HARTENBOS HEUWELS RESIDENTIAL DEVELOPMENT
Faunal Assessment

SEF Reference No. 504632

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Declaration of Independence

I, **Karin van der Walt,** in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- 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 No. 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement;
- Reserve the right to modify aspects pertaining to the present investigation should additional information become available through ongoing research and/or further work in this field; and
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered.

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Terrestrial Ecologist
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16 October 2013
Date

EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental consultants and ecological specialists, was appointed by the Afrikaans Taal en Kultuurvereniging (ATKV) to undertake a faunal (including avifaunal) assessment of the proposed Residential Development on Erf 3122, Hartenbos Heuwels, Mossel Bay.

The study area falls in the Fynbos Biome and more specifically within the Groot Brak Dune Strandveld vegetation type. This vegetation type is currently listed as Endangered by Mucina and Rutherford (2006) with more than 50% of the natural habitat transformed. The Groot Brak Due Strandveld Ecosystem is also listed as Endangered in terms of Section 52 of NEMBA (Government Gazette, 2011). The original extent of this ecosystem is 20 000ha with approximately 52% remaining of which 0% is protected in statutory reserves.

Faunal habitat within the study area included drainage lines, short scrub veld, Renosterveld, grassy hillsides as well as natural (termite mounds, rock piles) and artificial (building rubble) refugia. Fifty nine (59) bird species were recorded during the survey, three of these are of conservation concern, namely *Neotis ludwigii* (Ludwig's Bustard), *Circus maurus* (Black Harrier) and *Falco biarmicus* (Lanner Falcon). In addition, four Lepidoptera species which are of conservation concern were given a medium to high probability of occurring in the study area based on the presence of suitable habitat. Further, one amphibian, *Cacostermum boetgerii* (Boetger's Caco) and one reptile species, *Bradypodion gutturale* (Karoo Dwarf Chameleon) were also recorded in the study area.

The natural areas associated with Erf 3122 were classified as medium to high ecological sensitivity due to the presence of species of conservation concern within the area and although alien plant species such as *Acacia cyclops* and *Acacia mearnsii* were recorded in the drainage lines, high avifaunal activity was recorded in these areas.

It is indicated that the proposed residential development will only affect approximately 50ha mostly on the higher laying plateau. Therefore, should mitigation measures recommended in this report be implemented, the proposed development will not have a significant impact on the fauna within the area. It is furthermore possible that through the removal of alien vegetation, rehabilitation and habitat management, the development can have a positive effect on faunal species, especially species of conservation concern.

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LIST OF ABBREVIATIONS

CBA	Critical Biodiversity Area
CMS	Convention of Migratory Species
CWAC	Coordinated Waterbird Counts
DDD	Data Deficient Distribution
DDT	Data Deficient Taxanomic
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
GDARD	Gauteng Province: Department of Agriculture and Rural Development
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
NT	Near Threatened
PA	Protected Area
POSA	Plants of Southern Africa
SEF	Strategic Environmental Focus
VU	Vulnerable

1. INTRODUCTION

1.1 Project Description

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental consultants and ecological specialists, was appointed by Afrikaanse Taal en Kultuurvereniging (ATKV) to undertake a faunal (including avifaunal) assessment of the proposed Residential Development on Erf 3122, Hartenbos Heuwels, Mossel Bay.

1.2 Terms of Reference

The terms of reference for the floral and faunal assessments were as follow:

- Identify any ecologically sensitive areas and active/potential ecological processes associated with the project area, including data from field surveys as well as from existing databases;
- Highlight any Red Data species or species considered to be of conservation importance, including species identified on-site as well as those potentially occurring;
- Evaluate the sensitivity of the habitat for fauna;
- Note and describe any sensitive systems or species that could be impacted on by the proposed housing development;
- Provide a general biodiversity sensitivity map for the proposed housing development; and
- Determine the impacts of the proposed development on the faunal species and recommend mitigation measures to lessen these impacts.

1.3 Methodology

The field surveys were undertaken from the 19th to the 20th of September 2013. The methodology entailed the following:

<u>Avifauna</u>

A list was compiled of the avifaunal species which are likely to occur within QDGC 3422AA by combining data generated from Roberts Multimedia version 7, South African Bird Atlas Project 2 (SABAP2) as well as data obtained from the Animal Demography Unit at the University of Cape Town for the Coordinated Waterbird Counts (CWAC) for the nearby Hartenbos Estuary. Barnes (2000), Hockey, Dean and Ryan, P.G. (2005), Cillié, Oberprieler and Joubert (2004), Tarboton and Erasmus (1998) and Chittenden (2007) were consulted for identification.

During the field survey, all avifaunal species within the study area as well as those flying over the study were recorded by sight and sound. Approximately 20 hours were spend within the study area and included the following time frames:

- Nocturnal surveys were conducted on one evening and two mornings and at least one and a half hour before sunrise and after sunset;

- Two surveys were conducted at dusk; and
- Two surveys were conducted at dawn.

Mammals

Mammal surveys were conducted during the day, night, at dusk and dawn with the presence of mammals within the study area noted by sightings, sounds and signs (tracks, dung, diggings and burrows). Nocturnal surveys were conducted by using a Zartek 350 Lumens Led Spotlight which was fitted with a red lens to prevent temporary blindness to encountered faunal species. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner and Chimimba (2005), Cillié, Oberprieler and Joubert (2004), Apps (2000), Walker (1996), Stuart and Stuart (2000) and Liebenberg (1990) were consulted.

Reptiles

A list of reptiles which have been recorded from QDGC 3422AA was obtained from ReptileMAP which is a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012).

During the field survey, different habitat types across the study area were surveyed which included grassland, rocky hillsides, drainage lines and building rubble. These surveys were conducted during the warmest parts of the day when reptiles are generally more active. The reptile surveys used a combination of the following two techniques:

- Visual searches were conducted by slowly walking through different habitat types while scanning the area with 32x10 Linx binoculars. Exposed areas and building rubble such as corrugated iron sheets were also watched since reptiles often bask on top of these structures;
- Refugia such as rocks and building rubble within the study area were inspected by carefully lifting objects to determine if any reptiles were sheltering underneath it.

Branch (1998), Marais (2004), Alexander and Marais (2007) and Cillié, Oberprieler and Joubert (2004) were used as identification guides.

Amphibians

A list of amphibian species which are likely to occur in QDGC 3422AA was obtained from FrogMAP which is a continuation of the Southern African Frog Atlas Project. Since most amphibian (frog) species are vocal at night, nocturnal surveys were conducted and these surveys focussed on calls. No surface water was present at the time of the survey.

Invertebrates

Invertebrates (insects) surveys consisted of visual searches (nocturnal and diurnal) which were conducted to determine invertebrate activity in the study area.

Arachnida includes scorpions, spiders, pseudoscorpions, sunspiders, micro whipscorpions, tailless whipscorpions and ricinuleids. These creatures are often very secretive and spend up to 97% of their time inactive. Although searches for arachnids were conducted by looking under objects such as rocks, branches and artificial refugia such as building rubble, this did not include a full invertebrate assessment.

1.4 Limitations

The following limitations were experienced during the course of the field survey:

- In order to obtain a comprehensive understanding of the dynamics of the biota on the site, including species of conservation concern, on a specific site, studies should include investigations through different seasons, over a number of years and should include extensive sampling. Due to project time constraints, such long term research was not feasible;
- Low temperatures experienced during the field survey resulted in low reptile activity while windy conditions were mostly unsuitable for butterfly and other invertebrates and it is therefore likely that higher diversity of these groups will be present under ideal weather conditions; and
- Due to time constraints, no trapping was undertaken;

2. BACKGROUND

2.1 Location

The study area is located on Erf 3122, Hartenbos Heuwels in Mosselbay, Western Cape and is located approximately 1.5km north east of the centre of Hartenbos town. The study area falls within Quarter Degree Grid Cell (QDGC) 3422AA between 34°07'00.6" – 34°08'16.5" south and 22°05'31.4" – 22°04'30.6" east (Figure 1).

2.2 Climate

The study area receives an annual rainfall between 350mm in the west to 750mm in the east with approximately 50% falling in summer between October and March and 60% in winter between April and September. The mean daily temperatures are 26ºC for February and 7ºC in July (Mucina & Rutherford, 2006).

2.3 Weather

Weather conditions experienced during the field surveys have a significant influence on faunal activities, with low faunal activity usually associated with windy, rainy or cold conditions. Table 1 summarizes the weather conditions experienced during the field survey period (worldweatheronline.com). Temperatures were generally low during the field survey with strong wind and rain experienced on Friday, 20th September 2013.

Table 1: Weather conditions recorded during the field survey

Date	Time	Temperature	Rain	Percentage cloud cover	Wind
Wednesday: 18 September	14:00	19ºC	0	81%	15km/h
	17:00	19ºC	0	81%	15km/h
	20:00	17ºC	0	73%	10km/h
Thursday: 19 September	05:00	12ºC	0	21%	4km/h
	08:00	15ºC	0	36%	3km/h
	14:00	25ºC	0	14%	13km/h
	17:00	22ºC	0	11%	14km/h
	20:00	15ºC	0	13%	17km/h
Friday: 20 September	05:00	10ºC	3.9mm	72%	21km/h
	08:00	11ºC	1.5mm	30%	22km/h
	14:00	13ºC	0.4mm	21%	42km/h

2.4 Regional Vegetation

The study area is located in the Fynbos Biome which occupies most of the Cape Fold Belt as well as the adjacent lowlands between the mountains and the Atlantic Ocean. The Fynbos Biome is also a member of the global Mediterranean Biome which is located on the western shores of the continents of the world (Mucina & Rutherford, 2006). Furthermore, there are three major vegetation complexes within the Fynbos Biome namely Fynbos, Renosterveld and Strandveld.

The study area is located within the Western Strandveld vegetation complex which consists of nine vegetation types, with one vegetation type, Groot Brak Dune Strandveld represented within the study area (Mucina & Rutherford, 2006). The Groot Brak Dune Strandveld vegetation type is located on the coastal stretches between the mouth of the Gouritz River to the Victoria Bay near the Wilderness. According to Mucina & Rutherford (2006), this vegetation type is currently listed as Endangered with no areas conserved and more than half of the area already transformed by cultivation, roads and infrastructure.

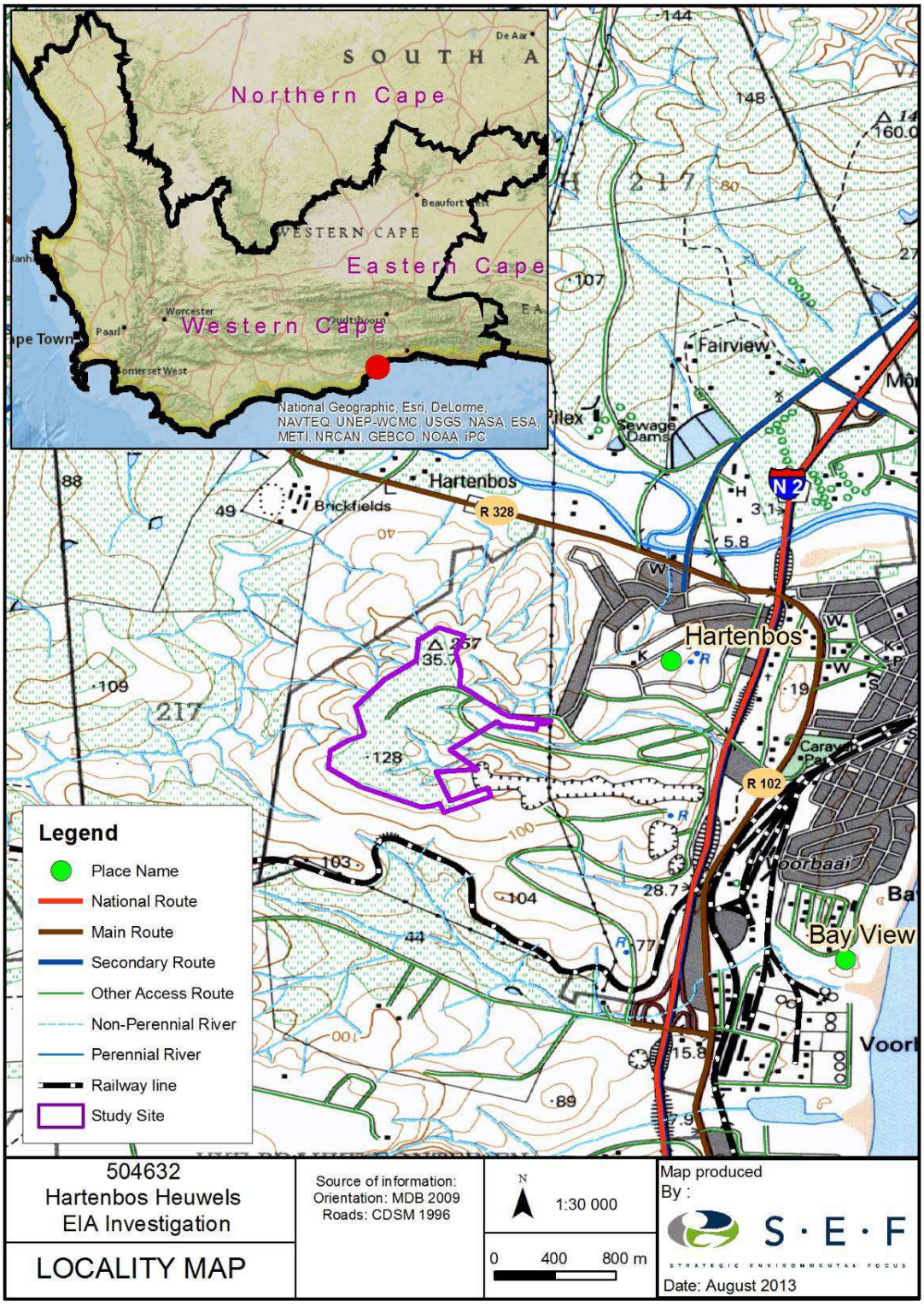


Figure 1: Location of the study site

2.5 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (Government Gazette, 2011). The main purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of threatened ecosystems.
Threatened terrestrial ecosystems have been delineated based on the following:

- The South African Vegetation Map;
- National forest types;
- Priority areas identified in a provincial systematic biodiversity plan (in this case the Mpumalanga Conservation Plan); or

High irreplaceability forest patches and clusters. The criteria used for identifying threatened terrestrial ecosystems was done through extensive stakeholder engagement and based on the best available science. The criteria for thresholds for critically endangered, endangered and vulnerable ecosystems are summarized in Table 2.

