements

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

Birds: Birds occurring at the sites of the proposed infrastructure components, were assessed in several steps via a desktop study and field survey, as detailed below. Red-listed species were identified using the most recent (2015) edition of the Red Data Book for South Africa, Lesotho and Swaziland (Taylor et al. 2015).

A desktop study was undertaken in which bird species that potentially occur at the site and in the surrounding areas were identified using data from the first and second South African Bird Atlas Projects (SABAP 1 and 2). SABAP 2 data are based on records for pentads (i.e., 5' X 5'), where SABAP 1 data were based on quarter-degree grid cells (i.e., 15' X 15'). A list of species potentially occurring at the site was developed using data for all the SABAP 2 pentads within which the project is located, plus surrounding pentads (Figure 10). The study is located within pentad 2545_2705. The area considered during the desktop study is thus much larger than the area likely to be affected by the project (Figure 10). This approach is adopted to ensure that all species potentially occurring at the site, whether resident, nomadic, or migratory, are identified.

During the field survey on 8 November 2016, birds occurring at the site were identified during transects and adjacent areas. During these transects, an observer with binoculars walked slowly through the site, identifying all birds encountered (seen or heard), identifying nests observed, and assessing the avian habitats present. This methodology is loosely based on the point count method of Ralph et al. (1993).

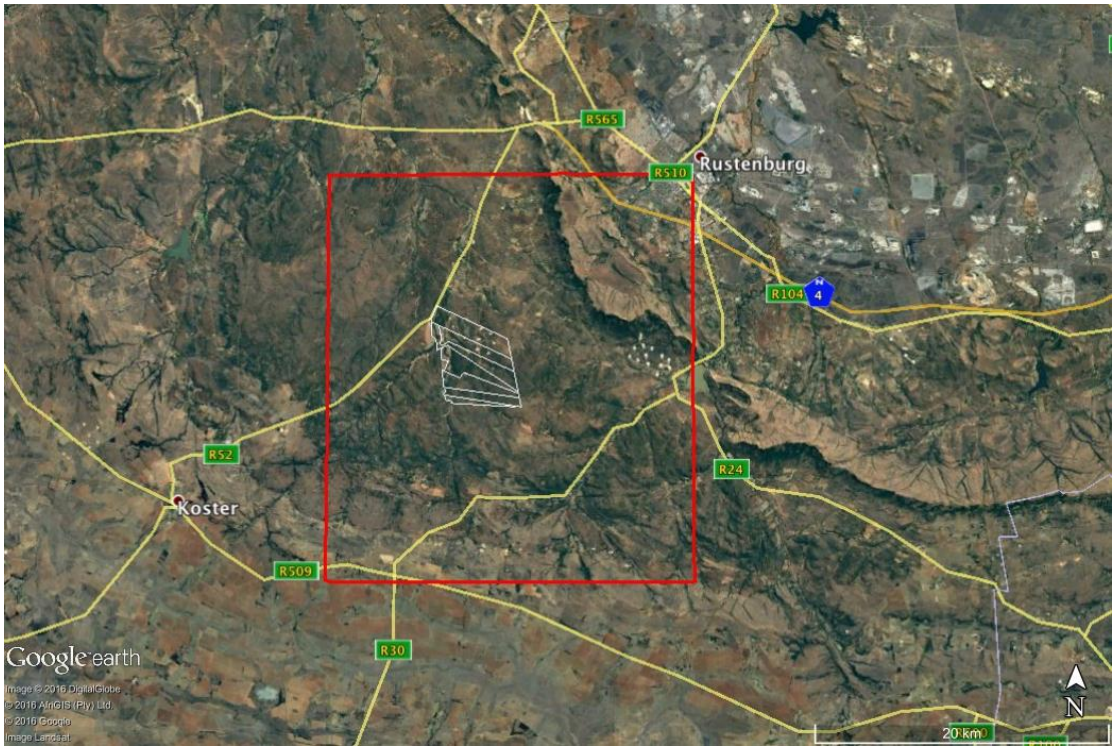

Figure 10. Approximate extent of area included (red square) when generating the list of birds potentially occurring at the site of the proposed development (study site shown in white outline). Image courtesy of Google Earth.

Herpetofauna: During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data species in Limpopo Province (Minter, *et al*, 2004; Alexander & Marais, 2007; Du Preez & Carruthers, 2009 and Bates, *et al*, 2014), such as: Nile Crocodile (*Crocodylus niloticus*); Nile Crocodile (*Crocodylus niloticus*); Woodbush Flat Gecko (*Afroedura multiporis multiporis*); Muller's Velvet Gecko (*Homopholis mulleri*); Granite Dwarf Gecko (*Lygodactylus graniticolus*); Methuen's Dwarf Gecko (*Lygodactylus methueni);* Cryptic Dwarf Gecko (*Lygodactylus nigropunctatus incognitus);* Makgabeng Dwarf Gecko (*Lygodactylus nigropunctatus montiscaeruli);* Soutpansberg Dwarf Gecko (*Lygodactylusocellatus soutpansbergensis);* Waterberg Dwarf Gecko (*Lygodactylus waterbergensis);* Soutpansberg Rock Lizard (*Vhembelacerta rupicola*); Coppery Grass Lizard (*Chamaeasaura aenea*); Large-scaled Grass Lizard (*Chamaesaura macrolepis*); Northern Crag Lizard (*Pseudocordylus transvaalensis*); Unexpected Flat Lizard (*Platysaurus intermedius inopinus*); Orange-Throated Flat Lizard (*Platysaurus monotropis*); Fitzsimons' Flat Lizard (*Platysaurus orientalis fitzimonsi*); Eastwood's Long-Tailed Seps (*Tetradactylus eastwoodae*); Stripe-Bellied Legless Skink (*Acontias kgalagadi subtaeniatus*); Richard's Legless Skink (*Acontias richardi*); Woodbush Legless Skink (*Acontias rieppeli*); White-Bellied Dwarf Burrowing Skink (*Scelotes limpopoensis albiventris*); Striped Harlequin Snake (*Homoroselaps dorsalis*); Northern Forest Rain Frog (*Breviceps sylvestris*) and Giant Bullfrogs (*Pyxicephalus adspersus*);

6.4 Assessment criteria

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

High: Ecologically sensitive and valuable land, with high species richness, sensitive ecosystems or Red Data species, that should be conserved and no development allowed.
Medium-high:Land where sections are disturbed but that is still ecologically sensitive to development/disturbance.
Medium: Land on which low-impact development with limited impact on the ecosystem could be considered, but where it is still recommended that certain portions of the natural habitat be maintained as open spaces.
Medium-low: Land on which small sections could be considered for conservation but where the area in general has little conservation value.
Low: Land that has little conservation value and that could be considered for developed with little to no impact on the habitats or avifauna.

These correlate with the significance ratings for the development as discussed in Section 6.5, and are tabulated as follows:

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor
CONSERVATION STATUS	High	Medium-high	Medium	Medium-low	Low

6.5 Impact Assessment Criteria

The methods and format of the impact tables used in this report are in accordance to the requirements of the 2014 NEMA Regulations. This approach is more empirical and yields quantitative values ideal for comparative purposes.

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

» The **probability (P)** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

» The **duration (D)**, wherein it will be indicated whether:

∗ the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;

∗ the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;

∗ medium-term (5–15 years) – assigned a score of 3;

∗ long term (> 15 years) - assigned a score of 4; or

∗ permanent - assigned a score of 5;

» The **extent (E)**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

» The **magnitude (M)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they

temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» the **significance (S)**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high;

» the significance rating is calculated by the following formula:

S (significance) = (D + E + M) x (P)

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

The numerical value of the calculation is assigned to a significance category.

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

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

7 RESULTS

7.1 MAMMALS

7.1.1 Mammal Habitat Assessment

Acocks (1988), Mucina and Rutherford (2006), Low & Rebelo (1996), Knobel and Bredenkamp (2006) and SANBI & DEAT (2009) discuss the distinguishing plant associations of the study area in broad terms. It should be acknowledged that botanical geographers have made immense strides in defining plant associations (particularly assemblages denoted as vegetation units or veld types), whereas this cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant associations. Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006) as well Knobel and Bredenkamp (2006). Hence, although the former's work has been superseded by the work of the latter two, the definitions of biomes are similar and both remain valid for mammals, birds, reptiles and frogs.

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

All four of the major habitat types are represented on the study site, i.e. terrestrial, rupiculous, arboreal and wetlands.

Most of the site is ecotonal in character, i.e. terrestrial, arboreal and generally very rocky to the point of providing substandard rupiculous habitat. Basal cover was poor as result of the preceding dry summer and winter as well as the shade effect of the dense stand of trees (in particular olienhout trees), although dried tussocks of sour grass are present in abundance to provide refuge and nourishment (Figures 8 and 9). Mature thorn trees are present, which is important as tree rats have a predilection for thorn trees with dense canopies. Of interest are the denuded terrestrial habitats around historical settlements (visible on enlarged maps by Google Earth), most likely by cattle urine poisoning or long-term trampling and by firewood harvesting.

Of interest is the wetland habitat represented by a number of dams in drainage lines and the riparian forests along the seasonal streams to the west of the site. The fluctuating levels of the dams resulted in poorly-developed riparian vegetation. Riparian forests along the streambeds towards the west of the site are noticeable (Figures 4 and 6). In the past fields have been planted in the alluvial soils along these streambeds, but these are now fallow and regenerated into secondary grasslands.

7.1.2 Observed and Expected Mammal Species Richness

A prevailing perception gained during the site visit is that mammal populations should be healthy (albeit at a nadir at the end of winter) and that refuge and sustenance are available year-round in the absence of veld fires.

Large mammals (such elephants, buffaloes, giraffes, blue wildebeests, red hartebeests, white rhinos, lions, spotted hyenas and others) have long since been extirpated for sport and later to favour grazing and growing crops. By-and-large a surprising number of herbivores and carnivores persisted (such as baboons, monkeys, duiker, steenbok, kudu) (Table 1) in the rural and relatively unaltered property. Several large herbivores were re-introduced such as zebras, giraffes, nyala, eland, blue wildebeest, red hartebeest and several others (Tables 1 and 2).

It is concluded that 73 species of mammals are still part of the present-day mammal species assemblage. The presence of all larger and most of the medium-sized was confirmed by Mr van der Merwe, an official of the company.

Most of the species of the resident diversity (Table 1) are common and widespread (viz. scrub hares, rodent moles, multimammate mice, pygmy mice, genets, mongooses and others). Many of the species listed in Table 1 are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses).

The extensive size and quality of conservation certainly allowed hedgehogs to persist.

As a precautionary measure the tree rat, the pygmy mouse and the dwarf shrew species are included in the list of occurrences. The latter species have a penchant to use moribund

termitaria as refuges and are herein assumed to be residents. Although there is not an abundance of mature thorn trees, it is submitted that tree rats are present.

It is most likely that the semi-aquatic vegetation along the watercourses will harbour cane rats, vlei rats and the listed shrews, - these taxa have strong survival traits bar their narrow dependence on wetland habitat. The lack of permanent deep water obviates the presence of otter species, marsh mongooses and quite likely white-tailed mongooses.

The rupiculous habitat is poor and lack substantial rock faces and boulder accumulations to provide refuge for dassies. But the rocky terrain is deemed sufficient to support rock elephant shrews, red rock rabbits and Namaqua rock rats,

Aardvark, porcupines, springhares, kudu, duikers, steenbok, baboons, vervet monkeys, galagos, black-backed jackals, leopards, caracal, serval, aardwolves, brown hyenas and others (Table 1) still occur in the district and, as can be expected, are still are present on the site given its high conservation profile.

In spite of their vulnerability to interference by humans and their pets, the extensive nature of the site and adjoining district prompt the inclusion of hedgehogs as likely occupants.

The listed Mauritian tomb bat, the two free-tailed bats and the three vespertilionid bats showed remarkable adaptability by expanding their distributional ranges and population numbers significantly by capitalizing in the roosting opportunities offered by manmade structures inland; in this instance against trunks of large trees (in the case of the former) and in the houses on the site and in the vicinity in the case of the latter five). Versper bats are more tolerant towards roost opportunities and it is more than likely that small colonies found roosting opportunities in the roofs of buildings near the study site. Free-tailed bats are likewise partial to narrow-entrance roosts provided by buildings; in some instances roost occupation could numerically reach epidemic proportions. It can be expected that the watercourses, dams and stream beds are an excellent source of insects that rise in swarms at summer sunsets and function as feeding patches for hawking vesper bats.

African wild cats are submitted to be inhabitants, but they are inclined to interbreed with domestic cats and it is more likely that crossbred offspring persist. The two genet species as well as the yellow and slender mongooses all have wide habitat tolerances, and that coupled to their catholic diets and reticent habits render them persistent carnivores, even close to human settlements. Banded and dwarf mongooses are common bushveld small carnivores.

The species richness is high, even for such an extensive area. That is ascribed to the fact that habitats have not been extensively compromised and that several herbivores have been re-introduced. Blesbok have been introduced but the site falls outside their natural distribution area. The surrounding properties are in similar conservation condition, but connectivity is hindered by the game fence. The overall quality of conservation is largely ranked as good.

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

	SCIENTIFIC NAME	ENGLISH NAME	Habitat
	Order Macroscelididae		
	Family Macroscelididae		
*	*Elephantulus intufi*	Bushveld elephant shrew	Terr.
?	*Elephantulus myurus*	Eastern rock elephant shrew	Rup.
	Order Tubulidentata		
	Family Orycteropodidae		
√	*Orycteropus afer*	Aardvark	Terr.
	Order Lagomorpha		
	Family Leporidae		
√	*Lepus saxatilis*	Scrub hare	Terr.
?	*Pronolagus randensis*	Jameson's red rock rabbit	Rup.
	Order Rodentia		
	Family Bathyergidae		
√	*Cryptomys hottentotus*	African mole rat	Subter.
	Family Hystricidae		
√	*Hystrix africaeaustralis*	Cape porcupine	Terr.
	Family Tryonomyidae		
?	*Thryonomys swinderianus*	Greater cane rat	Terr.
	Family Pedetidae		
√	*Pedetes capensis*	Springhare	Terr.
	Family Sciuridae		
√	*Paraxerus cepapi*	Tree squirrel	Arbor.
	Family Myoxidae		
DD?	*Graphiurus platyops*	Rock dormouse	Rup.
*	*Graphiurus murinus*	Woodland dormouse	Arbor.
	Family Muridae		
*	*Rhabdomys pumilio*	Four-striped grass mouse	Terr.
*	*Mus minutoides*	Pygmy mouse	Terr.
*	*Mastomys natalensis*	Natal multimammate mouse	Terr.
*	*Mastomys coucha*	Southern multimammate mouse	Terr.
?	*Thallomys paedulcus*	Acacia rat	Arbor.
*	*Aethomys ineptus*	Tete veld rat	Terr.
*	*Aethomys namaquensis*	Namaqua rock mouse	Rup.
?	*Otomys angoniensis*	Angoni vlei rat	Wetl.
?	*Otomys irroratus*	Vlei rat	Wetl.
*	*Gerbillurus paeba*	Hairy-footed gerbil	Terr.
DD*	*Gerbilliscus leucogaster*	Bushveld gerbil	Terr.
*	*Saccostomus campestris*	Pouched mouse	Terr.
*	*Dendromus melanotis*	Grey pygmy climbing mouse	Terr.
*	*Dendromus mesomelas*	Brants' climbing mouse	Terr.
*	*Dendromus mystacalis*	Chestnut climbing mouse	Terr.
*	*Steatomys pratensis*	Fat mouse	Terr.
	Order Primates		
	Family Galagidae		
√	*Galago moholi*	South African galago	Arbor.
	Family Cercopithecidae		
√	*Papio hamadryas*	Chacma baboon	Terr.
√	*Cercopithecus pygerythrus*	Vervet monkey	Terr. /Arbor.
	Order Eulipotypha		

	Family Soricidae		
DD*	*Suncus lixus*	Greater dwarf shrew	Terr.
DD*	*Suncus infinitesimus*	Least dwarf shrew	Terr.
DD*	*Crocidura cyanea*	Reddish-grey musk shrew	Terr.
DD*	*Crocidura hirta*	Lesser red musk shrew	Terr.
	Family Erinaceidae		
NT√	*Atelerix frontalis*	Southern African hedgehog	Terr.
	Order Chiroptera		
	Family Embalonuridae		
?	*Taphozous mauritianus*	Mauritian tomb bat	Aerial
	Family Molossidae		
*	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Aerial
?	*Chaerephon pumila*	Little free-tailed bat	Aerial
	Family Vespertilionidae		
√	*Neoromicia capensis*	Cape serotine bat	Aerial
√	*Scotophilus dinganii*	African yellow house bat	Aerial
√	*Scotophilus viridis*	Greenish yellow house bat	Aerial
	Order Pholidota		
	Family Manidae		
V?	*Manis temminckii*	Ground pangolin	Terr.
	Order Carnivora		
	Family Hyaenidae		
√	*Proteles cristatus*	Aardwolf	Terr.
NT?	*Parahyaena brunnea*	Brown hyena	Terr.
	Family Felidae		
√	*Panthera pardus*	Leopard	Terr. /Arbor.
√	*Caracal caracal*	Caracal	Terr.
√	*Felis silvestris*	African wild cat	Terr.
	Family Viverridae		
√	*Genetta genetta*	Small-spotted genet	Terr.
	Genetta tigrina	SA large-spotted genet	Terr.
	Family Herpestidae		
√	*Cynictis penicillata*	Yellow mongoose	Terr.
√	*Galerella sanguinea*	Slender mongoose	Terr.
√	*Mungos mungo*	Banded mongoose	Terr.
√	*Helogale parvula*	Dwarf mongoose	Terr.
	Family Canidae		
√	*Canis mesomelas*	Black-backed jackal	Terr.
	Family Mustelidae		
√	*Mellivora capensis*	Honey badger	Terr.
DD*	*Poecilogale albinucha*	African weasel	Terr.
*	*Ictonyx striatus*	Striped polecat	Terr.
	Order Perissodactyla		
	Family Equidae		
√	*Equus quagga*	Plains zebra	Terr.
	Order Suiformes		
	Family Suidae		
?	*Potamochoerus larvatus*	Bushpig	Terr.
√	*Phacochoerus africanus*	Common warthog	Terr.
	Order Ruminanta		
	Family Giraffidae		
√	*Giraffa camelopardalis*	Giraffe	Terr.
	Family Bovidae		
√	*Tragelaphus strepsiceros*	Kudu	Terr.
√	*Tragelaphus angasii*	Nyala	Terr.

√	*Tragelaphus scriptus*	Bushbuck	Terr.
√	*Tragelaphus oryx*	Eland	Terr.
√	*Connochaetes taurinus*	Blue wildebeest	Terr.
√	*Alcelaphus buselaphus*	Red hartebeest	Terr.
√	*Damaliscus p. phillipsi*	Blesbok	Terr.
√	*Oryx gazella*	Gemsbok	Terr.
√	*Sylvicapra grimmia*	Common duiker	Terr.
√	*Kobus ellipsiprymnus*	Waterbuck	Terr.
√	*Raphicerus campestris*	Steenbok	Terr.
√	*Aepyceros melampus*	Impala	Terr.

√ Definitely there or have a *high* probability to occur;
***** *Medium* probability to occur based on ecological and distributional parameters;
? *Low* probability to occur based on ecological and distributional parameters.

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

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

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
L. saxatilis	Scrub hare	Faecal pellets	Short grass
C. hottentotus	African mole rat	Tunnel system	Universal
C. penicillata	Yellow mongoose	Sight record	Good cover
G. sanguinea	Slender mongoose	Reported by residents	Good cover
E. quagga	Plains zebra	Sight record	Grasslands
G. camelopardalis	Giraffe	Sight record	Savanna
T. strepsiceros	Kudu	Sight record	Universal
T. oryx	Eland	Sight record	Grassalnd
A. melampus	Impala	Sight record	Savanna

These are a few of the residents encountered during the six-hour site visit.

7.1.3 Red Listed Mammal Species Identified:

-By the Scientific Community (Friedman and Daly (editors) 2004).

The rock dormouse, five shrew species and African weasel cited as 'Data Deficient' in Table 1 are not necessarily endangered. These small mammals have not been adequately studied to provide quantitative field data to accurately assign to a conservation ranking. As a precaution they are thus considered as 'Data Deficient'. Shrews, to a lesser extent rock dormouse (which is partially insectivorous) as well as the African weasel exist at the apex of the food pyramid, which means that their population numbers are inevitably significantly lower than that of similar-sized herbivorous mammals and especially of their smaller prey species. Because of the diet of these ferocious little insectivores / carnivores, they are furthermore not readily trapped with conventional bait or traps which may mean that their

numbers are under-estimated. Good capture results for shrews are obtained with drift fences and pitfalls and that support the latter statement.

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

Bushveld gerbils are in fact common and colonies are often found in areas with softish sand amenable to burrowing. It is an enigma why Friedman and Daly (2004) list it as a Red Data species, *albeit* as "Data Deficient".

Brown hyenas have been prosecuted to the point that they are deemed as "Near Threatened". It is amazing how the fallacy of brown hyenas as 'sheep killers' persist. Brown hyenas are known to range far and wide, and it must therefore be accepted that vagrants from the extensive district occasionally visit the study site.

Pangolins persist on the Rainbow properties as well as in the district. This is testimony to the high conservation profile of the two farms.

Considering the good conservation character of the site and adjoining farms, it is submitted that the Red Data species mentioned here are not under survival pressure.

No other Red Data or sensitive species are deemed present on the site, either since the site falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

-By the IUCN Red Data List
The compilation of Red Data mammals (Friedman and Daly (editors) 2004) is in fact a contribution to the IUCN initiative. Opinions expressed therein are elucidated above.

-By the Biodiversity Act No 10 of 2004
Protected Species: African hedgehog.
Brown hyena

-Endemism:
None of the species purported to be residents of the study site and surrounding areas are endemic to the North-West Province.

7.2 AVIFAUNA

The site of the proposed development falls within the Magaliesberg Important Bird and Biodiversity Area (IBA) (Marnewick et al. 2015). The fact that it is located within an IBA demands that particular care be taken to identify and mitigate negative impacts on avifauna.

7.2.1 Avian habitats

The dominant avian habitat type at the site is randjiesveld woodland dominated by olienhout trees (*Olea europaea*), interspersed with grassy patches, together with denser riparian

vegetation along streambeds and in the vicinity of artificial dams (most notably as at Figure 11).

7.2.2 Avifauna

A total of 374 species have been recorded in the area considered for the desktop study (Table 3). Of these, 69 were confirmed present at the site during the field survey, and an additional 73 have a high likelihood of being present, given the available habitats. The dense vegetation around artificial dams and along water courses supports several species that would likely not be present at the site otherwise; these include species such as orange-breasted bushshrike.

Figure 11: Dry dam located at 25° 48' 24" S 27° 06' 33" E (Site 13). Although the dam was dry at the time of the visit, the dense vegetation it supports provides habitat for species such as orange-breasted bush-shrike that would likely not otherwise be present.

Table 3. Bird species recorded in the area considered for the desktop survey (SABAP 2 pentad 2545_2705 plus eight adjacent pentads – see Figure 10). The current (2015) status of each red-listed species is provided (NT = Near Threatened; VU = Vulnerable;

EN = Endangered; CR = Critically Endangered), and the likelihood of each species occurring at the site is rated as confirmed, high, medium or low.

