

**BLANCO 400/132KV SUBSTATION & LOOP IN – LOOP OUT LINES
Ecological Assessment**

SEF Reference No. 504769

**Prepared for:
Eskom Holdings SOC Limited**

Megawatt Park
Maxwell Drive
Sandton
P.O. Box 1091
Johannesburg
2001



Prepared by:

Strategic Environmental Focus (Pty) Ltd

P.O. Box 74785
Lynnwood Ridge
0040
Tel. No.: (012) 349-1307
Fax. No.: (012) 349-1229
E-mail: sef@sefsa.co.za



S T R A T E G I C E N V I R O N M E N T A L F O C U S

November 2014

COPYRIGHT WARNING

Copyright in all text and other matter, including the manner of presentation, is the exclusive property of the author. It is a criminal offence to reproduce and/or use, without written consent, any matter, technical procedure and/or technique contained in this document. Criminal and civil proceedings will be taken as a matter of strict routine against any person and/or institution infringing the copyright of the author and/or proprietors.

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.



Karin van der Walt *Cert. Sci. Nat.*
Terrestrial Ecologist
SACNASP Reg. No. 300028/12

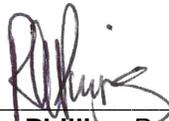
10 November 2014

Date

Declaration of Independence

I, **Robyn Phillips**, 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 ability;
- 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.



Robyn Phillips *Pr. Sci. Nat.*
Faunal Specialist
SACNASP Reg. No. 400401/12

10 November 2014

Date

EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd, as independent environmental practitioners and ecological specialists, was appointed by Eskom Holdings SOC Limited to undertake ecological studies (flora and fauna) for the proposed establishment of a new 400/132kV MTS, with an expected development footprint of approximately 425m², and loop in – loop out line with a length estimated at 2.2 km. Six alternative sites were investigated for the proposed new substation, along with the associated alternative loop in – loop out powerlines. The ecological assessment covered a 200m corridor surrounding each line alternative.

The study area is located within Eden District Municipality in the Western Cape, approximately 5 km due west of the town of Blanco and falls under the jurisdiction of the George Local Municipality. The study area occurs within the Fynbos biome and more specifically within the Garden Route Granite Fynbos and Garden Route Shale Fynbos vegetation types. The Garden Route Granite Fynbos ecosystem is currently listed as Endangered while the Garden Route Shale Fynbos ecosystem is listed as Vulnerable in terms of Section 52 of NEMBA (Government Gazette, 2009). However, the study area was largely transformed and supported very limited to no indigenous vegetation.

As the study area was predominantly transformed through agriculture and supported limited indigenous plant species, no natural vegetation communities could be described and subsequently no areas of high ecological sensitivity were identified. Areas that were found to support faunal communities, such as farm dams, the Koesterbos River and associated riparian habitat, a portion of secondary shrubland and stands of exotic trees, were classified as medium and medium-low sensitivity. The Koesterbos River and associated riparian vegetation represents an important corridor for movement through the landscape and is situated in the centre of the study area.

Certain bird species susceptible to the impacts of powerlines usually congregate around waterbodies such as farm dams and will move between such features in search of food, water and shelter. It is advised that the powerline routes avoid traversing such features and bisecting major corridors for movement between such features. Construction activities and powerline routes also avoid the Koesterbos River. **Substation alternatives 3 and 4** and associated powerlines will offer the least impact from a **floral** perspective as they traverse only transformed areas, while **alternatives 3 and 5** will offer the least impact from an **avifaunal** perspective as the powerline route is either short (alternative 3) and/or follows existing powerlines (alternatives 3 and 5).

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	vi
LIST OF PHOTOGRAPHS	vi
LIST OF TABLES	vii
1 INTRODUCTION	1
1.1 Terms of Reference	1
1.2 Methodology	1
1.3 Limitations.....	2
2 BACKGROUND	2
2.1 Location	2
2.2 Climate.....	2
2.3 Regional Vegetation.....	2
2.4 Listed Ecosystems and Centres of Endemism	3
2.5 Critical Biodiversity Areas.....	6
3 RESULTS: FLORA	9
3.1 Overview.....	9
3.1.1 Alternative 1 and Associated Powerline	9
3.1.2 Alternative 2 and Associated Powerline	10
3.1.3 Alternative 3 and Associated Powerline	11
3.1.4 Alternative 4 and Associated Powerline	11
3.1.5 Alternative 5 and Associated Powerline	12
3.1.6 Alternative 6 and Associated Powerline	13
3.2 Plants of Conservation Concern.....	14
3.3 Provincially Protected Plants	14
3.4 Alien and Invasive Plants	14
3.5 Medicinal Plants.....	17
4 RESULTS: FAUNA	17
4.1 Faunal Habitats.....	17
4.2 Faunal Species Occurrence	19
4.2.1 Avifauna.....	19
4.2.2 Mammals	19
4.2.3 Herpetofauna	20
4.2.4 Lepidoptera.....	21
5 ECOLOGICAL SENSITIVITY	21
5.1 Areas of High Sensitivity	22
5.2 Areas of Medium Sensitivity	22
5.3 Areas of Medium-low Sensitivity.....	22
5.4 Areas of Low Sensitivity	22
6 IMPACT ASSESSMENT AND MITIGATION	24
6.1 Assessment Criteria	24
6.2 Impact Assessment.....	25
6.2.1 Construction Phase.....	25
6.2.2 Operational Phase	27

7 CONCLUSION	31
REFERENCES.....	32
GLOSSARY	35
APPENDICES.....	38

LIST OF FIGURES

Figure 1: Location of the study site.....	4
Figure 2: Regional vegetation within the study area	7
Figure 3: Critical Biodiversity Areas in relation to the study area	8
Figure 4: Ecological sensitivity	23

LIST OF PHOTOGRAPHS

Photograph 1: Cultivated fields with no natural vegetation remaining on alternative substation site 1	9
Photograph 2: Two drainage lines crossed by powerline alternative 1, disturbed and dominated by alien species	9
Photograph 3: Alternative substation site 2 is transformed by cultivated fields of potato (left) and pasture fields (right).....	10
Photograph 4: Large drainage line associated with powerline alternative 2. Although dominated by exotic species such as <i>Solanum mauritianum</i> (Bugweed) and <i>Lantana camara</i> (Wild Lantana) (left), it supported indigenous species such as <i>Prionium serratum</i> (Palmiet) (right)	10
Photograph 5: The two disturbed drainage lines dominated by alien species which powerline alternative 2 crosses	11
Photograph 6: Alternative substation site 3 situated in a maize field (left) with secondary vegetation covering the south-western corner (right)	11
Photograph 7: Pasture fields associated with the proposed alternative substation site 4 (left) with a disturbed drainage line to the west (right)	12
Photograph 8: Alternative substation site 6 with pasture fields and no natural vegetation remaining (left) and the existing powerline servitude through an area dominated by alien vegetation (right).....	12
Photograph 9: Alternative substation site 6 with old commercial plantations and secondary fields dominated by pioneer species	13
Photograph 10: <i>Populus x canescens</i> (Grey Poplar) (left) and <i>Acacia mearnsii</i> (Black Wattle) (right) forming dense infestations along drainage lines	16
Photograph 11: Secondary grassy shrubland recovering from previously cultivated fields with stands of exotic trees in the background.....	18
Photograph 12: Farm dams (left) and dense riparian vegetation of the Koesterbos River (right) in the study area	18

LIST OF TABLES

Table 1: Criteria used to identify threatened terrestrial ecosystems.....	5
Table 2: Summary of plant species recorded on the six alternative sites and associated powerlines	13
Table 3: Alien species recorded in the study area, the species in red should be prioritised for control.....	16
Table 4: Possible impacts arising during the construction phase.....	25
Table 5: Possible impacts arising during the operational phase.....	25

1 INTRODUCTION

Strategic Environmental Focus (Pty) Ltd, as independent environmental practitioners and ecological specialists, was appointed by Eskom Holdings SOC Limited to undertake ecological studies (flora and fauna) for the proposed establishment of a new 400/132kV Main Transmission Substation, with an expected development footprint of approximately 425m², and loop in – loop out line with a length estimated at 2.2km, near the town of Blanco in the Western Cape. Six alternative sites are being considered for the proposed substation, along with the associated alternative loop in – loop out powerlines. The ecological assessment covered a 200m corridor surrounding each line alternative, 100m on either side of the centre line, which will make provision for any 'shifting' of pole positions at the final stages of the project.

1.1 Terms of Reference

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

- Provide a description of the dominant floral and faunal species occurring in the study area, including floral composition and structure;
- Describe the threatened, endemic, rare or protected plant and animal species, and/or potential habitats in the area under investigation;
- Map the sensitivities of ecological habitat associated with the study area;
- List the floral and faunal species identified during the field survey as well as species expected to inhabit the study site;
- List the threatened, endemic, rare or protected plant and animal species that could occur on the site, GPS those confirmed to occur and indicate the confirmed localities on a map; and
- Provide an impact assessment and recommend mitigation measures for species of conservation concern that may be affected by the proposed project.

1.2 Methodology

The field surveys were undertaken from the 11th to the 15th of March 2013. The methodology entailed the following:

- Review of relevant literature, which included the vegetation unit(s) expected to occur on the site, the conservation status of the vegetation unit(s) and the distribution data of fauna within the study area;
- Review of available information layers within the Geographical Information System (GIS); and
- Field surveys to confirm the presence or absence of threatened, endemic, rare or protected faunal and floral species on the study site and to identify suitable habitat for these species.

Further details regarding the methodology employed during the surveys are provided in Appendix A.

1.3 Limitations

In order to obtain a comprehensive understanding of the dynamics of the biota on the 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, and information contained within the report is based on a single field survey.

2 BACKGROUND

2.1 Location

The study area is located within Eden District Municipality in the Western Cape, approximately 5 km due west of the town of Blanco and falls under the jurisdiction of the George Local Municipality. The study area lies within Quarter Degree Grid Cell (QDGC) 3322CD between 33°55'13" – 33°57'54" south and 22°19'16" – 22°22'33" east (Figure 1).

2.2 Climate

The region receives approximately 670mm of rain per year, with rainfall occurring evenly throughout the year. The region receives the lowest rainfall in June and the highest in March. The average midday temperature ranges from 18°C in July to 27.8°C for January-February. The region is the coldest in July when the temperature drops to 6.2°C on average during the night. Frost incidence is two to three days per year (Mucina and Rutherford, 2006).

2.3 Regional Vegetation

The study site is located within the Fynbos biome which occupies most of the Cape Fold Belt as well as the adjacent lowlands between the mountains and the Atlantic Ocean. There are three major vegetation complexes within the Fynbos biome namely Fynbos, Renosterveld and Strandveld. Directly translated Fynbos means "fine bush" and comprises an evergreen, fire-prone shrubland characterised by restioid bushes and ericoid shrubs (including families such as Ericaceae, Asteraceae, Rhamnaceae, Thymelaeaceae and Rutaceae) (Mucina and Rutherford, 2006). In structural terms, Fynbos is defined as a shrubland or restioland with a cover of more than 5% Restionaceae which usually contains elements of Ericaceae and Proteaceae. The Fynbos biome is divided into smaller units known as vegetation types. According to Mucina and Rutherford (2006), the study area is situated within the Garden Route Granite Fynbos and Garden Route Shale Fynbos (Figure 2).

The Garden Route Granite Fynbos is limited to the Western Cape Province where it consists of moderately undulating plains and undulating hills on the coastal forelands. Important taxa in the Garden Route Granite Fynbos include tall shrubs such as *Passerina corymbosa*, *Cliffortia serpyllifolia*, *Protea coronata*, *P. lanceolata*, *P. neriifolia* as well as low shrubs such as *Erica discolour*, *E. peltata*, *Phyllica confusa*, *Syncarpha paniculata*, *Agathosma ovata*, and *Hermannia angularis*. Succulent shrubs include *Lampranthus sociorum* and graminoids such as *Tetraria cuspidata*,

Brachiaria serrata, *Eragrostis capensis*, *Ficinia nigrescens*, *Heteropogon contortus*, *Pentaschistis eriostoma*, *Restio triticeus* and *Themeda triandra*. According to Mucina and Rutherford (2006), this vegetation type is classified as Endangered, with less than 1% conserved in the proposed Garden Route National Park while more than 70% has been transformed by cultivation, pine plantations and urban development.

The Garden Route Shale Fynbos occurs in the Western and Eastern Cape Provinces and includes undulating hills and moderately undulating plains on the coastal forelands. In the wetter areas this vegetation type includes tall, dense proteoid and ericaceous Fynbos while the drier areas are dominated by graminoid Fynbos (Mucina and Rutherford, 2006). Important taxa in the Garden Route Shale Fynbos include *Leucadendron eucalyptifolium*, *Protea aurea* subsp. *aurea*, *P. coronata*, *Leucospermum formosum*, *Metalasia densa* and *Passerina corymbosa* while the low shrubs include species such as *Acmadenia alternifolia*, *A. tetragona*, *Anthospermum aethiopicum*, *Cliffortia ruscifolia*, *Leucadendron salignum*, *Pelargonium cordifolium* and *Eriospermum vermiforme*. Graminoid species include *Ischyrolepis sieberi*, *Aristida junciformis*, *Brachiaria serrata*, *Cymbopogon marginatus*, *Elegia juncea*, *Eragrostis capensis*, *Restio triticeus*, *Themeda triandra* and *Tristachya leucothrix*.

According to Mucina and Rutherford (2006), Garden Route Shale Fynbos is classified as Least Threatened with only about 1% transformed and infestations of alien species generally being low.

2.4 Listed Ecosystems and Centres of Endemism

The National Environmental Management: Biodiversity Act (NEMBA, 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 (Pr) (DEA, 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 identified in NEMBA were delineated using the following:

- The South African Vegetation Map (Mucina and Rutherford, 2006);
- National forest types (Von Maltitz *et al.*, 2003);
- Priority areas identified in a provincial systematic biodiversity plan (in this case the KwaZulu-Natal Terrestrial Conservation Plan (C-Plan) V4 (2007); or
- High irreplaceability forest patches and clusters identified by the Department of Agriculture, Forestry and Fisheries (DAFF; Berliner, 2005).

The criteria used to identify threatened terrestrial ecosystems listed in NEMBA 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 summarised in Table 1.

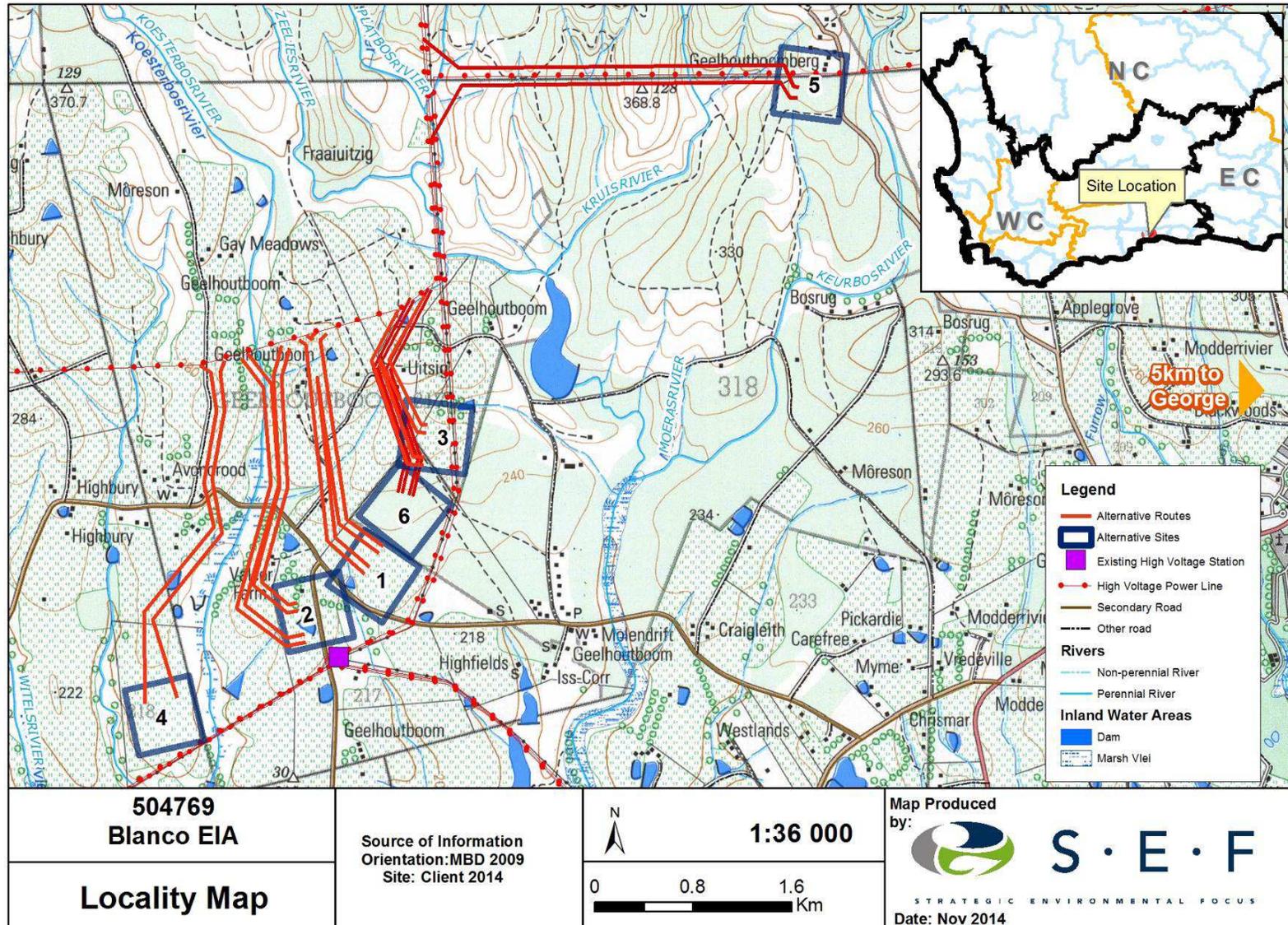


Figure 1: Location of the study site

Table 1: Criteria used to identify threatened terrestrial ecosystems

Criterion	Critically Endangered	Endangered	Vulnerable
A1: Irreversible loss of natural habitat	Remaining natural habitat \leq biodiversity target	Remaining natural habitat \leq biodiversity target + 15%	Remaining natural habitat \leq 60% of original area
A2: Ecosystem degradation and loss of integrity	\geq 60% of ecosystem significantly degraded	\geq 40% of ecosystem significantly degraded	\geq 20% of ecosystem significantly degraded
C: Limited extent and imminent threat	-	Ecosystem extent \leq 3000ha and imminent threat	Ecosystem extent \leq 6000ha and imminent threat
D1: Threatened plant species associations	\geq 80 threatened Red List plant species	\geq 60 threatened Red List plant species	\geq 40 threatened Red List plant species
Priority areas for meeting explicit 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 implications for development in listed ecosystems. Development in listed ecosystems requires the following:

- Planning: linked to the requirement in NEMBA for listed ecosystems to be taken into account in municipal Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs);
- Environmental Authorisation (EA): in terms of the Environmental Impact Assessment (EIA) Regulations (2010) promulgated under the National Environmental Management Act (NEMA; Act 107 of 1998) as amended;
- Proactive management: in terms of NEMBA; and
- Monitoring and reporting: in terms of NEMBA.