Table 2: Criteria used to identify threatened terrestrial ecosystems

Criterion	Critically Endangered	Endangered	Vulnerable
A1: Irreversible loss of natural habitat	Remaining natural habitat ≤ biodiversity target	Remaining natural habitat ≤ biodiversity target + 15%	Remaining natural habitat ≤ 60% of original area
A2: Ecosystem degradation and loss of integrity	≥ 60% of ecosystem significantly degraded	≥ 40% of ecosystem significantly degraded	≥ 20% of ecosystem significantly degraded
C: Limited extent and immenent threat	-	Ecosystem extent ≤ 3000ha and immenent threat	Ecosystem extent ≤ 6000ha and immenent threat
D1: Threatened plant species associations	≥ 80 threatened Red List plant species	≥ 60 threatened Red List plant species	≥ 40 threatened Red List plant species
F: Priority areas for meeting explict biodiversity targets as defined in a systematic biodiversity plan	Very high irreplaceability and high threat	Very high irreplaceability and medium threat	Very high biodiversity and low threat

There are four main types of implications of listed ecosystems on development:

- Planning related implications, linked to the requirement in the National Environmental Management Biodiversity Act (NEMBA) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications, especially in terms of NEMA and EIA regulations;

- Proactive management implications, in terms of the Biodiversity Act; and
- Monitoring and reporting implications, in terms of the Biodiversity Act.

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010);
- Listing Notice 2: activities that require scoping and environmental impact report (EIR)(R545 of 2010);
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m² of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. 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. It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

The present study area is located within the Groot Brak Dune Strandveld ecosystem which is currently listed as Endangered in terms of Section 52 of NEMBA (Government Gazette, 2011). The original extent of this ecosystem is 20 000ha with approximately 52% remaining of which 0% is protected in statutory reserves. At least six plant species of conservation concern have been recorded from this ecosystem.

2.6 Ramsar Convention

The Convention on Wetlands of International Importance is called the Ramsar Convention and is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is a global environmental treaty which was adopted in the Iranian city of Ramsar in 1971 and deals with a particular system. The Convention came into force for South Africa on the 21st of December 1975 and currently includes 21 designated sites as Wetlands of International Importance. Although there is no Ramsar site within the study area, the Wilderness Lakes is the closest Ramsar site and it is located approximately 52km east of Hartenbos Heuwels (http://ramsar.org).

2.7 Convention on Migratory Species

The Convention on the Conservation of Migratory Species of Wild Animals is also known as CMS or the Bonn Convention and aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty and is concluded under the aegis of the United Nations Environment Programme and includes 119 parties from Africa, Central and South America, Europe and Oceania.

More than 400 species from around the world are currently listed on Appendix I and Appendix II on the CMS Convention, 135 of these species occur within South Africa while 52 species have been recorded in QDGC 3422AA.

2.8 Important Bird Areas (IBA)

The important Bird Areas (IBA) Programme is a conservation initiative by BirdLife International and identifies and works towards a network of sites which are critical for the long-term survival of species which are globally threatened, have restricted ranges and/or are restricted to specific Biomes or vegetation types. In addition to this, sites which have significant populations are also classified as IBA.

The South African IBA Programme is coordinated by BirdLife South Africa and its purpose is to identify and protect a network of sites at a biogeographical scale which are critical for the long-term viability of naturally occurring bird populations. Although there are no IBA's located within the study area, the Outeniqua Mountains IBA is located approximately 21km north of the study area.

2.9 Coordinated Waterbird Counts (CWAC)

The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to the International waterbird conservation. It is one of the largest and most successful citizen science programmes in Africa and currently this project regularly monitors over 400 wetlands around the country.

The Hartenbos Estuary, which is located less than 500m south east of the study area, is an active CWAC site with 96 recorded bird species.

3. RESULTS: FAUNA

3.1 Faunal Habitats

The study area falls within the Cape Brak Dune Strandveld vegetation type and consists of flats with undulating landscapes and steep coastal slopes which are covered by dense and tall spiny sclerophyllous scrub. For the purpose of the faunal assessment, these vegetation types were further divided into structural vegetation units which are likely to

support different faunal species. The structural units recorded within the study area are described below and illustrated in Photograph 1.

Drainage lines

Drainage lines were recorded in the low laying areas of the study area and although these areas were disturbed and mostly dominated by alien invasive plant species such as *Acacia cyclops* and *Acacia mearnsii*, these areas still supported high faunal activity with numerous bird species nesting within these drainage lines. Furthermore, these areas provided a corridor for faunal movement throughout the study area and into neighbouring residential areas and other natural areas.

Short scrub veld

Scrub veld was recorded on the higher laying areas and the plateaus throughout the study area and consisted of a grass and scrub layer of approximately 30cm high. These areas appeared to have been burned frequently which resulted in stunted growth. The short scrub veld was high in floral species diversity and included species such as *Brunsvigia* sp.*, Bulbine frutescens, Gazania* sp. and *Sutherlandia frutescens.*

Renosterveld

Renosterveld was recorded on the south eastern boundary of the study area and consisted of a mixture of tall spiny sclerophyllous scrub with some woody species such as *Carissa bispinosa* and *Searsia* species. Although the majority of this Renosterveld section was located outside the study area boundaries, faunal species are likely to move between the Renosterveld and the study area.

Grassy hillsides

Grassy hillsides were recorded between the plateaus and lower laying drainage lines and were mostly dominated by various graminoid species as well as some Cyperaceae species.

Natural and artificial refugia

Natural and artificial refugia included all habitats which are used by faunal species for shelter and nesting and included natural refugia such as termite mounds, rock piles and burrows as well as artificial refugia such as building rubble.

Photograph 1: Faunal habitat recorded within the study area included drainage lines (top left), grassy slopes (top right), natural refugia such as termite mounds (bottom left) and artificial refugia such as building rubble (bottom right)

3.2 Faunal Species Occurrence

3.2.1 Mammals

The region displays a medium diversity of mammals with the study area falling within the distribution range of 76 mammal species according to the IUCN. These species are listed in Appendix A along with the probability of each species occurring in the study area as well as their national (Friedmann and Daly, 2004) and global (IUCN) conservation status. Six faunal species were confirmed in the study area through sightings, sound or signs and included *Sylvicapra grimmia* (Common Duiker), *Hespestes pulverulentus* (Cape Grey Mongoose), *Ictonyx striatus* (Striped Pole Cat), *Genetta genetta* (Common Genet), *Lepus saxatilis* (Scrub Hare) and *Hystrix africaeaustralis* (Cape Porcupine). Furthermore, subterranean diggings likely to be *Cryptomys hottentotus* (African Mole Rat) were also widely recorded throughout the higher laying areas while old evidence of *Orycteropus afer* (Aardvark) were also recorded. A further 28 species were given a high probability of utilizing the study area based on the presence of suitable habitat.

3.2.2 Avifauna

A list was compiled of the avifaunal species which are likely to occur within QDGC 3422AA by combining data generated from Roberts Multimedia version 7, South African Bird Atlas Project 2 (SABAP2) as well as CWAC data which was obtained from the Animal Demography Unit at the University of Cape Town. Of the 354 species which have been recorded in the QDGC, 63 species are endemic to South Africa, 50 species are of conservation concern (Appendix B) and 52 species are listed on Appendix I and Appendix II of the Convention of Migratory Species (Appendix C). Fifty nine (59) species were confirmed during the site visit (Appendix D) including three species of conservation concern (two of which are also listed on the Convention of Migratory Species). These are described further below.

Circus maurus – Black Harrier

One *Circus maurus* (Black Harrier) was recorded on the plateau towards the centre of the study area. *C. maurus* is globally listed as Vulnerable and Near Threatened in South Africa, and is also listed on Appendix II of the Convention of Migratory Species. It is endemic to South Africa where it prefers Fynbos areas, especially Strandveld and mountain Fynbos where is relies on remnant patches of natural vegetation.

Neotis ludwigii – Ludwig's Bustard

A single *Neotis ludwigii* (Ludwig's Bustard) was observed feeding in the short Shrubveld towards the centre of the study area. *N.ludwigii* is currently listed as Vulnerable in South Africa and Endangered globally, with the species being impacted on by power lines and telephone lines while some birds are also killed intentionally for food. *Neotis ludwigii* favours semi-arid dwarf shrublands, arid savanna and Fynbos where is moves in response to rainfall. Although this is a very large bird, it is capable of strong and sustained flight.

Falco biarmicus – Lanner Falcon

A pair of *Falco biarmicus* (Lanner Falcon) was recorded on the power lines towards the south eastern boundary of the study area. *Falco biarmicus* is currently listed as Near Threatened in South Africa and is listed on Appendix II of the Convention of Migratory Species. Breeding and migratory populations have been recorded in South Africa. This species favours open grassland and woodland and breeds on cliffs or on power pylons.

3.2.3 Reptiles

According to ReptileMAP, a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012), 30 reptile species have been confirmed to occur within QDS 3422AA (Appendix E). Only one species, *Bradypodion gutturale* (Karoo Dwarf Chameleon) (Photograph 2) was recorded during the field survey, but since temperatures experienced during the field survey was generally too low for reptile activity, this is not considered to be a true reflection of reptile diversity likely to be present within the study area. Furthermore, residents at Hartenbos indicated that

tortoises are often observed within the study area, and according to SARCA, three tortoise species, *Chersina angulate* (Angulate Tortoise), *Homopus areolatus* (Parrot-beaked Tortoise) and *Stigmochelys pardalis* (Leopard Tortoise) have been recorded in the QDGC.

Photograph 2: *Bradypodion gutturale* (Karoo Dwarf Chameleon) recorded at two localities in the study area

3.2.4 Amphibians

According to FrogMAP, a continuation of the Southern African Frog Atlas Project (SAFAP, Minter *et al,* 2004)), ten (10) amphibian species have been confirmed to occur within QDGC 3422AA (Appendix F). None of these species are of conservation concern, while two species, *Vandijkophrynus angusticeps* (Sand Toad) and *Tomopterna delalandi* (Cape Sand Frog) are endemic to South Africa. One species, *Cacosternum boettgeri* (Common Caco) was recorded during the survey while *Vandijkophrynun angusticeps* (Sand Toad) was given a high probability of occurring in the study area based on the presence of suitable habitat.

3.2.5 Lepidoptera

South Africa is home to approximately 666 species of butterflies (Woodhall, 2005). Butterflies, like most invertebrates are highly sensitive to environmental change making them more vulnerable to the presence of toxins in the ecosystem. The most significant causes of habitat loss for butterflies include invasive alien vegetation, changing fire regimes, agricultural activities, urbanisation, plantation forestry, increased grazing and road construction (Henning *et al.*, 2009).

Studies about the vegetation and habitat of threatened butterfly species in South Africa showed that ecosystems with a unique combination of features are selected by these often localised threatened butterfly species (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal and Cilliers 2003; Lubke, Hoare, Victor and

Ketelaar 2003; Edge, Cilliers and Terblanche, 2008). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

According to Henning *et al*. (2006), 236 Lepidoptera species have been recorded in the Western Cape of which 72 species are endemic and 20 species are of conservation concern (Mecenero *et al*, 2013). These are listed in Appendix G together with their conservation status, habitat requirements and likelihood of occurring in the study area. Lepidoptera activity was low at the time of the survey due to strong wind and cool temperatures and the low diversity recorded is thus not considered to be a true reflection of the species likely to be present within the area under ideal weather conditions. The four species of conservation concern which have a medium or high probability of occurring in the study area are described below.

Lepidochrysops littoralis

This species is currently listed as Near Threatened and Endemic to the Western Cape. It occurs from the De Mond Nature Reserve to just west of Mossel Bay where it prefers limestone ridges or sand dunes in coastal Fynbos. It is usually found close to the shore and it mostly active from August to the end of January. This species was given a medium probability of occurring in the study area.

Aloeides trimeni southeyae

This species is listed as Endangered and is Endemic to the area where it is restricted to the southern coastal areas between Albertinia and Hartenbos. It prefers gentle, north-facing slopes with sparse vegetation and bare patches in between within the Mossel Bay Shale Renosterveld, Langeberg Sandstone Fynbos and Groot Brak Dune Strandveld vegetation types. This species is declining due to developments from Mossel Bay. The main activity period of this species is between October to the first week in January. This species were given a high probability of occurring in the study area.

Aloeides pallida littoralis

A. pallida littoralis is currently listed as Data Deficient and is Endemic to the Western Cape where it occurs from Somerset West to Plettenberg Bay favouring flat terrain close to the coast within various vegetation types including Groot Brak Dune Strandveld. This species is active from September until the end of December. This species was given a high probability of occurring in the study area.