English name	Scientific name	Red Data Status	Likelihood of occurrence
Avocet, Pied	*Recurvirostra avosetta*		Low
Babbler, Arrow-marked	*Turdoides jardineii*		Confirmed
Babbler, Southern Pied	*Turdoides bicolor*		Low
Barbet, Acacia Pied	*Tricholaema leucomelas*		High
Barbet, Black-collared	*Lybius torquatus*		Confirmed
Barbet, Crested	*Trachyphonus vaillantii*		Confirmed
Batis, Chinspot	*Batis molitor*		Confirmed
Bee-eater, Blue-cheeked	*Merops persicus*		Low
Bee-eater, European	*Merops apiaster*		Confirmed
Bee-eater, Little	*Merops pusillus*		Low
Bee-eater, White-fronted	*Merops bullockoides*		Medium
Bishop, Southern Red	*Euplectes orix*		Confirmed
Bishop, Yellow-crowned	*Euplectes afer*		Low
Bittern, Little	*Ixobrychus minutus*		Low
Bokmakierie, Bokmakierie	*Telophorus zeylonus*		Medium
Boubou, Southern	*Laniarius ferrugineus*		Confirmed
Brubru, Brubru	*Nilaus afer*		High
Bulbul, African Red-eyed	*Pycnonotus nigricans*		Low
Bulbul, Dark-capped	*Pycnonotus tricolor*		Confirmed
Bunting, Cape	*Emberiza capensis*		Medium
Bunting, Cinnamon-breasted	*Emberiza tahapisi*		High
Bunting, Golden-breasted	*Emberiza flaviventris*		Medium
Bunting, Lark-like	*Emberiza impetuani*		Low
Bush-shrike, Grey-headed	*Malaconotus blanchoti*		Medium
Bush-shrike, Orange-breasted	*Telophorus sulfureopectus*		Confirmed
Buttonquail, Kurrichane	*Turnix sylvaticus*		Low
Buzzard, Jackal	*Buteo rufofuscus*		High
Buzzard, Lizard	*Kaupifalco monogrammicus*		Low
Buzzard, Steppe	*Buteo vulpinus*		High
Camaroptera, Green-backed	*Camaroptera brachyura*		Low
Camaroptera, Grey-backed	*Camaroptera brevicaudata*		Confirmed
Canary, Black-throated	*Crithagra atrogularis*		Confirmed
Canary, Yellow	*Crithagra flaviventris*		Low
Canary, Yellow-fronted	*Crithagra mozambicus*		Confirmed
Chat, Anteating	*Myrmecocichla formicivora*		Low
Chat, Familiar	*Cercomela familiaris*		Medium
Cisticola, Cloud	*Cisticola textrix*		High
Cisticola, Desert	*Cisticola aridulus*		High

Cisticola, Lazy	*Cisticola aberrans*		Medium
Cisticola, Levaillant's	*Cisticola tinniens*		Medium
Cisticola, Rattling	*Cisticola chiniana*		Medium
Cisticola, Tinkling	*Cisticola rufilatus*		Low
Cisticola, Wailing	*Cisticola lais*		Low
Cisticola, Wing-snapping	*Cisticola ayresii*		High
Cisticola, Zitting	*Cisticola juncidis*		Confirmed
Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*		Low
Cliff-swallow, South African	*Hirundo spilodera*		Low
Coot, Red-knobbed	*Fulica cristata*		Medium
Cormorant, Reed	*Phalacrocorax africanus*		Confirmed
Cormorant, White-breasted	*Phalacrocorax carbo*		Medium
Coucal, Burchell's	*Centropus burchellii*		High
Courser, Temminck's	*Cursorius temminckii*		Medium
Crake, Black	*Amaurornis flavirostris*		Low
Crane, Blue	*Anthropoides paradiseus*	NT	Low
Crombec, Long-billed	*Sylvietta rufescens*		Confirmed
Crow, Cape	*Corvus capensis*		Low
Crow, Pied	*Corvus albus*		Confirmed
Cuckoo, African	*Cuculus gularis*		Low
Cuckoo, Black	*Cuculus clamosus*		Confirmed
Cuckoo, Diderick	*Chrysococcyx caprius*		Confirmed
Cuckoo, Great Spotted	*Clamator glandarius*		Medium
Cuckoo, Jacobin	*Clamator jacobinus*		Medium
Cuckoo, Klaas's	*Chrysococcyx klaas*		Medium
Cuckoo, Levaillant's	*Clamator levaillantii*		Medium
Cuckoo, Red-chested	*Cuculus solitarius*		Confirmed
Cuckoo-shrike, Black	*Campephaga flava*		High
Darter, African	*Anhinga rufa*		Medium
Dove, Laughing	*Streptopelia senegalensis*		Confirmed
Dove, Namaqua	*Oena capensis*		Medium
Dove, Red-eyed	*Streptopelia semitorquata*		Confirmed
Dove, Rock	*Columba livia*		Confirmed
Drongo, Fork-tailed	*Dicrurus adsimilis*		Confirmed
Duck, African Black	*Anas sparsa*		Low
Duck, Comb	*Sarkidiornis melanotos*		Low
Duck, Fulvous	*Dendrocygna bicolor*		Low
Duck, Maccoa	*Oxyura maccoa*	NT	Low
Duck, White-faced	*Dendrocygna viduata*		High
Duck, Yellow-billed	*Anas undulata*		High
Eagle, Booted	*Aquila pennatus*		Low
Eagle, Long-crested	*Lophaetus occipitalis*		Low
Eagle, Martial	*Polemaetus bellicosus*	EN	Medium

Eagle, Tawny	*Aquila rapax*	EN	Medium
Eagle, Verreaux's	*Aquila verreauxii*	VU	High
Eagle, Wahlberg's	*Aquila wahlbergi*		High
Eagle-owl, Cape	*Bubo capensis*		Low
Eagle-owl, Spotted	*Bubo africanus*		High
Egret, Cattle	*Bubulcus ibis*		High
Egret, Great	*Egretta alba*		Low
Egret, Little	*Egretta garzetta*		Low
Egret, Yellow-billed	*Egretta intermedia*		Low
Eremomela, Yellow-bellied	*Eremomela icteropygialis*		Low
Falcon, Amur	*Falco amurensis*		High
Falcon, Lanner	*Falco biarmicus*	VU	Medium
Falcon, Peregrine	*Falco peregrinus*		Medium
Finch, Cuckoo	*Anomalospiza imberbis*		Medium
Finch, Cut-throat	*Amadina fasciata*		High
Finch, Red-headed	*Amadina erythrocephala*		Medium
Finch, Scaly-feathered	*Sporopipes squamifrons*		Medium
Firefinch, African	*Lagonosticta rubricata*		Medium
Firefinch, Jameson's	*Lagonosticta rhodopareia*		High
Firefinch, Red-billed	*Lagonosticta senegala*		High
Fiscal, Common (Southern)	*Lanius collaris*		Confirmed
Fish-eagle, African	*Haliaeetus vocifer*		Low
Flamingo, Greater	*Phoenicopterus ruber*	NT	Low
Flamingo, Lesser	*Phoenicopterus minor*	NT	Low
Flycatcher, Fairy	*Stenostira scita*		Low
Flycatcher, Fiscal	*Sigelus silens*		Confirmed
Flycatcher, Marico	*Bradornis mariquensis*		Confirmed
Flycatcher, Pale	*Bradornis pallidus*		Low
Flycatcher, Southern Black	*Melaenornis pammelaina*		High
Flycatcher, Spotted	*Muscicapa striata*		High
Francolin, Coqui	*Peliperdix coqui*		High
Francolin, Crested	*Dendroperdix sephaena*		Confirmed
Francolin, Orange River	*Scleroptila levaillantoides*		Low
Francolin, Red-winged	*Scleroptila levaillantii*		Low
Francolin, Shelley's	*Scleroptila shelleyi*		Low
Go-away-bird, Grey	*Corythaixoides concolor*		Confirmed
Goose, Egyptian	*Alopochen aegyptiacus*		Confirmed
Goose, Spur-winged	*Plectropterus gambensis*		Low
Goshawk, Gabar	*Melierax gabar*		Low
Goshawk, Southern Pale Chanting	*Melierax canorus*		Low
Grass-owl, African	*Tyto capensis*	VU	Low
Grassbird, Cape	*Sphenoeacus afer*		Low
Grebe, Black-necked	*Podiceps nigricollis*		Low

Grebe, Great Crested	*Podiceps cristatus*		Low
Grebe, Little	*Tachybaptus ruficollis*		Low
Green-pigeon, African	*Treron calvus*		Low
Greenbul, Yellow-bellied	*Chlorocichla flaviventris*		Low
Greenshank, Common	*Tringa nebularia*		Low
Guineafowl, Helmeted	*Numida meleagris*		Confirmed
Gull, Grey-headed	*Larus cirrocephalus*		Low
Hamerkop, Hamerkop	*Scopus umbretta*		Medium
Harrier-Hawk, African	*Polyboroides typus*		Medium
Hawk, African Cuckoo	*Aviceda cuculoides*		Low
Hawk-eagle, African	*Aquila spilogaster*		Low
Helmet-shrike, White-crested	*Prionops plumatus*		Low
Heron, Black	*Egretta ardesiaca*		Low
Heron, Black-headed	*Ardea melanocephala*		High
Heron, Goliath	*Ardea goliath*		Low
Heron, Green-backed	*Butorides striata*		Low
Heron, Grey	*Ardea cinerea*		High
Heron, Purple	*Ardea purpurea*		Low
Heron, Squacco	*Ardeola ralloides*		Low
Hobby, Eurasian	*Falco subbuteo*		Low
Honey-buzzard, European	*Pernis apivorus*		Low
Honeybird, Brown-backed	*Prodotiscus regulus*		Low
Honeyguide, Greater	*Indicator indicator*		Medium
Honeyguide, Lesser	*Indicator minor*		Low
Hoopoe, African	*Upupa africana*		Confirmed
Hornbill, African Grey	*Tockus nasutus*		Confirmed
Hornbill, Red-billed	*Tockus erythrorhynchus*		Low
Hornbill, Southern Yellow-billed	*Tockus leucomelas*		Low
House-martin, Common	*Delichon urbicum*		Medium
Ibis, African Sacred	*Threskiornis aethiopicus*		High
Ibis, Glossy	*Plegadis falcinellus*		Low
Ibis, Hadeda	*Bostrychia hagedash*		High
Indigobird, Dusky	*Vidua funerea*		Medium
Indigobird, Purple	*Vidua purpurascens*		Low
Indigobird, Village	*Vidua chalybeata*		Medium
Jacana, African	*Actophilornis africanus*		Low
Kestrel, Greater	*Falco rupicoloides*		Low
Kestrel, Lesser	*Falco naumanni*		Low
Kestrel, Rock	*Falco rupicolus*		High
Kingfisher, Brown-hooded	*Halcyon albiventris*		High
Kingfisher, Giant	*Megaceryle maximus*		Low
Kingfisher, Half-collared	*Alcedo semitorquata*	NT	Low
Kingfisher, Malachite	*Alcedo cristata*		Low

Kingfisher, Pied	*Ceryle rudis*		Medium
Kingfisher, Striped	*Halcyon chelicuti*		Confirmed
Kingfisher, Woodland	*Halcyon senegalensis*		Medium
Kite, Black	*Milvus migrans*		Low
Kite, Black-shouldered	*Elanus caeruleus*		High
Kite, Yellow-billed	*Milvus aegyptius*		Low
Korhaan, Northern Black	*Afrotis afraoides*		High
Korhaan, Red-crested	*Lophotis ruficrista*		Medium
Korhaan, White-bellied	*Eupodotis senegalensis*	VU	Low
Lapwing, African Wattled	*Vanellus senegallus*		High
Lapwing, Blacksmith	*Vanellus armatus*		High
Lapwing, Crowned	*Vanellus coronatus*		High
Lark, Eastern Clapper	*Mirafra fasciolata*		Medium
Lark, Eastern Long-billed	*Certhilauda semitorquata*		Low
Lark, Fawn-coloured	*Calendulauda africanoides*		Low
Lark, Flappet	*Mirafra rufocinnamomea*		Medium
Lark, Monotonous	*Mirafra passerina*		Low
Lark, Pink-billed	*Spizocorys conirostris*		Low
Lark, Red-capped	*Calandrella cinerea*		Low
Lark, Rufous-naped	*Mirafra africana*		Confirmed
Lark, Sabota	*Calendulauda sabota*		Medium
Lark, Spike-heeled	*Chersomanes albofasciata*		Medium
Longclaw, Cape	*Macronyx capensis*		High
Mannikin, Bronze	*Spermestes cucullatus*		Medium
Marsh-harrier, African	*Circus ranivorus*	EN	Low
Martin, Banded	*Riparia cincta*		Medium
Martin, Brown-throated	*Riparia paludicola*		Medium
Martin, Rock	*Hirundo fuligula*		High
Martin, Sand	*Riparia riparia*		Low
Masked-weaver, Lesser	*Ploceus intermedius*		Medium
Masked-weaver, Southern	*Ploceus velatus*		Confirmed
Moorhen, Common	*Gallinula chloropus*		Low
Mousebird, Red-faced	*Urocolius indicus*		Confirmed
Mousebird, Speckled	*Colius striatus*		Confirmed
Mousebird, White-backed	*Colius colius*		Low
Myna, Common	*Acridotheres tristis*		Confirmed
Neddicky, Neddicky	*Cisticola fulvicapilla*		Confirmed
Night-Heron, Black-crowned	*Nycticorax nycticorax*		Low
Nightjar, European	*Caprimulgus europaeus*		Low
Nightjar, Fiery-necked	*Caprimulgus pectoralis*		High
Nightjar, Freckled	*Caprimulgus tristigma*		Medium
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*		Low
Olive-pigeon, African	*Columba arquatrix*		Low

Oriole, Black-headed	*Oriolus larvatus*		High
Oriole, Eurasian Golden	*Oriolus oriolus*		Low
Osprey, Osprey	*Pandion haliaetus*		Low
Ostrich, Common	*Struthio camelus*		Confirmed
Owl, Barn	*Tyto alba*		High
Owl, Marsh	*Asio capensis*		Low
Owlet, Pearl-spotted	*Glaucidium perlatum*		Medium
Oxpecker, Red-billed	*Buphagus erythrorhynchus*		Low
Palm-swift, African	*Cypsiurus parvus*		High
Paradise-flycatcher, African	*Terpsiphone viridis*		Confirmed
Paradise-whydah, Long-tailed	*Vidua paradisaea*		High
Pelican, Pink-backed	*Pelecanus rufescens*	VU	Low
Petronia, Yellow-throated	*Petronia superciliaris*		Medium
Pigeon, Speckled	*Columba guinea*		Confirmed
Pipit, African	*Anthus cinnamomeus*		High
Pipit, Buffy	*Anthus vaalensis*		High
Pipit, Bushveld	*Anthus caffer*		Low
Pipit, Long-billed	*Anthus similis*		Medium
Pipit, Plain-backed	*Anthus leucophrys*		Medium
Pipit, Striped	*Anthus lineiventris*		Medium
Pipit, Tree	*Anthus trivialis*		Medium
Plover, Common Ringed	*Charadrius hiaticula*		High
Plover, Kittlitz's	*Charadrius pecuarius*		Low
Plover, Three-banded	*Charadrius tricollaris*		High
Pochard, Southern	*Netta erythrophthalma*		Medium
Pratincole, Black-winged	*Glareola nordmanni*	NT	Low
Prinia, Black-chested	*Prinia flavicans*		High
Prinia, Tawny-flanked	*Prinia subflava*		Confirmed
Puffback, Black-backed	*Dryoscopus cubla*		Confirmed
Pytilia, Green-winged	*Pytilia melba*		Medium
Quail, Common	*Coturnix coturnix*		Low
Quail, Harlequin	*Coturnix delegorguei*		Low
Quailfinch, African	*Ortygospiza atricollis*		High
Quelea, Red-billed	*Quelea quelea*		High
Rail, African	*Rallus caerulescens*		Low
Reed-warbler, African	*Acrocephalus baeticatus*		Low
Reed-warbler, Great	*Acrocephalus arundinaceus*		Low
Robin-chat, Cape	*Cossypha caffra*		Confirmed
Robin-chat, White-throated	*Cossypha humeralis*		High
Rock-thrush, Cape	*Monticola rupestris*		Medium
Rock-thrush, Short-toed	*Monticola brevipes*		Medium
Roller, Lilac-breasted	*Coracias caudatus*		Low
Roller, Purple	*Coracias naevius*		Low

Ruff, Ruff	*Philomachus pugnax*		Low
Rush-warbler, Little	*Bradypterus baboecala*		Low
Sandgrouse, Double-banded	*Pterocles bicinctus*		Low
Sandgrouse, Yellow-throated	*Pterocles gutturalis*	NT	Low
Sandpiper, Common	*Actitis hypoleucos*		High
Sandpiper, Curlew	*Calidris ferruginea*		Low
Sandpiper, Marsh	*Tringa stagnatilis*		Low
Sandpiper, Wood	*Tringa glareola*		Medium
Scimitarbill, Common	*Rhinopomastus cyanomelas*		Medium
Scops-owl, African	*Otus senegalensis*		Medium
Scrub-robin, Kalahari	*Cercotrichas paena*		Medium
Scrub-robin, White-browed	*Cercotrichas leucophrys*		High
Secretarybird	*Sagittarius serpentarius*	VU	Low
Seedeater, Streaky-headed	*Crithagra gularis*		High
Shelduck, South African	*Tadorna cana*		Low
Shikra, Shikra	*Accipiter badius*		Low
Shoveler, Cape	*Anas smithii*		Medium
Shrike, Crimson-breasted	*Laniarius atrococcineus*		Confirmed
Shrike, Lesser Grey	*Lanius minor*		High
Shrike, Magpie	*Corvinella melanoleuca*		Low
Shrike, Red-backed	*Lanius collurio*		High
Shrike, Southern White-crowned	*Eurocephalus anguitimens*		Low
Snake-eagle, Black-chested	*Circaetus pectoralis*		High
Snake-eagle, Brown	*Circaetus cinereus*		Medium
Snipe, African	*Gallinago nigripennis*		Low
Sparrow, Cape	*Passer melanurus*		Confirmed
Sparrow, Great	*Passer motitensis*		Low
Sparrow, House	*Passer domesticus*		Confirmed
Sparrow, Southern Grey-headed	*Passer diffusus*		Confirmed
Sparrow-weaver, White-browed	*Plocepasser mahali*		Confirmed
Sparrowhawk, Black	*Accipiter melanoleucus*		Low
Sparrowhawk, Little	*Accipiter minullus*		Medium
Sparrowhawk, Ovambo	*Accipiter ovampensis*		Medium
Sparrowlark, Chestnut-backed	*Eremopterix leucotis*		Low
Spoonbill, African	*Platalea alba*		Low
Spurfowl, Natal	*Pternistis natalensis*		Confirmed
Spurfowl, Swainson's	*Pternistis swainsonii*		Confirmed
Starling, Burchell's	*Lamprotornis australis*		Low
Starling, Cape Glossy	*Lamprotornis nitens*		Confirmed
Starling, Pied	*Spreo bicolor*		Low
Starling, Red-winged	*Onychognathus morio*		High
Starling, Violet-backed	*Cinnyricinclus leucogaster*		Medium
Starling, Wattled	*Creatophora cinerea*		Medium

Stilt, Black-winged	*Himantopus himantopus*		Low
Stint, Little	*Calidris minuta*		Low
Stonechat, African	*Saxicola torquatus*		High
Stork, Abdim's	*Ciconia abdimii*	NT	Medium
Stork, Black	*Ciconia nigra*	VU	Low
Stork, Marabou	*Leptoptilos crumeniferus*	NT	Low
Stork, White	*Ciconia ciconia*		Low
Stork, Yellow-billed	*Mycteria ibis*	EN	Low
Sunbird, Amethyst	*Chalcomitra amethystina*		Confirmed
Sunbird, Greater Double-collared	*Cinnyris afer*		Medium
Sunbird, Malachite	*Nectarinia famosa*		Medium
Sunbird, Marico	*Cinnyris mariquensis*		Medium
Sunbird, White-bellied	*Cinnyris talatala*		Confirmed
Swallow, Barn	*Hirundo rustica*		Confirmed
Swallow, Greater Striped	*Hirundo cucullata*		Confirmed
Swallow, Lesser Striped	*Hirundo abyssinica*		High
Swallow, Pearl-breasted	*Hirundo dimidiata*		Medium
Swallow, Red-breasted	*Hirundo semirufa*		Medium
Swallow, White-throated	*Hirundo albigularis*		High
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*		Low
Swamphen, African Purple	*Porphyrio madagascariensis*		Low
Swift, African Black	*Apus barbatus*		High
Swift, Alpine	*Tachymarptis melba*		Medium
Swift, Common	*Apus apus*		Medium
Swift, Horus	*Apus horus*		Medium
Swift, Little	*Apus affinis*		High
Swift, White-rumped	*Apus caffer*		Confirmed
Tchagra, Black-crowned	*Tchagra senegalus*		Confirmed
Tchagra, Brown-crowned	*Tchagra australis*		High
Teal, Cape	*Anas capensis*		Low
Teal, Hottentot	*Anas hottentota*		Low
Teal, Red-billed	*Anas erythrorhyncha*		Medium
Tern, Caspian	*Sterna caspia*		Low
Tern, Whiskered	*Chlidonias hybrida*		Low
Tern, White-winged	*Chlidonias leucopterus*		Low
Thick-knee, Spotted	*Burhinus capensis*		High
Thrush, Groundscraper	*Psophocichla litsipsirupa*		Confirmed
Thrush, Karoo	*Turdus smithi*		Confirmed
Thrush, Kurrichane	*Turdus libonyanus*		Confirmed
Tinkerbird, Yellow-fronted	*Pogoniulus chrysoconus*		Confirmed
Tit, Ashy	*Parus cinerascens*		Low
Tit, Southern Black	*Parus niger*		Medium
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*		High

Tit-flycatcher, Grey	*Myioparus plumbeus*		High
Turtle-dove, Cape	*Streptopelia capicola*		Confirmed
Vulture, Cape	*Gyps coprotheres*	EN	Medium
Vulture, White-backed	*Gyps africanus*	CR	Low
Wagtail, African Pied	*Motacilla aguimp*		Low
Wagtail, Cape	*Motacilla capensis*		Confirmed
Warbler, Garden	*Sylvia borin*		High
Warbler, Icterine	*Hippolais icterina*		Low
Warbler, Marsh	*Acrocephalus palustris*		Low
Warbler, Sedge	*Acrocephalus schoenobaenus*		Low
Warbler, Willow	*Phylloscopus trochilus*		High
Waxbill, Black-faced	*Estrilda erythronotos*		Low
Waxbill, Blue	*Uraeginthus angolensis*		Confirmed
Waxbill, Common	*Estrilda astrild*		High
Waxbill, Orange-breasted	*Amandava subflava*		Low
Waxbill, Swee	*Coccopygia melanotis*		Low
Waxbill, Violet-eared	*Granatina granatina*		Low
Weaver, Cape	*Ploceus capensis*		High
Weaver, Thick-billed	*Amblyospiza albifrons*		Medium
Weaver, Village	*Ploceus cucullatus*		Low
Wheatear, Capped	*Oenanthe pileata*		Low
Wheatear, Mountain	*Oenanthe monticola*		Low
White-eye, Cape	*Zosterops virens*		Confirmed
Whydah, Pin-tailed	*Vidua macroura*		High
Whydah, Shaft-tailed	*Vidua regia*		Low
Widowbird, Long-tailed	*Euplectes progne*		Low
Widowbird, Red-collared	*Euplectes ardens*		Low
Widowbird, White-winged	*Euplectes albonotatus*		Low
Wood-dove, Emerald-spotted	*Turtur chalcospilos*		Low
Wood-hoopoe, Green	*Phoeniculus purpureus*		High
Woodpecker, Bearded	*Dendropicos namaquus*		High
Woodpecker, Bennett's	*Campethera bennettii*		Low
Woodpecker, Cardinal	*Dendropicos fuscescens*		High
Woodpecker, Golden-tailed	*Campethera abingoni*		Confirmed
Wryneck, Red-throated	*Jynx ruficollis*		Low

7.2.3 Threatened Species

A total of 22 threatened or near-threatened species have been recorded in the area considered for the desktop survey (Table 4). Of these, the *Vulnerable* Cape Vulture and *Vulnerable* Verreauxs' Eagle are the species most likely to occur at the site periodically. Both these species breed in mountainous areas, but are known to venture away from mountains

when foraging (particularly the vulture). There are no red-listed species for which the site is likely to represent important breeding habitat.

7.2.4 Overall sensitivity

From an avifaunal perspective, the site can be considered moderately sensitive. The avian community of the site is typical of relatively undisturbed woodland and bushveld, and it is unlikely that the site provides critical breeding habitat for any red-listed species. However, the sensitive nature of the vegetation at this site means that greater effort should be taken to minimize avifaunal impacts compared then would be the case in a highly-disturbed area.

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

Species	Scientific name	Red Data[1]	NEMBA[2]	Assessment of likelihood of presence at site
Pelican, Pink-backed	*Pelecanus rufescens*	VU	EN	Occurrence extremely unlikely. No suitable habitat.
Stork, Marabou	*Leptoptilos crumeniferus*	NT		Occurrence unlikely, although occasional vagrants cannot be ruled out.
Stork, Yellow-billed	*Mycteria ibis*	*EN*		Largely restricted to rivers and wetlands. Occurrence unlikely.
Stork, Abdim's	*Ciconia abdimii*	NT		Occurs in grasslands, woodlands and cultivated fields in rural areas. May visit the site from time to time.
Stork, Black	*Ciconia nigra*	VU	VU	Occurrence possible. Typically occurs in mountainous areas, and nearby Magaliesberg means it may visit site occasionally.
Flamingo, Greater	*Phoenicopterus ruber*	NT		Extremely unlikely. No suitable habitat.
Flamingo, Lesser	*Phoenicopterus minor*	NT		Extremely unlikely. No suitable habitat.
Duck, Maccoa	*Oxyura maccoa*	NT		Unlikely. Could occasionally visit nearby dams.
Secretarybird	*Sagittarius serpentarius*	VU		Possible, but unlikely. Occurs in open grasslands, a habitat type not present at the site
Vulture, Cape	*Gyps coprotheres*	EN	EN	Likely to occur in the area when feeding on carcasses. Cliff-nester, so unlikely to breed in the area. Large colony present in nearby Magaliesberg.