The EIA Regulations include three lists of activities that require EA:

- 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); and
- 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 or more of vegetation, which will trigger a basic assessment within any Critically Endangered or Endangered ecosystem listed in terms of Section 52 of NEMBA. 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 when remaining natural habitat within each ecosystem is threatened. A basic

assessment report is not required where natural habitat has already been irreversibly lost in listed ecosystems.

The Garden Route Granite Fynbos ecosystem occurs within the study area is currently listed as Endangered while the Garden Route Shale Fynbos is listed as Vulnerable in terms of Section 52 of NEMBA (Government Gazette, 2009). However, the study area was largely transformed and supported very limited to no indigenous vegetation.

2.5 Critical Biodiversity Areas

The Critical Biodiversity Areas (CBA's) is a map that was developed with the aim to guide sustainable development by providing a summary of biodiversity information to decision makers (SANBI Biodiversity GIS, 2007). The CBA map highlights areas that should be safeguarded in their natural state if biodiversity is to persist and ecosystems are to continue functioning. Terrestrial areas in this category are referred to as CBA's and include the following:

- Areas that are needed to meet national biodiversity thresholds;
- Areas which are required to ensure the continued existence and functioning of species and ecosystems which includes the delivery of ecosystems services; and
- Important locations for biodiversity features or rare species.

Ecological Support Areas (ESA's) are supporting zones which are required to prevent the degradation of CBA's and Protected Areas and usually connect and sustain CBA's or other terrestrial features such as riparian habitat surrounding and supporting aquatic biodiversity areas.

Natural areas which are not classified as a CBA or ESA are areas consisting of natural vegetation which are not presently required to meet targets but these areas are still subjected to appropriate rural development controls and authorisations. It is however possible that unidentified threatened species or small wetlands can be present in these areas and since a certain amount of loss of CBA or ESA is inevitable, in future some of these natural areas may be required to meet biodiversity targets.

Areas referred to in the CBA map as "No Natural Areas Remaining" consists of once natural vegetation which has been irreversibly transformed through development and no longer contributes to the biodiversity of the area. However, some of the areas referred to as "No Natural Areas Remaining" are still classified as ESA's or even CBA's since these areas can still play an important role in supporting ecological processes (especially in the case of riparian areas, catchment areas and key pieces of corridors).

According to the CBA map (Figure 3), there are several areas regarded as Critical Biodiversity Areas and Ecological Support Areas associated with the Koesterbos River which traverses the study area from north to south.

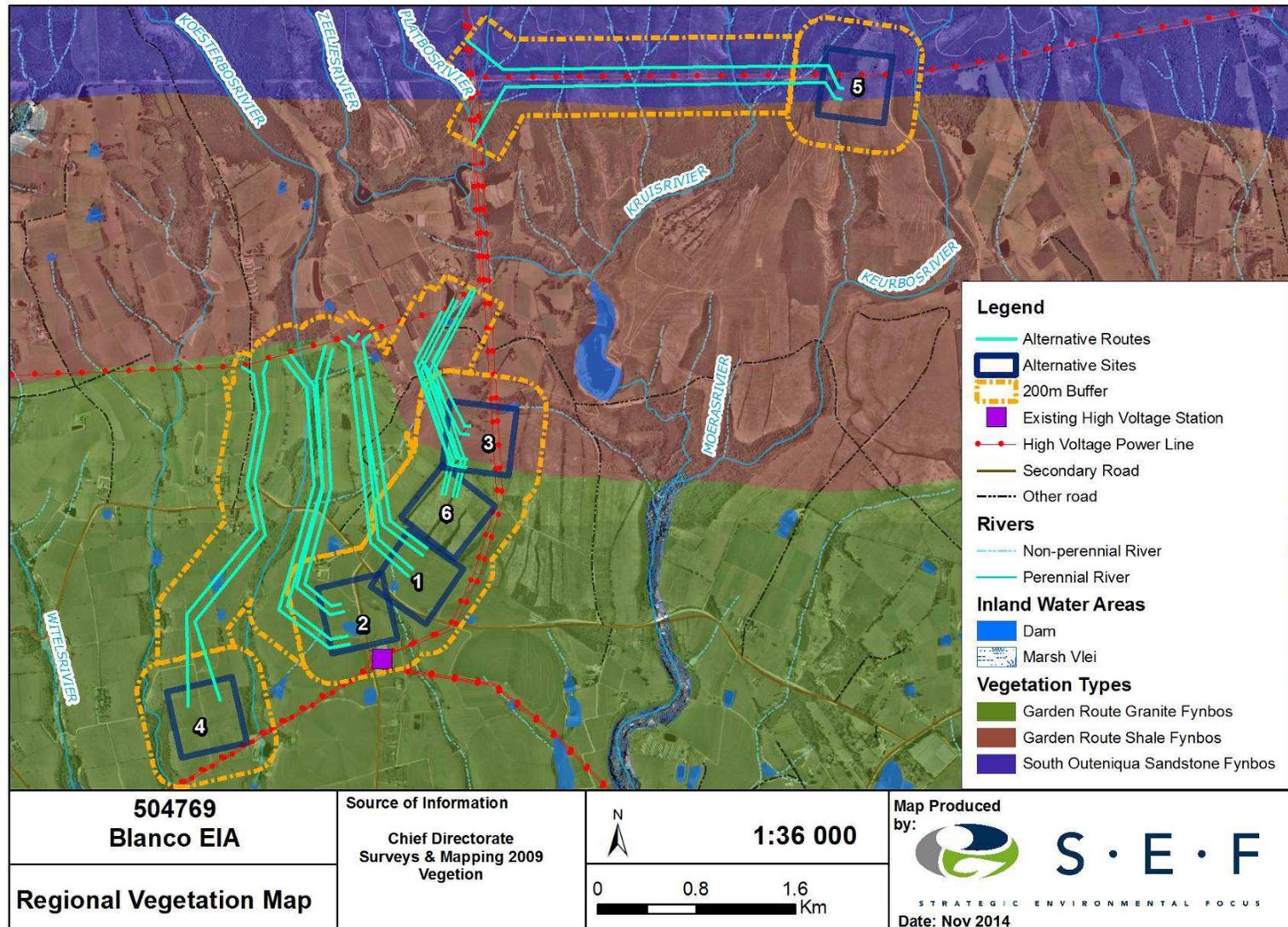


Figure 2: Regional vegetation within the study area

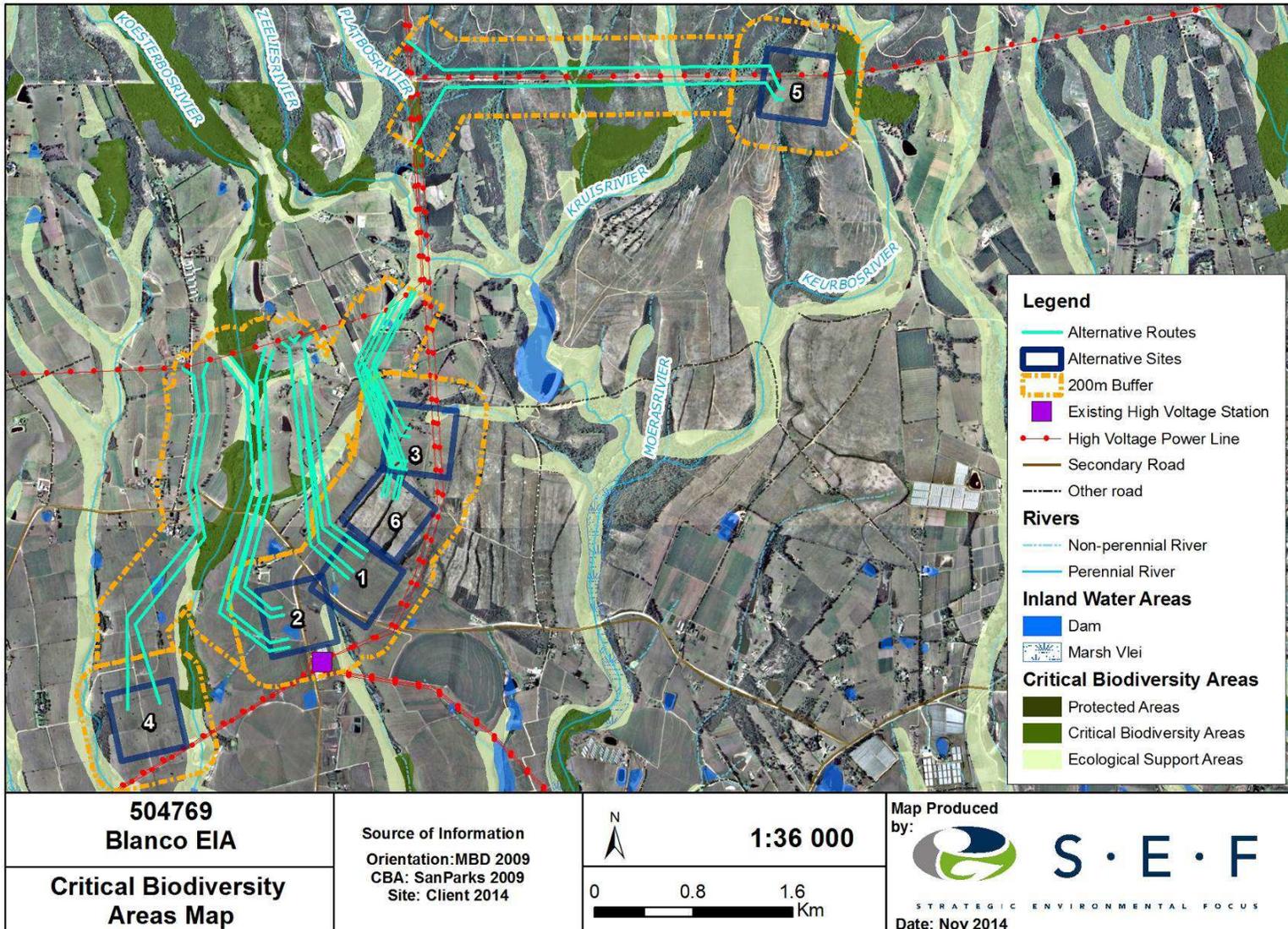


Figure 3: Critical Biodiversity Areas in relation to the study area

3 RESULTS: FLORA

3.1 Overview

The study area included six possible alternatives for the proposed substation and associated powerline. The affected areas were mostly transformed by agriculture and supported limited indigenous plant species and subsequently no natural vegetation communities could be described. The six alternative substation sites with their associated powerlines are described below and illustrated in Figure 4 (see Section 5 Ecological Sensitivity) while Table 2 below summarises the species recorded. (See Appendix B for complete plant species list.)

3.1.1 Alternative 1 and Associated Powerline

Alternative substation site 1 consisted entirely of pasture fields planted with *Pennisetum clandestinum* (Kikuyu Grass) and no remaining natural vegetation (Photograph 1). The proposed powerline route exits alternative 1 on the north-western boundary, turns and heads in a northerly direction crossing two drainage lines. The first drainage line was disturbed and dominated by weedy indigenous species such as *Pteridium aquilinum* (Bracken Fern) as well as exotic species such as *Solanum mauritianum* (Bugweed) and *Rubus fruticosus* (European Blackberry). The second drainage line was entirely dominated by alien species such as *Acacia mearnsii* (Black Wattle), *Solanum mauritianum* (Bugweed) and *Eucalyptus* spp. (Photograph 2).



Photograph 1: Cultivated fields with no natural vegetation remaining on alternative substation site 1



Photograph 2: Two drainage lines crossed by powerline alternative 1, disturbed and dominated by alien species

3.1.2 Alternative 2 and Associated Powerline

Alternative substation site 2 is located adjacent and to the west of alternative 1 and immediately north of the existing substation, and contained no natural vegetation. The entire area was transformed by agriculture which included *Solanum tuberosum* (Potato) fields and pasture planted with *Pennisetum clandestinum* (Kikuyu Grass) (Photograph 3).



Photograph 3: Alternative substation site 2 is transformed by cultivated fields of potato (left) and pasture fields (right)

The proposed powerline route exits alternative 2 on the western boundary and heads in a northerly direction where it traverses cultivated fields and then runs parallel with and finally over the Koesterbos River. This riparian area supported indigenous species such as *Pronium serratum* (Palmiet), *Pycnus polystachyos* and *Fimbristylis* sp., as well as numerous exotic species such as *Lantana camara* (Wild Lantana), *Solanum mauritianum* (Bugweed) and *Populus x canescens* (Grey Poplar) (Photograph 4). The Koesterbos River is also indicated as a Critical Biodiversity Area.



Photograph 4: Large drainage line associated with powerline alternative 2. Although dominated by exotic species such as *Solanum mauritianum* (Bugweed) and *Lantana camara* (Wild Lantana) (left), it supported indigenous species such as *Pronium serratum* (Palmiet) (right)

The powerline continues in a northerly direction where it crosses a second drainage line before linking with the existing high voltage powerline. The second drainage line

was entirely dominated by alien species such as *Acacia mearnsii* (Black Wattle), *Solanum mauritanum* (Bugweed) and *Eucalyptus* spp. (Photograph 5).



Photograph 5: The two disturbed drainage lines dominated by alien species which powerline alternative 2 crosses

3.1.3 Alternative 3 and Associated Powerline

Alternative substation site 3 is located approximately 500m north of alternative 1 and consisted predominantly of a maize field which supported no indigenous vegetation (Photograph 6). The south-western corner was covered by secondary vegetation dominated by pioneer species such as *Stoebe aethiopica* (Knoppiesbos), *Stoebe alopecuroides*, *Erica gracilis* and *Lobelia linearis* (Photograph 6), while a farm dam occurred in the north-eastern corner of the site. The proposed powerline route exits alternative 3 on the western boundary, turns and heads in a northerly direction traversing areas transformed by roads and agriculture with no remaining indigenous vegetation.



Photograph 6: Alternative substation site 3 situated in a maize field (left) with secondary vegetation covering the south-western corner (right)

3.1.4 Alternative 4 and Associated Powerline

Alternative substation site 4, located in the south western corner of the study area, was divided into pasture camps (used for horses and cattle) planted with pasture species such as *Eragrostis tef* (Tef). A drainage line located on the western boundary was found to be disturbed and although some indigenous species such as *Asparagus burchellii*, *Searsia glauca*, *Rapanea melanophloeos* (Cape Beech) and

Burchellia bubalina (Wild Pomegranate) were present, it was largely dominated by exotic species including *Pinus* spp., *Acacia melanoxylon* (Blackwood), *Cortaderia selloana* (Pampas Grass) and *Populus x canescens* (Grey Poplar) (Photograph 7). The proposed powerline route exits alternative 4 on the northern boundary and continues in a northerly direction traversing transformed areas which contained no natural vegetation, except at one point where the powerline route encroaches on the riparian vegetation of the Koesterbos River.



Photograph 7: Pasture fields associated with the proposed alternative substation site 4 (left) with a disturbed drainage line to the west (right)

3.1.5 Alternative 5 and Associated Powerline

Alternative substation site 5 is located in the extreme north east of the study area, separate from the other site alternatives, and consisted mostly of pasture fields planted with *Pennisetum clandestinum* (Kikuyu Grass) with no remaining natural vegetation (Photograph 8) and woody areas dominated by exotic species such as *Acacia mearnsii* (Black Wattle), *Solanum mauritianum* (Bugweed) and *Eucalyptus* spp. The proposed powerline route exits alternative 5 on the western boundary and continues in a westerly direction following an existing powerline servitude which crosses vegetation dominated by exotic species such as *Acacia mearnsii* (Black Wattle), *Solanum mauritianum* (Bugweed) and *Eucalyptus* spp.