Aloeides thyra orientis

A. thyra orientis is currently listed as Endangered and is Endemic to the Western Cape where it occurs in the south coastal regions from Witsand to Mossel Bay and Knysna. It prefers coastal Fynbos on flat sandy ground between 40m and 240m above sea-level. It has been recorded in various vegetation types, although not currently known from Groot Brak Dune Strandveld. This species is active from late in September to January. This species was given a high probability of occurring in the study area.

3.2.6 Arachnida

Arachnids include spiders (Aranaea), pseudoscorpions, sunspiders, micro whipscorpions, tailless whipscorpions, harvestmen, mites & ticks, whipscorpions and ricinuleids. These animals are small and secretive and are mostly active at night which usually results most species remaining unnoticed. One Arachnid likely to be *Parabuthus capensis* from the family *Scorpiones* (Scorpions) was found under an old roof tile towards the centre of the study area (Photograph 3). This species can get up to 105mm long and is usually found in scrapes under rocks and although it is venomous, it is not known to have caused any human deaths. The conservation status of *Parabuthus capensis* has not yet been determined.

Photograph 3: Old roof tiles (left) under which a scorpion species likely to be *Parabuthus capensis* was found

3.2.7 Chiroptera (Bats)

Bats are highly adaptable to their environment with 116 species recorded throughout South Africa. Of these 116 species, five species are globally listed as Vulnerable, 17 Near Threatened, 14 Data Deficient and 3 have not been evaluated (Monadjem *et al.,* 2010). Bats can be divided into three groups based on their foraging ecology which includes:

- **Frugivores:** Also referred to as pteropids, these species feed on fruits, leaves, flowers and nectar of a wide range of indigenous trees such as *Ficus* and *Podocarpus* as well as cultivated trees such as papayas, avocados, litchis, bananas and dates;
- **Carnivores:** Only a small number of species are carnivorous and feed on smaller vertebrates such as frogs, fish, mice, birds and other bats; and
- **Insectivores:** More than 70% of bats wold wide are insectivores and feed on a wide range of insects with different species usually specializing in certain insect groups. The aerial hunters such as the families Vespertilionidae, Emballonuridae and Molossidae, hunt flying insects exclusively on the wing while families such as

Hipposideridae and Rhinolophidae capture stationary prey from branches or on the ground and these species are capable of slow, manoeuvrable flight.

Different species of bats roosts in various places during the day, a short summary of which is provided below:

- **Foliage-roosting species:** Most Pteropodidae, which includes *Rousettus aegyptiacus* (Egyptian Fruit Bat) which has been recorded from QDGC 3422AA hang or cling onto surfaces in trees or shrubs;
- **Hollow-roosting and Crevice-roosting species**: These species occupy underground caves, hollows in trees, and anthropogenic hollows such as roofs and basements of houses, tunnels or other cavities such as abandoned mine shafts. Two species which have been recorded from QDGC 3422AA and which roost in tree hollows include *Myotis tricolor* (Cape Hairy Bat) and *Neoromicia capensis* (Cape Serotine Bat); and
- **Specialised roost sites**: Night roosts or feeding stations which provide temporary shelter are often used by cave-dwelling bats and this usually includes open structures such as garages, outhouses, thatched game hides, culverts under roads and eaves of buildings.

According to the IUCN, the study area falls within the distribution range of nine (9) bat species (Appendix A), although it is considered to be an under representation of the diversity likely to occur within the area. Five (5) species have a regional conservation status of Near Threatened and these are summarized in Table 2.

Table 2: Threatened bat species recorded in QDGC, their conservation status, habitat requirements and likelihood of occurring in the study area

Scientific Name	Common Name	Regional Conservation Status	Global Conservation Status	Habitat requirements	Likelihood of occurring in the study area
Rhinolophus capensis	Cape Horseshoe Bat	NT	NT	Roosts in caves and mine adits, forages predominantly in the canopy of trees	Low
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	LC	Roosts in caves and mine adits, establish feeding stations during the night often using verandas of houses. Utilizes a variety of habitats	High - feeding area
Miniopterus fraterculus	Lesser Long-fingered Bat	NT	LC	Cave dependant species and availability of suitable roosting	Medium – Although no suitable roosting habitat

				sites is critical for the species	exists within the study area, mountains and hills within a 15km radius of the study area is likely to provide suitable cave and it is therefore possible that the species can use the area for foraging
Miniopterus natalensis	Natal Long-fingered Bat	NT	NT	Core distribution is in savanna and grasslands of southern Africa. It is a cave dependant species. Large numbers recorded at De Hoop	Medium – Although no suitable roosting habitat exists within the study area, mountains and hills within a 15km radius of the study area is likely to provide suitable cave and it is therefore possible that the species can use the area for foraging
Myotis tricolor	Cape Hairy Bat	NT	LC	Roosts gregariously in caves and is absent from flat terrain. Closely associated with mountainous terrain	Low

4. SENSITIVITY BASED ON FAUNAL SPECIES RECORDED AND HABITAT FUNCTIONALITY

Ecological sensitivity and importance of the site for faunal species in terms of breeding, foraging as well as corridors to other natural areas was assessed and based on the criteria listd below. Figure 2 illustrates the ecological sensitivities.

Ecological Function: The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

High – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or 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.

Medium – Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

Low – Degraded and highly disturbed vegetation with little ecological function.

Conservation Importance: The conservation importance of the site gives an 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.

High – Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. These areas should be protected.

Medium – Ecosystems with intermediate levels of species diversity without any threatened species.

Low – Areas with little or no conservation potential and usually species poor (most species are usually exotic).

4.1 Areas of Medium-High Sensitivity

The majority of the study area was classified as being of medium to high ecological sensitivity due to the presence of natural habitat within the area. In a regional context, Groot Brak Dune Strandveld is classified as an Endangered vegetation type as well as

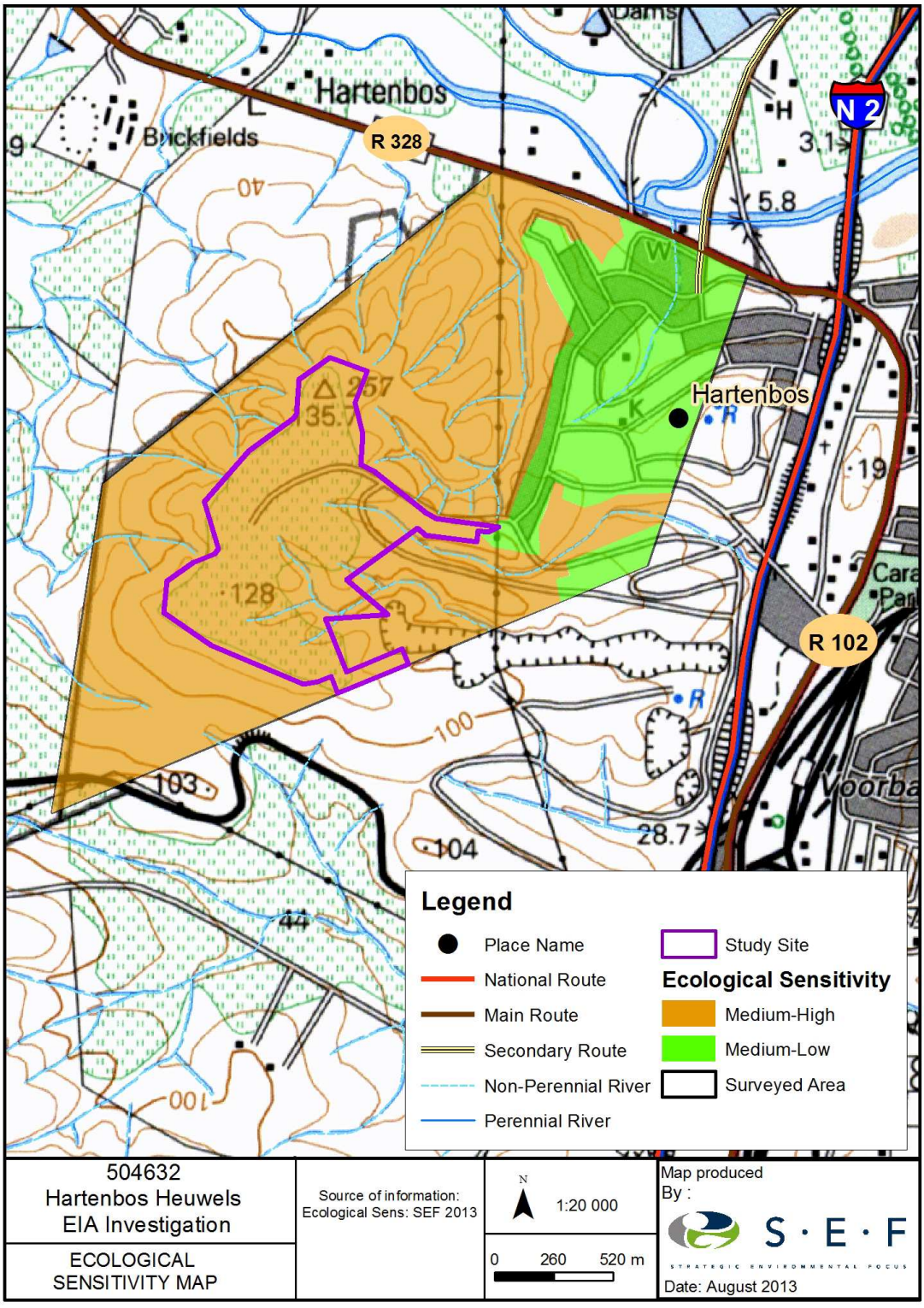


Figure 2: Ecological sensitivities recorded in the study area

an Endangered Ecosystem with large areas already transformed mostly due to infrastructure development. Furthermore, the study area provided a diversity of faunal habitats which included grassy slopes, drainage lines, short scrubveld and Renosterveld and although some areas have been infested by alien vegetation such as *Acacia cyclops* and *Acacia mearnsii*, high faunal activity was still present in these areas.

Three avifaunal species of conservation concern, namely *Circus maurus* (Black Harrier) currently listed as Vulnerable, *Neotis ludwigii* (Ludwig's Bustard) currently listed as Vulnerable in South Africa and globally as Endangered and *Falco biarmicus* (Lanner Falcon) currently listed as Near Threatened, were recorded in the study area during the survey.

Although weather conditions experienced during the field survey were mostly unsuitable for reptiles and invertebrate activity, four Lepidoptera species which are of conservation concern were given a medium to high probability of occurring within the study area based on previous records from the QDGC as well as the presence of suitable habitat within the study area. Further, three bat species which are of conservation concern were also given a medium to high probability of utilizing the study area for foraging.

4.2 Areas of Medium-Low Sensitivity

The areas which have already been developed were given a medium to low ecological sensitivity. The drainage line which connects this developed area with the study area furthermore provides a corridor for faunal movement and feeding and high avifaunal activity recorded within these areas.

5. POTENTIAL IMPACTS ON FAUNAL SPECIES AND RECOMMENDED MITIGATION MEASURES

Any developmental activities in a natural system will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the impacts caused by the proposed activity and to provide a description of the mitigation required so as to limit the perceived impacts on the natural environment.

There are various impacts on fauna which results from the proposed development and these can be divided into the following four categories:

- **Direct Impacts**: These impacts are directly as a result of the construction of the development and associated power lines and include collision, electrocution, habitat destruction and displacement;
- **Indirect Impacts**: These impacts are not directly associated with this proposed housing development but affects the species recorded within the area and could include impacts on a population level especially for species of conservation concern;

- **Induced Impacts**: The impacts are not directly attributed to the project, but occur because of the presence of the project in the area such as the increase of residential settlements leading to pressure on biodiversity. Induced impacts are not considered to the relevant to this project; and
- **Cumulative Impacts**: These are impacts from the past, existing and foreseeable future projects which are all affecting the same species.

Once the risk levels of the proposed development on the recorded faunal species within the area are deemed acceptable, then the mitigation hierarchy of avoidance, minimisation/mitigation and rehabilitation/restoration and offset where residual impacts remain should be adhered to. This hierarchy is described below:

Mitigation measures should aim to achieve "no net loss" of biodiversity which is defined by the International Finance Corporation (IFC) as:

> *"the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimise the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale".*

Mitigation is a broad term and involves the following steps of the mitigation hierarchy:

1. Avoid or prevent loss to biodiversity and ecosystem services: This is the first option and refers to project location and layout of the project, phasing to avoid impacts on biodiversity. These areas need to be identified early in the development's lifecycle so that impacts can be avoided;
2. Minimise impacts on biodiversity and ecosystem services: The location, layout, technology and phasing of the project should minimise the impacts on biodiversity. This should be considered even in areas where the environmental constraints are not particularly high and every effort should be made to minimise these impacts;
3. Rehabilitate concurrently or progressively with the activity and on cessation of the activity: This refers to the rehabilitation of areas where impacts were unavoidable and impacted areas should be returned to a condition ecologically similar to their "pre-development natural state". Unfortunately, rehabilitation is a limited process that usually falls short of replicating the diversity of natural systems. Rehabilitation should occur progressively; and
4. Offset significant residual negative impacts on biodiversity or ecosystem services: This refers to the compensation for the remaining and unavoidable negative impacts on biodiversity.

The development of the residential area at Hartenbos should firstly aim to prevent any adverse impact on the fauna and this can be done through the appropriate routing and by employing the mitigation measures recommended in this report. For the purposes of this development, offsets are not considered to be a viable option.

5.1 Assessment Criteria

The environmental impacts are assessed with mitigation measures (WMM) and without mitigation measures (WOMM) and the results presented in impact tables which summarise the assessment. Mitigation and management actions are also recommended with the aim of enhancing positive impacts and minimising negative impacts.

The following risk assessment will be used to determine the significance of impacts (Prime Resources Impact Rating Methodology).