Vulture, White-backed	*Gyps africanus*	CR	EN	Possible, but not likely to be regular visitor.
Falcon, Lanner	*Falco biarmicus*	VU		Occurrence possible, but the area is unlikely to be important hunting habitat.
Eagle, Verreaux's	*Aquila verreauxii*	VU		Medium likelihood. Occurs at relatively high densities in nearby Magaliesberg, and may venture far from mountains on occasion.
Eagle, Tawny	*Aquila rapax*	EN	VU	Occurrence possible, but not very likely.
Eagle, Martial	*Polemaetus bellicosus*	EN	VU	Occurrence possible.
Marsh-harrier, African	*Circus ranivorus*	EN	PR	Unlikely. Requires marshes and grasslands, which are not present at the site.
Crane, Blue	*Anthropoides paradiseus*	NT	EN	Very unlikely. No suitable habitat.
Korhaan, White-bellied	*Eupodotis senegalensis*	VU		Very unlikely. No suitable grassland habitat.
Pratincole, Black-winged	*Glareola nordmanni*	NT		Unlikely. Occurs in open habitats such as agricultural fields.
Sandgrouse, Yellow-throated	*Pterocles gutturalis*	NT		Very unlikely. Habitat not suitable, and site is at the very eastern edge of the species' range.
Grass-owl, African	*Tyto capensis*	VU	VU	Very unlikely. No suitable habitat (marshes and grasslands).
Kingfisher, Half-collared	*Alcedo semitorquata*	NT		Extremely unlikely. Requires clear, well-vegetated streams.

[1]Current (2015) IUCN Red List Status for South Africa, Lesotho and Swaziland (Taylor et al. 2015). NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered

[2]Indicates species listed as Protected ("PR"), Vulnerable ("VU"), Endangered ('EN") or Critically Endangered ("CR") in the National Environmental Management: Biodiversity Act, 2004 list of Threatened or Protected Species (2007 version).

7.3 HERPETOFAUNA

7.3.1 Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological habitat perspective, it was established that all four major habitats are naturally present on the study site, namely terrestrial, rupiculous, arboreal and wetland-associated vegetation cover.

Many parts of the study site consist of transformed habitat. The natural grasslands and arboreal habitat were first transformed for agricultural purposes like overgrazing and fields and later by anthropogenic influences such as roads and chicken farms units. The study site is thus ecologically disturbed in some parts. Moribund termitaria were recorded on the study site. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for the study site is higher. At the time of the site visit the basal cover was poor in many places and would not provide adequate cover for small terrestrial herpetofauna.

The terrain is generally very rocky to the point of providing rupiculous habitat for some herpetofauna, but due to the absence of large natural rupiculous habitat, some discerning species like, common girdled lizard and rock agama were omitted from the species list in Table 5. Manmade rupiculous habitat exists in the form of buildings.

Mature thorn trees are present and provide arboreal habitat. Riparian forests along the streambeds towards the west of the site are noticeable. Larger trees may offer refuge to tree-living reptiles like flap-neck chameleons and tree agamas. There are dead logs, which could provide shelter and food for some herpetofauna.

The wetland habitat represented by a number of dams in drainage lines and the riparian forests along the seasonal streams to the west of the site. The fluctuating levels of the dams resulted in poorly-developed riparian vegetation. The temporary provide habitat for most water-dependent herpetofauna.

7.3.2 Observed and Expected Herpetofauna Species Richness

Of the 52 reptile species which may occur on the study site (Table 5), none were confirmed during the site visit and of the 20 amphibian species which may possibly occur on the study site (Table 5); none were confirmed during the site visit. Table 5 lists the reptiles & amphibians which were observed on or deduced to occupy the site.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is minimally disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 5) are fairly common and widespread (viz. the common dwarf gecko, Transvaal gecko, Wahlberg's snake-eyed skink, speckled rock skink, southern rock monitor, common flap-neck chameleon, eastern ground agama, common house snake, puff adder, red toad, guttural toad, southern foam nest frog and Boettger's caco).

The species richness is fair to good due to the size of the study site, its above average conservation ranking and all four habitat types occurring on the study site.

Table 5: The Reptile and Amphibian species observed on or deduced to occupy the site.

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	REPTILES
	Order: TESTUDINES	TORTOISES & TERRAPINS
	Family: Pelomedusidae	Side-necked Terrapins
?	Pelomedusa subrufa	Marsh Terrapin
	Family: Testudinidae	Tortoises
?	Kinixys lobatsiana	Lobatse Hinged-Back Tortoise
*	Stigmochelys pardalis	Leopard Tortoise
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder: LACERTILIA	LIZARDS
	Family: Gekkonidae	Geckos
?	Chondrodactylus turneri	Turner's Gecko
?	Hemidactylus mabouia	Common Tropical House Gecko
√	Lygodactylus capensis	Common Dwarf Gecko
√	Pachydactylus affinis	Transvaal Gecko
√	Pachydactylus capensis	Cape Gecko

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Lacertidae	Old World Lizards or Lacertids
?	Meroles squamulosus	Savanna Lizard
?	Nucras holubi	Holub's Sandveld Lizard
*	Nucras intertexta	Spotted Sandveld Lizard
?	Pedioplanis lineoocellata lineoocellata	Spotted Sand Lizard
	Family: Cordylidae	
?	Cordylus jonesii	Jones' Girdled Lizard
	Family: Gerrhosauridae	Plated Lizards
*	Gerhosaurus flavigularis	Yellow-throated Plated Lizard
	Family: Scincidae	Skinks
?	Acontias occidentalis	Savanna Legless Skink
√	Afroablepharus wahlbergii	Wahlberg's Snake-Eyed Skink
√	Mochlus sundevallii sundevallii	Sundevall's Writhing Skink
√	Trachylepis capensis	Cape Skink
√	Trachylepis punctatissima	Speckled Rock Skink
√	Trachylepis varia	Variable Skink
	Family: Varanidae	Monitors
√	Varanus albigularis albigularis	Southern Rock Monitor
	Family: Chamaeleonidae	Chameleons
√	Chamaeleo dilepis dilepis	Common Flap-Neck Chameleon
	Family: Agamidae	Agamas
√	Agama aculeata distanti	Eastern Ground Agama
√	Acanthocercus atricollis atricollis	Southern Tree Agama
	Suborder: SERPENTES	SNAKES

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Typhlopidae	Blind Snakes
√	Afrotyphlops bibronii	Bibron's Blind Snake
*	Rhinotyphlops lalandei	Delalande's Beaked Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
*	Leptotyphlops distanti	Distant's Thread Snake
√	Leptotyphlops scutifrons	Peter's Thread Snake
	Family: Pythonidae	Pythons
√	Python natalensis	Southern African Python
	Family: Viperidae	Adders
√	Bitis arietans arietans	Puff Adder
?	Bitis caudalis	Horned Adder
√	Causus rhombeatus	Rhombic Night Adder
	Family: Lamprophiidae	
√	Aparallactus capensis	Black-headed Centipede Eater
?	Atractapis bibronii	Bibron's Stiletto Snake
√	Boaedon capensis	Common House Snake
?	Lamprophis aurora	Aurora House Snake
?	Lycophidion capense	Cape Wolf Snake
√	Psammophis brevirostris	Short-snouted Grass Snake
?	Psammophis subtaeniatus	Western Yellow-Bellied Sand Snake
√	Psammophylax tritaeniatus	Striped Grass Snake
?	Pseudaspis cana	Mole Snake
	Family: Elapidae	Cobras, Mambas and Others
?	Elapsoidea sunderwallii	Sundevall's Garter Snake
?	Dendroaspis polylepis	Black Mamba
√	Naja annulifera	Snouted Cobra

	SCIENTIFIC NAME	ENGLISH NAME
√	Naja mossambica	Mozambique Spitting Cobra
	Family: Colubridae	
√	Crotaphopeltis hotamboeia	Red-Lipped Snake
√	Dasypeltis scabra	Rhombic Egg Eater
*	Dispholidus typus	Boomslang
?	Phiothamnus hoplogaster	Southeastern Green Snake
√	Philothamnus semivariegatus	Spotted Bush Snake
√	Telescopus semiannulatus emiannulatus	Eastern Tiger Snake
?	Thelotornis capensis capensis	Southern Twig Snake
	CLASS: AMPHIBIA	AMPHIBIANS
	Order: ANURA	FROGS
	Family: Pipidae	Clawed Frogs
√	Xenopus laevis	Common Platanna
	Family: Bufonidae	Toads
?	Poyntonophrynus fenoulheti	Northern Pygmy Toad
√	Amietaophrynus gutturalis	Guttural Toad
√	Amietaophrynus poweri	Western Olive toad
√	Schismaderma carens	Red Toad
	Family: Breviceptidae	Rain Frogs
*	Breviceps adspersus adspersus	Bushveld Rain Frog
	Family: Microhylidae	Rubber Frogs
?	Phrynomantis bifasciatus	Banded Rubber Frog
	Family: Hyperoliidae	Reed Frogs
√	Kassina senegalesis	Bubbling Kassina

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Phrynobatrachidae	Puddle Frog
?	Phrynobatrachus natalensis	Snoring Puddle Frog
	Family: Breviceptidae	Rain Frogs
	Breviceps adspersus	Bushveld Rain Frog
	Family: Pyxicephalidae	
?	Amietia angolensis	Common River Frog
?	Strongylopus fasciatus	Striped Stream Frog
?	Ptychdena anchietae	Plain Grass Frog
?	Ptychdena mossambica	Broad-Banded Grass Frog
√	Cocosternum boettgeri	Boettger's Caco
NT√	Pyxicephalus adspersus	Giant Bullfrog
?	Pyxicephalus edulis	Edible Bullfrog
√	Tomopterna cryptotis	Tremolo Sand Frog
√	Tomopterna natalensis	Natal Sand Frog
	Family: Rhacophoridae	Foam Nest Frog
√	Chiromantis xerampelina	Southern Foam Nest Frog

Systematic arrangement and nomenclature according to Branch (1998), Alexander & Marais (2007), Minter, et.al (2004), Du Preez & Carruthers (2009) and Bates, et.al 2014.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103. In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, et.al, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

7.3.3 Red Data Listed Herpetofauna identified

The study site falls inside the natural range of the Nile crocodile, but there is no suitable habitat for this species and it should not occur on the study site.

The study site falls inside the natural range of the Southern African python. According to Bradley (1990), Southern African pythons favour moist, rocky, well-wooded valleys, plantations or bush country, but seldom if ever stray far from permanent water. The study site, with its 500 meters buffer, provides suitable habitat for the Southern African python and the study site is large enough to support a viable population. It is estimated that a single python needs at least a 100ha area to forage.

The Southern African python's national status has changed from Vulnerable (Branch, 1988) to regional Least Concern (Alexander, 2014), although it is currently still a ToPS-listed species (Threatened or Protected Species).

The study site contains temporary water bodies, which are potential breeding places for giant bullfrogs. Giant bullfrogs prefer warm, stagnant water, which giant bullfrog tadpoles need for rapid development (Van Wyk, Kok & Du Preez, 1992). Bullfrog breeding sites are mostly temporary, in order to avoid predation from fish. Many of the dams on the study site have gentle slopes, which giant bullfrogs prefer. A gentle slope allows for shallow water (less than 10cm deep), which enables the female bullfrog to stand when she lays her eggs outside the water for the male to fertilise. Many parts of the study site consist of sandy soil and are very suitable as dispersal areas, which combine feeding and aestivation. It is essential that the soil be suitable for burrowing on a daily basis during the short activity period at the beginning of the rainy season and for deeper retreats during the resting periods.

It is important to note that in the latest literature (Measey (ed.) 2011 and Carruthers & Du Preez 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter *et al*, 2004) to Least Concern in South Africa.

8. PRESENT CONSERVATION STATUS AND PROJECTED IMPACT OF THE DEVELOPMENT

8.1 Conservation status

The conservation sensitivity (See Section 6.4 above) of the study area is rated as **High,** i.e. *"Ecologically sensitive and valuable land, with high species richness, sensitive ecosystems or Red Data species, that should be conserved and no development allowed"* (see Section 6.4 above).

8.2 Quantitative impacts on vertebrates

The impact of the envisaged development is tabulated below:

Table 6: Direct impact on mammal and herpetofaunal communities.

Nature: The construction of the 15 chicken farms and two other facilities will each displace natural habitat over a small area, and relative to the 3200 hectares extent of the property will be insignificant. Collectively these17 sites will comprise ca. 0.3% of the entire size of the Rainbow Chickens property.

The chicken farms and two other facilities will be connected with the central facility with hard-topped roads, which adds another surface area which will displace biota.

The development can be reversed by natural processes and with human intervention.

Mitigating of the impacts is impossible.

	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Definite	5		n.a.
Duration	Short duration	2		n.a.
Extent	Limited to site	2		n.a.
Magnitude	Very high	10		n.a.
Significance	**Very high**	**70**		**n.a.**
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Definite	5		n.a.
Duration	Long term	4		n.a.
Extent	Limited to site	2		n.a.
Magnitude	Very high	10		n.a.
Significance	**Very high**	**80**		**n.a.**
Status (positive or negative)	**Negative**		**n.a.**	
Reversibility	Yes		n.a.	
Irreplaceable loss of resources?	Yes		n.a.	
Can impacts be mitigated?	No			

Mitigation:

- Impossible. But see conclusions.

Cumulative impacts: A destructive process over a relatively short term is just that.

***Residual Risks*:** Local displacement of resident species on 17 small sites of extraordinary high vertebrate species richness.

Table 7: Loss of mammal and herpetofaunal habitat and ecological structure.

Nature: Nature: The construction of 15 chicken farms plus two other facilities will displace natural habitats entirely. Collectively these 17 sites will comprise ca. 0.3% of the entire size of the Rainbow Chickens property.

The chicken farms will be connected with the central facility with hard-topped roads, which adds another surface area which will displace biota.

The development can be reversed with human intervention.

Mitigating of the impacts is impossible considering the prerequisite design and application of a chicken farm.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5		n.a
Duration	*Short duration*	*2*		n.a.
Extent	*Site specific*	*2*		n.a.
Magnitude	Very high	10		n.a.
Significance	**Very high**	**7 0**		n.a.
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Definite	5		n.a.
Duration	Long term	4		n.a.
Extent	Regional	2		n.a.
Magnitude	Moderate	10		n.a.
Significance	**Vey high**	**80**		n.a.
Status (positive or negative)	Negative		n.a.	
Reversibility	No		n.a.	
Irreplaceable loss of resources?	Yes		n.a.	
Can impacts be mitigated?	No			

Mitigation:

- Habitats will be destroyed on each of the 17 localities.
- Rehabilitation will be obligatory at the cessation of chicken production.

Cumulative impacts: No more than a localised destructive process over a relatively short term is just that.

Residual Risks: The habitats on the footprints of the 15 new chicken farms and two other facilities will be entirely displaced.

Table 8: Loss of avian habitats.

Nature: Depending on the size of the 15 chicken facilities and two other facilities, an area in the region of 100 Ha of avian habitats comprising mainly randjiesveld woodland will be destroyed by the proposed development. The construction of road network will result in additional losses. This will represent a moderate loss of habitat, and is unlikely to significantly negatively impact bird communities at the site or in the region.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short duration	2	Short duration	2
Extent	Site specific	2	Site specific	2
Magnitude	Low	4	Minor	2
Significance	**Low**	**40**	**Low**	**30**
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Long-term	4	Long-term	4
Extent	Site specific	2	Site specific	2
Magnitude	Low	4	Low	2
Significance	**Medium**	**50**	**Low**	**40**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		High	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation: • Areas cleared for the chicken facilities, roads and other infrastructure must be minimised during both the construction and operational phases. • The facility at site 13, where the artificial dam is located, should be positioned so as avoid destroying the dam. During the site visit, it was indicated that the intention is to build the facility at the site of existing dam, and that the dam would be relocated. However, this approach does not take into account the well-developed vegetation surrounding the existing dam, which represents important avian habitat. Moving the facility so as to avoid destroying the dam is the recommended solution.				
Cumulative impacts: The proposed development will result in additional avifaunal habitat loss in the region. However, the small area involved means that this impact is minor.				
Residual Risks: None.				

Table 9: Increased disturbance of birds by human activities.

Nature: In addition to direct habitat loss, the disturbance of birds in the surrounding areas will increase because of increased human activity and movements in the area. This impact will be more pronounced during the construction phase than the operational phase.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Very probable	4	Probable	3

Duration	Short duration	2	Short duration	2
Extent	Site specific	2	Site specific	2
Magnitude	Low	4	Low	2
Significance	**Moderate**	**32**	**Low**	**18**
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Probable	3	Improbable	2
Duration	Long-term	4	Long-term	4
Extent	Site specific	2	Site specific	1
Magnitude	Low	4	Low	2
Significance	**Moderate**	**30**	**Low**	**14**
Status (positive or negative)	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: • Construction activities must be limited to the sites of the chicken facilities, and personnel should not be allowed to disturb birds in the surrounding areas. • Measures must be put in place to ensure that no illegal hunting of birds takes place on the property or in surrounding areas.				
Cumulative impacts: Increased disturbance at a local scale, but unlikely to be significant.				
Residual Risks: None.				

Table 10: Mortality associated with new roads linking the 17 new facilities.

Nature: Vehicles using the roads will result in an increased mortality risk for birds, mammals, reptiles and amphibians though collisions with moving vehicles.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Very probable	4	Probable	3
Duration	Short duration	2	Short duration	2
Extent	Site specific	2	Site specific	2
Magnitude	Low	4	Low	2
Significance	**Moderate**	**32**	**Low**	**18**
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Probable	3	Improbable	2
Duration	Long-term	4	Long-term	4

Extent	Site specific	2	Site specific	1
Magnitude	Low	4	Low	2
Significance	**Moderate**	**30**	**Low**	**14**
Status (positive or negative)	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: • Strict enforcement of a 40 kmph speed limit • Minimize unnecessary driving, and in particular limit driving at night. • Ensure all personnel driving on the property are aware of the risk of roadkills				
Cumulative impacts: Increased roadkill mortality at a local scale, but unlikely to be significant.				
Residual Risks: None.				

Table 11: Environmental contamination, including disease transmission from chickens to wild birds.

Nature: The new chicken and other facilities will create a risk of contamination of natural habitats in the surrounding areas is spillages of substances such as chicken manure occur. A related risk concerns the possibility of contact between chickens and wild birds, and the possibility of disease transmission occurring.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Very improbable	1	Very improbable	1
Duration	Short duration	2	Short duration	2
Extent	Site specific	2	Site specific	2
Magnitude	Very low	1	Very low	1
Significance	**Low**	**5**	**Low**	**5**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	3	Very improbable	1
Duration	Long-term	4	Long-term	4
Extent	Regional	3	Regional	3
Magnitude	Medium	5	Low	1
Significance	**High**	**36**	**Low**	**8**
Status (positive or negative)	Negative		Negative	

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: • Standard biosecurity procedures must be implemented in order to ensure that no contact between chickens and wild birds, mammals or any other groups takes place.		
Cumulative impacts: Poultry farms, by their nature, elevate the risk of disease transmission between wild and domestic species. However, as long as adequate biosecurity measures are put in place, the cumulative impact should not be cause for concern.		
Residual Risks: Elevated risk of disease transmission between domestic and wild birds.		

Table 12: Power lines: collision and electrocution risk to birds.

Nature: It is assumed that new distribution lines will need to be constructed to provide power to the chicken facilities. These will create electrocution and collisions risks for birds, although these will be minor compared to those associated with large transmission lines.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Improbable	2
Duration	Short duration	2	Short duration	2
Extent	Site	1	Site	1
Magnitude	Low	1	Low	1
Significance	**Low**	**8**	**Low**	**8**
Status (positive or negative)	Negative			
OPERATIONAL PHASE				
Probability	Improbable	2	Improbable	2
Duration	Long-term	4	Long-term	4
Extent	Site	1	Site	1
Magnitude	Low	2	Low	1
Significance	**Low**	**14**	**Low**	**8**
Status (positive or negative)	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			

Mitigation: • Assuming that the usual small transmission lines are used, no specific mitigation measures are required. If any collisions are recorded subsequently, the installation of devices to increase the visibility of lines to birds can be considered. But the risk posed by low distribution lines is very minor compared to larger transmission lines. • Information regarding the design of these lines should be made available to the ornithologist before construction commences, in order to confirm the assumptions made here about their height and likely impacts.
Cumulative impacts: None.
Residual Risks: None.

9. CONCLUSIONS

The 15 new chicken farms and two other new facilities will entirely displace all biota on their footprints. Whereas environmental impacts on these will be Very High, the collective area to be sacrificed for construction will be ca. 0.3% of the total size of Roodewal and Kwa-Mmatau Farms, which are currently managed as a game farm and nine chicken farms. Hard-topped roads will be constructed to service the new farms from a central facility. The surface area of the roads is not known, but together with the chicken farms will probably be in the order of 1% of the landmass of the two farms. Chicken farms are sealed units and none of its by-products will leach into the environment. It should also be pointed out that these farms, like all farms, are managed for commercial purposes, quite often at the expense of environmental damage such as tilled fields.

The impact of the construction of the chicken farms on its footprints will at most be 70%, and impact during the operational phase over a period of >15 years will at most be 80%, which are deemed to be Very High (See Section 6.5). Add to that the impact of the service roads. This will still be insignificant considering the commercial objective of the properties and the size of the land sacrificed (within a significantly larger conservation area) for this purpose.

Rainbow Chickens manages the areas not utilized for chicken production as a commercial game farm. In terms of environmental conservation it makes thus no sense whatsoever that game are to be relocated and kept on the fallow fields like domestic animals, in order to construct chicken farms on prime veld. It makes more sense to build the chicken farms on the fallow fields and manage the game on it natural habitat.

The sister report dealing with impacts on the flora points out that the planned development of the 17 new facilities will indeed place endangered / sensitive species at risk and suggests that the new farms are built amongst the nine existing farms as well as along the secondary

grassland along the western portion of the property. We support this notion, especially since the main portion of the Roodewal and Kwa-Mmatau Farms will therefore remain unfettered and can be managed within the context of an Ecological Management Plan which will include the game species.

No sensitive species, sensitive areas, ecological systems or services will be significantly negatively affected by the proposed development. We can therefore not submit reasonable objections to the proposed development, but must point out that should the developments are on fallow fields, the environmental and conservation impact would be virtually nil!

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Roodewaal Chicken Farm
RCL Foods, Rustenburg (North West Province)

Vegetation Assessment

Date: November 2016

Updated March 2017

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Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study. Therefore, the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although the author exercises due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. henever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

The Environmental Impact Assessment Regulations (Government Notice No. R982 of 4 December 2014), requires that certain information is included in specialist reports. The terms of reference, purpose of the report, methodologies, assumptions and limitations, impact assessment and mitigation (where relevant to the scope of work) and summaries of consultations (where applicable) are included within the main report. Other relevant information is set out below:

Expertise of author:

- Working in the field of ecology, and in specific vegetation related assessments, since 2007;
- Is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology (Reg. No. 400019/11); and
- Has been working with plants indigenous to South Africa since 1997.

Declaration of independence:

Dimela Eco Consulting in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by Dimela Eco Consulting is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

Dimela Eco Consulting undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during the course of this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.

_____ ____2017._____

Antoinette Eyssell Date

SACNASP Reg. No. 400019/11

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EXECUTIVE SUMMARY

RCL Foods proposes an extension of a chicken farm on the portions of the farm Roodewal 322 and a portion of the farm Elandsfontein 366, North West Province. The project entails the establishment of seventeen (17) new chicken runs, south of their nine (9) existing chicken runs. As part of the Environmental Impact Assessment Process, Dimela Eco Consulting, through Limosella Consulting, was appointed to undertake a vegetation assessment of the proposed areas for expansion.

The terms of reference were interpreted as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the sites proposed for expansion;
- Broad description of the vegetation associations found on the site compared to the expected natural state as listed in the national vegetation map;
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed "red data plants") and sensitive vegetation associations that could be impacted by the prosed developments; and
- Impact assessment and mitigation measures and recommendations to limit the potential impact(s) that the proposed development could have on natural and sensitive vegetation

The study site contains sensitive ecosystems earmarked for conservation on a provincial level (CBA'1, CBA2 and ESA2) additionally all wetland and aquatic ecosystems are protected by the National Water Act. The study site also lies in close proximity to areas earmarked as part of the protected areas expansion project for statutory protection. In terms of the landscape setting the study site is situated in a landscape to the south west of the Magaliesberg mountain range which has low levels of fragmentation. Therefore, plays an important role in meeting provincial conservation targets.

Four main vegetation groups were identified; they are bushveld, plains bushveld, riparian woodlands and derelict agricultural fields. The bushveld and riparian vegetation groups were largely natural; in a primary state; contained provincially protected plant species and had a low level of invasion present. These vegetation groups were all assigned a high sensitivity value. The derelict fields had low species diversity and high level disturbance and subsequent high levels of invasion. This vegetation group was therefore assigned a low level of sensitivity and could support the proposed development.

The proposed development of seventeen (17) additional chicken houses in areas of high sensitivity is not supported in terms of the guidelines set out in the North West Biodiversity Sector Plan for CBA2 and ESA1 areas. The only vegetation group where this activity could be supported is the low sensitivity agricultural fields where all natural vegetation has already been cleared, or areas close to this to prevent fragmentation of the natural habitats. The bushveld, plains bushveld as well as riparian woodland vegetation groups are all deemed not feasible for the proposed development.