Photograph 8: Alternative substation site 6 with pasture fields and no natural vegetation remaining (left) and the existing powerline servitude through an area dominated by alien vegetation (right)

3.1.6 Alternative 6 and Associated Powerline

Alternative substation site 6 is located between alternatives 1 and 3 and consisted of strips of old plantations dominated by commercial *Eucalyptus* spp. and secondary vegetation dominated by pioneer species such as *Stoebe aethiopica* (Knoppiesbos), *Stoebe alopecuroides*, *Erica gracilis* and *Lobelia linearis* (Photograph 9). The proposed powerline exits alternative 6 on the north-eastern boundary and heads in a northerly direction traversing areas transformed by roads and agriculture with no remaining indigenous vegetation.



Photograph 9: Alternative substation site 6 with old commercial plantations and secondary fields dominated by pioneer species

Table 2: Summary of plant species recorded on the six alternative sites and associated powerlines

Indigenous species at the time of the survey:	<p><u>Grasses:</u> <i>Themeda triandra</i> <i>Tristachya leucothrix</i> <i>Carex cognate</i></p> <p><u>Herbs</u> <i>Erica gracilis</i> <i>Lobelia linearis</i> <i>Stoebe aethiopica</i> <i>Stoebe alopecuroides</i></p> <p><u>Trees and shrubs:</u> <i>Burchellia bubalina</i> <i>Maytenus acuminata</i> var. <i>acuminata</i> <i>Pronium serratum</i> <i>Searsia glauca</i></p>
Plants of conservation concern confirmed to occur:	None
Plants of conservation concern for which suitable habitat was observed:	None (within development footprint)
Provincially protected plants confirmed to occur:	None
Provincially protected plants for which suitable habitat was found:	None
Nationally protected tree species confirmed:	None

Alien species:	<i>Eucalyptus</i> sp. <i>Pinus pinaster</i> <i>Solanum mauritianum</i> <i>Acacia mearnsii</i> <i>Populus x canescens</i> <i>Zea mays</i> <i>Solanum tuberosum</i> <i>Pennisetum clandestinum</i> <i>Eragrostis tef</i>
-----------------------	--

3.2 Plants of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes. A plant taxon is of conservation concern when it is considered to be threatened, or close to becoming threatened with extinction and therefore classified as Critically Endangered, Endangered, Vulnerable or Near Threatened. These plants are nationally protected by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Within the context of this report, plants that are Declining, Rare and Data Deficient (Taxonomic and Distribution) are also referenced under this heading.

Rare and Endangered species are mostly small, very localized and visible for only a few weeks in the year when they flower (Ferrar and Lötter, 2007). As these plants might not have been visible at the time of the field survey, the probabilities of occurrence for these plants were based on distribution data and information gathered concerning the area.

A minimum of twenty (20) plant species of conservation concern could occur within the study area (Raimondo *et al.*, 2009; POSA, 2011) although the high level of habitat transformation through agriculture makes it highly unlikely that any species of conservation concern still occur within the study area and none of these species were observed during the field survey.

3.3 Provincially Protected Plants

Due to the high level of habitat transformation there was no suitable habitat for provincially protected species.

3.4 Alien and Invasive Plants

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

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

- **Category 1** plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish, plant, maintain, propagate or sell/import any category 1 plant species;
- **Category 2** plants are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and
- **Category 3** plants are ornamentally used plants and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30m of a 1:50 year flood line and must be prevented from spreading.

The following categories are proposed on the revised Conservation of Agriculture Resource act (CARA) and the National Environmental Management Biodiversity Act (NEMBA):

- **Category 1a** plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned.
- **Category 1b** plants are widespread invasive species controlled by a management programme.
- **Category 2** plants are invasive species controlled by area. Can be grown under permit conditions in demarcated areas. All breeding, growing, moving, and selling are banned without a permit.
- **Category 3** plants are ornamental and other species that are permitted on a property but may no longer be planted or sold.

Numerous alien species were recorded throughout the study area especially in the drainage lines and rivers where species such as *Populus x canescens* (Grey Poplar), *Acacia mearnsii* (Black Wattle), *Eucalyptus* spp., *Pinus pinaster* (Cluster Pine), *Solanum mauritianum* (Bugweed) and *Acacia melanoxylon* (Blackwood) formed dense infestations and in many instances resulting in a complete loss of indigenous vegetation (Photograph 10). Agricultural species such as *Eragrostis tef* (Tef), *Pennisetum clandestinum* (Kikuyu Grass), *Zea mays* (Corn) and *Solanum tuberosum* (Potato) were cultivated throughout the study area. Table 3 summarizes the alien species recorded in the study area.



Photograph 10: *Populus x canescens* (Grey Poplar) (left) and *Acacia mearnsii* (Black Wattle) (right) forming dense infestations along drainage lines

Table 3: Alien species recorded in the study area, the species in red should be prioritised for control

Scientific name	Common name	Category	Proposed CARA / NEMBA	Occurrence in study area
<i>Acacia melanoxylon</i>	Blackwood	Invader: 2	2	Recorded in drainage line close to alternative 4
<i>Centella asiatica</i>	Marsh Pennywort	No category	None	Sporadically throughout study area, especially in moist areas
<i>Cirsium vulgare</i>	Spear Thistle	Weed: 1	1b	Sporadically throughout the study area especially associated with cultivated fields
<i>Conyza canadensis</i>		No Category		Recorded sporadically next to cultivated areas
<i>Cortaderia selloana</i>	Pampas Grass	None		Recorded in the drainage line associated with alternative 1
<i>Eucalyptus species</i>	Blue Gum Trees	Invader: 2	2	Plantations throughout the study area
<i>Jacaranda mimosifolia</i>	Jacaranda	Invader: 3	3	Not common in study area, only recorded on the powerline route from alternative 3
<i>Lantana camara</i>	Common Lantana	Weed	1b	Recorded in disturbed drainage lines
<i>Melia azedarach</i>	Syringa	Invader: 3	1b	Not common in the study area, only recorded in the area associated with the powerline from alternative 3
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Proposed invader: 2	None	Recorded sporadically in study area
<i>Pinus pinaster</i>	Cluster Pine	Invader: 2	2	Recorded most drainage lines and alternative site 3

Scientific name	Common name	Category	Proposed CARA / NEMBA	Occurrence in study area
<i>Populus x canescens</i>	Grey Poplar	Invader: 2	2	Recorded in most drainage lines in the study area
<i>Rubus fruticosus</i>	European Blackberry	Invader: 2	1b	Common throughout the study area
<i>Solanum mauritianum</i>	Bugweed	Weed	1b	Sporadically throughout study area
<i>Solanum pseudocapsicum</i>	Jerusalem cherry		1b	Recorded in the drainage line close to alternative 4
<i>Trifolium repens</i>		Weed	None	Common in moist areas throughout the study area
<i>Verbena aristigera</i>	Fine-leaved Verbena	No category	None	Recorded throughout the study area
<i>Verbena bonariensis</i>	Wild Verbena	No category	1b	Recorded throughout the study area

3.5 Medicinal Plants

The demand for medicinal plants is on the increase while the frequently used species and the communal land that it is harvested from, are on the decline. With an increase in the country's population and the high rate of infectious diseases, this will put an even higher strain on the already scarce natural medicinal resources (Emery *et al.*, 2002). Areas of high biodiversity are thus important for the conservation and sustainable use of these resources and should be protected. Due to the high level of habitat transformation resulting in low number of indigenous plant species within the study area, only one medicinal plant species, *Prionium serratum* (Palmiet) was observed in the study area.

4 RESULTS: FAUNA

4.1 Faunal Habitats

Faunal habitat within the predominantly agricultural landscape of the study area included areas of old fields now converted to secondary grassy shrubland, several watercourses with associated riparian vegetation, man-made farm dams and stands of exotic trees. The highest faunal activity was observed in the secondary shrubland and around the water courses, especially the dense riparian vegetation associated with the Koesterbos River, as well as farm dams which attracted many waterbirds.

Although previously disturbed, the secondary shrubland provided suitable feeding and breeding habitat for many bird, mammal, reptile and invertebrate species (Photograph 11). The stands of exotic trees on site likely provided shelter for many faunal species especially birds and bats. Stands of exotic trees, especially in transformed landscapes, provide shelter for roosting, perching and nesting.



Photograph 11: Secondary grassy shrubland recovering from previously cultivated fields with stands of exotic trees in the background

Watercourses and wetlands (including farm dams) are usually areas of high faunal diversity as the riparian environment while dense vegetation provides abundant cover, feeding and breeding habitat for many species of invertebrates, birds, mammals, reptiles and amphibians. When it is available, surface water provides drinking water for many faunal species while the soft substrate provides perfect burrowing environments for mammals, reptiles and invertebrates. The increase in prey and vegetation attracts a high diversity of birds, as well as terrestrial mammals and reptiles, including predators. Watercourses and the associated riparian vegetation also tend to be corridors of movement through the landscape for fauna and flora. They are especially important in cultivated or transformed landscapes where most of the natural terrestrial habitat has been destroyed or transformed. Such is the case of the Koesterbos River in the study area (Photograph 12).



Photograph 12: Farm dams (left) and dense riparian vegetation of the Koesterbos River (right) in the study area

The proposed powerline route for alternative substation site 5 borders the global Important Bird Area (IBA) ZA091 Outeniqua Mountains (SA112). The function of BirdLife's IBA Programme (Barnes, 1998; BirdLife, 2013) is to identify, protect and manage a network of sites that are significant for the long-term viability of naturally occurring bird populations. The continued ecological integrity of these sites will be decisive in maintaining and conserving such birds. Legal protection, management and monitoring of these sites are all important targets for action, and many bird species may be effectively conserved by these means. As the proposed powerline

route follows an existing high voltage powerline, the proposed project should not affect the ecological integrity of the IBA.

4.2 Faunal Species Occurrence

4.2.1 Avifauna

Approximately 308 bird species have been confirmed to occur within QDGC 3322CD. Of this total, approximately 233 species (76%) are associated with farmland, towns and terrestrial water systems, as is the character of the study area, 40 of which were observed during the field survey (listed in Appendix C). Overall the bird species observed on site were mostly generalist species indicative of the transformed nature of the landscape.

A high level of endemism exists in the area as is typical of the western regions of the country, with 67 endemic bird species occurring in QDGC 3322CD. A smaller proportion of species are of conservation concern, with a total of 28 bird species occurring in QDGC 3322C listed either nationally (Barnes, 2000) or globally (IUCN, 2012) as being of conservation concern (Appendix D).

Four bird species endemic to southern Africa, *Melierax canorus* (Southern Pale Chanting Goshawk), *Prinia maculosa* (Karoo Prinia), *Sphenoeacus afer* (Cape Grassbird) and *Cinnyris afer* (Greater Double-collared Sunbird), were confirmed to occur in the area of the study site during the field survey. Although not recorded during the field survey, four additional species of conservation concern and 11 species endemic to southern Africa were given a high probability of occurring in the study area due to the presence of suitable breeding and/or foraging habitat (as discussed in the section above). Such species included *Bradypterus sylvaticus* (Knysna Warbler), *Polemaetus bellicosus* (Martial Eagle), *Campethera notata* (Knysna Woodpecker) and *Falco biarmicus* (Lanner Falcon), all which are currently listed nationally or globally as either Vulnerable or Near Threatened (Appendix D).

Appropriate habitat existed in the area for a further eight bird species of conservation concern. However, due to the level of transformation and disturbance of the surroundings (intensive farming), these species were given a medium or medium-high probability of occurring in the study area (Appendix D).

4.2.2 Mammals

Non-volant mammals

Approximately 67 indigenous terrestrial, non-volant (non-flying) mammal species are expected to occur within QDGC 3322CD according to the IUCN distribution ranges. These species are listed in Appendix E along with the probability of each species occurring in the study area as well as their national (Friedmann and Daly, 2004; DEAT, 2007) and global (IUCN, 2012) conservation status. Three mammal species were identified in the study area during the field survey by sight or field evidence such as spoor, droppings or burrows (Appendix E). All three species identified, namely *Chlorocebus pygerythrus* (Vervet Monkey), *Atilax paludinosus* (Water Mongoose) and *Genetta tigrina* (South African Large-spotted Genet), are currently

listed nationally and globally as Least Concern. A further 14 species were given a high probability of occurring in the study area due to the presence of suitable habitat, one of which is a species of conservation concern, namely *Dasymys incomtus* (African Marsh Rat), which is currently listed nationally as Near Threatened. A further 22 species, including five species of conservation concern, were given a medium probability of occurring on the study site (Appendix E). While suitable habitat existed on the site for some of these species, the level of disturbance of the surrounding landscape (intensive farming) suggests that they are unlikely to be present.

Chiroptera

Nine species of Chiroptera (bats) have been confirmed to occur within QDGC 3322CD, five of which are species of conservation concern. These include *Rhinolophus clivosus* (Geoffroy's Horseshoe Bat), the endemic *Miniopterus fraterculus* (Lesser Long-fingered Bat), *Miniopterus natalensis* (Natal Long-fingered Bat) and *Myotis tricolour* (Temminck's Myotis) all of which are currently listed nationally as Near Threatened, and the endemic *Rhinolophus capensis* (Cape Horseshoe Bat) which is currently listed both nationally and globally as Near Threatened (Appendix E).

No bat species were detected on site however *Rhinolophus clivosus* (Geoffroy's Horseshoe Bat) was given a high probability of occurring on site due to the species' wide habitat tolerance and the presence of stands of exotic trees. It's likely that the species will not use the site for roosting or breeding but for foraging only. The remaining species were given a low to medium probability of occurring in the study area due to the lack of suitable habitat (Appendix E).

4.2.3 Herpetofauna

Amphibians

According to FrogMAP, a continuation of the Southern African Frog Atlas Project (SAFAP) (ADU, 2012), which is based on Minter *et al.* (2004), 17 amphibian species have been confirmed to occur within QDGC 3322CD, while a further two possibly occur in the QDGC according to IUCN species distribution ranges (Appendix F). While no amphibian species were identified during the field survey, suitable habitat was observed for six species which were given a high probability of occurring on site, none of which were of conservation concern (Appendix F). A further seven species were given a medium probability of occurring in the study area, including *Hyperolius horstockii* (Arum Lily Frog) which is currently listed globally as Vulnerable. It is unlikely that this species occurs in the study area due to the level of disturbance and transformation (intensive farming) in the landscape.

Reptiles

According to ReptileMAP, a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012), 48 reptile species have been confirmed to occur within QDGC 3322CD (Appendix G). A high level of endemism exists in the region with 28 of the total confirmed to occur in the QDGC being endemic to southern Africa. While no reptile species were observed in the study area

during the field survey, only three species were given a high probability of occurring on the site due to the presence of suitable habitat (Appendix G). While the majority of species in the QDGC have not had their conservation status evaluated by the IUCN, a number of species appear on the Convention on International Trade in Endangered Species (CITES) Appendix II which implies that the species may become threatened with extinction if the trade or utilisation of the species is not carefully regulated. Most of these species were given a low probability of occurring in the study area due to the level of disturbance and transformation in the landscape (Appendix G).

4.2.4 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).

According to the South African Butterfly Conservation Assessment (SABCA), 92 butterfly species occur within QDGC 3322CD, none of which are of conservation concern (Appendix H). Very low lepidopteron activity was observed at the time of the survey which can be attributed to the lack of indigenous vegetation.

5 ECOLOGICAL SENSITIVITY

Based on the findings of the ecological assessments and the following criteria, ecologically sensitive habitats or areas of conservation importance were mapped for flora and fauna (Figure 4).

Ecological Function: The ecological function describes the intactness of the structure and function of the vegetation 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. The criteria are defined as follows:

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).

5.1 Areas of High Sensitivity

No areas of high ecological sensitivity were identified in the study area.

5.2 Areas of Medium Sensitivity

All farm dams and drainage lines where dense riparian vegetation persisted were classified as medium ecological sensitivity. These areas represented functional faunal habitat and faunal activity in the study area was observed mostly in these areas. Indigenous vegetation was recorded in the riparian areas of the Koesterbos River including *Prionium serratum* (Palmiet) which is an important medicinal species. The Koesterbos River and associated riparian vegetation also represents an important corridor for movement through the centre of the study area and should be avoided by construction activities. Certain bird species susceptible to the impacts of powerlines usually congregate around waterbodies such as farm dams. It is advised that the powerline routes avoid traversing such features.

5.3 Areas of Medium-low Sensitivity

Areas comprising secondary shrubland and stands of exotic trees were classified as medium-low ecological sensitivity. Although these areas were disturbed and supported little indigenous vegetation, relatively high faunal activity was observed. Such areas provide shelter for roosting and nesting as well as suitable foraging habitat for many faunal species, especially birds.

5.4 Areas of Low Sensitivity

All areas transformed by cultivation, settlement and roads were classified as low ecological sensitivity.