Significance = (Magnitude + Duration + Scale) x Probability

The maximum potential value for significance of an impact is 100 points. Environmental impacts can thus be rated as high, medium or low significance on the following basis:

- High environmental significance 60 – 100 points
- Medium environmental significance 30 – 59 points
- Low environmental significance 0 – 29 points

Table 3 illustrates the scale used to determine the overall ranking:

Table 3: Scale used to determine significance ranking

Magnitude (M)		Duration (D)	
Description	**Numerical value**	**Description**	**Numerical value**
Very high	10	Permanent	5
High	8	Long-term (ceases at end of operation)	4
Moderate	6	Medium-term	3
Low	4	Short-term	2
Minor	2	Immediate	1
Scale (S)		**Probability (P)**	
Description	**Numerical value**	**Description**	**Numerical value**
International	5	Definite (or unknown)	5
National	4	High	4
Regional	3	Medium	3
Local	2	Low	2
Site	1	Improbable	1
None	0	None	0

The criteria against which these activities were assessed are discussed below.

Nature of the Impact

This is an appraisal of the type of effect the project would have on the environment. This description includes what would be affected and how and whether the impact is expected to be positive or negative.

Scale of the Impact

A description of whether the impact will be local, limited to the study area and its immediate surroundings, regional, national or international scale.

Duration of the Impact

This provides an indication of whether the lifespan of the impact would be immediate, short term (0-5 years), medium term (6-15 years), long term (cesses at end of operational phase) or permanent.

Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as none, improbable (low likelihood), low, medium, high and definite.

Significance.

This describes the degree of significance for the predicted impact based on the available information and level of knowledge and expertise. It has been divided into low, medium or high.

5.2 Impact Assessment

Impacts described below are based on a single survey which was conducted during the spring of 2013. Impacts which are likely to affect the faunal species recorded as well as those which are likely to occur within the study area and immediate surroundings are divided into direct impacts, indirect impacts, cumulative impacts and positive impacts and are described below:

5.2.1 Direct Impacts

Direct impacts on faunal species within the study area are associated with the construction and operational phases of the development. Construction activities have the potential to significantly impact on the faunal species within the area and in particular resident species which have territories within or close to the study area. In general, good construction techniques include minimising any clearing of natural vegetation, implementing adequate measures to control soil erosion and runoff, ensuring proper disposal of waste, restoration of cleared areas with indigenous vegetation and preventing the introduction of alien invasive species. Impacts during the operational phase include collisions and electrocution with power lines, poaching of wild animals and faunal injuries or mortalities due to interactions with humans. These impacts are summarized in Table 4 and described underneath.

Table 4: Direct impacts on fauna likely to occur during the construction and operational phases of the housing development

Impact description	Source of impact	Area to be affected
Destruction of natural vegetation including faunal habitat	Ground clearing during construction of the residential area and access roads	Areas in the development zone
Interference with faunal activities	Ground clearing activities, construction crew, contractors	Study area and immediate surroundings
Introduction and spread of alien invasive plant species resulting in habitat degradation	Ground clearing activities and introduction of alien species by vehicles and people	Study area and immediate surroundings
Avifaunal mortalities due to collision with power lines	Power and telephone lines	Study area
Avifaunal mortalities due to electrocution	Structures and power lines	Study area
Pollution by hazardous material	Chemicals used to treat poles, oil and fuel from vehicles, pesticides and herbicides	Study area and immediate surroundings

5.2.1a) Destruction of natural vegetation including faunal habitat

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	Moderate (6)	Definite (5)	High (60)	High
WMM	Site (1)	Permanent (5)	Low (4)	Definite (5)	Medium (50)	High

Description of impact

The construction of the proposed residential area on Erf 3122 at Hartenbos Heuwels as well as the associated infrastructure will lead to the destruction of natural vegetation including faunal habitat. At least two avifaunal species of conservation concern, *Circus maurus* (Black Harrier) which is currently listed as Vulnerable and *Neotis ludwigii* (Ludwig's Bustard) which is currently listed as Endangered (Globally), will be displaced by the development. These two species utilizes large open areas which were recorded at the higher laying areas in the study area and will not use the study area once development has taken place. Furthermore, four (4) Lepidoptera species which are of conservation concern were given a medium to high probability of occurring within the

study area based on the presence of suitable habitat. One chameleon, *Bradypodion gutturale* (Karoo Dwarf Chameleon) was recorded at two localities in the study area, although this species hasn't yet had its conservation status evaluated.

Mitigation measures

- Although the area was mostly classified as medium to high ecological sensitivity it is recommended that all developments are restricted to the areas adjacent to current houses at Hartenbos Heuwels as well as the area west of Geelhout Road which provides current access to the site;
- Since the presence or absence of threatened Lepidoptera species could not be confirmed within the study area at the time of the survey due to the weather conditions, it is recommended that a Lepidoptera specialist study is conducted during a more suitable time period to determine if these species are present within the study area and also develop a habitat management plan where needed;
- Landscaping should be done with floral species that occur naturally within the study area and the use of any exotic species should be strictly prohibited. The recommendations made based on Lepidoptera studies should also be included in the landscaping plan for the development;
- Bat and owl nesting boxes should be used to encourage these species to reside within the study area. This will also provide a natural control method for rodents and invertebrates;
- All alien vegetation currently within the study area should be removed and these areas should be rehabilitated to prevent erosion;
- To prevent the transmission of diseases or faunal injury or mortality, no dogs or cats should be allowed to enter the natural areas surrounding the development;
- Access to the natural areas surrounding the development should be restricted to prevent poaching and snaring of wild life.

5.2.1b) Interference with avifaunal activities

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	Moderate (6)	Definite (5)	High (60)	High
WMM	Site (1)	Permanent (5)	Low (4)	Definite (5)	Medium (50)	High

Description of impact

The presence of the construction site may result in negative faunal interactions that could be associated with construction personnel including poaching, trapping and hunting of faunal species, as well as possible collisions of fauna with construction vehicles. Furthermore, construction will result in high levels of noise and vibrations and the operation of floodlights, should construction continue at night and this could affect

faunal species. This will disturb the faunal species utilising the surrounding vegetation, especially nocturnal species, and could result in a localised decrease in biodiversity as species move away from the disturbance into the surrounding areas.

Mitigation measures

- Construction should be restricted to the winter months when faunal breeding activities are generally low;
- Construction should only be conducted during day light hours and the use of artificial lights should be prevented as far as possible;
- An education programme should be compiled for all contractors, subcontractors and workers to ensure compliance to all aspects of the EMP as well as educating personnel in the safe and proper conduct within areas of natural habitat;
- No wild animal may under any circumstance be handled, removed or be interfered with by construction workers;
- No wild animal may be fed on site;
- No wild animal may under any circumstance be hunted, snared, captured, injured or killed. This includes animals perceived to be vermin. Checks of the surrounding natural vegetation must be regularly undertaken to ensure no traps have been set. Any snares or traps found on or adjacent to the site must be removed and disposed of;
- To prevent possible collisions with animals, drivers of construction vehicles must remain vigilant to the possibility of animals crossing their paths and a strict speed limit of 30 km/h should be adhered to;
- All food should be securely stored away to prevent attraction of faunal species and all rubbish should be disposed of away from the site. Bins located around the infrastructure should have tightly fitting lids to prevent faunal species raiding the bins and thereby becoming habituated to humans.

5.2.1c) Introduction and spread of alien invasive plant species

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Long term (4)	Low (4)	Medium (3)	Medium (27)	High
WMM	Site (1)	Short term (2)	Minor (2)	Low (2)	Low (10)	High

Description

Fairly dense infestations by two alien species, *Acacia cyclops* and *Acacia mearnsii* were recorded in some areas of the study area (especially the drainage lines) while *Hakea sericea* and *Opuntia ficus-indica* were also sporadically encountered. Although some alien species are already present in the study area, care should be taken not to introduce any additional alien species during the construction phase, while the use of exotic species for landscaping should be strictly forbidden.

Mitigation measures

Although some alien species are already present within the study area, it is recommended that these species are removed from the development footprint as well as the adjacent natural vegetation and these areas should be rehabilitated to prevent erosion. In addition to this, the following is recommended:

- During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation;
- Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation;
- All alien seedlings and saplings must be removed as they become evident for the duration of construction and operational phase;
- 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 site. This should be verified by the ECO;
- An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning.

5.2.1d) Avifaunal mortalities due to collision with power and telephone lines

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	High (8)	High (4)	High (56)	High
WMM	Site (1)	Short term (2)	Low (4)	Low (2)	Low (14)	High

Description of impact

Large bodied wandering birds such as cranes, bustards, herons and egrets are particularly vulnerable to collision with high voltage power lines which are not clearly visible to these species and due to their large size can't make quick turns to avoid collisions. Furthermore, these birds often fly to and from feeding and nesting sites during periods of low visibility such as at dusk and dawn increasing the risk of collision. One such species which has been confirmed within the study area, *Neotis ludwigii* (Ludwig's Bustard), currently globally listed as Endangered, is particularly vulnerable to collisions with power lines and even smaller telephone lines since these birds are heavy bodied and usually fly at fairly low altitudes. Furthermore, a study which was done in the

1990's in the eastern Karoo, recorded two *Neotis ludwigii* (Ludwig's Bustards) collisions per kilometre of high voltage power line per year (Jenkins and Smallie, 2009). Research into bird flappers installed on power lines in sections which are considered to pose a high collision risk has indicated that these devices are successful in limiting collisions of mostly crane species while it does not seem to be successful in avoiding collisions by *Neotis ludwigii* (Ludwig's Bustard).

Mitigation measures

- Power lines should be placed parallel to land features such as ridges, valleys and where possible drainage lines and should not cut across them;
- Where feasible, the thin neutral or earth wire above the high voltage transmission line should be removed or when it is not possible to remove this, the line should be marked to make it more visible;
- High voltage wires should be bundled to increase visibility;
- The vertical spread of the power lines should be minimised since having the lines in a horizontal plane, significantly reduces the collision risk; and
- Care should be taken not to establish areas which might attract large numbers of birds to the area such as waste water treatment plants and solid waste dumps;
- High impact areas should be marked with bird deflectors to increase the visibility of the lines. There are various deflectors and devices available which are summarized below: and
- A monitoring programme should be developed to determine the effects of the newly constructed power lines. This monitoring should be conducted by a suitably qualified avifaunal specialist or ecologist and the data/results should be made available to the EWT. Furthermore, any collisions recorded within the area should be reported to the Wildlife & Energy Interaction Group at wep@ewt.org.za.

Bird deflectors and marking devices for high voltage power lines

According to Van Rooyen (2005), there are various devices available in South Africa each having their own advantages and disadvantages. These are described below:

Static devices:

Static devices are more durable that dynamic devices since there is limited wear and tear of the movable parts. These static devices which are also referred to as Bird Flight Diverters or pigtails has had limited success in South Africa since they seems to be less visible and it is therefore not recommended.

Dynamic devices

Dynamic devices are also referred to as bird flappers, these have moving parts and are generally very effective in reducing collisions since the birds can see these devices better, probably due to the movement which attracts their attention (Van Rooyen, 2005).

However, dynamic devices have got a limited lifespan since the devices are subject to extensive wear and tear and have to be replaced every couple of years.

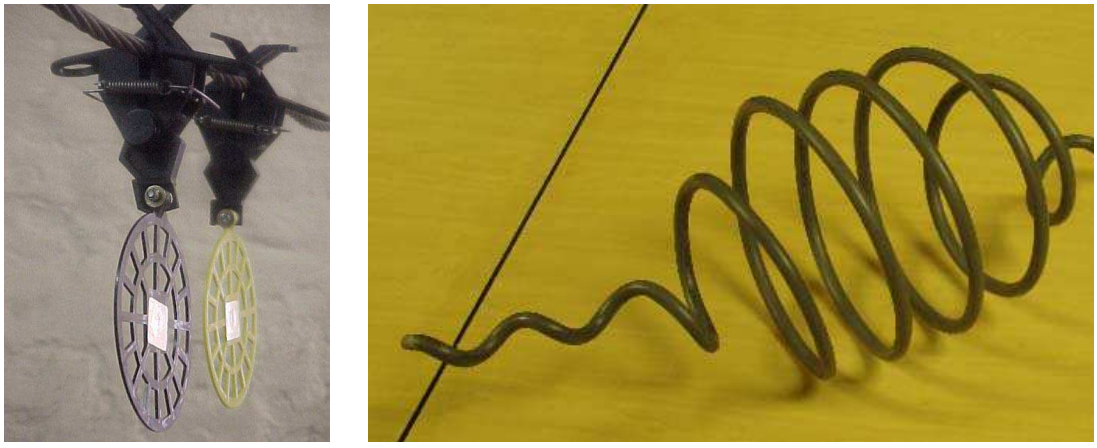
Reflective devices

These are relatively new and consist of a reflective steel sphere of 70mm diameter which are painted in yellow, red, white and black to increase visibility at dawn and dusk. The spherical shape reflects any available light in all directions and is therefore visible from all sides that the birds are flying in. Since this device does not require sunlight, it is effective in overcast conditions or in conditions of low light such as after sunset and before sunrise. This device has shown great potential and it therefore strongly recommended that these devices are installed in high impact zones on the power line.

According to Eskom's Technical Bulletin (No.09TB-01), the following two bird flight diverters are recommended for use on Eskom lines (Photograph 7):

- EBM Flappers: These flappers can be used on conductors ranging from 6mm to 24mm on ACSR and AAAC conducts and shield wires
- Tyco Flight Diverter: These diverters are used worldwide and are proving to be highly successful.

It should further be noted that the spacing intervals at which these devices are installed are vital in the success of these devices to divert birds from the lines and it is recommended that the Endangered Wildlife Trust (EWT) is consulted to ensure the devices are installed correctly.