However, RCL Foods proposes to conserve the remainder of the vegetation and introduce game into the area. In addition, a limited number of chicken batteries will likely have a lesser impact than extensive livestock production (which is allowed in an ESA1) where overgrazing could lead to a change in the species composition. However, it is likely that in due time, an expansion of the chicken farm might be proposed which will result in cumulative impacts, particularly fragmentation, an increase in edge effects and loss of species diversity from the current good condition bushveld vegetation.

The site is deemed sensitive from a vegetation perspective and the proposed development outside of the current low sensitivity areas and adjacent land is not supported. If the North-West conservation authority does consider the proposed development, the protection of the remainder of the land must be formalised, no further development or expansion of the activities on the site should be allowed and the following should form part of an ecological management plan for the site: grazing capacity and management plan, alien invasive plant species management plan, sensitive species management and monitoring plan, erosion monitoring and management plan. A fulltime, suitably qualified staff member(s) who will manage and continually evaluate any degradation in the vegetation composition and structure and who will report on the status of sensitive vegetation groups as well as the effective management of game and the ecosystem as a whole should be appointed. It is recommended that an external audit be conducted by an independent ecologist twice a year, to report on the state of the vegetation and effectiveness of the reserve management plan. This report should be submitted to the North West authorities for comment and review.

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1 INTRODUCTION

RCL Foods proposes an extension of a chicken farm on the portions of the farm Roodewal 322 and a portion of the farm Elandsfontein 366, North West Province. The project entails amongst others, the establishment of seventeen (17) new chicken runs, south of their nine (9) existing chicken runs. As part of the Environmental Impact Assessment Process, Dimela Eco Consulting, through Limosella Consulting, was appointed to undertake a vegetation assessment of the proposed areas for expansion.

1.1 Description of the proposed activity

During the site visit the 17 possible sites were indicated as areas already measured by a land meter for the construction of the proposed chicken houses (**Error! Reference source not found.**). It is envisaged that each chicken house will cover an area of 200m by 200m. The exact layout plans were not available to the specialist on the days which the site visit was conducted. The final layout was only received in March 2017 and was considered in the impact assessment section and included waste water treatment works, an egg bank, generator and solar plant, rearing and laying houses. In addition, game will also be introduced.

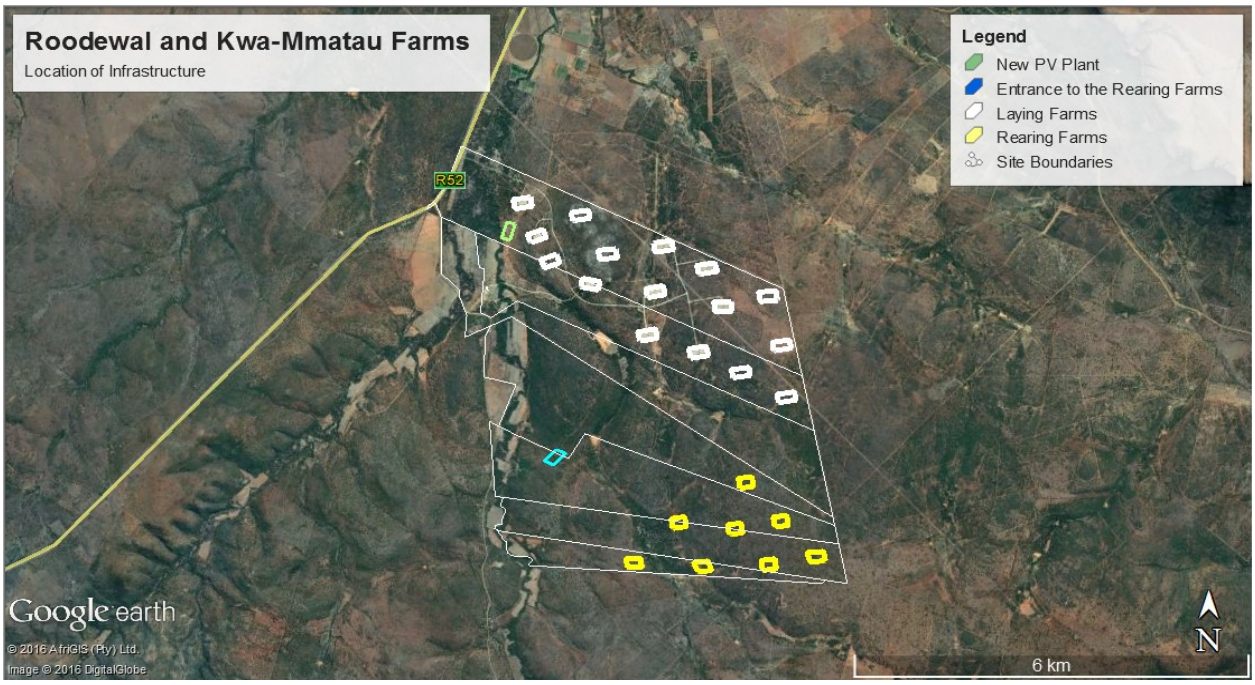


Figure 1: The approximate localities of the final facilities, including the 17 new facilities (i.e. 15 new rearing and laying farms + 2 facilities for other purposes) to be constructed on Roodewaal and Kwa-Mmatau Farms.

1.2 Terms of reference

The terms of reference was interpreted as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the sites proposed for expansion;
- Broad description of the vegetation associations found on the site compared to the expected natural state as listed in the national vegetation map (Mucina & Rutherford, 2006);
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed "red data plants") and sensitive vegetation associations that could be impacted by the prosed developments; and
- Impact assessment and mitigation measures and recommendations to limit the potential impact(s) that the proposed development could have on natural and sensitive vegetation.

1.3 Assumptions and Limitations

Local variations in the vegetation are not always distinguishable on the broad scale assessment undertaken for this report. Due to the inaccessibility of large portions of vegetation within the study area, comprehensive mapping of all the different vegetation communities present in the study area was not feasible as it can only be accomplished through thorough sampling undertaken over a number of seasons.

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably during November and February. However, this report relied on a single site visit undertaken during November 2016, soon after the first rains was experienced. The year preceding the site visit was unusually dry.

Plant species re-sprouting from storage tubers (geophytes) will take advantage of the first rains, stored reserves and low grass cover after the dry season to grow and flower during summer (December to March) and then die back. Herbs, forbs, and grasses first need adequate rainfall before being able to fully grow and flower between February and April. Most of the geophytes, forbs, succulents, and grasses can only be fully identified if they are actively growing and have either flowers or fruit. At the time of the survey, however, rains had not been sufficient to enable any significant recovery or growth of the vegetation.

The layout of the proposed chicken houses were not made available to the specialist during the site visit or during the compilation of the report. A detailed methods statement of the proposed construction and operation of the chicken houses were not available to the specialist during the site visit or compilation of the report.

2 METHODOLOGY

The assessment entailed a literature review which included short listing plants of conservation concern that could potentially occur within or in the vicinity of the proposed development, a site visit to the proposed area, mapping and reporting.

2.1 Literature Review

The description of the regional vegetation relied on literature from Mucina & Rutherford (2006) Plant names follow Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002), van der Walt (2009), and Bromilow (2010). In the absence of a guideline document for the North West Province, the study was undertaken in accordance with the Gauteng Requirements for Biodiversity Assessments Version 2 (GDARD, 2012) as best practice.

2.2 Field survey

The site visit took place from the 8th, 9th and 10th of November 2016.

The field survey focused on 17 areas which have been earmarked for the construction of the proposed chicken houses. Additionally other vegetation groups were also surveyed to get a representative sample of all the vegetation groups present on the study area i.e. savanna, grasslands, wetland and disturbed areas. The proposed new chicken houses are 200m by 200m in extent. The specialist walked random transects in the attempt to cover the footprint area as best possible.

The field survey focussed on identifying natural and untransformed vegetation, unique features that could indicate local sensitivities such as threatened and protected plants, as well as sensitive ecological features such as wetlands, ridges, inselbergs and rivers that are essential for the maintenance of ecosystems and ecological processes and which is likely to support plant species of conservation concern. A map of the sampling areas is given in Appendix A. Any additional information on any other feature thought to have ecological significance within the sampling areas, such as dominant species vegetation cover, erosion, rocky cover, alien/exotic/invasive plants, as well as plant species of conservation concern and/or their habitat was also recorded. Plant identification and vegetation description relied on species recorded in the sampling areas, in walked transects, areas driven, as well as relevant literature and distribution data.

2.3 Mapping

Mapping has been done by comparing data recorded in sampled areas to the visual inspection of available Google-Earth Imagery and extrapolating survey reference points to the entire study area. Vegetation associations described are predominant but could include numerous smaller vegetation associations that was not sampled or mapped separately. This would have involved numerous sampling points within the proposed study area. The mapping of wetland or riparian woodland communities was not done by

conducting a wetland assessment. Please refer to the wetland specialist report for an accurate delineation of wetland and riparian boundaries. The riparian woodland communities were mapped using a 100m buffer on all rivers (perennial and non-perennial), dams, pans as well as wetlands indicated on the 2006 topographic maps.

For a project of this extent, extended time on site and thorough sampling would be costly and was deemed unfeasible at this stage of the impact assessment. Vegetation delineations are therefore approximate. For the purpose of this study, the identification and basic descriptions of vegetation that are presented in this document should be adequate to highlight the likely status and sensitivities associated with the respective vegetation associations observed along the proposed corridors, as well as evaluating the likely impacts that will result from the proposed development.

2.4 Sensitivity Analysis

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Vegetation is thus an important determination of the biodiversity of an area.

The vegetation sensitivity assessment aimed to identify whether the broad vegetation associations within the proposed additional chicken houses are of ecological importance and vulnerable to linear infrastructure development as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Protected by national or provincial legislation;
- Habitat or potential habitat to plant species of conservation concern, protected plants or protected trees as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats;
- Situated within ecologically sensitive features such as wetlands, riparian areas or ridges, koppies that provides an important ecological function.

This implies that in the sensitivity analysis not only aspects that currently prevail on the area should be taken into consideration, but also if there is a possibility of a full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed.

In order to determine the sensitivity of the vegetation groups in the study area, weighting scores and criteria as in Appendix A were applied. The results of the scoring places the vegetation in either of the sensitivity classifications. Vegetation with a low score is not considered to be sensitive. Vegetation with a score of 7 was considered as medium-low, while a score of 13 was regarded as medium-high.

Scoring	13-18	7-12	1-6
Sensitivity / ecological condition	High	Medium	Low

3 BACKGROUND TO THE STUDY AREA

3.1 Locality

The study area comprised portion 6. 8, 11, 12, 15 and 17 of the farm Roodewal 322 as well as portion 58 of the farm Elandsforntein 366 in the North West Province. The site situated east of the R52 road between Rustenburg and the town of Koster (Figure 2). The site is situated about 15km south-west of Rustenburg, on the opposite side of the Magaliesberg and about 23km north-east of Koster. The Derby D3667 dirt road forms much of the western boundary of the study area. The study area is situated within the quarter degree square 2527CC, with a small northern portion of the study area within the quarter degree 2527CA. The additional chicken houses are proposed for the southern portion of the study area, while the existing chicken houses are situated on the northern portion of the study area.

3.2 Topography

The study area comprises mainly of plains, often sloping or irregular in between surrounding rocky hills. These areas are usually characterized by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions (GDACEL, 2001; Esler *et al,* 2006). Higher biodiversity and thus ecological sensitivities can be expected here.

3.3 Hydrology

The perennial Selons River flows through the north-western section of the site, with numerous non-perennial tributaries that drain the site (Figure 3)

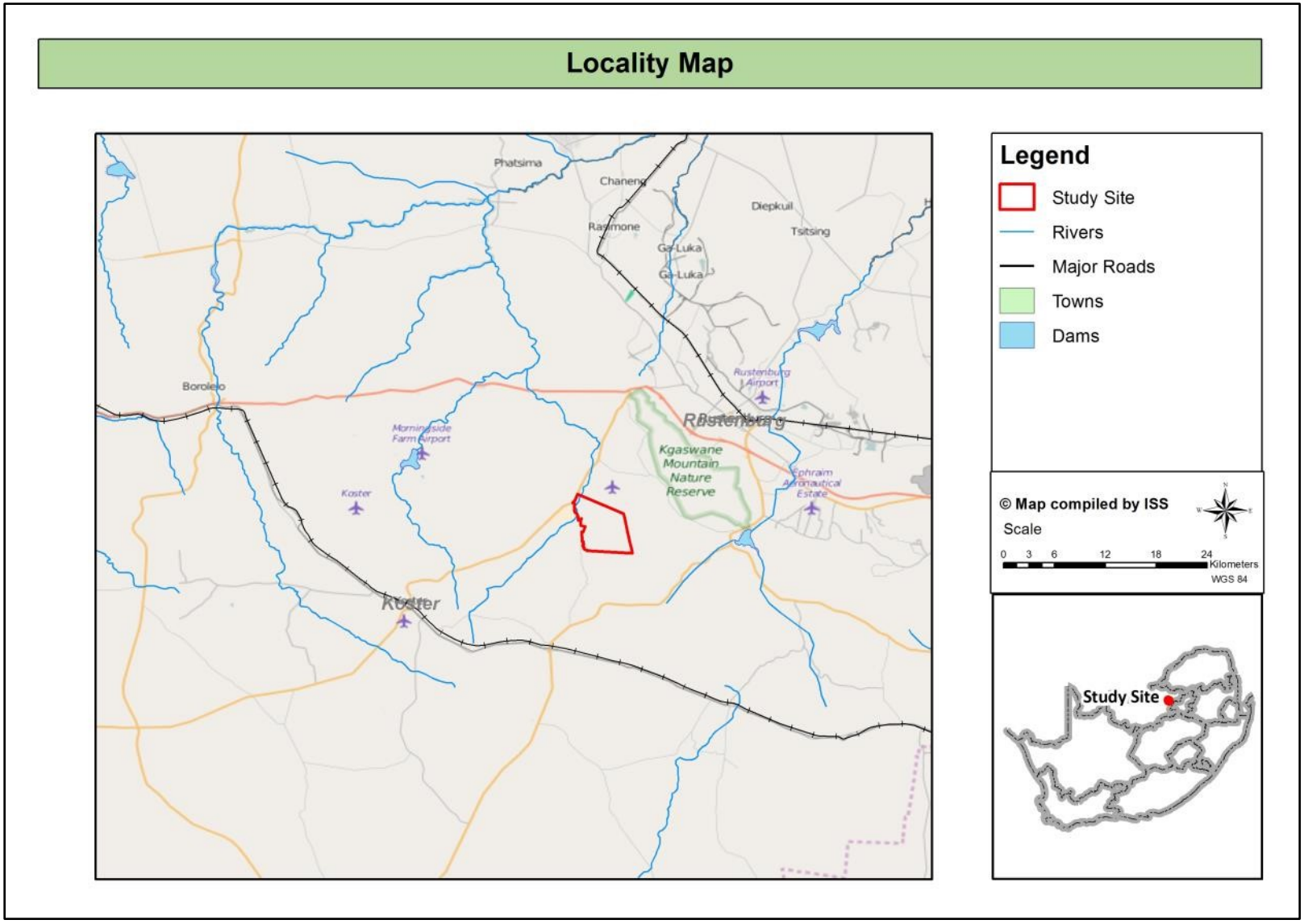


Figure 2: Locality map for the study area

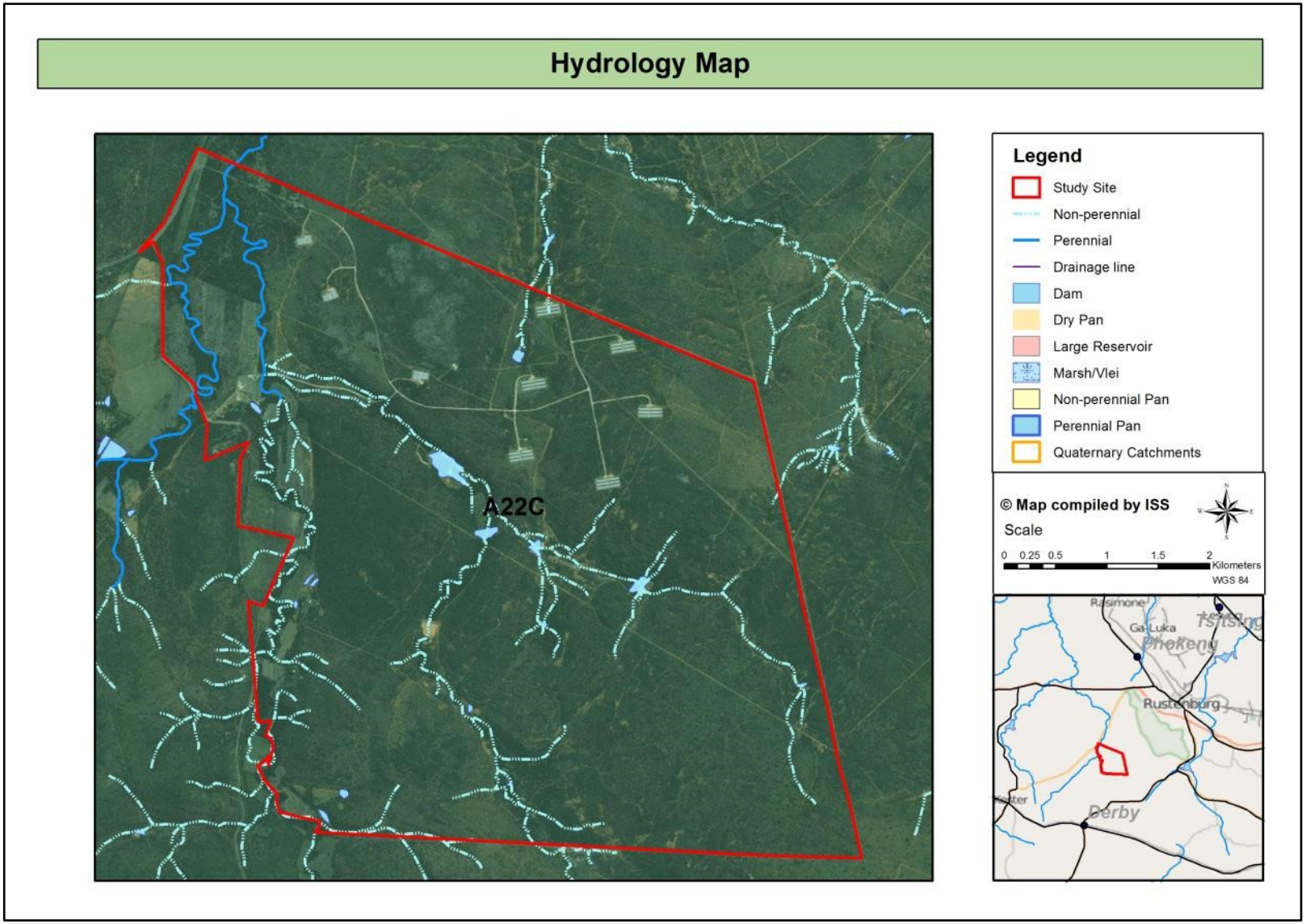
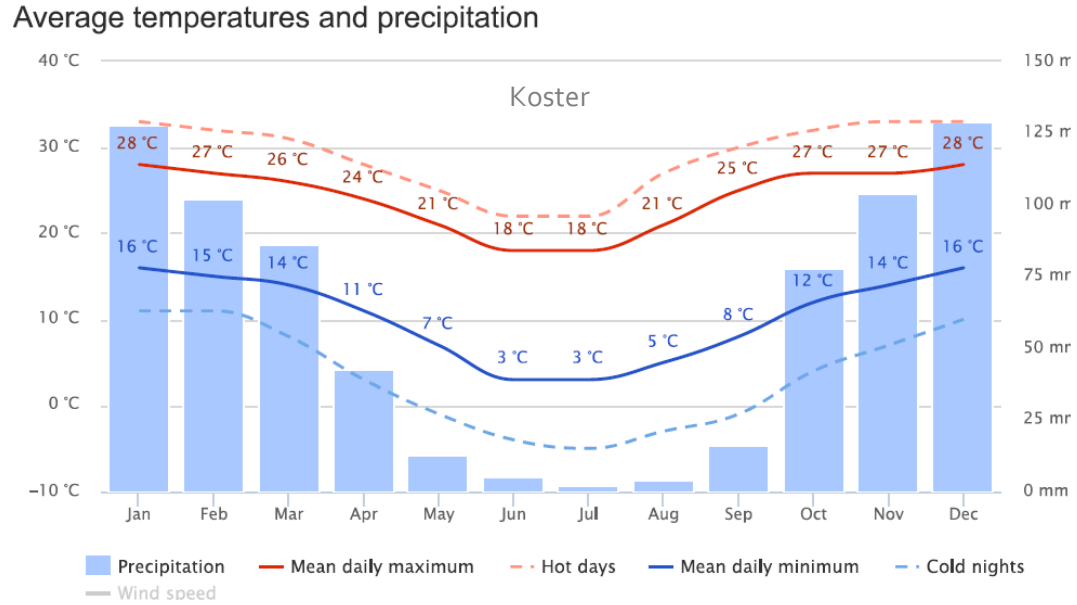


Figure 3: Hydrology of the area as per existing spatial layers.

3.4 Climate

The study area receives summer rainfall and winters are very dry winters. Although close to Rustenburg, the climate are likely more comparable with that of Koster which would be slightly cooler and wetter than Rustenburg, situated on the eastern side of the Magaliesberg Mountain (Figure 4) (meteoblue.com). The average summer highs could thus range between 28 and 31°C, with the minimum in winter about 3°C. Annual rainfall varies between 550-700mm.



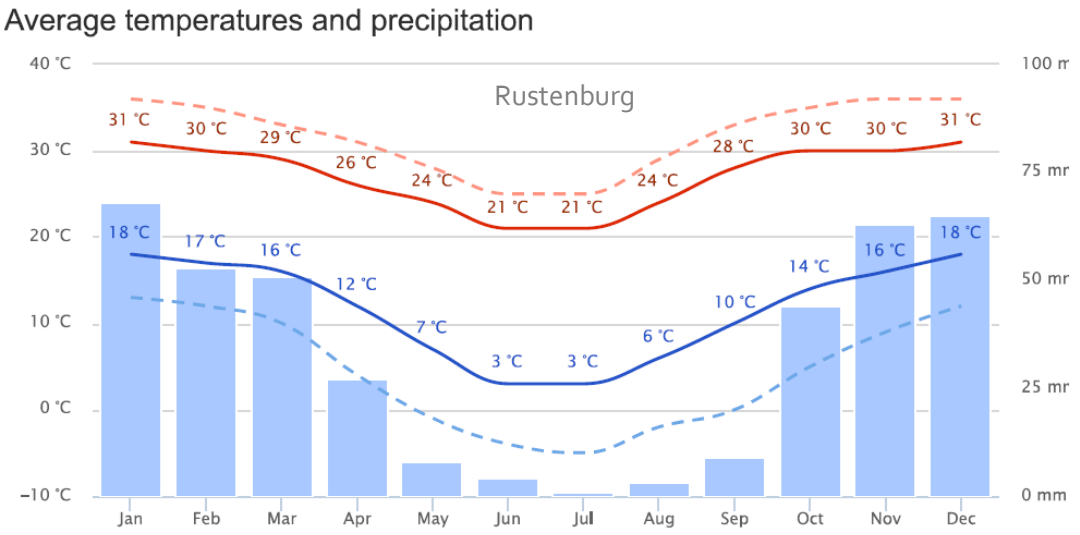


Figure 4: Climatic diagrams for Koster and Rustenburg (meteoblue.com)

3.5 Geology and soils

The geology comprise clastic sediments and minor carbonates and volcanics of the Pretoria Group (including the Silverton Formation) of the Transvaal Supergroup (Vaalian) (Mucina and Rutherford, 2006).The majority of the site comprise shallow soils on hard or weathering rock. Lime could be

present (National soils database, general soil description). Towards the northern portion of the study area, the soils are well drained, dark reddish and one or more vertic and melanic soils may be present.

3.6 Historical Vegetation Type Overview

The study area is situated within the Savanna biome of South Africa and in specific within the Central Bushveld Bioregion. The Savanna biome is the largest biome in southern Africa, occupying over one-third of the surface area of the country (Mucina & Rutherford, 2006). It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are commonly known as Bushveld (Mucina & Rutherford, 2006).

The Central Bushveld Bioregion (a bioregion is a vegetation organisation level between that of vegetation type and biome) comprises several vegetation types. The study area stretches over two vegetation types as geographically represented in Figure 5 and described in Table 1.