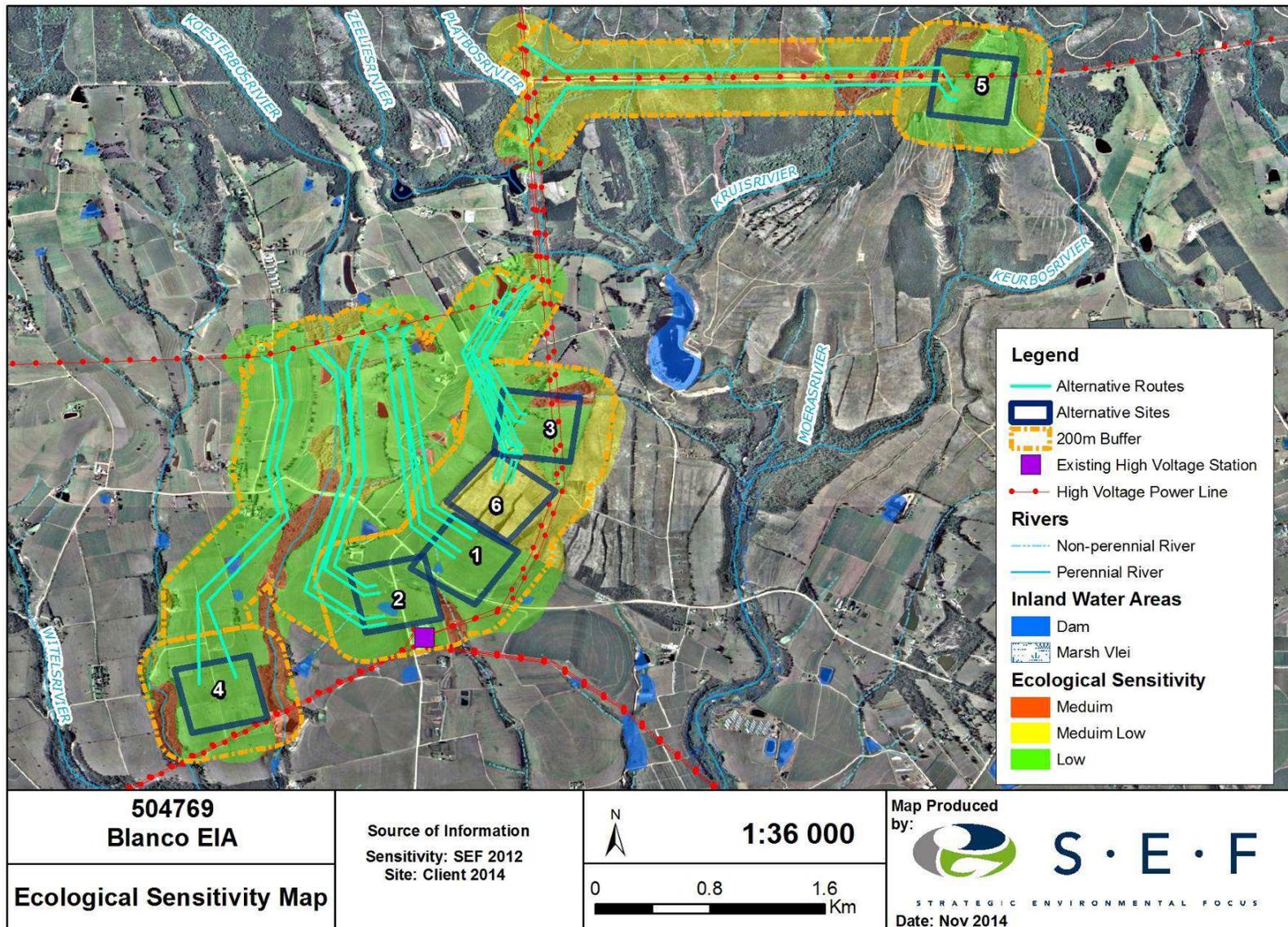


Figure 4: Ecological sensitivity

6 IMPACT ASSESSMENT AND MITIGATION

Any development (current or historic) or other 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 current impacts and to provide a description of the mitigation required so as to limit the perceived impacts on the natural environment.

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

Nature of the Impact

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

Extent of the Impact

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

Duration of the Impact

This provides an indication of whether the lifespan of the impact would be short term (0-5 years), medium term (6-10 years), long term (>10 years) or permanent.

Intensity / Magnitude

This indicates the degree to which the impact would change the conditions or quality of the environment. This was qualified as low, medium or high.

Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

Degree of Confidence

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

6.2 Impact Assessment

Possible impacts and their sources associated with the proposed development are provided in Table 4 (construction phase) and Table 5 (operational phase). Due to the high level of habitat transformation and subsequent low indigenous plant species diversity, the ecological impacts associated with the proposed development were low.

Table 4: Possible impacts arising during the construction phase

Possible impact	Source of impact	Area to be affected
Destruction of indigenous plant species through construction of power pylons	Power pylons	Areas where power pylons are constructed
Destruction and fragmentation of faunal habitat	Construction activity and construction vehicles	Riparian habitat; secondary shrubland; exotic tree stands
Disturbance to avifaunal habitat within an IBA	Construction workers, construction activity and construction vehicles	Habitat within IBA adjacent to powerline alternative 5

Table 5: Possible impacts arising during the operational phase

Possible impact	Source of impact	Areas to be affected
Electrocution of birds and large bat species	Live conductors	Pylons
Collisions by birds and bats with structures	Powerlines	Whole site
Loss and fragmentation of faunal habitat	Pylons and powerline servitude	Riparian habitat; secondary shrubland

6.2.1 Construction Phase

a) *Destruction of indigenous plant species*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site	Permanent	Medium	Medium	Medium	High
WMM	Site	Short term	Low	Unlikely	Low	High

Description of Impact

Powerlines associated with some of the alternatives will traverse drainage lines and rivers (such as the Koesterbos River) which still support some indigenous plant species. If the power pylons are constructed within these areas, these indigenous species will be destroyed.

Mitigation Measures

- Substation site alternatives 3 and 4 and the associated powerlines will offer the least impact from a **floral** perspective and either should be considered as the preferred site and route; and
- Power pylons should be constructed outside the buffer specified by the wetland specialist.

b) *Destruction and fragmentation of faunal habitat*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site	Permanent	Medium	Definite	Medium	High
WMM	Site	Permanent	Low	Definite	Low	Medium

Description of Impact

Depending on the substation and powerline route alternative, construction of new electrical infrastructure including the construction of access roads, clearing and maintenance of servitudes, construction of sub-station yards etc., may destroy, alter or degrade faunal habitat to varying degrees. Disturbance and destruction of natural habitat will lead to the displacement and/or exclusion of faunal species from the area.

Natural faunal habitat within the study area includes the Koesterbos River and associated riparian vegetation, which powerline alternative 2 and potentially alternative 4, will impact on; and the secondary shrubland and stands of exotic trees, which substation alternative site 6 and powerline alternative 2 will impact on.

Mitigation Measures

- In terms of the specific impact in discussion, substation alternative 3 and associated powerline alternative will offer the least impact from a **faunal** perspective and should be considered as a preferred site and route;
- If this alternative is chosen, the substation must be positioned to avoid the farm dam in the north-eastern corner of the proposed site;
- Construction and associated activities must remain outside of any buffer specified by the wetland specialist;
- Construction crew camps should not be located adjacent to the river;
- Clearing of large trees should be avoided where possible;
- Construction should commence in the early winter months in order to minimise the impacts on the breeding activities of faunal species especially birds nesting in stands of exotic trees; and
- A rubble clean-up plan must be implemented throughout the duration of the construction phase.

c) *Disturbance to avifaunal habitat within IBA*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local	Medium-term	Medium	Medium	Medium	Medium
WMM	Local	Immediate	Low	Low	Low	High

Description of Impact

The proposed powerline route for alternative substation site 5 is positioned on the southern border of the global Important Bird Area (IBA) ZA091 Outeniqua Mountains (SA112). Should this route be chosen for development, construction activities may destroy, alter or degrade faunal habitat found to the north of the proposed powerline route. Disturbance and destruction of natural habitat will lead to the displacement and/or exclusion of faunal species from the area. However, as the proposed powerline route follows an existing high voltage powerline, the proposed project should not affect the ecological integrity of the IBA if the following mitigation measures are adhered to.

Mitigation Measures

- Construction of the new powerline must remain to the **south** of the existing powerline;
- If widening of the current servitude is required, clearing of vegetation must occur only to the **south**;
- Construction of the substation must remain outside of the IBA boundary;
- Construction crew camps should **not** be located on the **north** side of the current servitude;
- No wild animal (including birds) may under any circumstance be handled, removed or be interfered with by construction workers;
- No wild animal may under any circumstance be hunted, snared, captured, injured or killed;
- No wild animal may be fed on site;
- No domesticated animals must be allowed on site;
- Construction should commence in the early winter months in order to minimise the impacts on the breeding activities of faunal species; and
- All fires must be prohibited.

6.2.2 Operational Phase

Electrical infrastructure comprises a significant interface between wildlife and man due to the nature and distribution of electrical structures within the landscape. The development of new electrical infrastructure poses three primary threats to avifauna and volant (flying) mammals (bats): (1) electrocution of individuals perching or roosting on or near conductors; (2) collisions with overhead wires; and (3) habitat loss through the destruction or degradation of vegetation during construction. Electrocution and collision associated with electrical infrastructure are common causes of unnatural mortality to many bird and bat species and may significantly impact on population structure (Sergio *et al.*, 2004; Cryan and Barclay, 2009). Conversely, power supply may be interrupted which has negative economic impacts resulting from damaged equipment, loss of service to the power grid, human safety issues and veld fires.

a) *Faunal electrocution*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Localised	Long-term	Medium	Medium	Medium	High
WMM	Localised	Long-term	Low	Low	Low	Medium

Description of Impact

Birds are more susceptible to electrocutions than bats generally due to their larger body size or long feathers. The impact of electrocution in bats is poorly documented however it is believed bats are less affected due to their small size and navigational ability through echolocation. Larger bat species such as the fruit bats are however at a higher risk due to their larger body size and lack of echolocation as these species rely on eyesight to locate their fruit diet. Bird species that are prone to electrocution are larger perching species such as birds of prey (including vultures, medium and large bodied raptors, and smaller raptors such as falcon), storks and herons. A number of these species may occur in the study area.

Electrocutions may happen in two ways, (1) phase-to-phase electrocution by bridging the air gap between two live conductors, and (2) phase-to-earth electrocution by contact between a live conductor and earthed device (pylon or pole), and occurs especially when the feathers / wings are wet (Bevanger, 1998). A number of factors determine the likelihood of electrocutions including landscape features such vegetation and topography, weather conditions, size of the individual, behaviour of the bird, and structure and dimensions of the pylon (Smallie *et al.*, 2009). Most bird electrocutions occur on lower voltage electricity pylons, where the gaps between conductors are small, and which are attractive perching and nesting alternatives to trees in otherwise open, flat areas. More electrocutions in birds occur in rainy and/or misty weather conditions.

Mitigation Measures

- Powerlines should be routed alongside existing infrastructure such as existing powerlines, roads, buildings, and railway lines where possible;
- Streams and drainage lines should not be crossed perpendicularly with powerlines where possible
- In terms of the impact in discussion, substation alternative 3 and associated powerline alternative will offer the least impact from an avifaunal perspective and should be considered as a preferred site and route;
- All jumpers at transformers, T-offs and strain structures should be insulated;
- Only pole structures that are approved as “bird friendly” by Eskom’s ENVIROTECH Forum should be used; and
- Lines traversing open areas must be marked with anti-collision devices. Bird Flight Diverters on the earth wires must be installed as per specifications devised by the EWT.

b) *Collisions of fauna with structures*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Localised	Long-term	Moderate	Medium	Medium	High
WMM	Localised	Medium-term	Low	Low	Low	Medium

Description of Impact

Collisions are the leading threat to birds caused by electrical infrastructure both globally and in southern Africa (Bevanger, 1994; van Rooyen, 2004). The likelihood of collisions with powerlines is determined by factors such as bird flight path/height, bird ocular structure and acuity, bird morphology, acquired knowledge of existing structures, bird behaviours, landscape topography, vegetation and weather conditions (APLIC, 1994; Bevanger, 1994; Hunting 2002; Jenkins *et al.*, 2010). Generally, bird species that are at risk include: large flocking species that commute at low altitudes; large, heavy bodied, less manoeuvrable species with low ocular acuity; individuals that have no acquired knowledge of existing infrastructure such as juveniles of migratory species, and individuals engaging in behaviours such as aerial displays, hunting chases, and flight at night, dusk or dawn. Such species which may occur in the study area include waterfowl such as ducks, geese, herons and waders; pigeons; various smaller bodied passerines, and high-speed predators such as falcons.

Generally, collisions are most prevalent in open, flat areas dominated by grassland and wetlands, and more collisions occur in rainy and/or misty weather conditions as well as strong winds. However in any landscape, a basic factor for survival requires birds to make regular and direct flights between resource points. In the case of the study area, waterbirds flying between waterbodies are at risk of collision with powerlines as they are generally large bodied, flocking species with low manoeuvrability, low ocular acuity and tend to fly at powerline height (APLIC, 1994).

Impacts of collisions of bats with powerlines is also not as well documented and does not have as high an impact as barotrauma (internal organ collapse, especially lungs, caused by rapid air pressure reduction around the rotating wind turbine blades) caused by wind energy turbines. Collisions of bats and powerlines do however occur and may have an impact on migratory bat species populations.

Mitigation Measures

- Powerlines should be routed alongside existing infrastructure such as existing powerlines, roads, buildings, and railway lines where possible;
- Streams and drainage lines should not be crossed perpendicularly with powerlines where possible;
- In terms of the impact in discussion, powerline route alternatives 3 and 5 will offer the least impact from an avifaunal perspective and either should be considered as a preferred route;

- Lines traversing open areas must be marked with anti-collision devices. Bird Flight Diverters on the earth wires must be installed as per specifications devised by the Endangered Wildlife Trust (EWT); and
- Only pole structures that are approved as “bird friendly” by Eskom’s ENVIROTECH Forum should be used.

c) *Loss and fragmentation of natural habitat*

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site	Long-term	Medium	Medium	Medium	High
WMM	Site	Long-term	Low	Low	Low	Medium

Description of Impact

Albeit a small footprint, removal of natural vegetation for pylons and servitudes will have a negative impact on the faunal communities through destruction of habitat. Generally, permanent habitat destruction may lead the surrounding natural areas becoming degraded with the inevitable establishment of alien invasive plant species. This creates a domino effect and would ultimately lead to a break-down in community structure within the ecosystem and an eventual loss of biodiversity. Bird species with specific habitat requirements and restricted ranges are the most at risk with respect to habitat destruction.

In the context of the study area, there were no natural areas classified as highly sensitive from an ecological perspective. The only areas that may be impacted on to a lesser degree are the Koesterbos River and associated riparian habitat (marked as medium sensitivity) and the secondary shrubland (marked as medium-low sensitivity).

Mitigation Measures

- Substation alternative 3 and the associated powerline will offer the least impact from an ecological perspective and should be considered as a preferred site and route;
- Maintenance activities should be located outside the catchments of existing watercourses to prevent possible impact from runoff water and other detrimental impacts; and
- Powerline servitudes should not be cleared of vegetation to ensure that indigenous species still occurring within these areas are maintained.

7 CONCLUSION

The study area occurs within the Fynbos biome and more specifically within the Garden Route Granite Fynbos and Garden Route Shale Fynbos vegetation types. The Garden Route Granite Fynbos ecosystem is currently listed as Endangered while the Garden Route Shale Fynbos ecosystem is listed as Vulnerable in terms of Section 52 of NEMBA (Government Gazette, 2009). The study area was however largely transformed and supported very limited to no indigenous vegetation.

The study area included six possible site alternatives for the proposed substation as well as the associated loop in – loop out powerline routes. The affected areas were mostly transformed through agriculture and supported limited indigenous plant species and subsequently no natural vegetation communities could be described. Indigenous vegetation was recorded in the riparian areas of the Koesterbos River including *Prionium serratum* (Palmiet) which is an important medicinal species.

No areas of high ecological sensitivity were identified in the study area. Areas that were found to support faunal communities, such as farm dams, the Koesterbos River and associated riparian habitat, a portion of secondary shrubland and stands of exotic trees, were classified as medium and medium-low sensitivity. The Koesterbos River and associated riparian vegetation represents an important corridor for movement through the landscape and is situated in the centre of the study area.

Certain bird species susceptible to the impacts of powerlines usually congregate around waterbodies such as farm dams and will move between such features in search of food, water and shelter. It is advised that the powerline routes avoid traversing such features and bisecting major corridors for movement between such features. Construction activities and powerline routes also avoid the Koesterbos River. **Substation alternatives 3 and 4** and associated powerlines will offer the least impact from a **floral** perspective as they traverse only transformed areas, while **alternatives 3 and 5** will offer the least impact from an **avifaunal** perspective as the powerline route is either short (alternative 3) and/or follows existing powerlines (alternatives 3 and 5).