Photograph 4: Bird flight diverters recommended by Eskom includes the EBM Flapper (left) and Tyco Flight Diverter (right) (photos obtained from Eskom Technical Bulletin No.09TB-01

5.2.1e) Avifaunal mortalities due to electrocution

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	Moderate (6)	Definite (5)	High (60)	High
WMM	Site (1)	Short term (2)	Low (4)	Low (2)	Low (14)	High

Description of impact

Raptors are more likely to suffer electrocution from power lines since they are likely to use these structures to perch or roost. Medium to low voltage power lines or distribution lines are more likely to electrocute species due to the birds making a connection between live components. To reduce the electrocution risk, the design of the poles are vital and the following should be considered:

Mitigation measures

To reduce the risk of electrocution the following mitigation measures are recommended (adapted from Migratory Soaring Birds Project):

- Insulators should be hanged under the cross arms and poles if the distance between the area which are likely to be used as a perch and the energised parts are at least 70cm;
- Upright insulators should be capped with a nonconductive material;
- Cables should be insulated close to the poles (at least 70cm on both sides and around the perching area) and in cases where large soaring birds are present, these distances should be increased to 140cm;
- If the poles are made of steel, the conductor lines should be insulated;
- Safe nesting and perching platforms should be provided above the poles at a minimum of 70cm above the energized components (or higher if larger species are present);
- Spacing between conductors should be not less than 140cm and 70cm between perching sites and live components; and
- A monitoring programme should be developed by a suitably qualified avifaunal specialist or ecologist to record any avifaunal mortalities within the study area due to electrocution. The data should include the date, species involved and number of individuals and the results should be made available to Birdlife South Africa and EWT.

5.2.1f) Pollution of the natural environment by hazardous materials

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	Moderate (6)	High (4)	Medium (36)	High
WMM	Site (1)	Short (2)	Low (4)	Medium (3)	Low (21)	High

Description of impact

Hazardous materials which are likely to be used in the study area include oil and fuel for construction vehicles, chemicals or products used for wood preservation and herbicides as well as pollution and rubbish from houses. These hazardous materials have the potential to pollute the natural environment through direct contamination or leaching and the following is recommended to prevent contamination of the study area:

Mitigation measures

- All the vehicles which are used during the construction phase should be inspected on a regular basis to ensure that these vehicles are not leaking oil and fuel;
- Vehicles which are stored within or close to the study area during night should be parked in areas of low ecological sensitivity and parking bays should be lined with trays to capture any leaking oil;
- Construction vehicles should not be serviced or wash within the study area;
- If any wooden poles are used within the study area, these poles should be treated with environmentally safe chemicals;
- The used of any herbicides or pesticides is strongly discouraged;
- All house hold rubbish, building rubble and garden refuge should be disposed of at official dump sites and should not be dumped in the natural areas surrounding the development.

5.2.2 Indirect Impacts

Indirect impacts are not directly associated with the proposed development but affects the species recorded within the area and could include impacts on a population level especially for species of conservation concern. The indirect impacts likely to occur in the study area are listed in Table 5 and described underneath.

Table 5: Indirect impacts likely to affect faunal species recorded in the study area and immediate surroundings

Impact description	Source of impact	Area to be affected
Habitat destruction and disturbance during construction phase forcing local territorial species into adjacent areas already occupied	Destruction of natural vegetation and noise generated during construction activities	National scale

5.2.2a) Changes in population densities on a national scale

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	National (4)	Permanent (5)	High (8)	Definite (5)	High (68)	High
WMM	Site (1)	Permanent (5)	Moderate (6)	High (4)	Medium (48)	High

Description of impact

The destruction of natural habitat will impact on species of conservation concern which have been confirmed in the study area. *Neotis ludwigii* (Ludwig's Bustard) males utilize regular sites with some individuals remaining and defending these areas for more than 25 years. Furthermore, *Neotis ludwigii* (Ludwig's Bustard) has low hatching success with three out of five clutches failing and nests often deserted if disturbed by humans. The destruction of natural habitat utilized by the territorial males of *Neotis ludwigii* (Ludwig's Bustard) and *Circus maurus* (Black Harrier) within the study area, will force the resident birds into adjacent suitable areas which in turn will displace more individuals. Furthermore, this will lead to an increase in competition for food and territories, possibly resulting in a national decrease in the population. In addition to this, the presence of the power lines and telephone lines within the study area might impact on these long lived species should these species be fatally injured through collisions or electrocutions.

Faunal species might also avoid the study area due to the disturbance caused during the construction phase and by this moving into areas which are less suitable or already occupied, thereby increasing the competition for food and resources resulting in a decrease in the population.

Three Lepidoptera (butterfly) species which are of conservation concern were given a high probability of occurring in the study area based on the presence of suitable habitat. The destruction of this habitat will not only result in the destruction of local populations, but will impact the species on a population level.

Mitigation measures

- The footprint of the residential development should be confined to areas adjacent to existing houses and should ideally avoid sensitive areas such as the grassy slopes, Renosterveld and drainage lines;
- Access to the natural areas should be restricted to ensure that faunal species breeding in these areas are not disturbed;
- A Lepidoptera specialist should be consulted to determine if species of conservation concern are present within the study area and immediate surroundings. Furthermore, should any species of conservation concern be

present in the study area or immediate surroundings, a species management plan including a vegetation management plan should be developed; and

- An alien vegetation management plan should be developed by a suitably qualified botanist or ecologist. This plan should include regular monitoring as well as a rehabilitation plan aiming to restore indigenous floral diversity and prevent erosion.

5.2.3 Cumulative Impacts

Cumulative impacts are defined as: "Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project (Hyder in Masden *et al*, 2010). The following cumulative impacts were recorded on a regional scale and are likely to affect the faunal species recorded in the study area (Table 5).

Table 6: Cumulative Impacts likely to affect the faunal species recorded in the study area and immediate surroundings

Impact description	Source of impact	Area to be affected
Destruction of vegetation representative of Groot Brak Dune Strandveld	Ground clearing and development of infrastructure	Study area

5.2.3a) Destruction of vegetation representative of Groot Brak Dune Strandveld

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	National (4)	Permanent (5)	High (8)	Definite (5)	High (85)	High
WMM	Site (1)	Medium (3)	Low (4)	Medium (3)	Low (24)	High

Description of impact

The study area falls within the Groot Brak Dune Strandveld vegetation type which is currently listed as Endangered according to Mucina & Rutherford (2006). Furthermore, it forms part of the Groot Brak Dune Strandveld Ecosystem which is also listed as Endangered in terms of Section 52 of NEMBA (Government Gazette, 2011). The original extent of this ecosystem is 20 000ha with approximately 52% remaining of which 0% is protected in statutory reserves. At least six plant species of conservation concern have been recorded from this ecosystem.

The area which was assessed is approximately 300ha in extent and consists of vegetation representative of the Groot Brak Dune Strandveld vegetation type. It has been indicated that the proposed development will only affect approximately 50ha mainly situated along the higher laying plateau.

Mitigation measures

- The footprint of the residential development should be confined to areas adjacent to existing houses and should ideally avoid sensitive areas such as the grassy slopes, Renosterveld and drainage lines;
- During construction, natural areas and areas which are not part of the development footprint should be cordoned off to prevent vehicles and people from accessing and damaging these natural areas; and
- The remaining natural areas on Erf 3122 should be rehabilitated and conserved and movement corridors to other natural areas should be considered during the planning phase.

5.2.4 Possible Positive Impacts

Possible positive impacts associated with the proposed residential development on Erf 3122, Hartenbos, include the removal of alien vegetation present within the natural areas, rehabilitation and restoration of the remaining natural vegetation in order to increase biodiversity within the area. These positive impacts are listed in Table 7 and described underneath.

Table 7: Possible positive impacts associated with the proposed development

Impact description	Source of impact	Area to be affected
Removal of alien vegetation and rehabilitation of drainage lines on Erf 3122	Alien species management plan	Study area and immediate surroundings
Habitat management for species of conservation concern confirmed within the study area	Habitat rehabilitation and management plan for species of conservation concern recorded in the study area	Local and national scale
Decrease in possible snaring and poaching of larger faunal species	Restricted access to natural areas	Local faunal populations

5.2.4a) Removal of alien vegetation on erf 3122

Fairly dense infestations of *Acacia cyclops* and *Acacia mearnsii* were recorded in the drainage lines within the study area while two other species, *Hakea sericea* and *Opuntia ficus-indica* were also sporadically recorded throughout the area. These species typically form large mono-specific stands which eventually eliminate indigenous flora and transform landscapes while they also absorb large quantities of water resulting in reduced flow in drainage lines. The following is recommended:

- An alien management plan should be compiled for the remainder of Erf 3122 to remove these species from the natural areas and rehabilitate the areas which have been affected by infestations;

- Regular monitoring should be conducted to ensure that newly emerged seedlings are removed as soon as possible; and
- Areas should be rehabilitated using indigenous floral species which occur naturally within the study area.

5.2.4b) Habitat management aimed at species of conservation concern

Three avifaunal species of conservation concern were confirmed on Erf 3122 during the survey period while four Lepidoptera species of conservation concern were given a medium to high probability of occurring in the study area, based on the presence of suitable habitat. If the proposed development footprint is confined to 50ha on the higher laying plateau, the remainder of the site can be managed to ensure that the recorded species will remain within the area. In order to achieve this, the following is recommended:

- The development as well as the associated infrastructure and impacts during the construction phase should be confined to the higher laying plateau and should affect the smallest area possible;
- Access to the remainder of Erf 2133 should be restricted to prevent any damage to natural habitat or trapping, snaring or poaching of faunal species;
- Areas containing natural vegetation should be cleared of alien vegetation and rehabilitated (see above); and
- A Lepidoptera specialist should be consulted to determine if the four species of conservation concern are present within the study area. Furthermore, a species management plan should be compiled where necessary;
- Landscaping of the residential area should be done with indigenous flora which naturally occur within the study area. The use of any exotic plant species should be strictly prohibited;
- The use of owl and bat boxes are strongly recommended to encourage these species to reside in the study area;
- No cats or dogs should be allowed to enter the areas containing natural vegetation; and
- The use of pesticides or herbicides within the study area, including residential areas and sub-urban gardens should be prohibited.

5.2.4c) Decrease in poaching and snaring of faunal species on Erf 3122

During the field survey in September 2013, snares were noted in the central portion of the study area. It was furthermore noted that the area was also used as a walk through by people on their daily commute between the village located immediately north east of the study area next to the R328 and Hartenbos Heuwels. In order to prevent future poaching of faunal species it is recommended that access to the natural areas is restricted and any trespassers should be removed from these areas. These areas should also be regularly inspected and any snares or traps should be removed.

6. CONCLUSION

The study area falls in the Fynbos Biome and more specifically within the Groot Brak Dune Strandveld vegetation type. This vegetation type is currently listed as Endangered by Mucina and Rutherford (2006) with more than 50% of the natural habitat transformed. The Groot Brak Due Strandveld Ecosystem is also listed as Endangered in terms of Section 52 of NEMBA (Government Gazette, 2011). The original extent of this ecosystem is 20 000ha with approximately 52% remaining of which 0% is protected in statutory reserves.

Faunal habitat within the study area included drainage lines, short scrub veld, Renosterveld, grassy hillsides as well as natural (termite mounds, rock piles) and artificial (building rubble) refugia.

Three bird species of conservation concern were recorded during the field survey and included *Neotis ludwigii* (Ludwig's Bustard), *Circus maurus* (Black Harrier) and *Falco biarmicus* (Lanner Falcon). Four Lepidoptera species which are of conservation concern were given a medium to high probability of occurring in the study area based on the presence of suitable habitat. One amphibian, *Cacostermum boetgerii* (Boetger's Caco) and one reptile species, *Bradypodion gutturale* (Karoo Dwarf Chameleon) were also recorded in the study area.

The natural areas associated with Erf 3122 were classified as medium to high ecological sensitivity due to the presence of species of conservation concern within the area and although alien plant species such as *Acacia cyclops* and *Acacia mearnsii* were recorded in the drainage lines, high avifaunal activity was recorded in these areas.

It is indicated that the proposed residential development will only affect approximately 50ha mostly on the higher laying plateau. Therefore should mitigation measures recommended in this report be implemented, the proposed development will not have a significant impact on the fauna within the area. It is furthermore possible that through the removal of alien vegetation, rehabilitation and habitat management, the development can have a positive effect on faunal species, especially species of conservation concern.

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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.
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.
Climax community	The presumed end point of successional sequence; a community that has reached a steady state, the most mature and fully developed vegetation that an ecosystem can achieve under the prevailing conditions. It is reached after a sequence of changes in the ecosystem, known as succession. Once climax vegetation develops, the changes are at a minimum and the vegetation is in dynamic equilibrium with its environment. Very few places show a true climax because physical environments are constantly changing so that ecosystems are always seeking to adjust to the new conditions through the process of succession.
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 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 Declining 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.
Correspondence Analysis	Correspondence Analysis simultaneously ordinates species and samples.

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.
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.
Fauna	The animal life of a region.
Flora	The plant life of a region.
Forb	A 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.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas.
Least Concern	A taxon is Least Concern when it has been evaluated against five IUCN criteria and does not qualify for the Threatened or Near threatened Categories (Raimondo *et al.*, 2009).
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.
Protected Plant	According to Provincial Nature Conservation Ordinances, 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 Species 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.
Succession	Progressive change in the composition of a community of plants, e.g. from the initial colonisation of a bare area, or of an already established community towards a largely stable climax. The complete process of succession may take hundreds or thousands of years and entails a number of intermediate communities - each called a seral community. The replacement of one seral community by another in most cases leads to the eventual formation of a climax community, a relatively stable community of plants and animals.
Vegetation Unit	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".
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).
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and is therefore facing a high risk of extinction in the wild in the future (Raimondo *et al.*, 2009).