Table 1: Vegetation types of the study area

Biome	**Bioregion** (vegetation organisation level between that of vegetation type and biome)	**Vegetation Type**	**Conservation Status**
Savanna	Central bushveld	1. Moot Plains Bushveld The vegetation comprises open to closed, low, often thorny savanna dominated by various species of *Vachellia* and *Senegalia* in the bottomlands and plains, as well as woodlands of varying height and density on the lower hillsides. The herbaceous layer is dominated by grasses.	Vulnerable. About 13% of the extent of this vegetation type is conserved within the Magaliesberg Nature Area, while about 28% is transformed by cultivation and urban. The vegetation is prone to invasion by alien invasive plant species if not managed properly.
		2. Zeerust Thornveld The vegetation comprises deciduous, open to dense short thorny woodland, dominated by *Vachellia* and *Senegalia* species with herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands, also between rocky ridges.	Least threatened. Less than 4% of this vegetation's extent is statutorily conserved with about 16% transformed mainly by cultivation, with some urban or built-up.

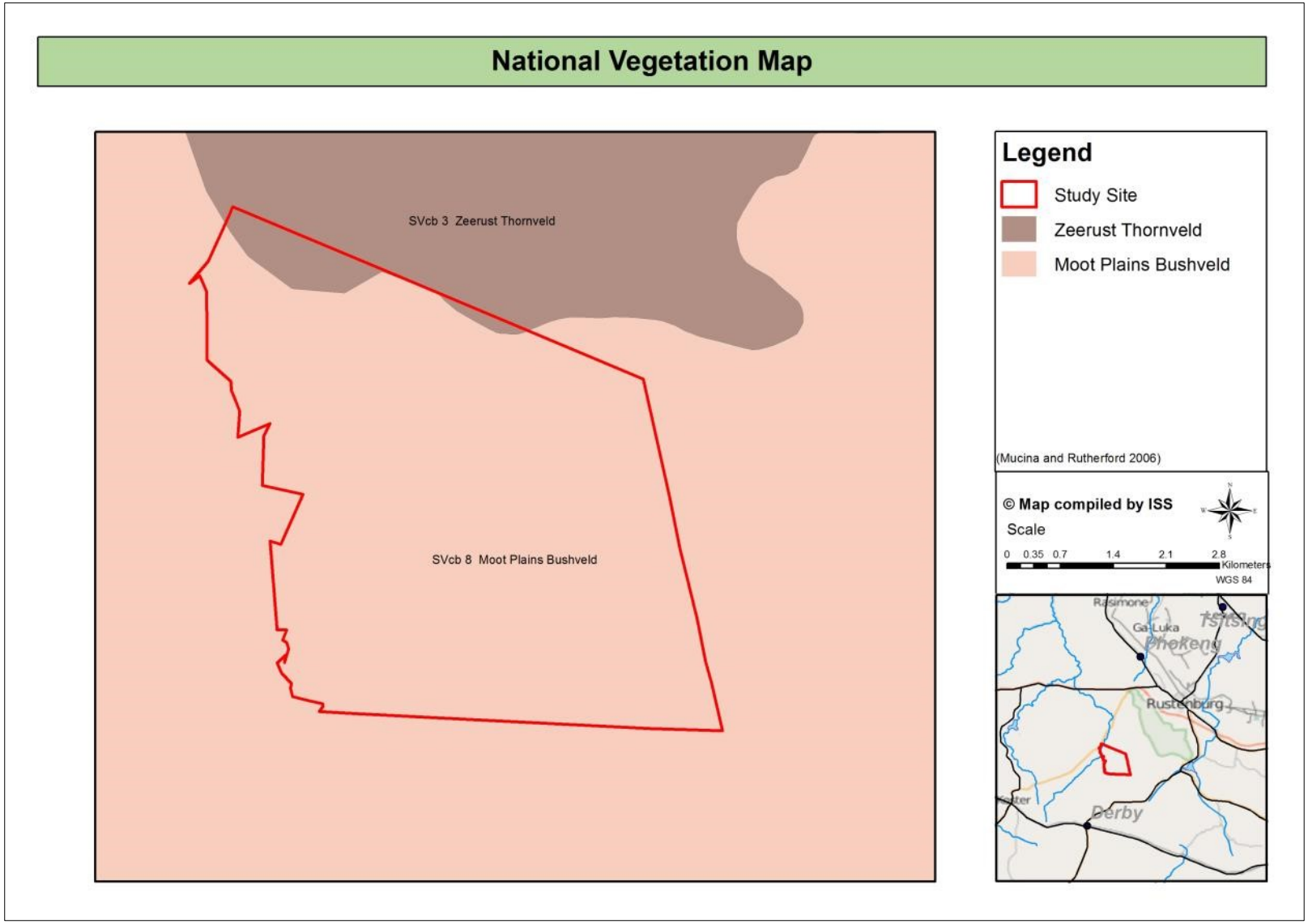


Figure 5: Vegetation types occurring within and in proximity to the study site

3.7 Listed Ecosystems

The South African Biodiversity Act (Act 10 of 2004) provides for the listing of threatened or protected ecosystems. These ecosystems are grouped into Critically Endangered-, Endangered-, Vulnerable- and Protected Ecosystems (Section 52(1) (a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). Development a listed ecosystem could have environmental authorization implications in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998) [NEMA] and Environmental Impact Assessment (EIA) regulations. This means any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a basic assessment in terms of the EIA regulations. Wherever listed ecosystems occur, these areas should be included as sensitive areas and be incorporated into Environmental Management Frameworks (EMF's). Therefore, impacts should be avoided, minimised, mitigated and / or offset considered were appropriate. The study site is not situated within a listed ecosystem.

3.8 North West Biodiversity Conservation Assessment

The North West Biodiversity Conservation Assessment includes reference to Critical Biodiversity Areas (North West DACE, 2009). Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making. CBA's are therefore areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (North West DACE, 2009).

In addition, the conservation assessment also made provision for Ecological Support Areas (ESA's), which are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for CBA's (North West DACE, 2009).

As per Figure 6, the majority of the proposed project is situated within a terrestrial ESA1 with a small portion of CBA2 present in the north-eastern corner and in the north-western corner. Areas covering CBA2's are areas are remaining natural patches larger than 5ha of provincially endangered and vulnerable ecosystems (in this case the Moot Plains Bushveld). Any further transformation of these vegetation types should be limited to existing transformed or heavily degraded areas. The ESA1 is based on much of the

site falling within a protective 1km buffer area to the Magaliesberg Natural Area, corridors along the rivers as well as the presence of hills.

The North West Biodiversity Sector Plan (2015) contains regulations for land use in CBA's as well as ESA areas. According to the Biodiversity Sector Plan game farming as well as livestock production is allowed in CBA's and ESA's but intensive animal farming (e.g. feedlot, dairy, piggery, chicken battery) is not allowed in CBA 1, CBA2 or ESA1 and should be regulated in n ESA2.

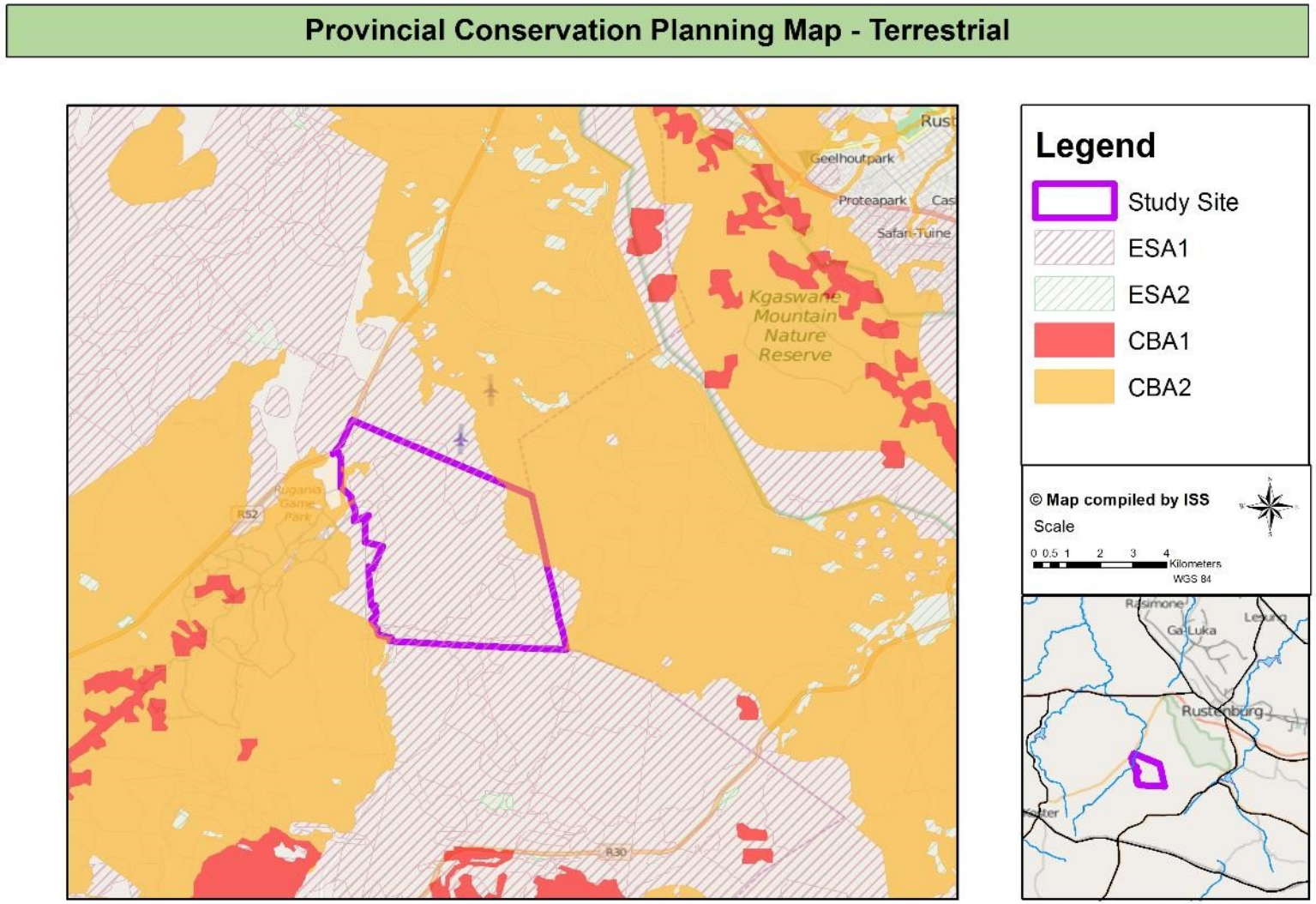


Figure 6: Critical Biodiversity Areas (CBA1 and CBA2) within the study site

3.9 Protected Areas and Protected Areas Expansion

3.9.1 Protected Areas

No national protected areas are present within the study area. The Magaliesberg Natural Area and the Rustenburg Nature Reserve is situated about 7km north-east of the site.

3.9.2 Protected Areas Expansion Strategy

South Africa's protected area network currently falls far short of sustaining biodiversity and ecological processes and therefore the National Protected Area Expansion Strategy (NPAES) are being implemented (DEA, 2009). The NPAES was commissioned by the Department of Environmental Affairs (DEA), co-ordinated by the South African National Biodiversity Institute (SANBI), and drafted in close collaboration with the South African National Parks (SANParks), other national conservation agencies and the Provincial conservation agencies. The goal of the NPAES is to achieve cost effective protected area expansion for ecological sustainability and increased resilience to climate change. The NPAES sets targets for PA expansion, provides maps of the most important areas for PA expansion, and makes recommendations on mechanisms for PA expansion. The NPAES uses two factors, importance and urgency, to identify priority areas for PA expansion in the terrestrial environment. Although not currently protected, these areas should be considered as being of high development constraint for infrastructure proposed to be located within or in close proximity to these areas.

Two portions of the North West / Gauteng Bushveld Focus Area for expansion are situated north-west, north and east of the site (Figure 7).

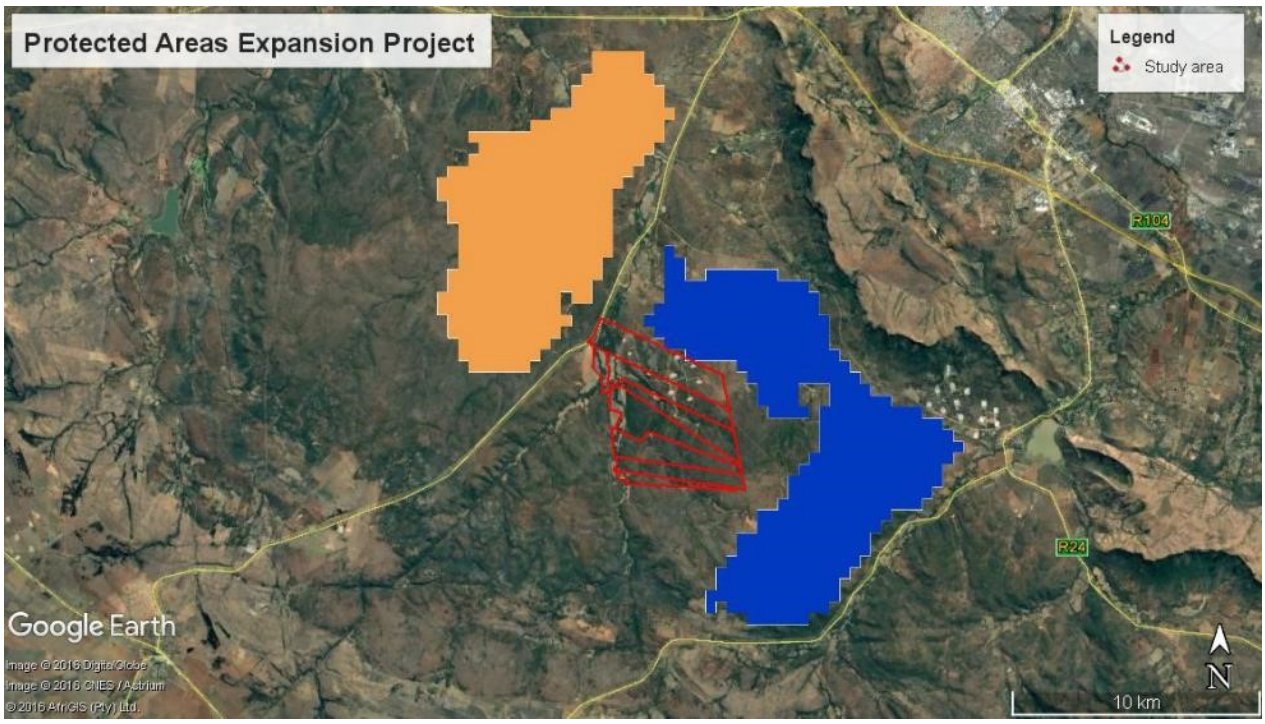


Figure 7: The study site in relation to the protected areas expansion project

4 RESULTS OF THE FIELD ASSESSMENT

4.1 Land use

The majority of the study area comprises of natural savanna vegetation. Along the western boundary, next to the Selons River, some cultivation took place. Nine (9) chicken houses are situated on the northern portion of the study area (Figure 8). An existing Eskom servitude traversers the site from the north-western corner to the south-eastern corner. Apparently, sections of the study area are incorporated into a conservancy but no details of the conservancy were made available to the specialist.

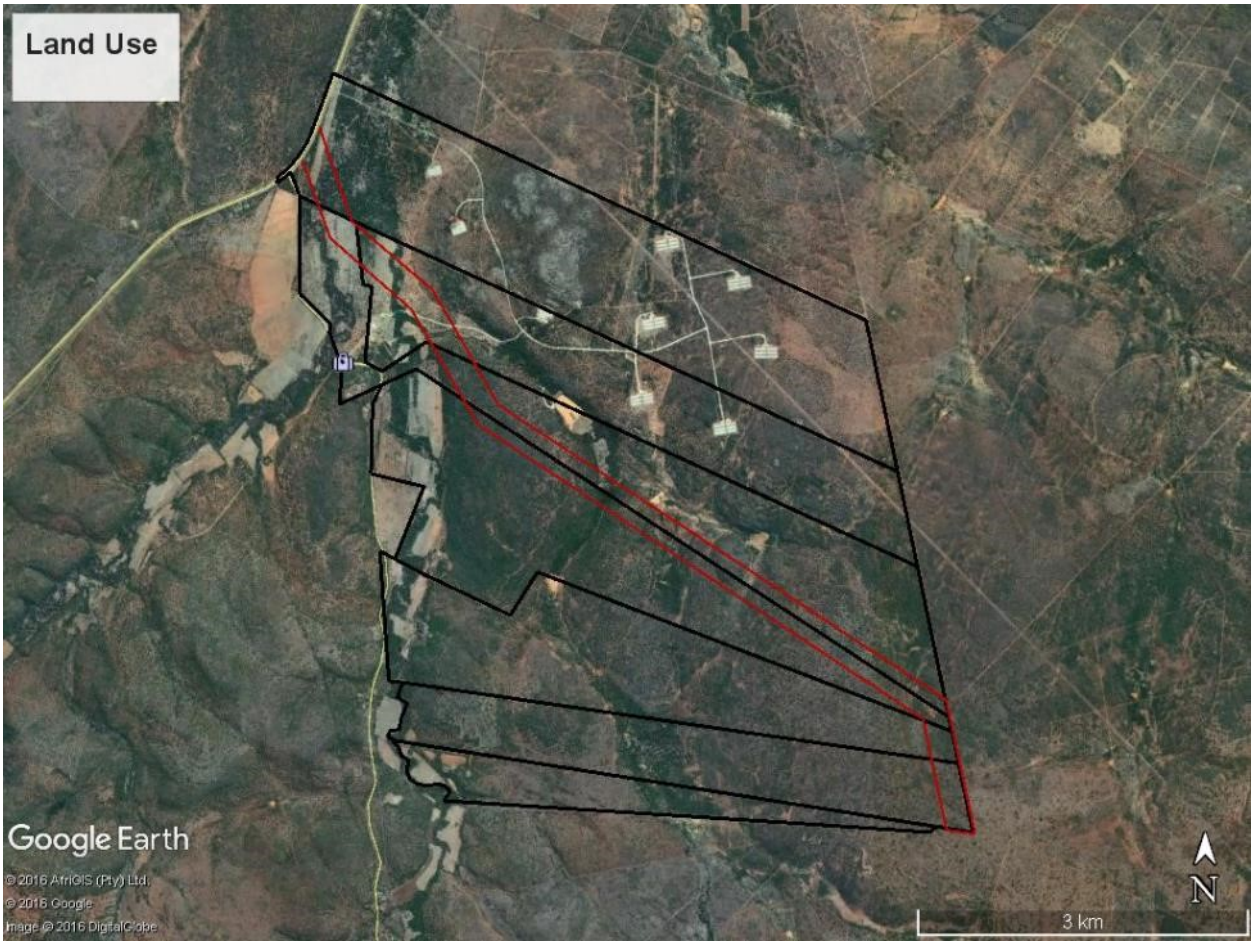


Figure 8: Land use on and around the site. Eskom servitude indicated in red

4.2 Landscape setting

In terms of the landscape the study site is situated to the south west of the Magaliesberg mountain range. The north and eastern side of the Magaliesberg Mountains lies the town of Rustenburg and the landscape has been modified due to urban sprawl as well as mining activities. However, to the southern and western side of this mountain range the landscape is largely intact only fragmented by a limited number of roads as well as some agricultural fields, landing strips, agricultural homesteads and associated agricultural

buildings (stores). Additionally, the transformed areas include the current RCL chicken houses close to the Magaliesberg mountain range as well as on the study site.

4.3 Vegetation Survey Overview

At the time of the survey, the area was still extremely dry and vegetation was poor as a result of the preceding drought. The majority of the expected geophyte-, grass- and annual forb layers were either absent or grazed short and in some instances not identifiable. Similarly, many of the dwarf shrubs were without any foliage and only a few were flowering, hence it can be expected that several species were not recorded as they could not be distinguished from the more common species.

From the above it can be expected that several additional species, mostly annuals and species resprouting from underground storage organs, can emerge throughout the study area later during the rainfall season. This is confirmed by the preliminary statistical analysis of the survey data:

Number of (indigenous and non-weed) species observed:	102
Second-order jack-knife estimate:	165
Number of weed and alien invasive species excluded from statistics:	11

The 165 species that may be present in the study area is only a rough estimate and has been used as a comparative tool to help assess the conservation value and sensitivities of habitats.
This, in addition to the lack of layout plans available for the chicken houses as well as the associated road network, means a pre-construction walkthrough survey will be required and must be conducted between December-April, prior to commencement of activity to ensure that all protected trees are marked and protected and endemic species localities are identified and their GPS localities recorded to enable avoidance and/or rescue.

Vegetation associations identified during this study are based on the overall similarity in vegetation structure, species composition, and abiotic features such as rivers and hills. However, phytosociological differences within each broadly grouped vegetation association is present. Vegetation associations occur in intricate mosaics throughout the study area, with edges of vegetation units generally very vague. Local species composition is primarily influenced by soil depth, soil surface texture and underlying geology. There is also a large degree of species overlap between the mapped edges of vegetation associations identified.

4.4 Description of vegetation associations and their habitats

Four main vegetation groups were identified for the study site (Figure 9):

1. Bushveld (ridges and inselbergs);
2. Plains Bushveld;
3. Riparian woodland; and
4. Derelict fields.

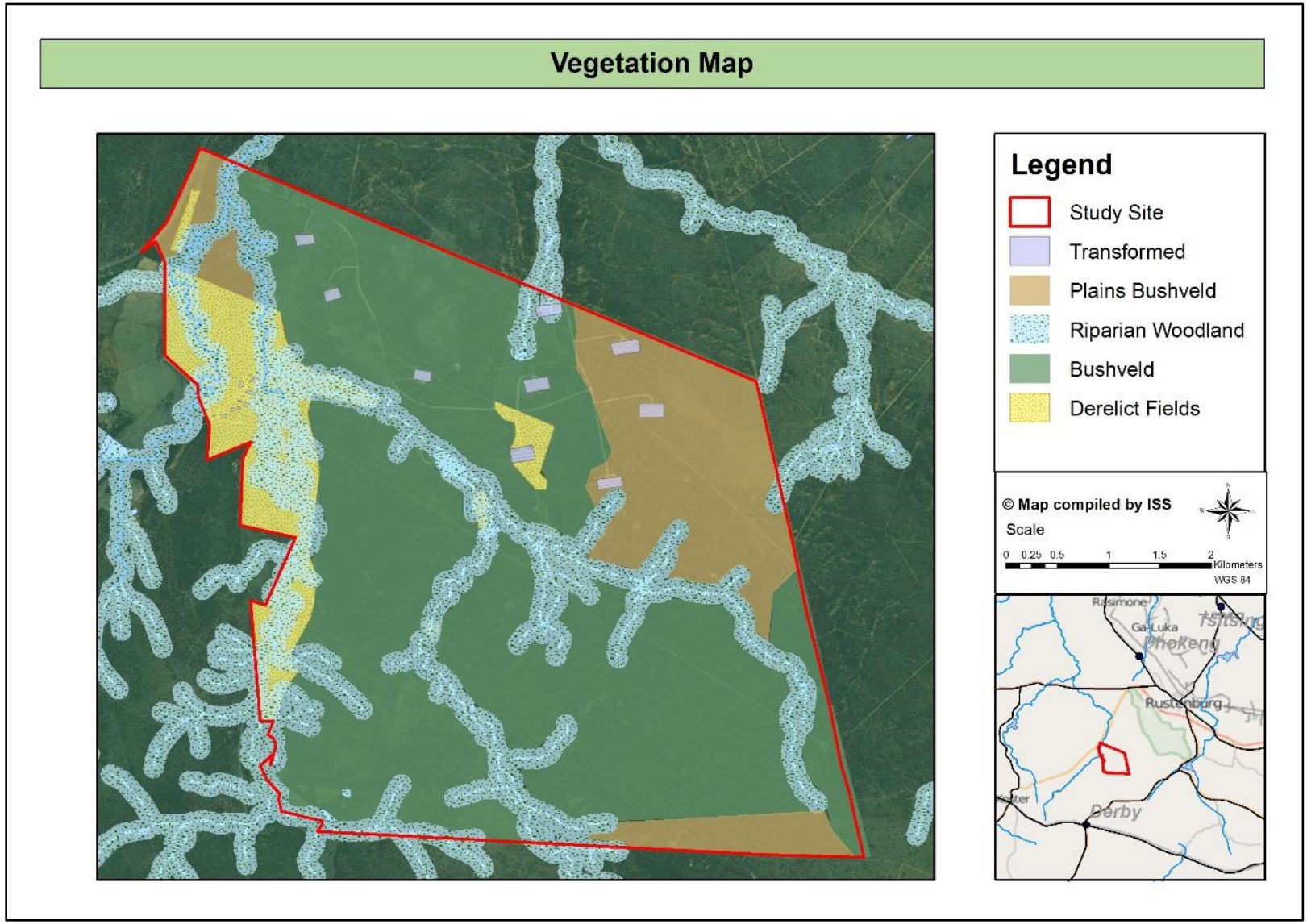


Figure 9: Fine scale vegetation groups

Additionally, transformed areas were identified during the mapping process. Each of the vegetation groups are described below. A complete species list of species identified during the site visit is included in Annexure B.