REFERENCES

- Alexander, G. and Marais, J. (2010): *A guide to the Reptiles of Southern Africa*, Cape Town: Struik Nature.
- Avian Power Line Interaction Committee (APLIC) (1994): *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*, Washington DC: Edison Electric Institute.
- Barnes, K.N. (2000): *The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland*, Johannesburg: BirdLife South Africa.
- Bevanger, K. (1994): Bird interactions with utility structures: collision and electrocution, causes and mitigating measures, *Ibis* 136: 412 – 425.
- Bevanger, K. (1998): Biological and conservation aspects of bird mortality caused by electric power lines, *Biological Conservation* 86: 67 – 76.
- Chittenden, H. (2007): *Roberts Bird Guide. A comprehensive field guide to over 950 bird species in southern Africa*, Cape Town: John Voelcker Bird Book Fund.
- Cryan, P.M. and Barclay, R.M.R. (2009): Causes of bat fatalities at wind turbines: Hypotheses and predictions, *Journal of Mammalogy* 90(6): 1330-1340.
- Department of Environmental Affairs and Tourism (2007): NEMBA 2004 (Act 10 of 2004): *Critically Endangered, Endangered, Vulnerable and Protected Species*, Regulation No. 151, Government Gazette No. 29657, 23 February 2007, Pretoria: DEAT.
- Du Preez, L. and Carruthers, V. (2009): *A Complete Guide to the Frogs of Southern Africa*, Cape Town: Struik Nature.
- Friedmann, Y. and Daly, B. (eds) (2004): *Red Data Book of the Mammals of South Africa: A Conservation Assessment*, Conservation Breeding Specialist Group (CBSG) Southern Africa (SSC/IUCN), Endangered Wildlife Trust, South Africa.
- Government Gazette No 32689, (2009): *Draft National List of Threatened Ecosystems in terms of the National Environmental Management Act, 2004 (Act No. 10 of 2004)*. Department of Environmental Affairs Notice 1477 of 2009 in Government Gazette No. 32689, 6 November 2009.
- Harrison, J.A., Allan D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. and Brown, C.J. (1997): *The Atlas of Southern African Birds*, Johannesburg: BirdLife South Africa.
- Henderson, L., (2001): *Alien Weeds and Invasive Plants. A complete guide to declared weeds and invaders in South Africa*, Plant Protection Research Institute Handbook No. 12, Agricultural Research Council, South Africa.
- Henning, G.A., Terblanche, R.F. and Ball, J.B. (2009): *South African Butterfly Conservation Assessment*, SANBI Biodiversity Series 13, Pretoria.
- Hockey, P.A.R., Dean, W.R.J. and Ryan P.G. (2005): *Roberts Birds of Southern Africa*, 7th Edition, Cape Town: John Voelcker Bird Book Fund.

- Hunting, K. (2002): *A roadmap for PIER research on avian collisions with power lines in California, Sacramento, CA*. Prepared for the California Energy Commission, Public Interest Energy Research Programme. Report No. P500-02-071F.
- Jenkins, A.R., Smallie, J.J. and Diamond, M. (2010): Avian collisions with power lines: a global review of causes and mitigation with a South African perspective, *Bird Conservation International* 20: 263 – 278.
- Manning, J., (2009): *Field Guide to Wild Flowers of South Africa*, Cape Town: Random House Struik (Pty) Ltd.
- Monadjem, A., Taylor, P.J., Cotterill, F.P.D., and Schoeman, M.C. (2010): *Bats of Southern and Central Africa. A Biogeographic and Taxonomic Synthesis*, Johannesburg: Wits University Press.
- Mucina, L. and Rutherford, M.C. (2006): The vegetation of South Africa, Lesotho and Swaziland, *Strelitzia* 19, Pretoria: South African National Biodiversity Institute.
- Pooley, E., (1998): *Guide to the Wildflowers of KwaZulu-Natal and the Eastern Region*. Durban: Natal Flora Publications.
- Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. and Manyama P.A., (eds) (2009): Red List of South African plants 2009, *Strelitzia* 25, Nelspruit: South African National Biodiversity Institute.
- Rutherford, M. C. and Westfall, R. H. (1994): *Biomes of Southern Africa: an objective categorisation*, Pretoria: National Botanical Institute.
- Sergio, F., Marchesi, L., Pedrini, P., Ferrer, M. and Penteriani, V. (2004): Electrocutation alters the distribution and density of a top predator, the eagle owl *Bubo bubo*, *Journal of Applied Ecology* 41: 836 – 845.
- Skinner, J.D. and Chimimba, C.T. (2005): *The Mammals of the Southern African Subregion*, London: Cambridge.
- Smallie, J., Diamond, M. and Jenkins, A. (2009): Lighting up the African continent – what does it mean for our birds? *Proceedings of the 12th Pan-African Ornithological Congress 2008*, Cape Town: Animal Demography Unit.
- Stuart, C. and Stuart, T. (2000): *A Field Guide to the Tracks & Signs of Southern and East African Wildlife*, Cape Town: Struik.
- Stuart, C. and Stuart, T. (2007): *Field Guide to Mammals of Southern Africa*, Cape Town: Struik Nature.
- Tainton, N. (1999): *Veld management in South Africa*, Pietermaritzburg: University of Natal Press.
- Van Oudtshoorn, F. (2004): *A Guide to Grasses of Southern Africa*, Pretoria: Briza Publications.
- Van Rooyen, C.S. (2004): The management of wildlife interactions with overhead lines. In: *The Fundamentals of Practice of Overhead Line Maintenance (132kV and above)*, pp 217-245, Johannesburg: Eskom Technology, Services International.

- Van Wyk, B. and Malan, S. (1997): *Field Guide to the Wild Flowers of the Highveld*, Cape Town: Struik Publishers.
- Van Wyk, B. and Smith, G. (2005): *Guide to the Aloes of South Africa*, Pretoria: Briza Publications.
- Van Wyk, B. and Van Wyk, P. (1997): *Field Guide to Trees of Southern Africa*, Cape Town: Struik.
- Woodhall, S. (2005): *Field Guide to Butterflies of South Africa*, Cape Town: Struik.

DIGITAL REFERENCES

- Animal Demography Unit: FrogMAP – South African Frog Atlas Project (SAFAP) (2013): <http://vmus.adu.org.za>
- Animal Demography Unit: ReptileMAP – South African Reptile Conservation Assessment (SARCA) (2013): <http://vmus.adu.org.za>
- Animal Demography Unit: LepiMAP – Southern African Butterfly Conservation Assessment (SABCA) (2013): <http://vmus.adu.org.za>
- Biodiversity GIS (2007): Critical Biodiversity Areas Map (CBA's): <http://bgis.sanbi.org>
- CITES (2012): CITES Appendices I, II & III valid 12 June 2013: <http://www.cites.org/eng/app/appendices.php>
- Important Bird Areas (IBA) Project (Barnes, 1998; BirdLife, 2013): <http://www.birdlife.org.za/conservation/iba>
- IUCN (2012): IUCN Red List of Threatened Species, Version 2012.2: www.iucnredlist.org
- Plants of Southern Africa (POSA) (2009): <http://posa.sanbi.org/searchspp.php>
- South African National Red List (2012): <http://redlist.sanbi.org>
- Southern African Birding cc. (2011): Roberts VII Multimedia, Birds of Southern Africa, Computer Software.

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 <i>inter alia</i> 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	<p>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.</p> <p>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.</p>
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 ordines 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 <i>et al.</i> , 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 <i>et al.</i> , 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 <i>et al.</i> , 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 Plants of Conservation Concern.
Species diversity	A measure of the number and relative abundance of species.
Species richness	The number of species in an area or habitat.
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 <i>et al.</i> , 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 <i>et al.</i> , 2009).

APPENDICES

APPENDIX A	Methodology
APPENDIX B	Plant species identified on the study site
APPENDIX C	Bird species observed in the study area as well as their national and global conservation status
APPENDIX D	Bird species of conservation concern as well as endemic species occurring within QDGC 3322CD, probability of occurring on site and habitat preference
APPENDIX E	Mammal species occurring within QDGC 3322CD, national and global conservation status, probability of occurring on site and habitat preference
APPENDIX F	Amphibian species occurring within QDGC 3322CD, national and global conservation status, probability of occurring on site and habitat preference
APPENDIX G	Reptile species occurring within QDGC 3322CD, national and global conservation status, probability of occurring on site and habitat preference
APPENDIX H	Lepidoptera species occurring within QDGC 3322CD including national conservation status

APPENDIX A: METHODOLOGY

FLORA

Desktop analysis and literature review

The desktop studies entailed a literature survey of all plant species occurring in QDGC 3322CD according to the Plants of Southern Africa online checklist (SANBI, 2009). Additional data such as habitat preference and species descriptions were gathered for all plants of conservation concern which were included in the list. Background information on the regional vegetation was gathered using GIS and Mucina and Rutherford (2006).

Field survey

The field survey was undertaken from the 11th to the 15th of March 2013. The surveys were focussed within areas where natural vegetation (including rehabilitated areas) persisted. The description of the regional vegetation relied on literature from Mucina and Rutherford (2006). Plant names follow Van Wyk and Malan (1997), Van Wyk and Van Wyk (1997), Van Wyk and Smith (2005) Pooley (1998), Henderson (2001), Schmidt *et al.*, (2002), Van Oudtshoorn (2004) and Manning (2009). The South African National Red List status follows the latest update <http://redlist.sanbi.org> (2012).

During the site visit, a number of line transects were sampled and additional points where plants of conservation concern (red data or protected plants) occurred were recorded and further investigated. The points were recorded using a hand-held Garmin GPSMAP 62sc GPS receiver. Waypoint localities are accurate to within 4m.

Due to the low basal cover, the cover abundance of the species was not assessed; rather presence and absence of species were noted. In order to identify as many plant species as possible, transects were walked throughout the study areas and supplementary notes such as past land use, soil etc. were collected.

Sensitivity classification was based on regional information such as the classification of the regional vegetation types and their sensitivity (Mucina and Rutherford, 2006) and the status of the vegetation as ascertained during the field survey.

FAUNA

Desktop analysis and literature review

Avifauna

A comprehensive list of bird species occurring in the area was compiled using electronic databases within Roberts VII Multimedia Birds of Southern Africa (SA Birding, 2011) where distribution maps have been interpreted and updated from the Atlas of Southern African Birds (Harrison *et al.*, 1997). Species of conservation concern that could potentially occur on site were noted and their habitat requirements were determined by consulting the relevant literature. Bird names follow Hockey *et al.* (2005).

Mammals

Geographical distribution and the presence of suitable habitat were used to determine the probability of occurrence of mammal species. High probability of occurrence would pertain to species with areas of occupancy within the geographic locality of the study site as well as the presence of suitable habitat occurring on the study site. Medium probability of occurrence refers to species whose area of occupancy is marginal to the study site or its habitat is found to be within the surroundings of the study area. Low probability of occurrence indicates that the species occupy an area surrounding the study area and that unsuitable habitat exists on site. Information was obtained from Skinner and Chimimba (2005), Stuart and Stuart (2007) and Monadjem *et al.* (2010).

Herpetofauna and Lepidoptera

A list of the reptile, amphibian and butterfly species occurring in the area was compiled using electronic databases such as FrogMAP (SAFAP), ReptileMAP (SARCA), the Southern African Butterfly Conservation Assessment (SABCA) and the IUCN.

Field survey

Avifauna

Bird species were detected by sight, call, and field evidence such as nests, feathers and droppings by walking slowly through the habitat. Species were verified using Chittenden (2007) as well as Roberts VII Multimedia Birds of Southern Africa (SA Birding, 2011).

Mammals

Mammal species were identified by sightings as well as field evidence such as spoor, droppings, roosting sights and burrows, and verified using Stuart and Stuart (2000 and 2007).

Herpetofauna and Lepidoptera

Herpetofauna and butterflies were noted and identified as they were encountered. Possible burrows or suitable habitats and host plant species (butterflies) were noted. Reptiles were identified using Alexander and Marais (2010) while amphibians were identified using Du Preez and Carruthers (2009). Identification of butterflies was verified using Woodhall (2005).

APPENDIX B: PLANT SPECIES IDENTIFIED ON THE SITEPlants in **RED** = Declining**(P)** Provincially protected species; **(D)** Declining; **(M)** Used medicinally

Scientific Name	Common Name	Locality in study area
Herbs		
<i>Asparagus burchellii</i>		Associated with secondary vegetation at substation 1 and 3 and in some drainage lines
<i>Erica gracilis</i>		Associated with secondary vegetation at substation 1 and 3
<i>Lobelia linearis</i>		Associated with secondary vegetation at substation 1 and 3
<i>Prionium serratum (M)</i>	Palmiet	Associated with large Koesterbos River
<i>Stoebe aethiopica</i>	Knoppiesbos	Associated with secondary vegetation at substation 1 and 3
<i>Stoebe alopecuroides</i>		Associated with secondary vegetation at substation 1 and 3
Trees		
<i>Burchellia bubalina</i>	Wild Pomegranate	In disturbed veld next to drainage line at substation 4
<i>Maytenus acuminata</i> var. <i>acuminata</i>		In disturbed veld next to drainage line at substation 4
<i>Morella serrata</i>		In disturbed veld next to drainage line at substation 4
<i>Rapanea melanophloeos</i>	Cape Beech	Large drainage line north of alternative 4
<i>Searsia glauca</i>		In disturbed veld next to drainage line at substation 4
Grass		
<i>Bracharia serrata</i>	Velvet Signal Grass	Associated with secondary vegetation at substation 1 and 3
<i>Carex cognata</i>	Nodding Sedge	Associated with secondary vegetation at substation 1 and 3
<i>Eragrostis capensis</i>	Heart-seed Love Grass	Associated with secondary vegetation at substation 1 and 3
<i>Eragrostis curvula</i>	Weeping Love Grass	Associated with secondary vegetation at substation 1 and 3
<i>Eragrostis tef</i>	Tef	Pasture grass
<i>Fimbristylis</i> sp.		Associated with large Koesterbos River
<i>Melinis nerviglumis</i>	Bristle-leaved Red Top	Associated with secondary vegetation at substation 1 and 3

<i>Pycnus polystachyos</i>		Associated with large Koesterbos River
<i>Themeda triandra</i>	Red Grass	Associated with secondary vegetation at substation 1 and 3
<i>Tristachya leucothrix</i>	Hairy Trident Grass	Associated with secondary vegetation at substation 1 and 3
Alien Species		
<i>Acacia mearnsii</i>	Black Wattle	Recorded in drainage lines throughout the study area
<i>Acacia melanoxylon</i>	Blackwood	Recorded in drainage lines throughout the study area
<i>Centella asiatica</i>	Marsh Pennyworth	Sporadically throughout the study area
<i>Cirsium vulgare</i>		Sporadically throughout the study area
<i>Conyza canadensis</i>	Horse Fleabane	Sporadically throughout the study area
<i>Cortaderia selloana</i>	Pampas Grass	Sporadically throughout the study area
<i>Eucalyptus</i> sp.		Recorded in drainage lines throughout the study area
<i>Jacaranda mimosifolia</i>	Jacaranda	Sporadically throughout the study area
<i>Lantana camara</i>	Common Lantana	Recorded in drainage lines throughout the study area
<i>Melia azedarach</i>	Syringa	Sporadically throughout the study area
<i>Paspalum dilatatum</i>	Dallis Grass	Sporadically throughout the study area
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Sporadically throughout the study area
<i>Pinus pinaster</i>	Cluster Pine	Recorded in drainage lines throughout the study area
<i>Populus x canescens</i>	Grey Poplar	Recorded in drainage lines throughout the study area
<i>Rubus fruticosus</i>	European Blackberry	Recorded in drainage lines throughout the study area
<i>Solanum mauritianum</i>	Bugweed	Recorded in all drainage lines and rivers throughout the study area
<i>Solanum pseudocapsicum</i>	Jerusalem Cherry	Sporadically throughout the study area
<i>Solanum tuberosum</i>	Cultivated Potato	Sporadically throughout the study area
<i>Trifolium repens</i>	White Clover	Recorded in drainage lines throughout the study area
<i>Verbena bonariensis</i>	Purple Top	Recorded throughout the study area

APPENDIX C: Bird species observed in the study area as well as their national and global conservation status (LC = Least Concern; En = Endemic; Intro = Introduced). Species are listed taxonomically

Scientific name	Common name	Conservation Status	
		RSA	IUCN
<i>Numida meleagris</i>	Helmeted Guineafowl	LC	LC
<i>Dendrocygna viduata</i>	White-faced duck	LC	LC
<i>Alopochen aegyptiaca</i>	Egyptian Goose	LC	LC
<i>Dendropicos griseocephalus</i>	Olive Woodpecker	LC	LC
<i>Upupa africana</i>	African Hoopoe	LC	LC
<i>Halcyon albiventris</i>	Brown-hooded Kingfisher	LC	LC
<i>Centropus burchellii</i>	Burchell's Coucal	LC	LC
<i>Apus caffer</i>	White-rumped Swift	LC	LC
<i>Bubo africanus</i>	Spotted Eagle-Owl	LC	LC
<i>Streptopelia capicola</i>	Cape Turtle-Dove	LC	LC
<i>Gallinago nigripennis</i>	African Snipe	LC	LC
<i>Vanellus armatus</i>	Blacksmith Lapwing	LC	LC
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC	LC
<i>Melierax canorus</i>	Southern Pale Chanting Goshawk	LC; En	LC
<i>Buteo buteo</i>	Steppe Buzzard	LC	LC
<i>Ardea melanocephala</i>	Black-headed Heron	LC	LC
<i>Bubulcus ibis</i>	Cattle Egret	LC	LC
<i>Bostrychia hagedash</i>	Hadedda Ibis	LC	LC
<i>Threskiornis aethiopicus</i>	African Sacred Ibis	LC	LC
<i>Lanius collaris</i>	Common Fiscal	LC	LC
<i>Corvus albus</i>	Pied Crow	LC	LC
<i>Oriolus larvatus</i>	Black-headed Oriole	LC	LC
<i>Dicrurus adsimilis</i>	Fork-tailed Drongo	LC	LC
<i>Terpsiphone viridis</i>	African Paradise-Flycatcher	LC	LC
<i>Cossypha caffra</i>	Cape Robin-Chat	LC	LC
<i>Saxicola torquatus</i>	African Stonechat	LC	LC
<i>Sturnus vulgaris</i>	Common Starling	LC	LC
<i>Hirundo rustica</i>	Barn Swallow	LC	LC
<i>Hirundo albigularis</i>	White-throated Swallow	LC	LC
<i>Psalidoprocne pristoptera</i>	Black Saw-wing	LC	LC
<i>Andropadus importunus</i>	Sombre Greenbul	LC	LC
<i>Cisticola fulvicapilla</i>	Neddicky	LC	LC
<i>Cisticola juncidis</i>	Zitting Cisticola	LC	LC
<i>Prinia maculosa</i>	Karoo Prinia	LC; En	LC
<i>Apalis thoracica</i>	Bar-throated Apalis	LC	LC
<i>Sphenoeacus afer</i>	Cape Grassbird	LC; En	LC
<i>Cinnyris afer</i>	Greater Double-collared Sunbird	LC; En	LC
<i>Passer domesticus</i>	House Sparrow	LC; Intro	LC
<i>Ploceus velatus</i>	Southern Masked-Weaver	LC	LC
<i>Vidua macroura</i>	Pin-tailed Whydah	LC	LC