APPENDICES

APPENDIX A	**Mammal species occurring within QDGC 3422AA, with national and global conservation status, and probability of occurring on site and habitat preference**
APPENDIX B	**Bird species of conservation concern recorded in QDGC 3422AA, their conservation status, habitat requirements and likelihood of occurring in the study area**
APPENDIX C	**Bird species listed on Appendix I and II of the Convention on Migratory Species (CMS) which have been recorded in QDGC 3422AA as well as the likelihood of occurring in the study area**
APPENDIX D	**Bird species recorded within the study area immediate surroundings during the field survey**
APPENDIX E	**Reptile species recorded in QDGC 3422AA, their conservation status, habitat requirements and likelihood of occurring in the study area**
APPENDIX F	**Amphibian species recorded in QDGC 3422AA, their conservation status, habitat requirements and likelihood of occurring in the study area**
APPENDIX G	**Lepidoptera species which are of conservation concern in the Western Cape, their conservation status, habitat requirements and likelihood of occurring in the study area**

APPENDIX A: MAMMAL SPECIES OCCURRING IN QGC 3422AA, WITH NATIONAL AND GLOBAL CONSERVATION STATUS, HABITAT PREFERENCE AND PROBABILITY OF OCCURRING IN THE STUDY AREA

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; Pr = Protected; En = Endemic; NBM = Non-breeding Migrant

Scientific Name	Common name	Global Conservation Status (IUCN)	National Conservation Status	Habitat	Likelihood of occurring in study area
Herpestes pulverulentus	**Cape Grey Mongoose**	**LC**	**LC**	**Shrubland, grassland, desert, coastline, rocky shores, invertebrates and small vertebrates**	**Confirmed**
Ictonyx striatus	**Zorilla, Striped Pole Cat**	**LC**	**LC**	**Savanna, grasslands, desert, forest, insects and mince, reptiles**	**Confirmed**
Genetta genetta	**Common Genet**	**LC**	**LC**	**Forest, savanna, omnivorous**	**Confirmed**
Sylvicapra grimmia	**Common Duiker, Grey Duiker**	**LC**	**LC**	**Widespread, thickets, savanna, widespread, karroid, forest and savanna**	**Confirmed**
Lepus saxatilis	**Scrub Hare, Savannah Hare**	**LC**	**LC**	**Arable land, savanna, grassland, desert, grazer**	**Confirmed**
Hystrix africaeaustralis	**Cape Porcupine**	**LC**	**LC**	**Arable land, savanna, grassland, temperate, desert, throughout southern Africa**	**Confirmed**
Orycteropus afer	**Aardvark, Antbear**	**LC**	**LC**	**Savanna, shrubland, grassland, vital association between ants and termites**	**Confirmed (old signs of species utilizing the study area)**
Amblysomus corriae	Fynbos Golden Mole	NT	NT	Mediterranean scrub, urban gardens, subterranean	High
Canis mesomelas	Black-backed Jackal	LC	LC	Savanna, shrubland, grassland, drier areas, omnivore, extreme generalist	High
Felis silvestris	Wild Cat, Wildcat	LC	LC	Savanna, shrubland, desert, broad habitat, small mammals, reptiles, birds and invertebrates	High
Genetta tigrina	South African Large- Gennet	LC	LC	Savanna, forest, shrubland, urban	High

				areas, omnivore	
Raphicerus campestris	Steenbok	LC	LC	Savanna, shrubland, grassland, drier areas	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	0	Savanna, urban areas, all vegetation types,	High
Nycteris thebaica	Egyptian Slit-faced Bat	LC	LC	Caves and subteranean habitats, savanna, fynbos, aerial, man-made structures, insectivore	High
Rousettus aegyptiacus	Egyptian Fruit Bat	LC	LC	Caves, temperate, savanna, frugivore	High
Rhinolophus capensis	Cape Horseshoe Bat	LC	NT	Grassland, caves and subterranean habitats,shrubland, fynbos, succulent and Nama karoo, aerial insectivore.	High
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	NT	Grassland, caves and subterranean habitats, savanna, shrubland, fynbos, woodland, succulent and Nama karoo, aerial insectivore.	High
Miniopterus fraterculus	Lesser Long-fingered Bat	LC	0	Forest, savanna, shrubland, afromontane and coastal forest, aerial insectivore	High
Pipistrellus capensis	Cape Serotine	LC	LC	Urban areas, aerial insectivore, roosts in man-made structures, crevices of plants	High
Crocidura cyanea	Reddish-gray Musk Shrew	LC	DD	Broad habitat tolerance, terrestrial, nocturnal	High
Crocidura flavescens	Greater Red Musk Shrew	LC	DD	Urban areas, disturbed habitats	High
Suncus varilla	Lesser Dwarf Shrew	LC	DD	Terrestrial, nocturnal, Broad tolerance but may be dependent on termite mounds	High
Lepus capensis	Cape Hare, Arabian Hare	LC	LC	Grazer, savanna, arable land, desert	High
Chlorocebus pygerythrus	Vervet	LC	LC	Savanna, forest, riparian vegetation, forest edge, omnivore	High
Bathyergus suillus	Cape Dune Mole Rat	LC	LC	Subterranean, sandy soils in fynbos	High

Cryptomys hottentotus	African Mole Rat/Common mole-rat	LC	LC	Subterranean, widespread	High
Georychus capensis	Cape Mole Rat	LC	LC	Subteranean, sandy soils, coastal sand dunes and montane regions	High
Acomys subspinosus	Cape Spiny Mouse	LC	LC	Rocky areas on mountain slopes in fynbos	High
Gerbilliscus afra	Cape Gerbil	LC	LC	Temperate, sandy soils	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	LC	Arid areas including desert, sandy soils with cover	High
Mastomys coucha	Southern African Mastomys	LC	LC	Widespread, nocturnal	High
Mus musculus	House Mouse	LC	0	Widespread	High
Myomyscus verreauxii	Verreaux's Mouse	LC	LC	Temperate, scrub on grassy hillsides, forest edge and riverine forest	High
Rattus rattus	Black Rat, House Rat	LC	0	Widespread	High
Rhabdomys pumilio	Four-striped Grass Mouse	LC	LC	Temperate, grassland with good cover, diurnal	High
Panthera pardus	Leopard	NT	LC	Forest, savanna, desert, predates small to medium mammals	Low
Atilax paludinosus	Marsh Mongoose, Water Mongoose	LC	LC	Coastline, rocky shores, intertidal, estuarine, brackish, bogs, marshes, swamps, freshwater and saltwater, eats invertebrates and small vertebrates	Low
Herpestes ichneumon	EGYPTIAN MONGOOSE, Eg	LC	LC	Permanent rivers and streams, rocky shores, savannas, shrubland, eats rodents, reptiles, frogs birds, invertebrates, crabs and crayfish	Low
Proteles cristata	Aardwolf	LC	LC	Savanna, shrubland, grassland, eats termites	Low
Philantomba monticola	Blue Duiker	LC	VU	Subtropical, afromontane forests, coastal thickets, selective forager on litter and fruit.	Low
Miniopterus natalensis	Natal Long-fingered Bat	LC	0	Caves	Low

Myotis tricolor	Cape Hairy Bat	LC	NT	Forest, shrubland, savanna, grassland, mountains, aerial insectivore, lives in caves	Low
Myosorex longicaudatus	Long-tailed Forest Shrew	VU	NT	Terrestrial, nocturnal,Bogs, marshes, swamps, fes, paetlands, forest, marginally in grasslands and boggy fynbos	Low
Myosorex varius	Forest Shrew	LC	DD	Terrestrial, nocturnal,Bogs, marshes, swamps, fens, peatlands, forest, marginally in grasslands and boggy fynbos	Low
Procavia capensis	Rock Hyrax, Rock Dassie	LC	LC	Krantzes and rocky outcrops throughout the fynbos, karroid habitats, generalist herbivore	Low
Pronolagus saundersiae	Hewitt's Red Rock Hare	LC	LC	Grassland, restricted to the top of rocky outcrops	Low
Elephantulus edwardii	Cape Elephant Shrew,	LC	LC	Small rocky outcrops and mountains, shrubland, desert and rocky cliffs and slopes	Low
Dasymys incomtus	African Marsh Rat /Water Rat	LC	NT	Bogs, marshes, swamps, fens, peatlands, nocturnal, semi-aquatic	Low
Otomys irroratus	Southern African Vlei Rat	LC	LC	Mesic grassland and mountain fynbos habitat	Low
Otomys saundersiae	Saunder's Vlei Rat	LC	0	Drakensberg grassland, thicket, fynbos	Low
Otocyon megalotis	Bat-eared Fox	LC	LC	Savanna, shrubland, grassland, cold grassland, invertebrates	Medium
Vulpes chama	Cape Fox, Silver Fox	LC	LC	Savanna, shrubland, grassland, desert, omnivorous, small vertebrates and invertebrates	Medium
Caracal caracal	Caracal, African Caracal	LC	LC	Savanna, shrubland, eats small mammals and birds	Medium
Leptailurus serval	Serval	LC	NT	Savanna, grassland, bogs, marshes, swamps, moist savanna, tall grass, smal mammals, reptile, fruit, invertebrates, fish	Medium

Mellivora capensis	Honey Badger	LC	NT	Habitat varied, rain forests to arid deserts, solitary carnivores	Medium
Poecilogale albinucha	African Striped Weasel	LC	DD	Grassland, savanna, shrubland, birds and eggs	Medium
Raphicerus melanotis	Cape Grysbok	LC	LC	Shrubland, fynbos, thicket	Medium
Tragelaphus scriptus	Bushbuck	LC	LC	Closed canopy forests, thickets and woodlands, coastal sand forests	Medium
Potamochoerus larvatus	Bushpig	LC	LC	Forests, shrub dominated wetlands, afromontane and coastal forests, thickets, reedbeds and wetland associated grassland.	Medium
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	LC	Desert, Rocky, semi-arid areas with cover	Medium
Papio ursinus	Southern Chacma Baboon	LC	LC	Savanna and grassland, forest edges, omnivore	Medium
Graphiurus murinus	Woodland Dormouse	LC	LC	Woodland, terrestrial arboreal	Medium
Graphiurus ocularis	Namtap, Spectacled Doormouse	LC	LC	Temperate, rocky areas	Medium
Aethomys namaquensis	Namaqua Rock Rat	LC	LC	Rocky outcrops and koppies	Medium
Mus minutoides	Pygmy Mouse	LC	LC	Ground cover in shrubland, grassland, temperate areas	Medium
Dendromus melanotis	Gray African Climbing Mouse	LC	LC	Tall grass and bushes in bogs, marshes, swamps, fens, peatlands	Medium
Dendromus mesomelas	Brant's Climbing Mouse	LC	LC	Rank grassland and forest edges, Tall grass and shrub, eats insects and grass seeds	Medium
Saccostomus campestris	Pouched Mouse	LC	LC	Savanna, shrubland, grassland, temperate, nocturnal seed eater	Medium
Aonyx capensis	African Clawless Otter	LC	LC	Permanent streams and rivers, coastline, rocky shores,, frshwater and marine, crustaceans and fish	Zero
Oreotragus oreotragus	Klipspringer	LC	LC	Throughout most biomes, rocky outcrops, hillsides and scree sclopes	Zero

Pelea capreolus	Grey Rhebok, Common Rhebok	LC	LC	Savanna, grassveld and renosterveld, hilly and mountainous terrain, ecotonal	Zero
Syncerus caffer	African Buffalo	LC	LC	Savanna, temperate shrublands, bulk feeder occuring throughout savannas lowveld and Eastern Cape thickets	Zero
Tragelaphus oryx	Common Eland, Eland	LC	LC	Woodlands and woodland mosaics, grassslands and thickets	Zero
Ceratotherium simum	Southern White Rhino	NT	LC	Temperate grasslands, short rass areas in savanna and busgveld, prefers woody cover, water, bulk grazer	Zero
Diceros bicornis	Southern-central Black Rhino	CR	VU	Savanna, bushveld habitats of Limpopo, Mpumalanga and KZN, prefers dense cover and permanent water, browser	Zero

APPENDIX B: BIRD SPECIES OF CONSERVATION CONCERN RECORDED IN QDGC 3422AA, THEIR NATIONAL AND GLOBAL CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

VU = Vulnerable; NT = Near Threatened; LC = Least Concern; En = Endemic

Scientific	English Name	Regional Conservation Status	Global Conservation Status	Habitat requirements	Likelihood of occurring in the study area
Circus maurus	**Black Harrier**	**NT; En**	**VU**	**Dry grassland, Karoo scrub, agricultural fields and high-altitude grasslands; intolerant of burnt areas**	**Confirmed**
Falco biarmicus	**Lanner Falcon**	**NT**	**LC**	**Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs favour habitats where cliffs available as nest and roost sites, but will use alternative sites (eg trees, electricity pylons, buildings) if cliffs absent**	**Confirmed**
Neotis ludwigii	**Ludwig's Bustard**	**VU; En**	**EN**	**Semi-arid dwarf shrublands of succulent Karoo, Nama Karoo and Namib, with rainfall < 500 mm; occ adjacent fynbos biome, arid western edge of grassland biome, and clearings in valley bushveld, also pastures and cultivated fields; typically on flat terrain**	**Confirmed**
Neotis denhami	Denham's Bustard	VU	NT	High-lying, open, sour grassland, often in rocky areas and on plateau grassland; occasionally uses cultivated fields, especially in winter and during droughts; attracted to burnt ground, especially in winter; avoids heavily grazed grassland	High
Alcedo semitorquata	Half-collared Kingfisher	NT	LC	Clear, fast-flowing perennial streams, rivers and estuaries, usually narrow and secluded, with dense marginal vegetation; often near rapids	Low