4.4.1 Bushveld

The bushveld vegetation group was present on the ridges and inselbergs within the study site. The dominant layer in the vegetation group was trees and shrubs and a very sparse grass and herb layer (Figure 10). Light still penetrated to the grass and herb layer as the canopy was not interlocking. Boulders formed an integral part of the micro and macro climate of this community. Patches of un-vegetated soils were also present in this vegetation group.

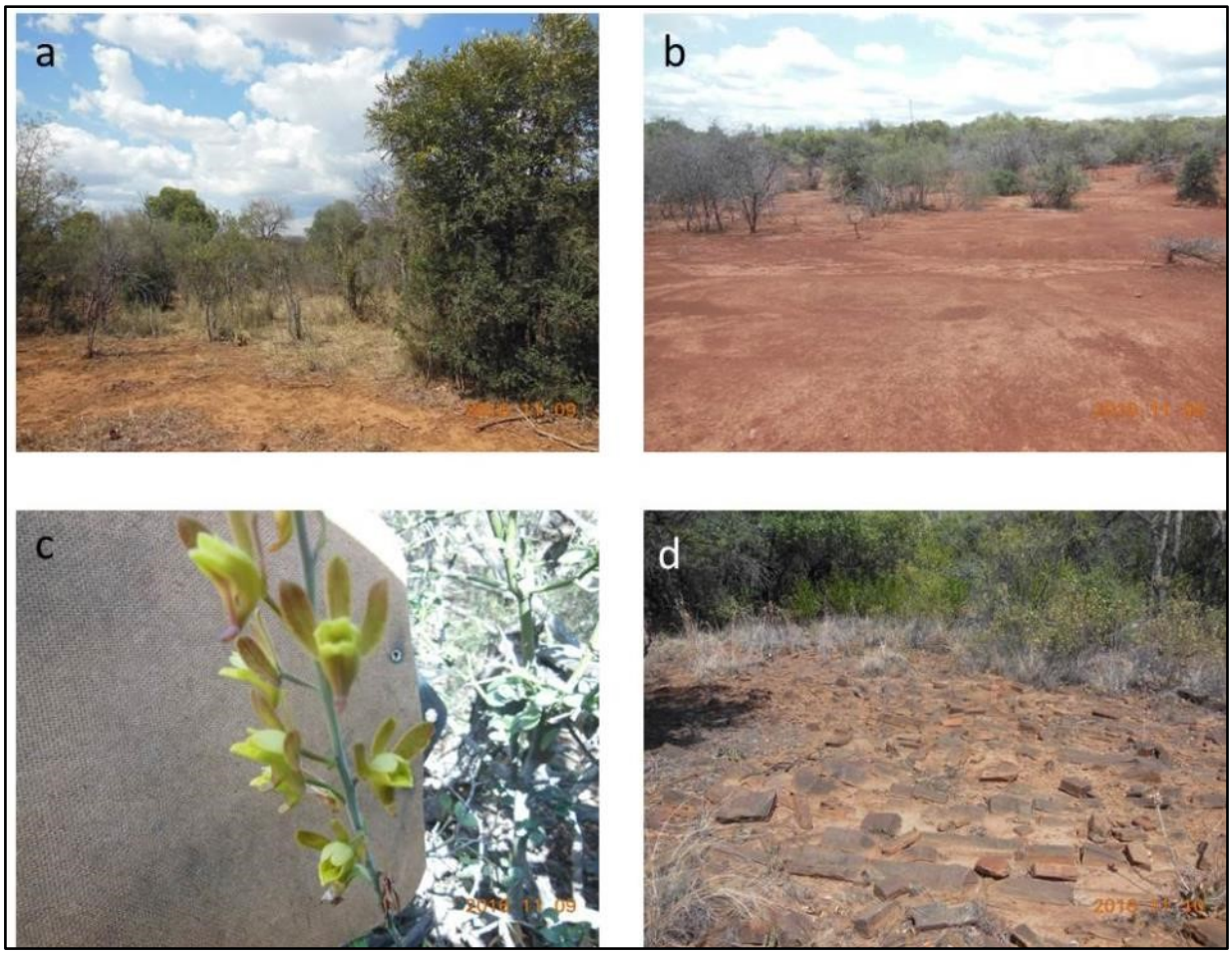


Figure 10: Bushveld vegetation group

a)Dominant tree layer with some open patches and grasses, b)Low vegetative cover along hillslope and presence of Dichrostachys cinerea. c) The protected orchid Eulophia hereroensis d) Rocky patch very characteristic of the vegetation group.

The dominant tree species within this vegetation group were *Olea europea* subsp *africana* (Wild Olive) and *Searsia lancea* (Sour Karee). The shrub layer contained mainly *Buddleja saligna* (False Olive), *Euclea undulata* (Common Guarri) and *Euclea crispa* subsp. *Crispa* (Blue Guarri). Although a lush herb grass layer is not expected for this vegetation unit the herb layer was affected by the reduced rainfall during 2016 as well as limited amount of rainfall during the current rainy season.

Some areas along steeper slopes had little to no ground cover and erosion was observed in these areas. Additionally, in these steeper hillslope areas invasion by *Dichrostachys cinerea* (Sickle Bush) was observed.

This vegetation group had the highest species diversity. Species of conservation concern included in this vegetation unit included the orchid *Eulophia hereroensis*, *Scadoxus puniceus* (Paintbrush), the tree *Cussonia paniculata* (Highveld Cabbage Tree) and the aloe species *Aloe verecunda.* Eight (8) alien invasive species were recorded within this vegetation unit. These alien and invasive species were observed in low abundance.

This vegetation unit is seen as primary bushveld with little to know disturbance excluding grazing by game.

4.4.2 Plains Bushveld

This vegetation occurs on the areas within the study site were the topography is relatively flat with the exclusion of the top of hills/mountains. This vegetation group shares a significant number of species with the bushveld vegetation group and if it is likely that it can be seen as a sub community of the bushveld vegetation group. However, in terms of structure this vegetation group is different to the bushveld vegetation group. The herb and shrub layer was dominant and although not very abundant during the time of the site visit it is likely that the abundance will increase after the a few days of rain (Figure 11).

There were still large patches of un-vegetated soils as well as rocky patches present within this vegetation group. This vegetation group is also seen as relatively undisturbed with the exception of grazing pressure from the game present on the study site.

Two of the four protected plant species are present within this vegetation: *Cussonia paniculata* (Highveld Cabbage Tree) and *Scadoxus puniceus* (Paintbrush). Alien invasive species are limited to two (2) plant species occurring in low abundances.

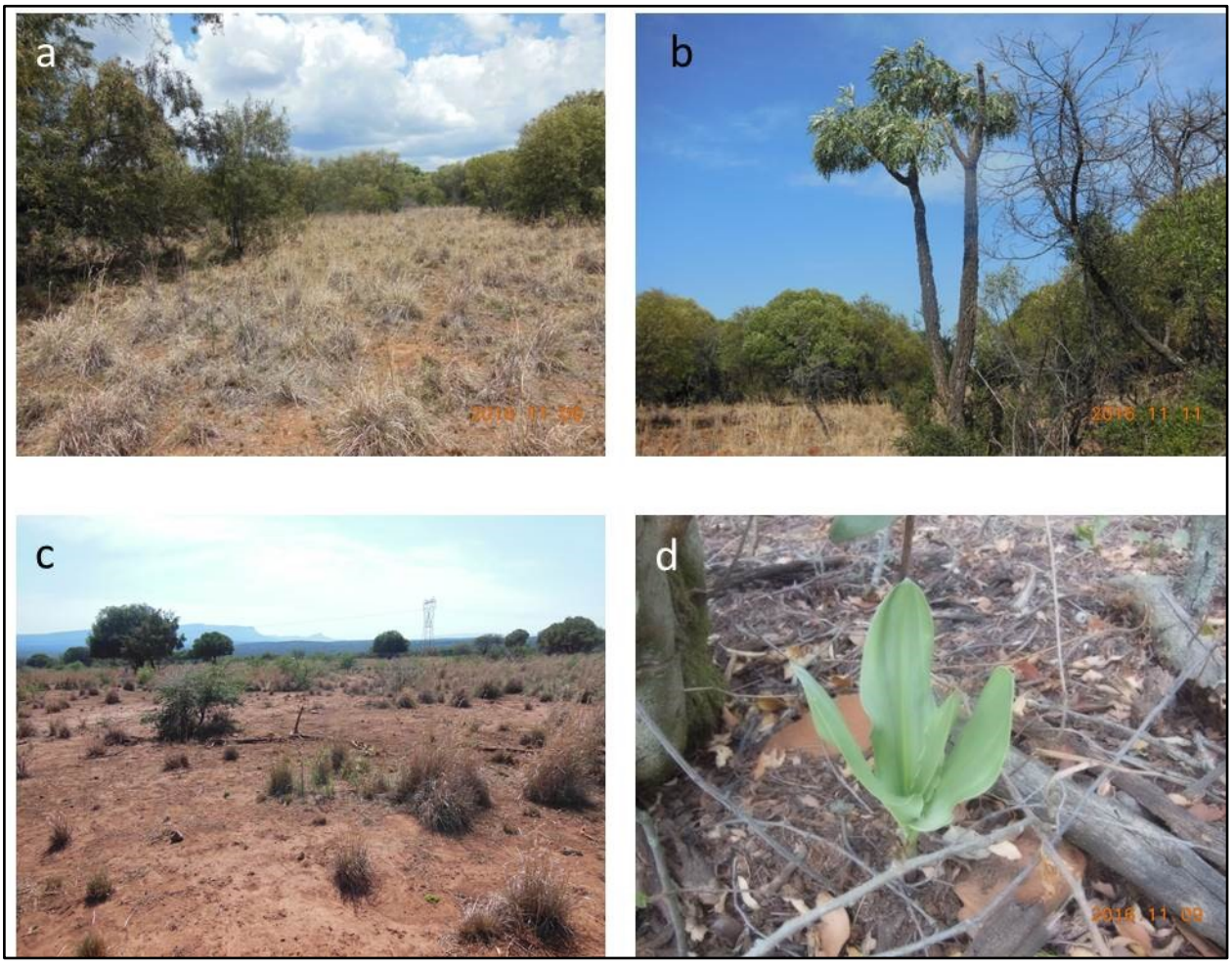


Figure 11: Plains Bushveld vegetation group

a) Dominant grass and herb layer with some interspersed bush clumps b) Cussonia paniculata. c) Sparse vegetative cover observed at some within this vegetation group. d) Scadoxus puniceus

4.4.3 Riparian woodland

This vegetation group is present along drainage lines, non-perrennial and perennial rivers as well as dams and pans within the study site. The tree layer is dominant in this vegetation group (Figure 12). The trees form a dense interlocking canopy representative of woodland vegetation. The herb and shrub layer is under developed in this vegetation group. Grass species adapted to reduced light conditions such as *Panicum maximum* (Guinea Grass) was present within this vegetation group in low abundances. It is likely that after rains the grass and herb layer could improve but the major limiting factor other than water in this vegetation group is light.

Dominant tree species in this vegetation unit included *Searsia lancea* (Sour Karee) and the diagnostic tree species within this vegetation group was *Combretum erytrophyllum (*River Bushwillow). The shrub layer

was well developed often forming a thicket. Dominant shrubs included *Buddleja saligna (*False Olive*)* and *Euclea undulata* (Common Guarri).

In terms of disturbance natural scouring of the river and stream banks was observed (Figure 12). Due to the low cover of the grass and herb layer erosion poses a threat to this vegetation group. Headcut erosion was visible along steeper slopes as well as drainage lines and poses a threat to this vegetation group as well as the associated aquatic ecosystems.

This vegetation group contained no protected plant species and only three (3) alien invasive species.

Figure 12: Riparian woodland vegetation group

a) Dominant interlocking tree layer with sparse herb-grass layer along a non-perennial tributary of the Selons River b) Selons River with dominant tree layer and scouring of the river banks c) Along a non-perennial tributary of the Selons River – tree layer present forming a ticket along banks and erosion evident d) Close up of the erosion present along the same non-perennial tributary of the Selons River as shown in c.

4.4.4 Derelict fields

Historically as well as recently cultivated derelict fields were present along the western study site boundary. These areas were easily accessible. The level of disturbance was high in this vegetation group and consisted mainly of pioneer species. Trees are scattered loosely within this vegetation group and the main species included *Vachellia karroo* (Sweet Thorn) and *Vachellia tortilis* (Umbrella thorn) (Figure 13).

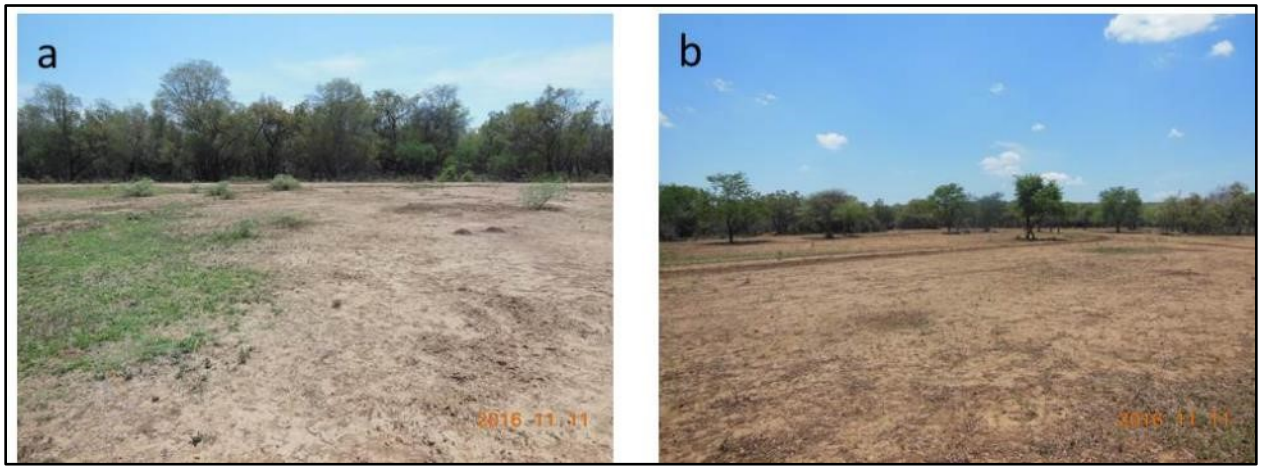


Figure 13: Derelict fields vegetation group

a) Derelict fields with a few individuals of Vachellia tortilis and plains bushveld in the background b)Derelict fields with a few individuals of Vachellia karroo.

The vegetation group had a low species diversity both in terms of abundance and richness and included 5 alien invasive species.

4.4.5 Transformed areas

These areas are the buildings (offices, storage, existing chicken houses) present within the study site. The area around the offices were cleared. Vegetation around the existing chicken houses was cleared (Figure 14).

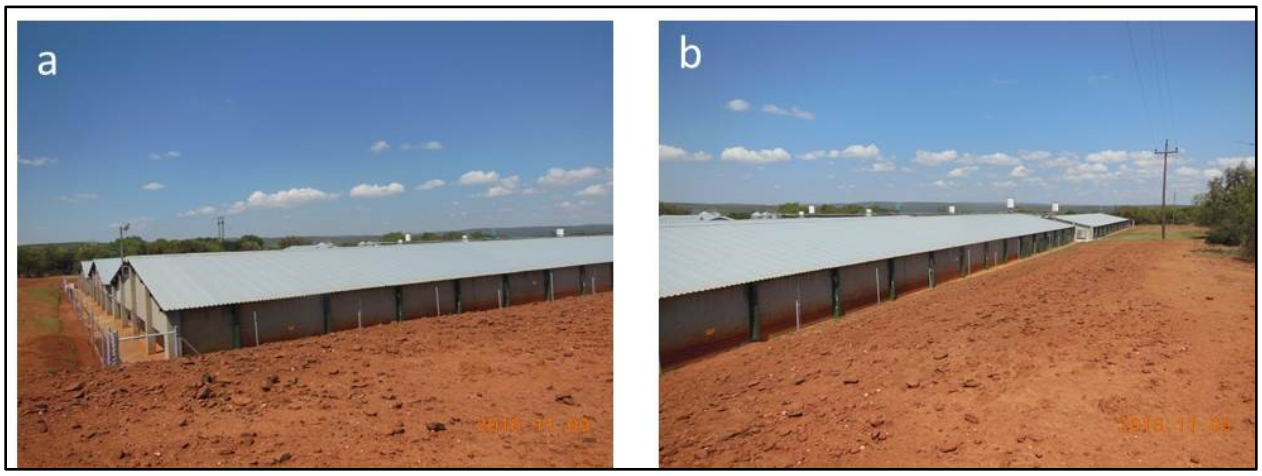


Figure 14: Transformed chicken houses

a) Chicken house with built on concrete slab b) Chicken houses with cleared vegetation.

4.4 Plants of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining (Figure 15). Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.

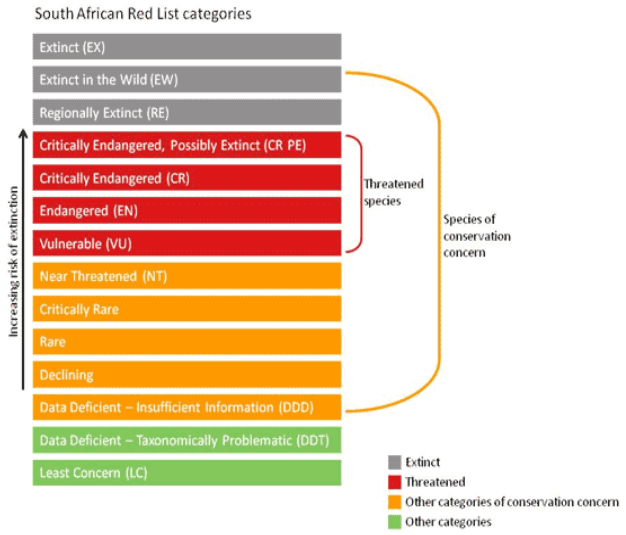


Figure 15: Threatened species and species of conservation concern

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

A list of plants of conservation concern was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo *et al*, (2009) and relevant literature pertaining to the area that the site is situated in. At least fourteen (14) plant species of conservation concern could occur within the greater study area (Table 2). None of these species were recorded, although suitable habitat for six (6) (printed in **bold** in Table 2) is present on the site.

Table 2: Species of conservation concern that could occur within the proposed corridors

Specie	Conservation status	Habitat notes and potential to occur on site	Flowering period
Aloe peglerae	Endangered	Grassland, in shallow, gravely quarzitic soils on rocky, north-facing slopes or summits of ridges from Magaliesberg to Witwatersberg *No suitable habitat*	July-August
Prunus africana	Vulnerable	Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100m. This tree is exploited for the medicinal plant trade. *Unlikely to occur*	Dec-June
Adromischus umbraticola subsp. umbraticola	Near threatened	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south. *Unlikely to occur*	Sept-Jan
Drimia sanguinea	**Near threatened**	**Open veld and scrubby woodland in a variety of soil types.** ***Likely to occur, not observed in sampled areas, at the time of the field survey***	**Aug-Dec**
Kniphofia typhoides	Near Threatened	Heavy, black clay soil, climax *Themeda triandra* grassland, low lying marshy ground - pans or vleis. *No suitable habitat*	Feb-March
Boophone disticha	**Declining**	**Rocky grasslands, but particularly in proximity or on rocky outcrops.** ***Likely to occur, not observed in sampled areas, at the time of the field survey***	**Oct-Jan**
Gunnera perpensa	Declining	Damp marshy area and vleis from coast to 2400m. *No suitable habitat*	Oct-March
Ilex mitis* var. *mitis	**Declining**	**Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes.** ***Likely to occur in riparian woodland, however, not observed in sampled areas, at the time of the field survey***	**Oct-Dec**

Specie	Conservation status	Habitat notes and potential to occur on site	Flowering period
Senegalia (Acacia) erioloba	**Declining**	**Widespread in the drier areas of the northern provinces of South Africa, deep sandy soils and drainage lines.** ***Likely to occur, however, not observed in sampled areas, at the time of the field survey***	**Late winter-summer**
Frithia pulcra	Rare	Coarse quartzitic shallow soils on sandstones. Magaliesberg. *Unlikely to occur*	Dec-Feb
Rapanea melanophloeos	**Rare**	**Forest and bush clumps, usually in damp areas. Declining due to harvesting of bark for medicinal trade** ***Likely to occur, however, not observed in sampled areas, at the time of the field survey***	**June-Dec**
Drimia elata	Data deficient (Taxonomic problems)	Varied habitat - rocky grassland *No suitable habitat*	Sept-Oct
Myrothamnus flabellifolius	**Data deficient (Taxonomic problems)**	**Habitat comprises shallow soil over rock, crevices and rocky hillsides in full sun** ***Likely to occur, however, not observed in sampled areas, at the time of the field survey***	**spring-summer**
Acalypha caperonioides var. caperonioides	Data deficient (taxonomic problems)	Likely occurrence within natural grasslands *Unlikely to occur*	-

4.5 Protected plants

4.5.1 NEMBA Threatened or Protected Plant Species (TOPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others,

species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as 'Restricted Activities', are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species.

At the time of this assessment, no TOPS listed species were recorded within the proposed development footprint.

4.5.2 Protected Trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. No protected tree species were identified during the site visit along the walked transects.

4.5.3 Provincially Protected Plants

Provincially, a number of plants are protected by the Transvaal Nature Conservation Ordinance Act No.12 of 1983, the North West Biodiversity Bill (North West Provincial Gazette, No 7603 of 2016). The removal or pruning of these plants will require a permit from the North West department of Rural, Environment and Agriculture Development. Table 3 lists provincially protected species that were confirmed to occur in the study area and those recorded in walked transects are geographically represented in Appendix A.

Table 3: Species recorded that are protected in the North West Province

Species	Common name
Eulophia hereroensis species	Orchid
Scadoxus puniceus	Paintbrush (geophyte)
Cussonia paniculata	Highveld Cabbage Tree
Aloe verecunda	Aloe

4.6 Alien Invasive Plant Species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by

means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).
The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations were published in the Government Gazette No. 37886, 1 August 2014. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse.

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

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

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

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

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

The alien plant species identified on the study site are listed in Appendix B. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:
(a) notify the competent authority in writing
(b) take steps to manage the listed invasive species in compliance with
(i) section 75 of the Act;
(ii) the relevant invasive species management programme developed in terms of regulation 4; and
(iii) any directive issued in terms of section 73(3) of the Act.

Table 4: Alien invasive plants were observed within the study area

Species	Category
Achyranthes aspera **(M)**	Category 1 (CARA)
Argemone ochroleua	Category 1 (CARA)
Cereus jamacaru	Category 1b (NEMBA)
Datura stramonium (M)	Category 1b (NEMBA
Flaveria bidentis	Category 1b invader (NEMBA)
Opuntia ficus-indica	Category 1b (NEMBA)
Portulaca quadrifida	Not listed
Richardia brasilliensis	Not listed
Senna didymobotyra	Category 3 (CARA)
Solanum elaegnifolium	Not listed
Verbena tenuisecta	Not listed

5 SENSITIVITY RATINGS

In order to determine the sensitivity of the vegetation groups in the study site, weighting scores and criteria as in Appendix A were applied. The results of the scoring places the vegetation in either of the sensitivity classifications as listed in Table 5 below. Vegetation with a low score is not considered to be sensitive. Note that the precautionary approach applies and that all good condition natural vegetation will be designated as sensitive, as well as confirmed localities and associated habitats for plant species that are of conservation concern.

Table 5: Weighting scores

Scoring	13-18	12	7-11	6	0-5
Sensitivity	High	Medium-high	Medium	Low-medium	Low

5.1 Sensitivity Analysis

As per 6 below, the result of the assessment indicated that both of the bushveld vegetation groups had a high sensitivity. Both of these vegetation groups contained provincially protected plants and fell into the Moot Plains Bushveld which is listed as a vulnerable vegetation unit in terms of national conservation efforts. The transformed areas are considered to have a low sensitivity as they are heavily disturbed and most natural vegetation has been removed. The vegetation sensitivity is geographically represented in Figure 16.

Table 6: Scoring of vegetation that occur within the site

Site	Conservation Status of regional Vegetation unit	Listed Ecosystem or state of vegetation	Level of legislative	Suitable habitat for plants of conservation concern	Ecological Function	Ecological importance	Total Score out of max of 18
Bushveld	1	3	2	2	3	3	**14 High**
Plains Bushveld	1	3	2	2	3	3	**14 High**
Riparian Woodland	**1**	3	2	2	3	3	**14 High**
Derelict and agricultural fields	1	0	2	0	0	0	Low

5.1.1 Vegetation of low sensitivity

Vegetation with low sensitivity is generally degraded or disturbed vegetation with little ecological function and is usually species poor (most species are usually exotic or pioneers). This was typical for the derelict fields within the study site. The main form of disturbance was removal of vegetation due to ploughing and cultivation of crops.

This vegetation group is deemed feasible for the proposed development.