APPENDIX D: Bird species of conservation concern including endemic species occurring within 3322CD, national and global conservation status (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; En = Endemic; Ebr = Breeding range Endemic; NBM = Non-breeding Migrant), probability of occurring on site and habitat preference. Species are listed by probability of occurring on site

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Melierax canorus</i>	Southern Pale Chanting Goshawk	LC; En	LC	Confirmed	Karoo shrubland and Kalahari woodland; also dry open Acacia thornveld and scrub, mopane woodland
<i>Prinia maculosa</i>	Karoo Prinia	LC; En	LC	Confirmed	Fynbos, renosterveld and karroid, coastal and montane shrubland, drainage lines in dry areas, shrubby regrowth on fallow fields, and gardens
<i>Sphenoeacus afer</i>	Cape Grassbird	LC; En	LC	Confirmed	Rank grasses, restios and ferns
<i>Cinnyris afer</i>	Greater Double-collared Sunbird	LC; En	LC	Confirmed	Edges of Afromontane forest, coastal and dune forests, montane tall shrubland such as <i>Protea</i> spp, dry valley bushveld, <i>Acacia</i> savanna, woodland along rivers and streams in dry areas, and parks and gardens
<i>Bradypterus sylvaticus</i>	Knysna Warbler	VU; En	VU	High	Low, dense tangled growth, usually along watercourses, on edge of temperate forest or in thickets of aliens, including <i>Lantana camara</i> and brambles (<i>Rubus</i> spp.)
<i>Polemaetus bellicosus</i>	Martial Eagle	VU	NT	High	Open woodland, arid and mesic savanna, forest edges
<i>Campethera notata</i>	Knysna Woodpecker	NT; En	NT	High	Thornveld and <i>Euphorbia</i> thickets, coastal, riparian and montane evergreen forests; also marginally in tall <i>Protea</i> , coastal White Milkwood <i>Sideroxylon inerme</i> thickets, and alien trees
<i>Falco biarmicus</i>	Lanner Falcon	NT	LC	High	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 (e.g. trees, electricity pylons, buildings) if cliffs absent
<i>Laniarius ferrugineus</i>	Southern Boubou	LC; En	LC	High	In dense tangles of vegetation in diverse woodland types from sea level to high altitudes. In montane forest, coastal thicket, riverine scrub (incl. mangroves), gardens and alien plantations

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Telophorus zeylonus</i>	Bokmakierie	LC; En	LC	High	Most abundant in Karoo, fynbos and grassland biomes. Favours habitats with scattered shrubs or trees in open areas, open bushveld, bush-clump grassveld, alien tree plantations
<i>Batis capensis</i>	Cape Batis	LC; En	LC	High	Afromontane and lowland evergreen forest, closed woodlands, valley bushveld, and fairly open <i>Acacia</i> patches along rivers in drier parts of range. Also in secondary forest, plantations, orchards and gardens
<i>Lamprotornis bicolor</i>	Pied Starling	LC; En	LC	High	Open areas dominated by grassland, associated with agriculture; often on open ground around farm homesteads, on cultivated lands, and near domestic stock. In villages and small towns in rural areas
<i>Parus afer</i>	Grey Tit	LC; En	LC	High	Dry woodland along seasonal rivers, dwarf shrubland, strandveld and farmlands; also hills and valleys containing remnant patches of renosterveld, and monoculture croplands
<i>Zosterops capensis</i>	Cape White-eye	LC; En	LC	High	Montane evergreen forest, riverine scrub, <i>Acacia</i> veld, montane fynbos, woodland thickets, <i>Eucalyptus</i> plantations, parks and gardens
<i>Cinnyris chalybeus</i>	Southern Double-collared Sunbird	LC; En	LC	High	Fynbos shrubland, arid and mesic Karoo shrubland, woodland, Afromontane forest and forest edge, gardens and plantations
<i>Passer melanurus</i>	Cape Sparrow	LC; En	LC	High	Arid and semi-arid savanna, dry woodland along drainage lines and seasonal watercourses, farmlands, alien plantations, orchards, and parks and gardens in towns and cities
<i>Ploceus capensis</i>	Cape Weaver	LC; En	LC	High	Open grassland, lowland fynbos, coastal thicket and farmland; always with some trees and permanent water. In semi-arid regions, restricted to riverine and montane areas
<i>Estrilda melanotis</i>	Swee Waxbill	LC; En	LC	High	Edge of Afromontane and coastal forest; plantations, gardens, bushy hillsides, farmyards, thick riparian bush, wooded valleys in fynbos and grassy clearings in moist woodland

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Serinus canicollis</i>	Cape Canary	LC; En	LC	High	Open <i>Protea</i> woodland, montane grassland with shrubs and patches of Oldwood <i>Leucosidea sericea</i> , open savanna, gardens, parks, alien plantations and edges of croplands
<i>Anthropoides paradiseus</i>	Blue Crane	VU; En	VU	Medium-high	Open grassland and grassland/Karoo ecotone; wetlands, cultivated pastures and crop lands; tolerant of intensively grazed and burnt grassland
<i>Gyps coprotheres</i>	Cape Vulture	VU; En	VU	Medium-high	Wide habitat range; cliffs
<i>Coracias garrulus</i>	European Roller	LC; NBM	NT	Medium-high	Open, broadleaved and <i>Acacia</i> woodlands with grassy clearings
<i>Gorsachius leuconotus</i>	White-backed Night-Heron	VU	LC	Medium	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
<i>Falco naumanni</i>	Lesser Kestrel	VU; NBM	LC	Medium	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
<i>Circus maurus</i>	Black Harrier	NT; En	VU	Medium	Dry grassland, Karoo scrub, agricultural fields and high-altitude grasslands; intolerant of burnt areas
<i>Falco peregrinus</i>	Peregrine Falcon	NT	LC	Medium	Resident birds mostly restricted to mountainous, riparian or coastal habitats with cliffs; breeding pairs prefer habitats that favour specialised, high-speed, aerial hunting, e.g. high cliffs
<i>Oxyura maccoa</i>	Maccoa Duck	LC	NT	Medium	Permanent wetlands in open grassland and semi-arid country
<i>Pternistis capensis</i>	Cape Spurfowl	LC; En	LC	Medium	Scrubby heath, especially coastal fynbos (including strandveld and renosterveld), and sheltered scrub along streams and rivers
<i>Tadorna cana</i>	South African Shelduck	LC; En	LC	Medium	Core range encompasses semi-arid south-western parts of region (rainfall < 600 mm/yr), centred in Karoo, and spanning both summer- and winter-rainfall regions; favours shallow, brackish, seasonal pans, dams, rivers and sewage works

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Turnix hottentottus</i>	Hottentot Buttonquail	LC; En	LC	Medium	In W Cape, restionaceous coastal and mountain fynbos shrubland and grassy patches; also in fallow fields, west coast strandveld and coastal renosterveld
<i>Geocolaptes olivaceus</i>	Ground Woodpecker	LC; En	LC	Medium	Rock- and boulder-strewn slopes of hills and mountains, mostly in treeless grasslands and shrubland
<i>Colius colius</i>	White-backed Mousebird	LC; En	LC	Medium	Sparse woodland along perennial and seasonal rivers in semi-arid and arid regions; also farmyards, gardens and orchards
<i>Buteo rufofuscus</i>	Jackal Buzzard	LC; En	LC	Medium	Hilly and mountainous regions in fynbos, Karoo, grassland, open woodland and semi-desert, from sea level to > 3 000 m. One of the few raptor spp regularly encountered in the highest mountain ranges
<i>Tchagra tchagra</i>	Southern Tchagra	LC; En	LC	Medium	At northern limit of range, in bracken (<i>Pteridium</i> spp) and scrub at interface between montane grassland and forest
<i>Monticola rupestris</i>	Cape Rock-Thrush	LC; En	LC	Medium	Cliffs, rocky gorges, boulder-strewn hillsides and scree slopes, usually with scattered low trees, bushes and succulents
<i>Sigelus silens</i>	Fiscal Flycatcher	LC; En	LC	Medium	Most common in moist and semi-arid lowland grasslands and valley bushveld favouring fairly open vegetation, with some trees or shrubs as perches
<i>Oenanthe monticola</i>	Mountain Wheatear	LC; En	LC	Medium	Rocky hills, slopes with boulders and bushes, small cliffs, old mine workings, farmyards and gardens of houses on rocky hillsides
<i>Pycnonotus nigricans</i>	African Red-eyed Bulbul	LC; En	LC	Medium	Dry woodland, Acacia savanna, semi-arid shrubland, riverine bush, shrubby watercourses in open and treeless areas
<i>Pycnonotus capensis</i>	Cape Bulbul	LC; En	LC	Medium	Shrubby areas in fynbos and succulent Karoo, coastal scrub, dune forest, riverine bush and gardens; favours alien Rooikrans <i>Acacia cyclops</i> thickets; distribution corresponds with areas with winter and year-round rainfall
<i>Cisticola subruficapilla</i>	Grey-backed Cisticola	LC; En	LC	Medium	Shrubland in fynbos, renosterveld and Karoo, drainage lines with large tufts of Bamboo Grass <i>Stipagrostis namaquensis</i> , grassy patches on rocky hills in Karoo

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Phragmacia substriata</i>	Namaqua Warbler	LC; En	LC	Medium	<i>Acacia</i> woodland and reedbeds (<i>Phragmites</i> and <i>Typha</i>), fireweeds (<i>Conyza</i> spp), honey-thorn (<i>Lycium</i> spp) thickets and immediately adjacent vegetation along watercourses in karroid areas; also rank, overgrown orchards adjacent to irrigation canals and gardens
<i>Sylvia subcaerulea</i>	Chestnut-vented Tit-Babbler	LC; En	LC	Medium	Drainage-line woodland in savanna and semi-arid shrubland, edges of thickets, bushy hillsides, and gardens in rural villages
<i>Mirafra apiata</i>	Cape Clapper Lark	LC; En	LC	Medium	Densely vegetated dwarf shrubland, incl. sand-plain fynbos, mesic and arid mountain fynbos, renosterveld and succulent Karoo; also fallow fields with adequate cover
<i>Galerida magnirostris</i>	Large-billed Lark	LC; En	LC	Medium	Montane semi-arid grassland, semi-arid succulent and non-succulent dwarf shrubland, coastal fynbos, fallow fields and harvested croplands; most abundant in succulent Karoo
<i>Anthobaphes violacea</i>	Orange-breasted Sunbird	LC; En	LC	Medium	Endemic to fynbos, mostly dense stands of <i>Protea</i> and <i>Erica</i> spp; less common in coastal macchia and coastal renosterveld; also in gardens, especially around <i>Aloe</i> spp
<i>Macronyx capensis</i>	Cape Longclaw	LC; En	LC	Medium	Moist grassland from sea level to high montane slopes, mostly without tree cover; also in short fynbos
<i>Crithagra flaviventris</i>	Yellow Canary	LC; En	LC	Medium	Open karroid shrubland, especially along small drainage lines where shrubs are taller, semi-arid savanna, alpine shrubland
<i>Crithagra albogularis</i>	White-throated Canary	LC; En	LC	Medium	Semi-arid and arid shrubland, rocky hillsides with tall shrubs (e.g. Granaatbos <i>Rhigozum obovatum</i>), sparse woodland along ephemeral drainage lines, coastal strandveld and gardens in Karoo
<i>Botaurus stellaris</i>	Eurasian Bittern	CR	LC	Low	Tall, dense emergent vegetation in interior of seasonal and permanent large wetlands
<i>Neotis ludwigii</i>	Ludwig's Bustard	VU; En	EN	Low	Semi-arid dwarf shrubland of succulent Karoo, Nama Karoo and Namib, with rainfall < 500 mm; occasionally adjacent fynbos biome
<i>Sagittarius serpentarius</i>	Secretarybird	VU	VU	Low	Open grassland (< 0.5 m) with scattered trees, shrubland, open <i>Acacia</i> and bushwillow (<i>Combretum</i> spp) savanna; absent from dense woodland and rocky hills

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Neotis denhami</i>	Denham's Bustard	VU	NT	Low	High-lying, open, sour grassland, often in rocky areas and on plateau grassland; occasionally uses cultivated fields, especially in winter and during droughts
<i>Tyto capensis</i>	African Grass-Owl	VU	LC	Low	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 (<i>Stenotaphrum</i> sp) and sedge (<i>Juncus</i> sp)
<i>Sarothrura affinis</i>	Striped Flufftail	VU	LC	Low	Dry upland grassland, incl. sites with bracken and brambles, with woody vegetation such as Protea spp, Oldwood <i>Leucosidea sericea</i> and sagewood <i>Buddleja</i> spp, or close to forest fringes
<i>Circus ranivorus</i>	African Marsh-Harrier	VU	LC	Low	Almost exclusively inland and coastal wetlands
<i>Haematopus moquini</i>	African Black Oystercatcher	NT; Ebr	NT	Low	Rocky, sandy and mixed shores on mainland and islands; less common in estuaries, lagoons and coastal pans
<i>Charadrius pallidus</i>	Chestnut-banded Plover	NT	NT	Low	Natural and man-made salt pans; less often in coastal lagoons, shallow bays and estuaries; rarely in freshwater habitats
<i>Stephanoaetus coronatus</i>	African Crowned Eagle	NT	NT	Low	Forest, incl. gallery forest, dense woodland and forested gorges in savanna and grassland; also in <i>Eucalyptus</i> and pine (<i>Pinus</i> spp) plantations
<i>Phoeniconaias minor</i>	Lesser Flamingo	NT	NT	Low	Primarily open, eutrophic, shallow wetlands; breeds on saline lakes and salt pans
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	NT	LC	Low	Clear, fast-flowing perennial streams, rivers and estuaries, usually narrow and secluded, with dense marginal vegetation; often near rapids
<i>Rostratula benghalensis</i>	Greater Painted-snipe	NT	LC	Low	Waterside habitats with substantial cover
<i>Phoenicopterus roseus</i>	Greater Flamingo	NT	LC	Low	Large, shallow, eutrophic wetlands, salt pans, saline lakes, coastal mudflats
<i>Ciconia nigra</i>	Black Stork	NT	LC	Low	Dams, pans, floodplains, flooded grassland, associated with mountainous areas

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Numenius arquata</i>	Eurasian Curlew	LC; NBM	NT	Low	Coastal wetlands; forages on intertidal mud- and sandflats and roosts on adjoining salt-marshes, sand-dunes, mangroves or rocks
<i>Anas smithii</i>	Cape Shoveler	LC; En	LC	Low	Shallow pans and dams in open grassland, favouring saline pans; also shallow bays and upper reaches of large dams
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet	LC; En	LC	Low	Semi-arid savanna, particularly <i>Acacia</i> or mixed <i>Acacia</i> woodlands
<i>Tauraco corythaix</i>	Knysna Turaco	LC; En	LC	Low	Afromontane forest, riverine forest in fynbos, coastal forest and secondary growth in south of range; restricted to mistbelt Afromontane forest in KwaZulu-Natal
<i>Afrotis afra</i>	Southern Black Korhaan	LC; En	LC	Low	In succulent Karoo, in areas dominated by dwarf succulents, Mesembryanthemaceae and Aizoaceae, predominantly annual Asteraceae, and few grasses
<i>Eupodotis vigorsii</i>	Karoo Korhaan	LC; En	LC	Low	Dwarf xerophytic shrubland of succulent Karoo and shrubby areas in Nama Karoo; less abundant in grassy Nama Karoo. Usually on stony ground, in flat to undulating areas
<i>Buteo trizonatus</i>	Forest Buzzard	LC; En	LC	Low	Afromontane forest and plantations, mainly pines (<i>Pinus</i> spp) but also <i>Eucalyptus</i> spp. In north of range, confined to higher elevations
<i>Batis pririt</i>	Pirit Batis	LC; En	LC	Low	Semi-arid woodland and wooded watercourses in deserts and semi-deserts; primarily in open <i>Acacia</i> thornveld, but also <i>Grewia</i> , <i>Ziziphus</i> , <i>Boscia</i> and <i>Terminalia</i> woodlands
<i>Chaetops frenatus</i>	Cape Rock-jumper	LC; En	LC	Low	Rocky mountain fynbos, especially on high slopes and ridges (high-rainfall, windswept areas), but down to sea level around Cape Hangklip, W Cape
<i>Monticola explorator</i>	Sentinel Rock-Thrush	LC; En	LC	Low	Rolling alpine grasslands and heathland, rocky slopes, felled plantations with exposed rocks, and open, grassy rangeland with scattered stones
<i>Bradornis infuscatus</i>	Chat Flycatcher	LC; En	LC	Low	Arid <i>Acacia</i> savanna, Nama Karoo, and dry Karoo shrubland; favours arid, open country with low bushes and few trees and sparse grass cover