Botaurus stellaris	Eurasian Bittern	CR	LC	Tall, dense emergent vegetation in interior of seasonal and permanent large wetlands	Low
Bradypterus sylvaticus	Knysna Warbler	VU	VU	Low, dense tangled growth, usually along watercourses, on edge of temperate forest or in thickets of aliens, incl Cherry-pie Lantana camara and brambles (Rubus spp)3. Disappears from wooded areas if canopy becomes too thick, preventing understorey development10.	Low
Campethera notata	Knysna Woodpecker	NT	NT	From thornveld and Euphorbia thickets to coastal, riparian and montane evergreen forests; also marginally in tall Protea communities, coastal White Milkwood Sideroxylon inerme thickets, and alien trees13.	Low
Charadrius pallidus	Chestnut-banded Plover	NT	NT	Natural and man-made saltpans; rare at freshwater habitats	Low
Gorsachius leuconotus	White-backed Night-Heron	VU	LC	Clear and slow-flowing perennial rivers and streams with overhanging vegetation, in woodland and forest. Sometimes along vegetated watercourses in open country. Also lakes, dams and marshes with overhanging vegetation, mangrove swamps and, occasionally, reedbeds	Low
Gyps coprotheres	Cape Vulture	VU; En	VU	Wide habitat range; cliffs	Low
Oxyura maccoa	Maccoa Duck	Rare	DD	Prefers permanent wetlands in open grassland and semi-arid country (incl fynbos, succulent Karoo, Nama Karoo) that support rich concentrations of benthic invertebrates. Breeding habitat usually contains stands of young, emergent vegetation, mainly rushes and sedges48. In KwaZulu-Natal, br recorded only at farm dams15.	Low

Phalacrocorax capensis	Cape Cormorant	NT	NT	Restricted to inshore marine habitats, incl estuaries and coastal lagoons, mainly in cool waters of Benguela upwelling system14,15. Roosts at colonies and other coastal sites protected from predators (eg islands in wetlands), or open areas (broad beaches, saltpans) with good all-round visibility55.	Low
Phoeniconaias minor	Lesser Flamingo	NT	NT	Primarily open, eutrophic, shallow wetlands; breeds on saline lakes and saltpans	Low
Phoenicopterus roseus	Greater Flamingo	NT	LC	Large, shallow, eutrophic wetlands, slat pans, saline lakes, coastal mudflats	Low
Polemaetus bellicosus	Martial Eagle	VU	NT	Open woodland, arid and mesic savanna, forest edges	Low
Rostratula benghalensis	Greater Painted-snipe	NT	LC	Waterside habitats with substantial cover	Low
Sarothrura affinis	Striped Flufftail	VU	LC	Dry upland grassland, incl sites with bracken and brambles, with woody vegetation such as Protea spp, Oldwood Leucosidea sericea and sagewoods (Buddleja spp), or close to forest fringes16. Also in croplands, incl Millet Setaria anceps and Lucerne Medicago sativa16. In e S Africa, favours sour grasslands dominated by Red Grass Themeda triandra, often in association with other grasses incl thatching grasses (Hyparrhenia spp), fescues (Festuca spp), trident grasses (Tristachya spp) and turpentine grasses (Cymbopogon spp)16. In sw W Cape, in fountainbush (Psoralea)/mountain daisy (Osmitopsis) mesic mountain fynbos15. Key structural elements of habitat are dense cover, with open ground below for foraging. In KwaZulu-Natal, in grass 0.35-1.0 m tall, with mean ground cover > 80%16. Often	Low

				alongside streams and marshy habitats in grassland; most br territories (KwaZulu-Natal) incl a drainage line16. Similar preference for damp patches in mesic fynbos7,8, but also found far from water in same habitat1. Generally avoids steep slopes and rocky areas16. In S Africa, from sea level to 2 100 m; in Zimbabwe to 2 500 m16.	
Stephanoaetus coronatus	African Crowned Eagle	NT	NT	Forest, incl gallery forest, dense woodland and forested gorges in savanna and grassland6,36. Also in Eucalyptus16,31,33 and pine (Pinus spp) plantations4.	Low
Tyto capensis	African Grass-Owl	VU	LC	Treeless areas associated with damp substrata, mainly marshes and vleis. Favours patches of tall, rank grass, sedges or weeds. Also areas with dense ground cover in scattered thorn scrub, low fynbos and renosterveld, usually close to water and among thick stands of grass (Stenotaphrum sp) and sedge (Juncus sp)	Low
Anthropoides paradiseus	Blue Crane	VU; En	VU	Open grassland and grassland/Karoo ecotone; wetlands, cultivated pastures and crop lands; tolerant of intensively grazed and burnt grassland	Medium
Certhilauda brevirostris	Agulhas Long-billed Lark	NT	LC	Fallow and recently ploughed fields, sparse shrubland dominated by Renosterbos Dicerothamnus rhinocerotis, and dwarf Karoo shrubland on clay soils in foothills of Breede R valley8. Less common in coastal fynbos, favouring sandy areas dominated by restios6.	Medium
Ciconia nigra	Black Stork	NT	LC	Dams, pans, floodplains, flooded grassland, associated with mountainous areas	Medium

Circus ranivorus	African Marsh-Harrier	VU	LC	Almost exclusively inland and coastal wetlands	Medium
Coracias garrulus	European Roller	LC; NBM	NT	Open, broadleaved and Acacia woodlands with grassy clearings	Medium
Falco naumanni	Lesser Kestrel	VU; NBM	LC	Warm, dry, open or lightly wooded environments; concentrated in grassy Karoo, w fringes of grassland biome and se Kalahari; generally avoids foraging in transformed habitats but occurs in some agricultural areas, incl croplands in fynbos and renosterveld of W Cape	Medium
Sagittarius serpentarius	Secretarybird	VU	VU	Open grassland (< 0.5 m) with scattered trees, shrubland, open Acacia and bushwillow (Combretum spp) savanna; absent from dense woodland and rocky hills	Medium
Vanellus melanopterus	Black-winged Lapwing	NT	LC	Highland plateaux and slopes, fallow fields, meadows, pastures, coastal flats and mown grass areas, incl golf courses	Medium
Falco peregrinus	Peregrine Falcon	NT	LC	Resident birds mostly restricted to mountainous, riparian or coastal habitats, where high cliffs provide br and roosting sites; breeding pairs prefer habitats that favour specialised, high-speed, aerial hunting, e.g. high cliffs overlooking vegetation with raised and/or discontinuous canopy, or expanses of open water	Medium-Low
Diomedea dabbenena	Tristan Albatross	EN	CR	Open ocean	Zero
Diomedea exulans	Wandering Albatross	VU	VU	Open ocean, usually remaining at or seaward of shelf-break. Avoids pack ice where wave action is dampened, preventing dynamic soaring.	Zero
Eudyptes chrysocome	Rockhopper Penguin	NT	VU	Coastal waters and open ocean in sub-Antarctic and around south temperate islands.	Zero

Eudyptes chrysolophus	Macaroni Penguin	NT	VU	Coastal waters and open ocean in Antarctic and sub-Antarctic, vagrants coming ashore to moult.	Zero
Haematopus moquini	African Black Oystercatcher	NT	NT	Rocky, sandy and mixed shores on mainland and islands; less common in estuaries, lagoons and coastal pans15. No inland records.	Zero
Macronectes giganteus	Southern Giant-Petrel	NT	LC	Open ocean; seldom ashore in s Africa42, but often flies close to shore, even over kelp beds34.	Zero
Macronectes halli	Northern Giant-Petrel	NT	LC	Open ocean; seldom ashore in s Africa32,35, but often flies close inshore27.	Zero
Morus capensis	Cape Gannet	VU	VU	Breeds on flat or gently sloping open ground on islands, incl platforms at Ichaboe Is28. Colony usually with runways or elevated rocks which departing birds use to become airborne62. Ranges widely over continental shelf. Occasional birds ashore on mainland probably sick21.	Zero
Numenius arquata	Eurasian Curlew	LC; NBM	NT	Coastal wetlands; forages on intertidal mud- and sandflats and roosts on adjoining salt-marshes, sand-dunes, mangroves or rocks	Zero
Phoebetria fusca	Sooty Albatross	NT	EN	Open ocean, mostly north of Antarctic Polar Front; avoids continental waters17,20.	Zero
Phoebetria palpebrata	Light-mantled Albatross	NT	NT	Open ocean, mostly south of Antarctic Polar Front16.	Zero
Procellaria aequinoctialis	White-chinned Petrel	NT	VU	Oceanic and continental waters, especially at shelf-break, but also inshore18,29.	Zero
Procellaria cinerea	Grey Petrel	NT	NT	Oceanic waters; vagrant to continental shelf.	Zero
Procellaria conspicillata	Spectacled Petrel	EN	VU	Oceanic waters up to continental shelf-break	Zero

Pterodroma incerta	Atlantic Petrel	0	EN	Open ocean, seldom reaching continental shelf edge	Zero
Spheniscus demersus	African Penguin	VU	EN	Inshore marine waters. Breeds and moults ashore at coastal islands and isolated mainland localities. Favours flat sandy islands with sparse or abundant vegetative growth, but also on steep, rocky, sparsely vegetated islands. Mainland colonies in inaccessible caves in Namibia4,69; at some suburban and peri-urban sites around Cape Town and Port Elizabeth.	Zero
Sterna dougallii	Roseate Tern	EN	LC	Entirely coastal and marine. Breeds on well-vegetated, lowlying offshore islands, occasionally in bare, sandy depressions between rocks and stones. Colonies close to shallow-water fishing sites. During non-br season spends much time offshore. Favours low rocky headlands for loafing and roosting, less often on beaches and sandbanks at river mouths23	Zero
Thalassarche carteri	Indian Yellow-nosed Albatross	VU	EN	Open ocean and shelf-break; generally in warmer waters than other albatrosses19. Off W Cape, density at shelf-break ca 10 x density in shelf waters (< 200 m)5. Seldom comes close to shore off south and west coasts where shelf broad, but regular inshore along east coast in winter15.	Zero
Thalassarche cauta	Shy Albatross	VU	NT	Continental shelf waters; scarce in oceanic waters. Typically closer inshore than other albatrosses. Off W Cape, density at shelf-break ca 4-5 x that in shelf waters11.	Zero

Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross	NT	EN	Open ocean and shelf-break; generally in warmer waters than other albatrosses27. Off W Cape, density at shelf-break roughly 10 x that in shelf waters7. Only comes close to shore during strong winds.	Zero
Thalassarche chrysostoma	Grey-headed Albatross	VU	VU	Open ocean; typically avoids continental waters17, but small numbers scavenge at fishing vessels along shelf-break20.	Zero

BIRD SPECIES LISTED ON APPENDIX I AND II OF THE CONVENTION OF MIGRATORY WILD SPECIES (CMS) WHICH HAVE BEEN RECORDED IN QDGC 3422 AA. SPECIES IN BOLD HAVE BEEN RECORDED IN THE STUDY AREA

List of species protected by CMS Appendix I and II - February 2012	
Scientific Name	**Common Name**
Anas capensis	Cape Teal
Anas erythrorhyncha	Red-billed Teal
Anas hottentota	Hottentot Teal
Anas platyrhynchos	Mallard
Ardea purpurea	Purple Heron
Botaurus stellaris	Eurasian Bittern
Charadrius marginatus	White-fronted Plover
Charadrius pallidus	Chestnut-banded Plover
Charadrius pecuarius	Kittlitz's Plover
Charadrius tricollaris	Three-banded Plover
Buteo buteo	Common Buzzard
Calidris alba	Sanderling
Calidris ferruginea	Curlew Sandpiper
Calidris minuta	Little Stint
Diomedea dabbenena	Tristan Albatross
Diomedea exulans	Wandering Albatross
Ciconia ciconia	White Stork
Ciconia nigra	Black Stork
Circus maurus	**Black Harrier**
Coturnix coturnix	Quail
Falco naumanni	Lesser Kestrel
Falco peregrinus	Peregrine Falcon
Falco subbuteo	Eurasian Hobby
Falco biarmicus	**Lanner Falcon**
Hieraaetus pennatus	Booted Eagle
Himantopus himantopus	Black-winged Stilt
Ixobrychus minutus	Little Bittern
Macronectes halli	Northern Giant Petrel
Merops apiaster	European Bee-eater
Limosa lapponica	Bar-tailed Godwit
Macronectes giganteus	Southern Giant Petrel
Pandion haliaetus	Ospreay
Pernis apivorus	European Honey-buzzard
Netta erythrophthalma	Southern Pochard
Philomachus pugnax	Ruff
Phoebetria fusca	Sooty Albatross
Plectropterus gambensis	Spur-winged Goose
Spheniscus demersus	African Penguin
Procellaria cinerea	Grey Petrel

Procellaria conspicillata	Spectacled Petrel
Recurvirostra avosetta	Pied Avocet
Sterna paradisaea	Arctic Tern
Tadorna cana	South African Shelduck
Thalassarche carteri	Indian Yellow-nosed Albatross
Thalassarche cauta	Shy Albatross
Vanellus coronatus	Crowned Lapwing
Vanellus melanopterus	Black-winged Lapwing
Thalassarche melanophris	Black-browed Albatross
Threskiornis aethiopicus	Sacred Ibis
Tringa glareola	Wood Sandpiper
Tringa nebularia	Common Greenshank
Tringa stagnatilis	Marsh Sandpiper