5.1.2 Vegetation of high sensitivity

As best practise, all good condition natural vegetation must be designated as ecologically sensitive. This was particularly applicable to the sandy bushveld which was in good condition with hardly any alien invasive species present and only a few individuals of *Dichrostachys cinerea*, as well as alien invasive species. The Eskom servitude and existing disturbances increase the fragmentation of this vegetation, making remaining connected areas more sensitive.

The riparian woodland vegetation group is nationally protected by the National Water Act. The bushveld as well as the plains bushveld contained provincially protected plant species, suitable habitat for other plants of conservation concern and are provincially protected by the North West Biodiversity Sector Plan (READ, 2015). The moot plains bushveld and the riparian woodlands transverse a CBA2 as well as an ESA2. The bushveld vegetation group transverse CBA1, CBA2 and ESA2. Vegetation observed on site was in primary condition with very low levels of invasion present. Additionally, the study site is in very close proximity the planned protected areas expansion programmes earmarked site. In terms of the landscape setting there is very limited habitat fragmentation on the south western side of the

Magaliesberg mountain range. All these factors were taken into consideration when sensitivity of the vegetation groups was assigned.

Chicken houses; referred to as chicken batteries in the READ 2015 document; is not a supported land use in CBA1 or CBA2 and is a regulated land use in an ESA2. Therefore, the proposed land use is not aligned with provincial conservation planning strategies, particularly as the vegetation was found to be in good condition.

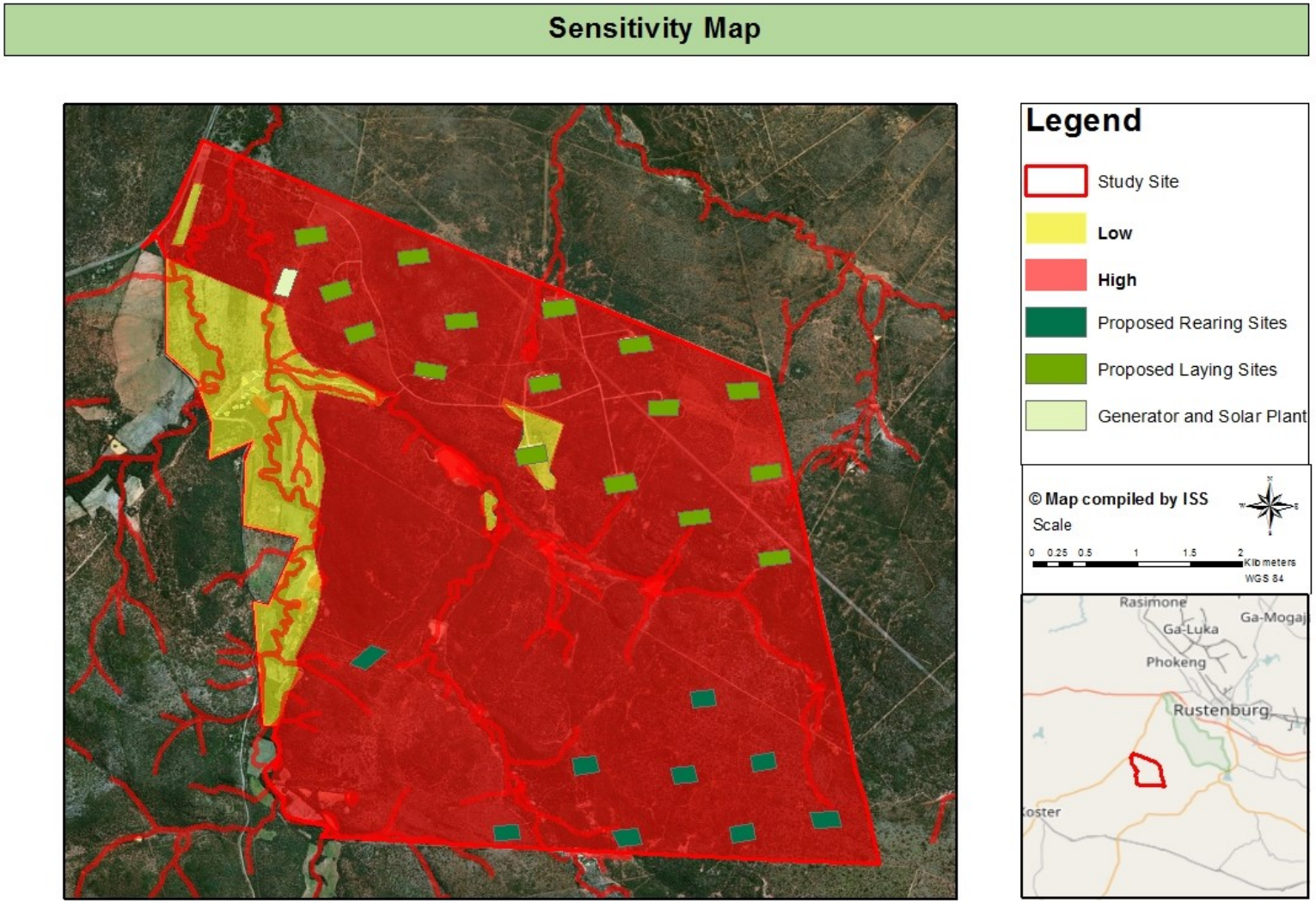


Figure 16: Vegetation sensitivity map of the study site

6 IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for a large number of ecological services provided for by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

6.1 Impact statement

The greatest impact of the proposed development on vegetation is expected to occur in bushveld on hills and ridges. One of the largest concerns would be the cutting and/or destruction of large trees, especially provincially protected tree species, as they grow slowly and are thus not easily replaced. Furthermore, disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of these species.

Although a limited number of chicken batteries will likely have a lesser impact than extensive livestock production (which is allowed in an ESA1) where overgrazing could lead to a change in the species composition, expansion of the chicken farm with a likely increase in chicken houses would increase fragmentation and edge effects, and a likely decrease in species diversity. The size of natural vegetated land affects the number, type and abundance of species they contain. Thus, the larger the patch of the un-fragmented and undisturbed land, the more likely it is to be of conservation importance. At the periphery of such patches of land, influences of neighbouring activities or other patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other factors and therefore these areas seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder 2005).

If new developments are kept as close as possible to existing developed and/or transformed areas, indirect and cumulative impacts can be reduced. If several developments are planned within close proximity, these developments should be situated as close together as possible.

If development is therefore grouped as close together or within transformed areas, the most significant impact is expected to occur during the construction phase. While the excavation of soil for the chicken house footprint would remove vegetation, the vegetation could be replanted after the construction and its re-establishment monitored to ensure that the soil and vegetation rehabilitated. The greatest threat to the rehabilitation of the land disturbed by construction, is the potential of invasive plant species rapidly establishing on the disturbed soil and spreading into adjacent natural areas. If remedial measures and monitoring is properly implemented, the vegetation that will be disturbed during construction could rehabilitate well over time, and long term impacts on vegetation and faunal habitats could thus be minimal.

However, if development is not concentrated (as per the layout received in March 2017), fragmentation could lead to the decrease in species diversity and slow degradation of remaining patches. In addition, the project also wants to introduce game species. Such a layout and game introduction could only be supported if a commitment to conserve the remaining vegetation is formalised, with the understanding that no future increase in fragmentation (e.g. extension of the chicken houses and other infrastructure) should be allowed. The protection of the area should be formalised and an ecological management plan, approved by the provincial conservation department, implemented and monitored bi-annually by an independent SACNASP registered botanist or ecologist.

6.2 Impact Assessment Criteria

The possible impacts of the March 2017 layout, as described in the next section, were assessed using parameters and methodologies given below (Labesh). Direct, indirect and cumulative impacts were assessed.

The **nature** of the impact: This will include a qualitative description of what caused the impact and how it will affect the environment;

The **extent** of the impact: The size (physical/geographical) that will be affected by the impact. The following weighting will be used:

- Onsite: Weighting value **1**: The impact is confined to the project site/property
- Local: Weighting value **2**: The impact is confined to the project site/property and a 10km radius around the project site/property
- Regional: Weighting value **3**: The impact extends further than a 10km radius around the project site/property

The **duration** of the impact: The length of time over which the impact will persist. The following weighting will be used:

- Short term: Weighting value **1**: The impact will persist for up to one year
- Medium term: Weighting value **2**: The impact will persist for longer than one year, but shorter than five years
- Long term: Weighting value **3**: The impact will persist for longer than five years

The **magnitude** of the impact: The intensity of the impact on the environment. The following weighting will be used:

- Low: Weighting value **1**: Natural processes continue, albeit in an altered manner
- Medium: Weighting value **2**: Natural processes cease temporarily
- High: Weighting value **3**: Natural processes cease indefinitely

The **probability** of the impact: How likely it is that the impact will happen. The following weighting will be used:

- Improbable: Weighting value **1**: It is unlikely that the impact will occur
- Probable: Weighting value **2**: There is a chance that the impact will occur
- Definite: Weighting value **3**: The impact will most certainly occur

The **status** of the impact: This will include a qualitative description of the following:

- Whether the impact is **positive** or **negative** in nature
- The degree to which the impact can be reversed
- The degree to which the impact can be mitigated
- The degree to which the impact may cause irreplaceable loss of resources

The **significance** of the impact: This will be calculated using the formula below:
Significance = (Duration + Extent + Magnitude) x Probability

Table 7: Description of significance rating

RANKING	19-27	10-18	1-9
SIGNIFICANCE	High	Medium	Low

6.3 Impact Assessments

The impacts of the proposed developments depend most on the type of vegetation impacted as well as the proximity of the infrastructure to other transformed areas (e.g. access roads).

6.3.1 Removal of natural, good condition vegetation

Nature: Vegetation of the study site will need to be removed for the construction of the proposed chicken runs and its associated infrastructure. The removal of vegetation from the study area could also lead to a loss in the current ecological function and a general loss of species and genetic diversity, increasing fragmentation and leading to smaller patches of vegetation prone to edge effects. Areas that will not be developed, but that may be impacted on by construction related activities (e.g. where building materials are stored) must also be considered. In addition, the

illegal disposal of construction material such as oil, cement etc. or vehicle access could destroy vegetation and compact soil.

Direct Impacts:

- Destruction of vegetation
- Potential loss of individuals of large tree species and associated microhabitats
- Potential loss of species of conservation concern and their habitats
- Potential increase in runoff and erosion
- Potential spread of alien invasive vegetation
- Potential contamination of soils with hydrocarbons and/or other pollutants

Indirect Impacts:

- Increase of fragmentation and edge effects into natural vegetation
- Bush densification (colonisation of disturbed areas by pioneer indigenous trees such as *Dichrostachys cinerea* see 6.3.5)

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	3 Definite	2 Probable-assuming that development footprint remains as small as possible and no further expansion is planned
Duration	2 medium term –construction period	2 medium term –construction period
Extent	1 onsite	1 onsite
Magnitude	2 medium	2 medium
Significance	**15 (medium)**	**10 (medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Rehabilitation is possible but could take a number of years	Rehabilitation is possible but could take a number of years
Irreplaceable loss of resources?	Moderate	Lower
Can impacts be mitigated?	Yes	

Mitigation:

Planning phase

- Due to the high sensitivity and good ecological condition of most of the vegetation on site, fragmentation of the habitat must be limited as much as possible.
- Plan the layout to make use of existing disturbed areas, focusing on areas of low sensitivity and then as little portion of high sensitivity situated close to the low sensitivity areas as possible.
- No areas of high sensitivity should be unduly fragmented.
- Plan to keep as many large trees intact as possible. Plan the layout to take cognisance of the localities of these trees.
- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any uncovered species of conservation concern are protected from destruction. Note that the species could be dormant until favourable conditions arise.

Construction:

- An independent Ecological Control Officer (ECO) should be appointed to oversee construction.
- Planning of the construction site must incorporate eventual rehabilitation of areas destroyed by construction and that does not contain infrastructure.
- Plan site layout and construction plan to leave as much of the natural vegetation intact as possible, while limiting the removal of tree species. Leaving groundcover and surrounding trees intact could help with dust suppression, as well as erosion control.
- A perimeter fence must be erected around the works area to prevent access to sensitive environs.
- Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. Ideally, the construction areas should be fenced off.
- Maintain site demarcations in position until the cessation of construction work.
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Ensure there is a method statement in place to remedy any accidental spillages immediately

General:

- A rehabilitation plan, using indigenous species from the study area, must be implemented that will restore disturbed areas beyond the footprint of the infrastructure to what it was prior to construction, thereby making the impact on the remainder of the site negligible in the long term. Due to the dry climate, natural colonisation could take a long time, in which vegetation may degrade further or become dominated by encroacher species. Therefore, timeous rehabilitation is imperative. Even in the event of good rains, annual pioneer plants are short-lived and therefore an effort must be made to keep as many shrubs in place as possible or to replace these as part of rehabilitation. As a start, runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler, *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006).
- No open fires are permitted under trees or within naturally vegetated areas.
- No vegetative matter may be removed for firewood or any other purpose other than the approved activity.
- Do not remove any large tree without the permission of the ECO. In all areas, mark trees earmarked for removal prior to felling for approval by the ECO. No protected trees or plants may be removed without the relevant permits from the local authority.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Workers may not tamper or remove flora and neither may anyone collect seed from the plants without permission from the local authority.
- Do not permit vehicular or pedestrian access into natural areas.
- Removed herbaceous plants could be housed in a temporary nursery and used to rehabilitate the areas affected during construction. The nursery and rehabilitation should form part of the rehabilitation plan.
- The planned conservation of the remainder of the farm must be formalised and written into the record of decision for this proposed development. The protection of this area should be enhanced by implementing

amongst others a vegetation and grazing management plan, based on the carrying capacity of the land, as well as an alien invasive species management plan.

Cumulative impacts:

- Possible erosion of surrounding areas if no mitigation is implemented
- Possible increased fragmentation of remaining natural vegetation
- Possible bush densification or invasion by alien invasive plant species
- Possible expansion of the chicken farm with additional infrastructure and chicken houses, will increase fragmentation and impact on the vegetation composition and structure.

6.3.2 Erosion, soil compaction and subsequent sedimentation

Nature: The removal of surface vegetation will expose the soils, which in rainy events could wash down into the rivers, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive species can spread easily into these eroded soils. Raindrops on bare soils disperses the clay fraction in the soil that settles into or block the soil pores on the surface, sealing it so that water cannot penetrate. The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation and inhibit re-vegetation. Soil compaction as a result of construction vehicles and traffic, could lead to a decrease of water infiltration and an increase of water runoff.

In general, excessive clearing of vegetation can and will influence runoff and storm water flow patterns and dynamics, which could cause excessive accelerated erosion of plains and possibly impact watercourses in the area. With bare soils and erosion already being a visible problem in the area, especially with the current low vegetation cover, the creation of new tracks should also be kept to a minimum.

Direct Impacts:

- Soil compaction
- Potential increase in runoff and erosion
- Possible change of natural runoff and drainage patterns
- Possible permanent loss of revegetation potential of soil surface
- Potential spread of alien invasive vegetation
- Negative impact on indigenous species growing conditions

Indirect Impacts:

- Sedimentation

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	2 Probable	1 Improbable
Duration	3 long term –construction period and beyond	2 medium term –construction period
Extent	1 onsite	1 onsite
Magnitude	3 high	2 medium
Significance	**14 (medium)**	**5 (low)**
Status (positive or negative)	Negative	neutral

Reversibility	Rehabilitation is possible but could take a number of years	Rehabilitation is possible if impact is limited or negated
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Planning phase

- An ecologically sound, storm water management plan must be implemented

Construction:

- No storm water from the construction site (or operational site) is allowed to be channelled directly into a non-perennial drainage line or the pan. Any water released from the site should be conform to specification as per a licence granted by the DWA.
- Do not allow erosion to develop on a large scale before taking action.
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005).
- Runoff from roads must be managed to avoid erosion and pollution problems.
- Remove only the vegetation where essential for operation and do not allow any disturbance to the adjoining natural vegetation cover.
- Where topsoils need to be removed, store such in a separate area where such soils can be protected until they can be re-used for post-construction rehabilitation. Never mix topsoils with subsoils or other spoil materials.
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- Make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006).
- Mulch and brush also reduces the force of raindrops, limiting the dispersion of clay and the extent of mineral crusting (Esler et al, 2006). It also traps dust, sand and seeds to ensure plant establishment (Esler et al, 2006).
- Vehicles may not veer from the dedicated roads.
- Once construction is complete, obsolete roads should be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, while the natural species composition should be re-established.

Operation:

- After construction clear any temporarily impacted areas of all foreign materials, re-apply and/or loosen topsoils and landscape to surrounding level.
- Disturbed areas must be revegetated as soon as possible.

- Ideally, grass sods should be removed prior to construction and these sods be re-used for re-vegetation. Smaller plant species that was removed from the development footprint should also be re-planted where possible. The areas could be left to re-vegetate naturally, provided that the establishment of indigenous vegetation similar to that which was removed are monitored. Monitoring must prevent invasion by alien invasive of bush densification species and ensure indigenous vegetation cover within 2-3 years.
- Bare soils must be protected from erosion and compaction until such time as an indigenous vegetation cover was re-established

Cumulative impacts:

- Sedimentation
- Possible bush densification or invasion by alien invasive plant species
- Further fragmentation of natural habitats
- Altered topsoil conditions
- Potential barren areas remaining after construction

6.3.3 Removal of protected species or species of conservation concern

Nature: The construction of the chicken runs could result in the removal of plant species of conservation concern, impact on their habitat, pollinators and inevitably the persistence of these species. This could put further strain on the already declining or rare populations. A number of threatened could occur and provincially protected plant species were recorded. This could put further strain on the already declining populations or populations of slow growing species.

Direct Impacts:

- Potential loss of individuals or populations of conservation concern.
- Changes is species composition.

Indirect Impacts:

- Loss of diversity.

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	2 Probable	2 Improbable -assuming that final development footprint is surveyed for these species and are amended to avoid them where possible
Duration	2 medium term –construction period	1 Short term –avoidance or relocation
Extent	3 regional	1 onsite
Magnitude	3 high	1 low
Significance	**19 (high)**	**6 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Rehabilitation is possible but could take a number of years	Rehabilitation is possible but could take a number of years
Irreplaceable loss of resources?	High	Moderate
Can impacts be mitigated?	Yes	

Mitigation:

Planning phase

- Plan the layout to avoid areas of high sensitivity. Due to the high sensitivity and good ecological condition of most of the vegetation on site, these areas must be avoided as far as possible and fragmentation of the habitat limited as much as possible.
- A suitably qualified person (e.g. botanist / horticulturist) should survey the final layout within the growing season of the plants (summer months, preferably between November and February), in order to confirm whether these plants occur within the development footprint. The layout should be flexible to avoid these species were recorded.
- Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activities, the plants should be removed (if it could survive this process) by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority).
- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any species not identified during the EIA phase, are protected from destruction. Note that the species could be dormant for some time until favourable conditions arise.
- Plan the layout to make use of existing disturbed areas, focusing on areas of low sensitivity and then as little portion of high sensitivity situated close to the low sensitivity areas as possible.
- No areas of high sensitivity should be unduly fragmented.
- Plan to keep as many large trees intact as possible. Plan the layout to take cognisance of the localities of these trees.

Construction:

- Construction workers may not tamper or remove these plants and neither may anyone collect seed from the plants without permission from the local authority

Cumulative impacts:

- Loss of diversity.
- Decline in provincial or national numbers of species of conservation concern
- Future expansion of the chicken farm will lead to a further reduction in these species and fragmentation and should be prohibited.

6.3.4 Invasion by alien invasive plant species

Nature: The seed of alien invasive plant species that occur on and in the vicinity of the operations areas could spread into the disturbed and stockpiled soil. Also, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site.

Direct Impacts:

- Increase in alien invasive plant species and densities on the site

Indirect Impacts:

- Loss of indigenous species diversity on the site
- Spread of alien invasive plant species from the site to adjacent vegetation and along proximate watercourses

e	**Without mitigation**	**With mitigation**
CONSTRUCTION PHASE		
Probability	2 Probable	1 Improbable
Duration	3 long term	2 short term
Extent	2 local	1 onsite
Magnitude	2 medium	1 low
Significance	**14 (medium)**	**4 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Rehabilitation is possible but costly and some species such as wattle, can take years before it is cleared	Reversible
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Planning phase

- Alien invasive species that were identified within the study area should be removed prior to construction-related soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.

Construction:

- All alien seedlings and saplings must be removed as they become evident for the duration of construction.
- Manual / mechanical removal is preferred to chemical control.
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO.
- Dispose of the eradicated plant material at an approved solid waste disposal site.

Operation:

- Dispose of the eradicated plant material at an approved solid waste disposal site.
- Compile and implement an alien invasive monitoring plan to remove alien invasive plant species as they become apparent
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.
- Ensure that only properly trained people handle and make use of chemicals.
- Rehabilitate all areas cleared of invasive plants as soon as practically possible, utilising specified methods and species.
- In addition, only indigenous plant species naturally occurring in the area should be used during the rehabilitation of the areas affected by the construction activities.

Cumulative impacts:

- Increase in alien invasive plant species in the area that the site is situated in
- Loss of indigenous species diversity

6.3.5 Bush densification

Nature: Savanna is prone to bush encroachment or bush densification, especially under bad land use practices or where soil disturbances have taken place.. Bush encroachment is a term used for "stands of plants of the kinds specified in Table 4 of Regulation 16 (CARA), where individual plants are closer to each other than three times the mean crown diameter" (Agricultural Research Council, 2013). Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded (Agricultural Research Council, 2013). The plants themselves are thus not the problem, but their increased abundance or encroachment into open savannah serves as an indicator of poor land management practices. It must be noted that factors causing bush encroachment are complex and likely the result of a number of variables (Letsoli *et al*, 2013, O'Connor et al 2014).
A number of encroacher species (e.g. *Dichrostachys cinerea*) occur within the study site. These species are known as indicator species of bush encroachment which transforms habitats and reduces species diversity.

Direct Impacts:

- Increase in bush encroacher species
- Change in vegetation structure

Indirect Impacts:

- Loss of species diversity

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	2 Probable	1 Improbable
Duration	3 Long term	2 medium term
Extent	1 onsite	1 onsite
Magnitude	2 medium	1 low
Significance	**12 (medium)**	**4 (low)**
Status (positive or negative)	Negative	Neutral
Reversibility	Rehabilitation is possible but could take a number of years	Reversible
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Construction:

- Leave as much natural vegetation intact as possible.
- Do not disturbed soil unnecessary.
- Monitor rehabilitation and do not allow grazing to take place until such time that re-vegetation was found to be successful.
- Ensure that areas outside of the operational footprint that were disturbed, are adequately rehabilitated and that dense stands of encroacher species are prevented.
- Develop a burning, cutting and/or grazing management plant with an ecologist which takes into account safety of the operation, local by-laws and national legislation, in order to effectively manage veld areas.

Operation:

- Monitor the establishment of dense stands of encroacher species and remove as soon as detected.

- A rehabilitation plan, using indigenous species from the study area, must be implemented that will restore disturbed areas beyond the footprint of the infrastructure to what it was prior to construction, thereby making the impact on the remainder of the site negligible in the long term.

Cumulative impacts:

- Possible bush densification on the site and loss of indigenous species diversity.

6.3.6 Deterioration of watercourses and riparian vegetation

Nature: The study site includes the perennial Selons River and numerous non-perennial rivers. Removal of vegetation surrounding the drainage lines will result in a disturbance and potential loss of habitat associated with the streams as well as loss of mature trees which could destabilise soil conditions. In addition, all watercourses (including non-perennial rivers) in South Africa are protected by legislation and must be classified as no-go areas along with protective buffer zones. Note that any activities within the watercourses are subject to authorisation by the Department of Water Affairs (DWA) by means of a Water Use License.

Direct Impacts:

- Destruction of vegetation
- Deterioration of vegetation and watercourse
- Potential contamination of soils with hydrocarbons and/or other pollutants

Indirect Impacts:

- Decrease in water quality
- Possible impact on the functionality of riparian vegetation

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	3 Definite	2 Probable
Duration	2 medium term –construction period	1 short term
Extent	2 local	1 onsite
Magnitude	3 high	2 medium
Significance	**21 (high)**	**10 (medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible, however costly and time consuming	Reversible
Irreplaceable loss of resources?	Moderate to High	Low
Can impacts be mitigated?	Yes	

Mitigation:

Planning phase

- A 100m buffer around the rivers on the site is recommended in which no development should take place, with the minimum buffer area of 15m as recommended by the wetland specialists (Limosella Consulting, 2017).

Construction:

• Where access through drainage lines and non-perennial rivers is unavoidable, only one road is permitted, constructed perpendicular to the drainage line. Avoid roads that follow drainage lines within the floodplain. Access roads through the watercourses should be formalised and any road construction within watercourses could only be undertaken if authorised by a Water Use License or permission from Department of Water Affairs (DWA). • No storm water from the construction site (or operational site) is allowed to be channelled directly into a non-perennial or perennial river. Any water released from the site should be conform to specification as per a licence granted by the DWA. • An ecologically sound, storm water management plan must be implemented, including all measures as set out above.
Cumulative impacts: • Possible loss of the ecological function of riparian vegetation and erosion of riverbanks • Decrease in water quality. • Flooding down stream

6.4 Evaluation of Alternatives

No layout alternatives were provided to the specialist. It is however, recommended that chicken houses are moved into the more disturbed vegetation unit such as transformed and derelict agricultural fields. In addition, the development footprint should be concentrated on the western portion of the site, in close proximity to already disturbed areas.