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Cossypha dichroa</i>	Chorister Robin-Chat	LC; En	LC	Low	Afromontane evergreen forest
<i>Cercomela schlegelii</i>	Karoo Chat	LC; En	LC	Low	Succulent and woody dwarf shrubland and stony hillsides in the Karoo; sparse, perennial desert grasslands on stony and gravelly plains in the Namib; rare in villages and settlements in the Karoo
<i>Anthoscopus minutus</i>	Cape Penduline-Tit	LC; En	LC	Low	Semi-arid and arid dwarf shrubland, and mesic and arid <i>Acacia</i> savannas
<i>Cisticola textrix</i>	Cloud Cisticola	LC; En	LC	Low	Short grassland with bare ground between grass tufts; also taller red grass / lemon grass (<i>Themeda / Cymbopogon</i>) grasslands
<i>Malcorus pectoralis</i>	Rufous-eared Warbler	LC; En	LC	Low	In Karoo and Kalahari, arid and semi-arid shrubland on plains and slopes; on Namib desert edge, shrubby vegetation in dry drainage lines
<i>Cryptillas victorini</i>	Victorin's Warbler	LC; En	LC	Low	Mostly mesic to wet mountain fynbos from sea level to high altitude; most common on moist, south-facing slopes favouring rank growth along streams or seeps
<i>Stenostira scita</i>	Fairy Flycatcher	LC; En	LC	Low	In breeding season, in shrubland (incl. succulent and Nama Karoo), fynbos, woody hillsides, thorn thickets, scrubby mountain kloofs and valleys, and sweet grassland
<i>Calendulauda albescens</i>	Karoo Lark	LC; En	LC	Low	Shrubland, incl. strandveld, sand-plain fynbos and dwarf Karoo shrubland, primarily on soft, sandy soils; less often on sandy clays; in stony areas of Karoo, largely confined to watercourses; avoids agricultural lands
<i>Chersomanes albofasciata</i>	Spike-heeled Lark	LC; En	LC	Low	Sparse grassland in higher-rainfall areas; also desert grassland, shrubland and degraded patches in semi-arid rangelands
<i>Eremopterix verticalis</i>	Grey-backed Sparrowlark	LC; En	LC	Low	Open, semi-arid to arid habitats, incl. sand and gravel plains with sparse grass and/or dwarf shrubs, short or burnt open grasslands, dry pans, harvested croplands and fallow fields
<i>Promerops cafer</i>	Cape Sugarbird	LC; En	LC	Low	Endemic to fynbos; dependent on Proteaceae for almost all resources occurring mainly in mixed stands of <i>Protea</i> and <i>Erica</i> spp

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Anthus crenatus</i>	African Rock Pipit	LC; En	LC	Low	Mountains, Karoo hills, and escarpment, favouring open areas with rocky outcrops, grass clumps, and low bushes; in east of range, usually > 1 000 m, up to 3 000 m in Lesotho
<i>Emberiza impetuani</i>	Lark-like Bunting	LC; En	LC	Low	Open, dry shrubland, desert grassland, sparse shrubland and grassland on rocky ridges, dry watercourses, eroded gullies and road verges
<i>Emberiza capensis</i>	Cape Bunting	LC; En	LC	Low	Dry shrubland and heathland on rocky hills and plains, open woodland and shrubland along dry watercourses, villages and gardens

APPENDIX E: Mammal species occurring within QDGC 3322CD, national and global conservation status (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; Pr = Protected; En = Endemic; Intro = Introduced), probability of occurring on site and habitat preference. Species are listed by probability of occurring on site

Scientific name	Common name	Conservation Status		Probability of occurring on site	Evidence / Habitat preference
		RSA	IUCN		
<i>Chlorocebus pygerythrus</i>	Vervet Monkey	LC	LC	Confirmed	Sighting / Savanna and riverine woodland
<i>Atilax paludinosus</i>	Water Mongoose	LC	LC	Confirmed	Spoor / Rivers, marshes, dams, lakes and estuaries
<i>Genetta tigrina</i>	South African Large-spotted Genet	LC	LC	Confirmed	Spoor / Savanna, forest, shrubland, urban areas
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	NT	LC	High	Variety of habitats including savanna, woodland and riparian forest; roosts in caves and mine adits
<i>Dasymys incomtus</i>	African Marsh Rat	NT	LC	High	Well vegetated and wet habitats
<i>Neoromicia capensis</i>	Cape Serotine	LC	LC	High	Wide habitat tolerance, semi-desert, grassland, forest, savanna; roosts under bark of trees, at base of aloe leaves and under roofs of houses
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	High	Forages over desert, semi-arid scrub, savanna, grassland and agricultural land; roosts in caves, crevices, hollow trees, under bark, and roofs of houses
<i>Otomys irroratus</i>	Vlei Rat	LC	LC	High	Vleis, swamps and moist grassland
<i>Cryptomys hottentotus</i>	Common Mole-rat	LC	LC	High	Most soils except heavy clay and compacted types
<i>Mastomys coucha</i>	Southern Multimammate Mouse	LC	LC	High	Wide habitat tolerance
<i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	LC	LC	High	Wide range of habitats preferring short, dense grass cover
<i>Felis silvestris</i>	African Wild Cat	LC	LC	High	Wide habitat tolerance but requires cover
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC	High	Occurs in all habitat types except true desert
<i>Ictonyx striatus</i>	Striped Polecat	LC	LC	High	Found in all habitat types including agricultural land
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC	High	Woodland and grassland with scrub cover; often seen in agricultural land

Scientific name	Common name	Conservation Status		Probability of occurring on site	Evidence / Habitat preference
		RSA	IUCN		
<i>Raphicerus campestris</i>	Steenbok	LC	LC	High	Open country with some cover; in arid areas inhabit dry river beds
<i>Sylvicapra grimmia</i>	Common Duiker	LC	LC	High	Wide range of habitats preferring areas with dense vegetation for cover
<i>Tragelaphus scriptus</i>	Bushbuck	LC	LC	High	Wide variety of habitats as long as ample cover available
<i>Mus musculus</i>	House Mouse	LC; Intro	LC	High	Widespread
<i>Rattus rattus</i>	Black Rat	LC; Intro	LC	High	Widespread
<i>Myosorex longicaudatus</i>	Long-tailed Forest Shrew	NT	VU	Medium	Terrestrial, nocturnal, bogs, marshes, swamps, peatlands, forest, marginally in grasslands and boggy fynbos
<i>Rhinolophus capensis</i>	Cape Horseshoe Bat	NT; En	NT	Medium	Fynbos and succulent karoo; forages predominantly in canopy of trees; roosts in caves and mine adits
<i>Vulpes chama</i>	Cape Fox	LC; En; Pr	LC	Medium	Open areas in grassland and arid scrub
<i>Leptailurus serval</i>	Serval	NT; Pr	LC	Medium	Usually near water in areas of tall grassland, reed beds or rank vegetation
<i>Mellivora capensis</i>	Honey Badger	NT; Pr	LC	Medium	Found in most habitat types; absent from desert
<i>Aonyx capensis</i>	Cape Clawless Otter	LC; Pr	LC	Medium	Rivers, marshes, dams and lakes
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC	LC	Medium	Wide range of habitats from karoo to savanna, avoids grassland; roosts in caves, Aardvark (<i>Orycteropus afer</i>) burrows, road culverts and large tree trunks
<i>Rousettus aegyptiacus</i>	Egyptian Fruit Bat	LC	LC	Medium	Requires caves for roosting
<i>Crocidura flavescens</i>	Greater Red Musk Shrew	LC; En	LC	Medium	Wide range of vegetation types receiving >500mm rain per year
<i>Bathyergus suillus</i>	Cape Dune Mole Rat	LC	LC	Medium	Subterranean, sandy soils in fynbos
<i>Gerbillurus paeaba</i>	Hairy-footed Gerbil	LC	LC	Medium	Sandy soils in arid areas extending into moister southern coastal zone

Scientific name	Common name	Conservation Status		Probability of occurring on site	Evidence / Habitat preference
		RSA	IUCN		
<i>Mus minutoides</i>	Pygmy Mouse	LC	LC	Medium	Savanna grassland and woodland
<i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	Medium	Savanna, shrubland, grassland, temperate, nocturnal seed eater
<i>Graphiurus murinus</i>	Woodland Dormouse	LC	LC	Medium	Woodland savanna
<i>Lepus capensis</i>	Cape Hare	LC	LC	Medium	Open, arid habitat with grass and scrub
<i>Procavia capensis</i>	Rock Hyrax	LC	LC	Medium	Widespread, dry savanna to dense forest, rocky areas
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	Medium	Dry, open grasslands or savannas
<i>Caracal caracal</i>	Caracal	LC	LC	Medium	Semi-desert, open grasslands and savanna woodland
<i>Genetta genetta</i>	Small-spotted Genet	LC	LC	Medium	Dry savanna woodland
<i>Poecilogale albinucha</i>	African Striped Weasel	DD	LC	Medium	Wide habitat tolerance but prefers grassland or open woodland
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	Medium	Open habitats in short grassland and arid scrub
<i>Herpestes pulverulentus</i>	Small Grey Mongoose	LC	LC	Medium	Wide habitat tolerance
<i>Herpestes ichneumon</i>	Large Grey Mongoose	LC	LC	Medium	Riparian vegetation, around lakes, dams and marshes
<i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC	Medium	Open country with short scrub, grassveld and sparsely wooded areas
<i>Potamochoerus larvatus</i>	Bushpig	LC	LC	Medium	Forest, dense bush; riparian woodland, reed beds and long grass near water
<i>Mystromys albicaudatus</i>	White-tailed Mouse	EN; En	EN	Low	Grassland / shrubland, vleis with black loam
<i>Philantomba monticola</i>	Blue Duiker	VU	LC	Low	Forest, thickets and dense coastal bush
<i>Amblysomus corriae</i>	Fynbos Golden Mole	NT	NT	Low	Mediterranean scrub, urban gardens, subterranean
<i>Panthera pardus</i>	Leopard	NT	NT	Low	Wide habitat tolerance; drinking water essential
<i>Miniopterus fraterculus</i>	Lesser Long-fingered Bat	NT; En	LC	Low	Temperate grasslands; cave dependent
<i>Miniopterus natalensis</i>	Natal Long-fingered Bat	NT	LC	Low	Savanna or grassland; caves required
<i>Myotis tricolor</i>	Temminck's Myotis	NT	LC	Low	Mountainous areas; roosts gregariously in caves

Scientific name	Common name	Conservation Status		Probability of occurring on site	Evidence / Habitat preference
		RSA	IUCN		
<i>Chlorotalpa duthieae</i>	Duthie's Golden Mole	LC	VU	Low	Subterranean, scrub and forested kloofs in the Karoo and Grassland biomes in savanna
<i>Elephantulus edwardii</i>	Cape Rock Sengi	LC; En	LC	Low	Rocky habitats
<i>Graphiurus ocellatus</i>	Spectacled Dormouse	LC; En	LC	Low	Mainly rocky areas but also utilises trees and buildings
<i>Macroscelides proboscideus</i>	Round-eared Sengi	LC; En	LC	Low	Arid areas with sparse grass or scrub
<i>Myosorex varius</i>	Forest Shrew	LC; En	LC	Low	Moist, densely vegetated areas ranging from primary forest and montane grassland to waterside vegetation
<i>Pelea capreolus</i>	Grey Rhebok	LC; En	LC	Low	Rocky hillsides / grassland
<i>Pronolagus saundersiae</i>	Hewitt's Red Rock Rabbit	LC; En	LC	Low	Rocky hillsides, rocky ravines
<i>Raphicerus melanotis</i>	Cape Grysbok	LC; En	LC	Low	Open areas in grassland and arid scrub
<i>Georychus capensis</i>	Cape Mole Rat	LC	LC	Low	Subterranean, sandy soils, coastal sand dunes and montane regions
<i>Acomys subspinosus</i>	Cape Spiny Mouse	LC	LC	Low	Rocky areas on mountain slopes in fynbos
<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	LC	LC	Low	Rocky habitats
<i>Dendromus melanotis</i>	Grey Climbing Mouse	LC	LC	Low	Tall grass and rank vegetation
<i>Dendromus mesomelas</i>	Brant's Climbing Mouse	LC	LC	Low	Tall grass and rank vegetation
<i>Myomyscus verreauxii</i>	Verreaux's Mouse	LC	LC	Low	Temperate, scrub on grassy hillsides, forest edge and riverine forest
<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	LC	LC	Low	Hard ground with grass or karroid bush
<i>Oreotragus oreotragus</i>	Klipspringer	LC	LC	Low	Dependent on rocky and mountainous terrain
<i>Orycteropus afer</i>	Aardvark	LC	LC	Low	Open woodland, sparse scrub and grassland
<i>Papio cynocephalus</i>	Savanna Baboon	LC	LC	Low	Wide habitat tolerance but characteristically woodland savanna
<i>Proteles cristatus</i>	Aardwolf	LC	LC	Low	Wide habitat tolerance with a preference for open areas
<i>Crociodura cyanea</i>	Reddish-grey Musk Shrew	DD	LC	Low	Dry terrain
<i>Suncus varilla</i>	Lesser Dwarf Shrew	DD	LC	Low	Grassland / termitaria

Scientific name	Common name	Conservation Status		Probability of occurring on site	Evidence / Habitat preference
		RSA	IUCN		
<i>Otomys saundersiae</i>	Saunder's Vlei Rat	DD	LC	Low	Drakensberg grassland, thicket, fynbos
<i>Diceros bicornis</i>	Black Rhinoceros	EN	CR	Zero	Restricted to conservation areas
<i>Ceratotherium simum</i>	White Rhinoceros	NT; Pr	NT	Zero	Restricted to conservation areas
<i>Syncerus caffer</i>	African Buffalo	LC	LC	Zero	Restricted to conservation areas
<i>Tragelaphus oryx</i>	Eland	LC	LC	Zero	Arid scrub, savanna woodland, montane grassland

APPENDIX F: Amphibian species occurring within QDGC 3322CD indicating national and global conservation status (VU = Vulnerable; LC = Least Concern; En = Endemic), probability of occurring on site and habitat preference. Species are listed by probability of occurring on site

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Amietia angolensis</i>	Common River Frog	LC	LC	High	Banks of slow-moving streams or other permanent bodies of water in a wide variety of wetland habitats in grassland, savanna and forest edge
<i>Amietia fuscigula</i>	Cape River Frog	LC	LC	High	Widespread around permanent rivers and streams in grassland, fynbos and Karoo scrub including farm dams and other artificial water bodies
<i>Amietophrynus rangeri</i>	Raucous Toad	LC	LC	High	Rivers and streams in grassland and fynbos; frequently in gardens and farmland
<i>Cacosternum nanum</i>	Bronze Caco	LC	LC	High	Variety of vegetation types including fynbos, savanna, grassland, thicket and forest; breeds in small ponds, dams, vleis, streams, roadside pools or flooded grassland
<i>Strongylopus grayii</i>	Clicking Stream Frog	LC	LC	High	Winter and summer rainfall areas in fynbos, succulent Karoo, Nama Karoo, savanna, grassland, thicket and forest from sea level to 3000m
<i>Xenopus laevis</i>	Common Platanna	LC	LC	High	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland
<i>Hyperolius horstockii</i>	Arum Lily Frog	LC; En	VU	Medium	Large or small pans, dams, vleis and slow-flowing streams in costal fynbos
<i>Tomopterna delalandii</i>	Cape Sand Frog	LC; En	LC	Medium	Lowlands and valleys in fynbos and succulent Karoo in the Western Cape and along southern Cape coast
<i>Vandijkophrynus angusticeps</i>	Cape Sand Toad	LC; En	LC	Medium	Temporary rain-filled depressions in sandy soils in the Western Cape
<i>Cacosternum boettgeri</i>	Boettger's Caco	LC	LC	Medium	Variety of habitats in Nama Karoo, succulent Karoo, grassland and thicket favouring open areas and especially abundant in grassland areas; occasionally forest clearings