BIRD SPECIES RECORDED IN THE STUDY AREA. SPECIES IN RED AND BOLD ARE OF CONSERVATION CONCERN

Scientific	English Name
Alopochen aegyptiaca	Egyptian Goose
Anas sparsa	African Black Duck
Andropadus importunus	Sombre Greenbul
Apus barbatus	African Black Swift
Batis capensis	Cape Batis
Bostrychia hagedash	Hadeda Ibis
Burhinus capensis	Spotted Thick-knee
Buteo rufofuscus	Jackal Buzzard
Caprimulgus pectoralis	Fiery-necked Nightjar
Cecropis cucullata	Greater Striped Swallow
Centropus burchellii	Burchell's Coucal
Cercomela schlegelii	Karoo Chat
Cinnyris chalybeus	Southern Double-collared Sunbird
Circus maurus	**Black Harrier**
Cisticola subruficapilla	Grey-backed Cisticola
Cisticola textrix	Cloud Cisticola
Colius striatus	Speckled Mousebird
Corvus albicollis	White-necked Raven
Cossypha caffra	Cape Robin-Chat
Crithagra flaviventris	Yellow Canary
Crithagra sulphurata	Brimstone Canary
Delichon urbicum	Common House-Martin
Dicrurus adsimilis	Fork-tailed Drongo
Elanus caeruleus	Black-shouldered Kite
Emberiza capensis	Cape Bunting
Erythropygia coryphaeus	Karoo Scrub-Robin
Estrilda astrild	Common Waxbill
Euplectes capensis	Yellow Bishop
Falco biarmicus	**Lanner Falcon**
Falco naumanni	Lesser Kestrel
Laniarius ferrugineus	Southern Boubou
Lanius collaris	Common Fiscal
Macronyx capensis	Cape Longclaw
Mirafra apiata	Cape Clapper Lark
Motacilla capensis	Cape Wagtail
Nectarinia famosa	Malachite Sunbird
Neotis ludwigii	**Ludwig's Bustard**
Numida meleagris	Helmeted Guineafowl
Onychognathus morio	Red-winged Starling
Passer diffusus	Southern Grey-headed Sparrow

Passer melanurus	Cape Sparrow
Plectropterus gambensis	Spur-winged Goose
Ploceus capensis	Cape Weaver
Prinia maculosa	Karoo Prinia
Promerops cafer	Cape Sugarbird
Pternistis capensis	Cape Spurfowl
Pycnonotus capensis	Cape Bulbul
Saxicola torquatus	African Stonechat
Scleroptila africana	Grey-winged Francolin
Sigelus silens	Fiscal Flycatcher
Spilopelia senegalensis	Laughing Dove
Streptopelia capicola	Cape Turtle-Dove
Struthio camelus	Common Ostrich
Sturnus vulgaris	Common Starling
Telophorus zeylonus	Bokmakierie
Threskiornis aethiopicus	African Sacred Ibis
Upupa africana	African Hoopoe
Urocolius indicus	Red-faced Mousebird
Zosterops capensis	Cape White-eye

APPENDIX E: REPTILE SPECIES RECORDED IN QDGC 3422AA AS WELL AS THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; En = Endemic;
Most species haven't had their conservation status evaluated and are indicated as a 0.

Scientific Name	Common Name	Conservation Status RSA	Conservation Status Global	Habitat requirements	Likelihood of occurring in study area
Bradypodium karrooicum	**Karoo Dwarf Chameleon**	**0**	**0**	**Occurs in the Southern and Eastern Karoo in sparse thorn bushes along river courses, able to adapt to urban gardens**	**Confirmed**
Homoroselaps lacteus	Spotted Harlequin Snake	LC	LC; En	Fynbos, costal forest, moist savanna and grassland	High
Boaedon capensis	Brown House Snake	0	0	Wide range of habitats and tolerant to human activities	High
Crotaphopeltis hotamboeia	Red-lipped Snake	0	0	Savanna and open woodland	High
Lycodonomorphus inornatus	Olive House Snake	0	0	Limited to temperate parts of the subregion and occur in moist savanna, lowland forest, grassland and fynbos	High
Lycophidion capense	Cape Wolf Snake	LC	NE	Variety of habitats including lowland forest, fynbos, moist savanna, grassland and karoo scrub	High
Prosymna sundevallii	Sundevall's Shovel-snout	0	0	Widely distributed over much of southern Africa	High
Psammophis notostictus	Karoo Sand Snake	0	0	Arid scrubland and karroid regions in the Cape and southern Free State	High
Psammophylax rhombeatus	Spotted Grass Snake	0	0	Highveld grassland, mesic thicket, fynbos, karroid areas	High
Chamaesaura anguina	Cape Grass Lizard	0	0	Grassy or fynbos covered gentle slopes in Cape, KwaZulu-Natal and Mpumalanga	High
Afrogecko porphyreus	Marbled Leaf-toed Gecko	0	0	Coastal and montane fynbos also entering cold evergreen forest and urban areas	High
Hemidactylus mabouia	Common Tropical House Gecko	0	0	Varied habitat including wet and dry savannas	High

Pachydactylus geitje	Ocellated Gecko	0	0	Varied, coastal strandveld, fynbos and rocky grassland associated with inland escarpment	High
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	0	0	Varied, montane and highveld grassland, savanna, bushveld and coastal forest	High
Pedioplanis lineoocellata	Common Sand Lizard	0	0	Very varied, karroid veld, mesic thicket and arid savanna	High
Trachylepis capensis	Cape Skink	0	0	Habitat generalist	High
Trachylepis homalocephala	Red-sided Skink	0	0	Varied, usually in moist condictions. Coastal bushy fynbos and riverine vegetation	High
Chersina angulata	Angulate Tortoise	0	0	Varied, sandy coastal regions, including mesic thicket and coastal fynbos	High
Homopus areolatus	Parrot-beaked Tortoise	0	0	Varied, coastal fynbos, karroid broken veld and open mesic thicket	High
Stigmochelys pardalis	Leopard Tortoise	0	0	Wide range of habitats throughout SA	High
Bitis arietans	Puff Adder	0	0	Absent only from desert, dense forest and mountain tops	High
Lycodonomorphus rufulus	Brown Water Snake	0	0	Small streams, pans and vleis	Low
Philothamnus natalensis	Western Natal Green Snake	0	0	Varied, wet montane and dry forest, miombo woodland	Low
Cordylus cordylus	Cape Girdled Lizard	0	0	Diverse habitat including coastal claffs, rock plateaus in fynbos, montane grassland and shale bands in mesic thicket	Low
Psammophis crucifer	Cross-marked Grass Snake	0	0	Highveld and montane grassland, entering fynbos	Medium
Naja nivea	Cape Cobra	0	0	Arid karroid regions, particularly along river courses, entering well-drained open areas along the southern coast	Medium
Acontias meleagris	Cape Legless Skink	0	0	Coastal and fynbos vegetation	Medium
Scelotes bipes	Silvery Dwarf Burrowing Skink	0	0	Coastal strandveld	Medium

Dispholidus typus	Boomslang	0	0	Widely distributed throughout much of southern Africa excluding the central Highveld and drier western half of South Africa	Medium.
Agama atra	Southern Rock Agama	0	0	Lives in colonies on rocky outcrops throughout SA except in sandy areas in the Northern Cape, some parts of Gauteng, Mpumalanga and KwaZulu-Natal	Medium-Low
Chelonia mydas	Green Turtle	0	0	Shallow waters with abundant vegetation	Zero

APPENDIX E: AMPHIBIAN SPECIES RECORDED IN QDGC 3422AA AS WELL AS THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Common Name	RSA	IUCN	Habitat requirements	Likelihood of occurring in study area
Cacosternum boettgeri	**Common Caco**	**LC**	**LC**	**Variety of habitats in Nama Karoo, succulent Karoo, grassland and thicket favouring open areas and especially abundant in grassland areas; occasionally forest clearings**	**Confirmed**
Vandijkophrynus angusticeps	Sand Toad	LC; En	LC	Temporary rain-filled depressions in sandy soils in the Western Cape	High
Hyperolius marmoratus	Painted Reed Frog	LC	LC	Reeds and other vegetation types around edges of a wide variety of waterbodies in savanna, grassland and forest; occasionally in fynbos	Low
Amietia fuscigula	Cape River Frog	LC	LC	Widespread around permanent rivers and streams in grassland, fynbos and Karoo scrub including farm dams and other artificial water bodies	Low
Strongylopus fasciatus	Striped Stream Frog	LC	LC	Open, grassy areas near dams, ponds or streams in forest, thicket, grassland and savanna, sometimes parks and gardens	Low
Strongylopus grayii	Clicking Stream Frog	LC	LC	Winter and summer rainfall areas in fynbos, succulent Karoo, Nama Karoo, savanna, grassland, thicket and forest from sea level to 3000m	Low
Amietophrynus rangeri	Raucous Toad	LC	LC	Rivers and streams in grassland and fynbos; frequently in gardens and farmland	Medium
Cacosternum nanum	Bronze Caco	LC	LC	Areas with relatively high rainfall in a variety of vegetation types including fynbos, savanna, grassland, thicket and forest; breeds in small ponds, dams, vleis, streams, roadside pools or flooded grassland	Medium
Tomopterna delalandii	Cape Sand Frog	LC; En	LC	Lowlands and valleys in fynbos and succulent Karoo in the Western Cape and along southern Cape coast	Medium

Xenopus laevis	Common Platanna	LC	LC	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland	Zero

APPENDIX G: THREATENED BUTTERFLY SPECIES IN THE WESTERN CAPE, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Conservation Status	Habitat requirements	Likelihood of occurring in the study area
Aloeides pallida littoralis	DD	Occurs in the coastal region from Somerset West where it is found on relatively flat terrain close to the coast within Groot Brak Dune Strandveld.	High
Aloeides trimeni southeyae	EN	Restricted to the southern coastal region between Albertinia in the west and Hartenbos in the east where it occurs on gentle, north-facing slopes which are sparsely covered by low shrubs with bare ground between.	High
Aloeides thyra orientis	EN	Occurs from Witsand to Mosselbay and Knysna where it prefers coastal Fynbos on flat sandy ground within various vegetation types.	High
Lepidochrysops littoralis	NT	De Mond nature reserve near Bredasdorp to Mossel Bays where it occurs on rocky limestone ridges or sand dunes in coastal Fynbos, usually close to seashore.	Medium
Stygionympha dicksoni	CR (possibly extinct)	Low hills south of Darling near Malmesbury where it occurs in Rhenosterveld-type fynbos. Larval host plant is *Tribolium echinatum*	Low
Aloeides carolynnae aurata	NT	From De Hoop Nature Reserve to Witsand. Occurs in flat, sandy terrain in subcoastal Fynbos within the De Hoop Limestone Fynbos vegetation type.	Low
Aloeides carolynnae carolynnae	EN	Montane Fynbos on the southwestern side of the Badsberg where it occurs in the Hawequas Sandstone Fynbos vegetation type. Host plant is *Aspalathus* species	Low
Aloeides lutescens	EN	Occurs in open karroid scrub vegetations around Wets Berg and Brand Vlei within the Breede Sand Fynbos vegetation type	Low
Chrysoritis dicksoni	CR	Occur north of Witsand on the south coast where it prefers arid lowland with low shrubs and sparse vegetation. Larval host plants include *Aphytophagous* and associated ants are *Crematogaster peringueyi*	Low
Chrysoritis thysbe mithras	DD	Occurs between Riversdale, Vermaaklikheid and Stil Bay to Brento-on-Sea within Canca Limetone Fynbos and Knysna Sand Fynbos	Low

Chrysoritis thysbe schloszae	CR	Restricted to the southern slopes of the small mountain called Swartberg near Moorreesburg. Prefers scrubby, low vegetation within the Swarland Shale Renosterveld vegetation type	Low
Chrysoritis rileyi	CR	Near Worcester where it is restricted to the Breede Sand Fynbos vegetation type	Low
Orachrysops niobe	CR	Confined to the Brenton Peninsula at Knysna where it occurs on cool moist south-facing slopes within the Knysna Sand Fynbos vegetation type	Low
Thestor brachycerus brachycerus	CR	From the eastern Knysna Head to Sparrebosch gold estate where it occur on north facing slopes covered with Knysna Sand Fynbos within the South Outeniqua Sandstone Fynbos and Knysna Sand Fynbos vegetation types	Low
Thestor dicksoni malagas	VU	Endemic to the Langebaan area where it occurs and sandy ground next to the sea within the Langebaan Dune Strandveld vegetation type	Low
Trimenia malagrida paarlensis	CR	Confined to the Paarls and Paardeberg mountains within the Boland Granite Fynbos vegetation type	Low
Trimenia wallengrenii gonnemoi	VU	Upper slopes of the Piketberg Mountain where it occurs on flat or sloping summits of the mountains inn small open areas between rocky, montane Fynbos vegetation	Low
Trimenia wallengrenii wallengrenii	CR	Between Darling and Mamre where it is found near the summits and on the western slopes of hills with Renosterveld vegetation within the Swartland Granite Renosterveld vegetation type	Low
Kedestes barberae bunta	CR	Restricted to the Cape Flats between Retreat and Strandfontein where it occurs in stands of *Imperata cylindrical* growing in damp seeps between the dunes.	Low
Kedestes lenis lenis	EN	Occurs from Strandfontein to Retreat within the Flats Dune Strandveld and Breede Shale Fynbos.	Low
Lepidochrysops methymna dicksoni	EX	Historically occurred in the Tygerberg Hills near Cape Town within the Swartland Shale Renosterveld and Swartland Silcrete Renosterveld vegetation types. Taxon has not been recorded for over 47 years	Zero
Trimenia malagrida malagrida	CR (Possibly extinct)	Western slopes of Table Mountain where it occurs on rocky slopes at an altitude of 250m to 300m in open vegetation	Zero