7 CONCLUSION

The study site contains sensitive ecosystems earmarked for conservation on a provincial level (CBA2 and ESA1). Additionally all wetland and aquatic ecosystems are protected by the National Water Act. The study site also lies in close proximity to areas earmarked as part of the protected areas expansion project for statutory protection. In terms of the landscape setting the study site is situated in a landscape to the south west of the Magaliesberg mountain range which has low levels of fragmentation. Therefore, plays an important role in meeting provincial conservation targets.

Four main vegetation groups were identified: bushveld, plains bushveld, riparian woodlands and derelict agricultural fields. The bushveld and riparian vegetation groups were largely natural; in a primary state; contained provincially protected plant species and had a low level of invasion by alien plant species. These vegetation groups were all assigned a high sensitivity value. The derelict fields had low species diversity and high level disturbance and subsequent high levels of invasion. This vegetation group was therefore assigned a low level of sensitivity and could support the proposed development.

The proposed development of seventeen (17) additional chicken houses and infrastructure such as a solar plant and waste water treatment works in areas of high sensitivity is not supported in terms of the guidelines set out in the North West Biodiversity Sector Plan for ESA1 and CBA2 areas. The only vegetation group where this activity could be supported is the low sensitivity agricultural fields where all natural vegetation has already been cleared, or areas close to this to prevent fragmentation of the natural habitats. The bushveld, plains bushveld as well as riparian woodland vegetation groups are all deemed not feasible for the proposed development.

However, RCL Foods proposes to conserve the remainder of the vegetation and introduce game into the area. In addition, a limited number of chicken batteries will likely have a lesser impact than extensive livestock production (which is allowed in an ESA1) where overgrazing could lead to a change in the species composition. However, it is likely that in due time, an expansion of the chicken farm might be proposed which will result in cumulative impacts, particularly fragmentation, an increase in edge effects and loss of species diversity from the current good condition bushveld vegetation.

The site is deemed sensitive from a vegetation perspective and the proposed development outside of the current low sensitivity areas and adjacent land is not supported. If the North-West conservation authority does consider the proposed development, the protection of the remainder of the land must be formalised, no further development or expansion of the activities on the site should be allowed and the following should form part of an ecological management plan for the site: grazing capacity and management plan, alien invasive plant species management plan, sensitive species management and monitoring plan, erosion monitoring and management plan. A fulltime, suitably qualified staff member(s) who will manage and continually evaluate any degradation in the vegetation composition and structure and who will report on the status of sensitive vegetation groups as well as the effective management of game and the ecosystem as a whole should be appointed. It is recommended that an external audit be conducted by an independent ecologist twice a year, to report on the state of the vegetation and effectiveness of the reserve management plan. This report should be submitted to the North West authorities for comment and review.

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9 GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Azonal	Water-logged and salt-laden habitats require specially adapted plants to survive in these habitats. Consequently the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character (Mucina & Rutherford, 2006)
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern (Plants of…)	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al*, 2009).

Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible
Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future
Endemic	Naturally only found in a particular and usually restricted geographic area or region
Exotic species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Forb	An herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
In Situ	"In the place" In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Mitigation	The implementation of practical measures to reduce adverse Impacts
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al*, 2009).
Plant Community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat *et al*, 2004)
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. *Now termed Plants of Conservation Concern*
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat

Suffrutex	Low-growing woody shrub or perennial with woody base, sometimes referred to as underground trees
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al,* 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Association	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future(Raimondo *et al*, 2009)

APPENDIX A: METHODOLOGIES

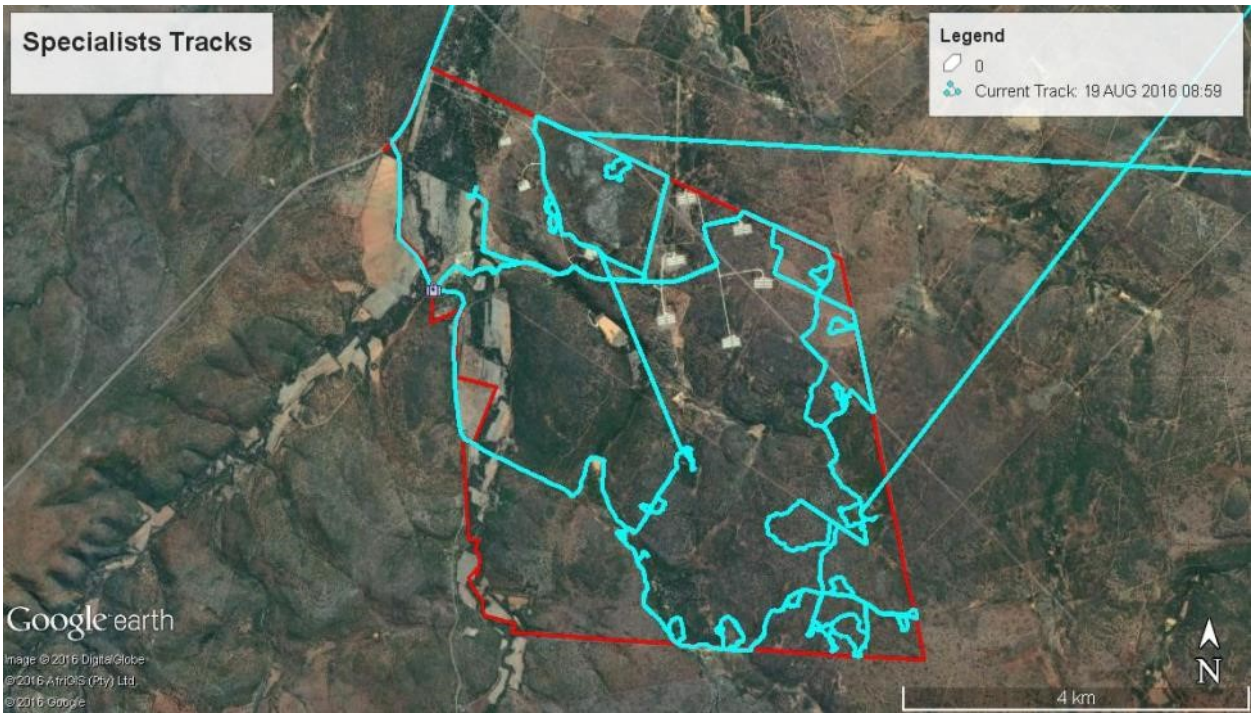

Figure 17: Map of sampling areas

Vegetation Sensitivity Evaluation

The following criteria and weighting was used to determine the vegetation sensitivity, function and conservation importance:

1. The status of the regional vegetation that is expected to occur on the study site, only where natural vegetation is still remaining.

Conservation status*	Scoring
Critically Endangered	3
Endangered	2
Vulnerable	1
Least threatened	0

*This scoring is not applicable (N/A) for areas devoid of natural vegetation.

2. Whether the study area is situated within a Listed Ecosystem in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) or in a vegetation that is classified as Vulnerable or Endangered.

Listed Ecosystem*	Scoring
Primary state	3
Sub-climax state	2
Secondary state	1

No natural vegetation remaining	0

3. Whether the vegetation or ecological feature is protected by legislation:

Level of legislative protection	**Scoring**
National legislation	3
Provincial policies and guidelines	2
Municipal or other protection	1
No legislated protection	0

4. The presence of suitable habitat for plants of conservation concern as well as the actual occurrence thereof.

Suitable habitat / presence	**Scoring**
Confirmed presence of red listed species (Threatened)	3
Confirmed presence of Orange listed (Near threatened, Declining), or provincially protected species or suitable habitat and some likelihood of occurrence of Threatened species	2
Suitable habitat but unlikely to occur	1
No suitable habitat	0

5. Ecological Function: areas important to ecological processes such as ecological corridors, hydrological processes and important topographical features such as ridges.

Ecological function	**Scoring**
High: Sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.	3
Medium to high: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with a high degree of connectivity with other ecological systems OR disturbed vegetation connected to an ecological and protected system e.g. ridge, wetland or river	2
Medium: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree or limited connectivity with other ecological systems	1
Low: Degraded and highly disturbed vegetation with little ecological function	0

6. Conservation Importance: indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area (degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation.

Ecological importance	Scoring
High: Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. OR protected ecosystems e.g. wetlands, riparian vegetation etc. These areas should be protected	3
Medium to high: Ecosystems with intermediate levels of species with the possible occurrence of threatened species	2
Medium: Ecosystems with intermediate levels of species diversity without any threatened species.	1
Low: Areas with little or no conservation potential and usually species poor (most species are usually exotic).	0

Weighting scores

Scoring	13-18	7-12	1-6
Sensitivity / ecological condition	High	Medium	Low

Protected species localities

The figure below represents the protected species recorded in the walked transects at the time of the field survey. Note that these are the minimum localities as the whole site was not walked.

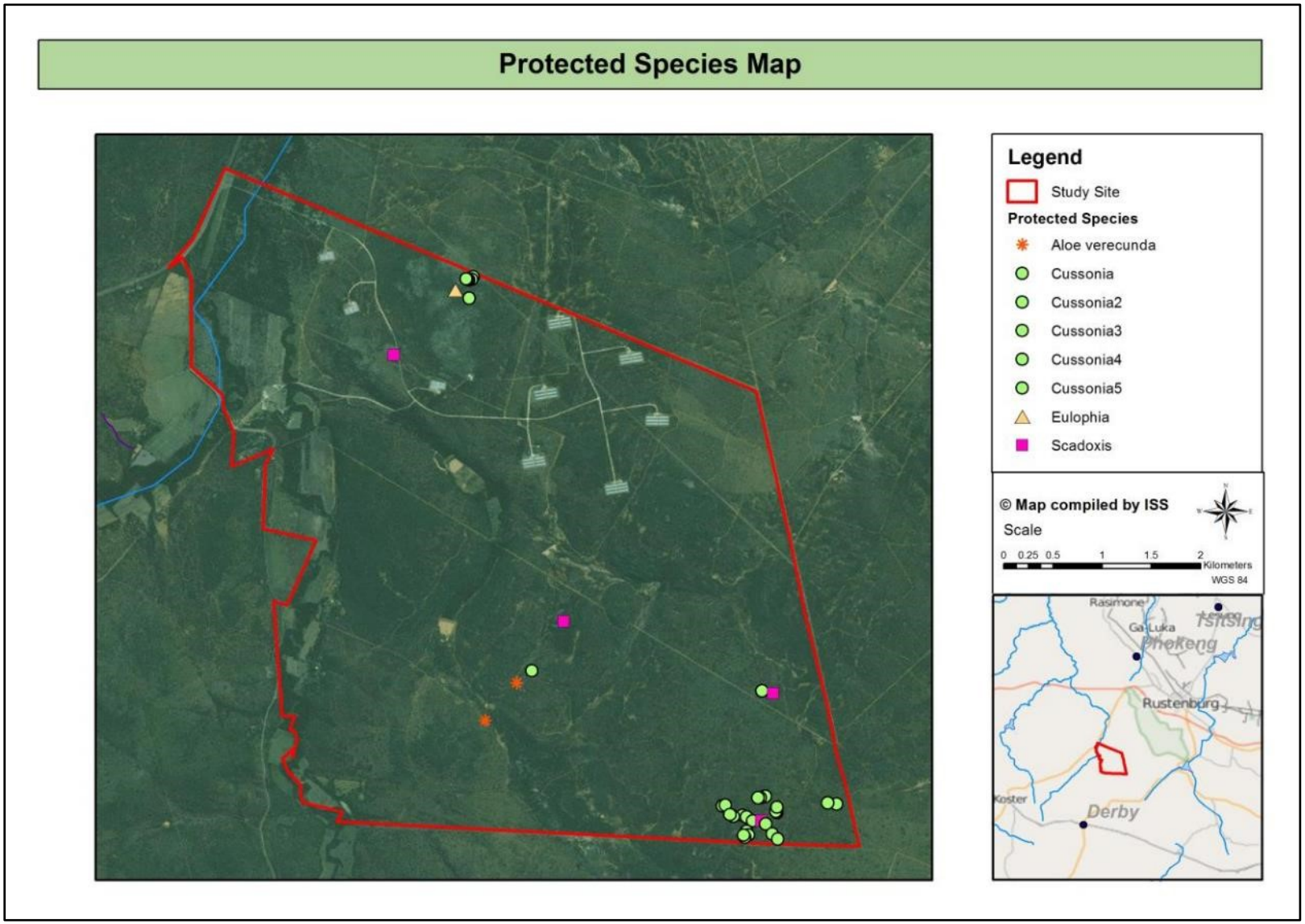

Figure 18: Protected species localities recorded in walked transects

APPENDIX B: PLANT SPECIES RECORDED

1=species recorded in the vegetation group

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Grasses						
Aristida congesta subsp *barbicollis*	Spreading Three-awn	Disturbed areas such as fallow lands and road reserves. Not palatable, Increaser II		1		
Bothriochloa insculpta	Pinhole Grass	Grows mostly in disturbed areas, also were water accumulates. Increaser II	1			
Chloris gayana	Rhodes Grass	Moist areas such as vlei's and along rivers.			1	
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Adapted to various growing conditions		1	1	
Cymbopogon nardus				1		
Cymbopogon plurinoides	Narrow-leafed Turpentine Grass	Grassland. Not palatable, Increaser III	1	1		
Cynodon dactylon	Couch grass	Most soils, usually in disturbed areas. Increaser II grass, palatable		1	1	1
Eragrostis curvula	Weeping Love Grass	Mostly occurs in disturbed areas / sown as pasture. Increaser II grass	1		1	
Hyperthelia dissoluta	Yellow Thatching Grass	Sandy bushveld areas, open grassland and disturbed areas.		1	1	
Melinis repens	Natal Red Top	Disturbed grassland. Increaser II grass.			1	
Panicum maximum	Guinea Grass	Grow in shade under trees, also in sun, moist to dry areas.			1	
Setaria sphacelata var *spacelata*	Common Bristle Grass	Rocky slopes or in moist soils		1		
Themeda triandra	red grass	Undisturbed or disturbed open grassland. Decreaser Grass	1	1		
Trachypogon spicatus	Giant Spear Grass	Grows mostly in undisturbed grassland, bushvled and close to vlei's. Often on	1			

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
		rocky ridges - indicative of sourveld. Increaser I grass				
Urochloa mosambicensis	Bushveld Signal Grass	Disturbed areas such as farmland, also in compacted soils. Good grazing grass. Increaser II				1
Total number of grass species =15			**5**	**8**	**7**	**2**
Forbs/ shrubs						
Albuca species		Rocky areas	1			
Aloe davyana	Spotted aloe; Highveld grass aloe	Grassland and bushveld. Often forming dense stands in overgrazed areas.	1	1	1	
Aloe verecunda (P)		**Grassland, on rocky ridges.LC on Redlist but provincially protected by Transvaal Ordinance Act.**	**1**			
Asparagus species		under trees	1			
Asparagus species		Under trees	1	1		
Asparagus laricinus	Cluster-leaved Asparagus	Thicket or disturbed areas, waste places. Difficult to eradicate if encroaching into grassland	1		1	1
Asparagus sauveolens	Bushveld Asparagus	Bushveld and thicket, rocky grassland	1		1	
Athrixia elata	Daisy-tee Bush	Rocky slopes	1	1		
Carissa bispinosa	Num-num	Wooded areas	1			
Commelina species			1			
Comelina africana		Widespread		1		
Crassula swaziensis		Grassland and bushveld, ususally in rocky crevices	1			
***Eulophia hereroensis* (P)**		**Orchid associated with dry habitats in dense thickets under trees. LC on Redlist but protected by the Transvaal Ordinance Act.**	**1**			
Euphorbia schinzii	Klipmelkbos	Rocky hillsides, rock fissures	1	1		

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Felicia mossamedensis	Yellow Felicia	Sandy areas	1	1		1
Geigeria burkei	Vermeerbos	Common in overgrazed and disturbed areas			1	
Gnidia capitata	Kerrieblom	Grassland	1	1		
Gomphocarpus fructicosus	Milkweed	Grassland, often along roadsides and abandoned cultivated fields.		1	1	1
Helichrysum rugulosum (M)		Grassland, often in vlei's or paths in disturbed areas		1		
Heliotropium ciliatum	Kalahari String of Stars	Common in overgrazed veld	1			
Hermannia depressa	Rooi-opslag / Creeping Hermannia	Grassland, also in trampled and overgrazed areas		1		1
Indigofera melanadenia		Common on rocky slopes in grassland		1		
Ipomoea crassipes	Leafy-flowered Ipomoea	Grassland		1		
Justicia species		Observed in rocky areas	1			
Kalanchoe paniculata	hassieoor	Grows in shallow soils overlaying rock.	1	1		
Kalanchoe rotundifolia	nentabos / plakkie	Grassland on rocky ridges, clumps among trees and shrubs, open woodland or thicket	1			
Kleinia longiflora	Sjambokbos	Hot, dry areas, under trees	1			
Kyphocarpa angustifolia	Silky Burweed	Grassland and disturbed areas.	1			
Lantana rugosa	Bird's Brandy	Common in bush clumps and on rocky ridges in shady places.		1		
Lippia rehmannia (M)	Laventelbossie	Grassland		1		
Nidorella hottentottica		Grassland, often along roadsides. Sometimes in moist areas				1
Oldenlandia herbacea		Grassland, usually on rocky ridges		1		
Osteospernum muricatum subs mutricatum		Grassland				1

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Portulaca kermesina		Grassland, bushveld usually in sandy soils.		1		
Protasparagus larcinus	Wild asparagus	Wees, mostly in disturbed places	1	1		
Protasparagus sauveolens	Wild asparagus	Rocky grassland	1			
Raphionacme hirsuta	Khadi-root	Stony grassland and bushveld	1	1		
Rhynchosia totta	Yellow Carpet Bean	Grassland, open woodland and forest margins	1	1		
Sansevieria aethiopica	Bowstring Hemp	Grassland, woodland, also on rocky areas under trees			1	
Scabiosa columbaria	Wild Scabiosa	Grassland, mainly in rocky areas	1	1		
Scadoxus puniceus (P) LC	Paintbrush	Grassland, moist places and around rocky outcrops. Protected by Transvaal ordinance Act. Redlist listed as least concern.	1	1		
Senecio oxyriifolius	False nasturtium	Grassland, mainly amongst rocks	1	1		
Senna italica subsp. a*rachoides (M)*	Eland's Pea	Increases in disturbed, overgrazed areas and along roads			1	
Sisymbrium thellungii	Wild Mustard	Often a weed in disturbed places				1
Solanum panduriforme	Poison Apple	Disturbed places, often under trees (probably an indigenous specie)	1	1		1
Sphenostylis angustifolia (M)	Wild Sweetpea	Clumps of bush, bushveld and rocky ridges	1	1		
Tribulus terrestris	Common Devil's Thorn / Dubbeltjie	Spreading weed in disturbed places				1
*Verbena bonariensis**	Wild Verbena	Marshy, seasonally wet grassland			1	
*Verbena brassiliensis**		Exotic weed invading moist areas.(Naturalised).		1		
Total number of forb and shrub species = 49			**30**	**26**	**8**	**9**
Trees						
Acacia (Senegalia) caffra (M)	Common Hook-thorn	Grassland, bushveld, often on rocky ridges	1	1		

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Acacia (Vachellia) karroo (M)	Sweet Thorn	Widespread, often proliferate in overgrazed areas	1	1	1	1
Acacia (Vachelia) nilotica (M)	Scented Thorn	Bushveld on sandy soils around pans and near riverbanks. Often colonising disturbed areas		1		
Acacia (Vachelia) robusta	Ankle Thorn	Bushveld and grassland	1			1
Acacia (Vachellia) tortilis	Umbrella Thorn	Bushveld and grassland.				1
Buddleja saligna	False Olive	Grassland, forest margins, forest and along wooded ravines	1	1	1	1
Chaetachme aristata	Thorny elm	Occurs in in bushveld and coastal forests	1			
Combretum erytrophyllum	River Bushwillow	Grassland and bushveld, usually along rivers or streams			1	
Combretum hereroense (M)	Russet Bushwillow	Bushveld, often on sandy soil	1			
Combretum molle	Velvet Bushwillow	Bushveld or sheltered rocky places in grassland	1			
Combretum zeyheri	Large-fruited Bushwillow	Bushveld and grassland, often in deep soil and along rivers.	1			
***Cussonia paniculata* (P)**	**Highveld Cabbage Tree**	**Grassland and rocky ridges. LC on redlist but protected through the Transvaal Ordinance act**	**1**	**1**		
Dichrostachys cinerea (M)	Sickle Bush	Bushveld, often invasive and thicket-forming	1	1		
Dodonea angustifolia (M)	Sand Olive	Open areas associated with bushveld, wooded grassland and forest	1			
Dombeya rotundifolia (M)	Common Wild Pear	Bushveld, rocky ridges.	1			
Ehretia rigida	Puzzle Bush	Wooded grassland, bushveld	1			
Euclea crispa subsp *crispa*	Blue Guarri	Rocky slopes, kloofs, along rivers and forest margins	1	1	1	
Euclea divinorum	magic quarri		1			
Euclea undulata	Common Guarri	Bushveld, grassland and often in rocky areas.	1	1	1	

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Faurea saligna	Willow Beech Wood / Boekenhout	Open woodland	1			
Grewia flava	Velvet Raisin	Bushveld and wooded grassland.	1	1	1	
Gymnosporia buxifolia	Common Spike Thorn	Widespread, often as pioneer in disturbed places	1	1		
Gymnosporia nemorosa	White Forest Spike-thorn	Forest, riverine vegetation or rocky outcrops	1			
Gymnosporia polyacantha	Kraal Spike Thorn	Valley Bushveld, Grassland.	1			
Gymnosporia senegalensis	Red Spike-thorn	Bushveld	1	1		
Olea europea subsp *africana (M)(P in NC, Mpu)*	Wild Olive	Wide range of habitats, usually on rocky hillsides or on streambanks.	1	1	1	
Ozoroa cf paniculosa	Common Resin Tree	Bushveld	1			
Pappea capensis	jacket-plum	Bushveld and wooded grassland.	1	1	1	
Searsia lancea	Sour Karee	Grassland and bushveld	1	1	1	1
Searsia leptodictya	Mountain Karee	Grassland and bushveld, often in rocky places	1	1		
Searsia pyroides (Rhus pyroides)	Common Wild Currant	Mountain grassland, bushveld, grassland - wide range of habitats	1		1	
Ximenia caffra	Sourplum	Bushveld as well as coastal bush	1			
Ziziphus mucronata	Buffalo-thorn	Widespread, in various habitats	1	1	1	1
Ziziphus zeyheriana	Dwarf Buffalo-thorn	Grassland	1			1
Total number of tree species =34			**31**	**16**	**11**	**7**
Sedges						
Cyperus sexangularis	Matjiesgoed	Along the edge of streams, rivers and pans, often in water, occasionally found growing in drier areas.				1
Total number of sedge species = 1				**20**	**15**	**1**
Climbers						
Clematis brahiata	Traveller's Joy	Bushy hillsides, particularly rocky places	1			

Species	Common name	Habitat notes	Hills and ridges Bushveld	Plains bushveld	Riparian woodlands	Derelict fields
Pentarrhinum insipidum	Donkieperske	Grassland and clumps of bush, often twining in fences. It is an aggressive grower and in slightly disturbed areas exhibits invasive tendencies.	1	1		
Rhoicissus tridentata	Bushmans' grape	Grassland, bushveld on rocky ridges or along streams	1			
Total number of climber species =3			**3**	**38**	**27**	**0**
Alien and invasive species						
Achyranthes aspera (M)	Burrweed	Grassland, savanna, forest margins - usually in shaded moist sites. Category 1 invader in CARA	1			
Argemone ochroleua	Mexican Poppy (White)	Category 1 (CARA)				1
Cereus jamacaru	Queen of the night	Category 1b	1	1		
Datura stramonium (M)	Thorn-apple / Olieboom	Category 1b				1
Flaveria bidentis	Smeltersbush	Grassland, usually in moist areas. Declared Category 1b invader (NEMBA)	1			
Opuntia ficus-indica	Sweet Prickly Pear	Category 1b	1	1	1	
Portulaca quadrifida		Usually in sandy soils, disturbed areas				1
Richardia brasilliensis		A weed from S America, naturalised in disturbed places			1	1
Senna didymobotyra	Peanut Butter Cassia	Category 3 (CARA)	3		1	
Solanum elaegnifolium	Silverleaf Bitter Apple	Widespread in ploughed and disturbed areas	1			
Verbena tenuisecta	Fine-leaved Verbena	Common in disturbed places				1
Total number of alien and invasive species = 11			**8**	**2**	**3**	**5**