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Hyperolius marmoratus</i>	Painted Reed Frog	LC	LC	Medium	Reeds and other vegetation types around edges of a wide variety of waterbodies in savanna, grassland and forest; occasionally in fynbos
<i>Semnodactylus wealii</i>	Rattling Frog	LC	LC	Medium	Summer and winter rainfall areas in well-vegetated areas around pans and vleis in grassland or fynbos heath in south of range
<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	LC	Medium	Open, grassy areas near dams, ponds or streams in forest, thicket, grassland and savanna, sometimes parks and gardens
<i>Breviceps fuscus</i>	Plain Rain Frog	LC; En	LC	Low	Forested slopes and plateaus of the southern Cape fold mountains
<i>Breviceps montanus</i>	Cape Mountain Rain Frog	LC; En	LC	Low	Restricted to fynbos from the summit of Table Mountain to the Cape fold mountains, and at sea level where the mountains reach the coast
<i>Capensibufo tradouwi</i>	Tradouw Mountain Toadlet	LC; En	LC	Low	High altitude fynbos in the inland areas of the Cape fold mountains
<i>Heleophryne regis</i>	Southern Ghost Frog	LC; En	LC	Low	Cold, clear, slow-to-fast flowing mountain streams in moist, forested montane fynbos with Afromontane plant communities
<i>Strongylopus bonaespei</i>	Banded Stream Frog	LC; En	LC	Low	Montane fynbos and forest margins in shallow pools in well-vegetated seasonal seepages and marshy areas in mountain ranges of the Western Cape
<i>Vandijkophrynus garipeensis</i>	Karoo Toad	LC	LC	Low	Dry thornbush areas in the catchment of the Orange River; arid Karoo scrub, fynbos and grassland occurring up to high altitudes; well adapted to the arid and cold conditions of the central hinterland in both summer and winter rainfall regions

APPENDIX G: Reptile species occurring within QDGC 3322CD, national and global conservation status (LC = Least Concern; NE = Not Evaluated; En = Endemic), probability of occurring on site and habitat preference. Species are listed by probability of occurring on site

Scientific name	Common name	Conservation Status			Probability of occurring on site	Habitat preference
		RSA	IUCN	CITES		
<i>Trachylepis homalocephala</i>	Red-sided Skink	En	NE		High	Habitat generalist; widespread and common
<i>Lamprophis capensis</i>	Brown House Snake		NE		High	Highveld grassland, karroid regions and tolerant in urban areas
<i>Trachylepis capensis</i>	Cape Skink		NE		High	Habitat generalist; widespread and common
<i>Chersina angulata</i>	Angulate Tortoise		NE	CITES App II	Medium	Varied, sandy coastal regions, including mesic thicket and coastal fynbos
<i>Dubertia lutrix</i>	Common Slug-eater	En	LC		Medium	Savanna, coastal bush and fynbos
<i>Lamprophis aurora</i>	Aurora House Snake	En	LC		Medium	Grassland, coastal bush and fynbos
<i>Lamprophis inornatus</i>	Olive House Snake	En	LC		Medium	Moist coastal bushveld and fynbos, grassland
<i>Homoroselaps lacteus</i>	Spotted Harlequin Snake	En	NE		Medium	Fynbos, costal forest, moist savanna and grassland
<i>Lycodonomorphus rufulus</i>	Common Water Snake	En	NE		Medium	Small streams, pans and vleis
<i>Afrogecko porphyreus</i>	Marbled African Leaf-toed Gecko	En	NE		Medium	Coastal and montane fynbos, cold evergreen forest, urban areas
<i>Leptotyphlops nigricans</i>	Cape Worm Snake	En	NE		Medium	Varied, fynbos, thicket, grassland and savanna
<i>Dasypeltis scabra</i>	Rhombic Egg-eater		LC		Medium	Absent only from closed canopy and desert areas
<i>Agama atra</i>	Southern Rock Agama		NE		Medium	Semi-desert to fynbos
<i>Crotaphopeltis hotamboeia</i>	Herald Snake		NE		Medium	Savanna and open woodland
<i>Lycophidion capense</i>	Common Wolf Snake		NE		Medium	Variety of habitats incl. lowland forest, fynbos, moist savanna, grassland and karoo scrub
<i>Psammophylax rhombeatus</i>	Spotted Skaapsteker		NE		Medium	Highveld grassland, mesic thicket, fynbos, karroid areas
<i>Pedioplanis lineocellata</i>	Spotted Sand Lizard		NE		Medium	Very varied
<i>Bradypodion damaranum</i>	Knysna Dwarf Chameleon	En	NE	CITES App II	Low	Wet, coastal forest
<i>Bradypodion gutturale</i>	Little Karoo Dwarf Chameleon	En	NE	CITES App II	Low	Low montane fynbos scrub

Scientific name	Common name	Conservation Status			Probability of occurring on site	Habitat preference
		RSA	IUCN	CITES		
<i>Cordylus Cordylus</i>	Cape Girdled Lizard	En	NE	CITES App II	Low	Diverse, coastal cliffs, rock plateaus in fynbos, montane grassland, mesic thickets
<i>Pseudocordylus microlepidotus</i>	Cape Crag Lizard	En	NE	CITES App II	Low	Mountain plateaus and upper slopes in fynbos or montane grassland
<i>Pseudocordylus capensis</i>	Graceful Crag Lizard	En	NE	CITES App II	Low	Mountain fynbos
<i>Cordylus coeruleopunctatus</i>	Blue-spotted Girdled Lizard	En	NE	CITES App II	Low	Rock outcrops in fynbos and forest fringes
<i>Homopus areolatus</i>	Parrot-beaked Padloper	En	NE	CITES App II	Low	Varied coastal fynbos, karroid broken veld and open mesic thicket
<i>Stigmochelys pardalis</i>	Leopard Tortoise		NE	CITES App II	Low	Varied, montane grassland, fynbos, mesic thicket, arid and mesic savanna
<i>Hemachatus haemachatus</i>	Rinkhals	En	LC		Low	Grassland
<i>Tetradactylus africanus</i>	African Seps	En	LC		Low	Coastal grassland in the north and coastal fynbos in the south
<i>Bitis atropos</i>	Berg Adder	En	LC		Low	Montane grassland and coastal montane fynbos
<i>Amplorhinus multimaculatus</i>	Many-spotted Snake	En	NE		Low	Mountain streams and vleis
<i>Chamaesaura anguina</i>	Cape Grass Lizard	En	NE		Low	Grassy or fynbos covered mountain slopes
<i>Naja nivea</i>	Cape Cobra	En	NE		Low	Arid karroid regions, along river courses
<i>Pachydactylus geitje</i>	Ocellated Gecko	En	NE		Low	Varied, coastal strandveld, fynbos, rocky grassland
<i>Tetradactylus seps</i>	Short-legged Seps	En	NE		Low	Coastal forests or montane grassy plateaus
<i>Nucras lalandii</i>	Delalande's Sandveld Lizard	En	NE		Low	Montane and temperate grassland
<i>Pedioplanis burchelli</i>	Burchell's Sand Lizard	En	NE		Low	Rocky montane grassland, succulent karroid veld and coastal fynbos
<i>Tropidosaura gularis</i>	Cape Mountain Lizard	En	NE		Low	Fynbos covered mountain summits
<i>Tropidosaura montana</i>	Common Mountain Lizard	En	NE		Low	Fynbos and montane grassland
<i>Acontias meleagris</i>	Cape Legless Skink	En	NE		Low	Coastal and fynbos areas, richer soils, karoo escarpment

Scientific name	Common name	Conservation Status			Probability of occurring on site	Habitat preference
		RSA	IUCN	CITES		
<i>Pachydactylus maculatus</i>	Large-spotted Gecko		LC		Low	Varied, fynbos and coastal bush to arid karroid veld
<i>Dispholidus typus</i>	Boomslang		NE		Low	Open bush and savanna, sparsely wooded grassland in the Winterberg
<i>Psammophis crucifer</i>	Crossed Whip Snake		NE		Low	Highveld and montane grassland, entering fynbos
<i>Psammophis notostictus</i>	Karoo Whip Snake		NE		Low	Arid scrubland and karroid regions
<i>Pseudaspis cana</i>	Mole Snake		NE		Low	Sandy scrubland in SW Cape, highveld grassland, mountainous and desert areas
<i>Chondrodactylus bibronii</i>	Bibron's Tubercled Gecko		NE		Low	Karroid veld and semi-desert
<i>Pelomedusa subrufa</i>	Marsh Terrapin		NE		Low	Slow-moving and still water, temporary pans
<i>Trachylepis sulcata</i>	Western Rock Skink		NE		Low	Karroid veld, desert and arid savanna
<i>Bitis arietans</i>	Puff Adder		NE		Low	Absent only from desert, dense forest and mountain tops
<i>Causus rhombeatus</i>	Rhombic Night Adder		NE		Low	Mesic savanna

APPENDIX H: Butterfly species occurring within QDGC 3322CD including national conservation status (LC = Least Concern; DD = Data Deficient; En = Endemic). Species are listed taxonomically

Family	Scientific name	Common name	Conservation Status
HESPERIIDAE	<i>Eagris nottoana knysna</i>	Rufous-winged elfin	LC; En
HESPERIIDAE	<i>Gegenes niso niso</i>	Common hottentot	LC
HESPERIIDAE	<i>Gomalia elma elma</i>	Green-marbled skipper	LC
HESPERIIDAE	<i>Metisella metis metis</i>	Gold-spotted sylph	LC; En
HESPERIIDAE	<i>Metisella metis paris</i>	Gold-spotted sylph	LC
HESPERIIDAE	<i>Pelopidas thrax</i>	White-banded swift	LC
HESPERIIDAE	<i>Spialia asterodia</i>	Star sandman	LC
HESPERIIDAE	<i>Spialia diomus ferax</i>	Common sandman	LC
HESPERIIDAE	<i>Spialia nanus</i>	Dwarf sandman	LC
HESPERIIDAE	<i>Spialia sataspes</i>	Boland sandman	Not listed
HESPERIIDAE	<i>Spialia spio</i>	Mountain sandman	LC
HESPERIIDAE	<i>Tsitana dicksoni</i>	Dickson's sylph	DD; En
HESPERIIDAE	<i>Tsitana tulbagha kaplani</i>	Tulbagh sylph	LC; En
LYCAENIDAE	<i>Aloeides almeida</i>	Almeida copper	LC; En
LYCAENIDAE	<i>Aloeides aranda</i>	Aranda copper	LC
LYCAENIDAE	<i>Aloeides depicta</i>	Depicta copper	LC; En
LYCAENIDAE	<i>Aloeides juana</i>	Juana copper	LC; En
LYCAENIDAE	<i>Aloeides pierus</i>	Dull copper	LC; En
LYCAENIDAE	<i>Aloeides quickelbergei</i>	Quickelberge's copper	LC; En
LYCAENIDAE	<i>Anthene definita definita</i>	Common hairtail	LC
LYCAENIDAE	<i>Cacyreus fracta fracta</i>	Water geranium bronze	LC
LYCAENIDAE	<i>Cacyreus lingeus</i>	Bush bronze	LC
LYCAENIDAE	<i>Cacyreus marshalli</i>	Common geranium bronze	LC
LYCAENIDAE	<i>Capys alpheus alpheus</i>	Orange banded protea	LC; En
LYCAENIDAE	<i>Chrysothis chrysaor</i>	Burnished opal	LC; En
LYCAENIDAE	<i>Chrysothis nigricans zwartbergae</i>	Dark opal	LC; En
LYCAENIDAE	<i>Chrysothis palmus margueritae</i>	Water opal	LC; En
LYCAENIDAE	<i>Chrysothis plutus</i>	Plutus' opal	LC; En
LYCAENIDAE	<i>Cupidopsis cissus cissus</i>	Common meadow blue	LC
LYCAENIDAE	<i>Durbaniella clarki clarki</i>	Clark's rocksitter	LC; En
LYCAENIDAE	<i>Eicochrysops messapus messapus</i>	Cupreous blue	LC
LYCAENIDAE	<i>Iolais mimosae mimosae</i>	Mimosa sapphire	LC; En
LYCAENIDAE	<i>Lampides boeticus</i>	Pea blue	LC
LYCAENIDAE	<i>Lepidochrysops asteris</i>	Brilliant blue	LC; En
LYCAENIDAE	<i>Lepidochrysops australis</i>	Southern blue	LC; En
LYCAENIDAE	<i>Lepidochrysops braueri</i>	Brauer's blue	LC; En
LYCAENIDAE	<i>Lepidochrysops dukei</i>	Duke's blue	LC; En
LYCAENIDAE	<i>Lepidochrysops ketsi ketsi</i>	Ketsi blue	LC; En
LYCAENIDAE	<i>Lepidochrysops oreas junae</i>	Peninsula blue	LC; En
LYCAENIDAE	<i>Lepidochrysops robertsoni</i>	Robertson's blue	LC; En
LYCAENIDAE	<i>Lepidochrysops swartbergensis</i>	Swartberg blue	LC; En
LYCAENIDAE	<i>Leptomyrina lara</i>	Cape black-eye	LC

Family	Scientific name	Common name	Conservation Status
LYCAENIDAE	<i>Leptotes brevidentatus</i>	Short-toothed zebra blue	LC
LYCAENIDAE	<i>Leptotes pirithous pirithous</i>	Common zebra blue	LC
LYCAENIDAE	<i>Oraidium barberae</i>	Dwarf blue	LC
LYCAENIDAE	<i>Tarucus thespis</i>	Vivid dotted blue	LC; En
LYCAENIDAE	<i>Thestor barbatus</i>	Bearded skolly	LC; En
LYCAENIDAE	<i>Thestor brachycerus dukei</i>	Duke's skolly	LC; En
LYCAENIDAE	<i>Thestor murrayi</i>	Murray's skolly	LC; En
LYCAENIDAE	<i>Trimenia argyroplaga argyroplaga</i>	Large silver-spotted copper	LC
LYCAENIDAE	<i>Trimenia macmasteri macmasteri</i>	McMaster's silver-spotted copper	LC; En
LYCAENIDAE	<i>Virachola antalus</i>	Brown playboy	LC
LYCAENIDAE	<i>Zizeeria knysna knysna</i>	African grass blue	LC
LYCAENIDAE	<i>Zizina otis antanossa</i>	Dark grass blue	LC
NYMPHALIDAE	<i>Acraea horta</i>	Garden acraea	LC
NYMPHALIDAE	<i>Aeropetes tulbaghia</i>	Table Mountain beauty	LC
NYMPHALIDAE	<i>Amauris echeria echeria</i>	Chief friar	LC; En
NYMPHALIDAE	<i>Bicyclus safitza safitza</i>	Common bush brown	LC
NYMPHALIDAE	<i>Cassionympha cassius</i>	Rainforest brown	LC; En
NYMPHALIDAE	<i>Cassionympha detecta</i>	Cape brown	LC; En
NYMPHALIDAE	<i>Charaxes brutus natalensis</i>	White-barred charaxes	LC
NYMPHALIDAE	<i>Charaxes pelias</i>	Protea charaxes	LC; En
NYMPHALIDAE	<i>Charaxes varanes varanes</i>	Pearl charaxes	LC
NYMPHALIDAE	<i>Charaxes xiphares xiphares</i>	Forest-king charaxes	LC; En
NYMPHALIDAE	<i>Cymothoe alcimeda alcimeda</i>	Battling glider	LC; En
NYMPHALIDAE	<i>Danaus chrysippus orientis</i>	African monarch	LC
NYMPHALIDAE	<i>Dira clytus clytus</i>	Cape autumn widow	LC; En
NYMPHALIDAE	<i>Hypolimnas misippus</i>	Common diadem	LC
NYMPHALIDAE	<i>Junonia hierta cebrene</i>	Yellow pansy	LC
NYMPHALIDAE	<i>Precis archesia archesia</i>	Garden commodore	LC
NYMPHALIDAE	<i>Pseudonympha hippia</i>	Burchell's brown	LC; En
NYMPHALIDAE	<i>Pseudonympha magus</i>	Silver-bottom brown	LC; En
NYMPHALIDAE	<i>Stygionympha vigilans</i>	Western hillside brown	LC; En
NYMPHALIDAE	<i>Tarsocera cassus outeniqua</i>	Spring widow	LC; En
NYMPHALIDAE	<i>Tarsocera dicksoni</i>	Dickson's widow	LC; En
NYMPHALIDAE	<i>Telchinia rahira rahira</i>	Marsh acraea	LC
NYMPHALIDAE	<i>Vanessa cardui</i>	Painted lady	LC
PAPILIONIDAE	<i>Papilio dardanus cenea</i>	Mocker swallowtail	LC
PAPILIONIDAE	<i>Papilio demodocus demodocus</i>	Citrus swallowtail	LC
PAPILIONIDAE	<i>Papilio nireus lyaeus</i>	Green-banded swallowtail	LC
PIERIDAE	<i>Belenois aurota</i>	Brown-veined white	LC
PIERIDAE	<i>Belenois gidica abyssinica</i>	African veined white	LC
PIERIDAE	<i>Belenois zochalia zochalia</i>	Forest white	LC
PIERIDAE	<i>Catopsilia florella</i>	African migrant	LC
PIERIDAE	<i>Colias electo electo</i>	African clouded yellow	LC
PIERIDAE	<i>Colotis antevippe gavisa</i>	Red tip	LC
PIERIDAE	<i>Colotis euippe omphale</i>	Smoky orange tip	LC
PIERIDAE	<i>Dixeia charina charina</i>	African small white	LC

Family	Scientific name	Common name	Conservation Status
PIERIDAE	<i>Mylothris agathina agathina</i>	Common dotted border	LC
PIERIDAE	<i>Pieris brassicae</i>	Cabbage white	LC
PIERIDAE	<i>Pinacopteryx eriphia eriphia</i>	Zebra white	LC
PIERIDAE	<i>Pontia helice helice</i>	Common meadow white	LC