

**MAREETSANE BATHO-BATHO SOLAR PV FACILITY
ECOLOGICAL ASSESSMENT
(FLORA AND FAUNA INCLUDING AVIFAUNA)**

SEF Reference No. 504744

Prepared for:
**Kgatelopele Private Equity and
Venture Capital (Pty) Ltd**
Tel. No.: 083 254 5210
E-mail: Keobakiles@kgatelopele.co.za



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



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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

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- 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

Date

Declaration of Independence

I, **Robyn Phillips**, in my capacity as a specialist consultant, hereby declare that I –

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- Have and will not have vested interest in the proposed activity proceeding;
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- 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

Date

EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental practitioners and ecological specialists, was appointed by Kgatelopele Private Equity and Venture Capital (Pty) Ltd (KPEVC) to undertake ecological studies (flora and fauna, including avifauna) for the proposed Mareetsane Batho-Batho Solar Photo Voltaic (PV) Facility which will generate approximately 30 Mega Watts (MW) of power and the associated powerline in the North West Province, South Africa.

The study area occurs within the Savanna and Grassland biomes, more specifically within the Klerksdorp Thornveld, Mafikeng Bushveld and Western Highveld Sandy Grassland vegetation types. The Western Highveld Sandy Grassland is currently listed as Critically Endangered while Mafikeng Bushveld is listed as Vulnerable in terms of Section 52 of the National Environmental Management: Biodiversity Act (NEM:BA) (Government Gazette, 2009).

The study area included a proposed solar plant site as well as three powerline route alternatives. Vegetation communities recorded within these areas included *Acacia erioloba* Bushveld, rocky areas, a wetland, numerous game camps, the Mareetsane River and modified areas. Numerous plant species of conservation concern, such as *Boophone disticha*, *Hypoxis hemerocallidea* and *Crinum c.f. stuhlmannii* were recorded in the study area. One nationally protected tree species, *Acacia erioloba* was very prolific throughout the study area. The vegetation associated with the solar plant site was largely in a natural state and represented the Critically Endangered Western Highveld Sandy Grassland vegetation type.

At least two avifaunal species which are of conservation concern, namely *Gyps africanus* (White-backed Vulture) currently listed as Endangered and *Sagittarius serpentarius* (Secretarybird) currently listed as Vulnerable were confirmed to be breeding at various localities throughout the study area. These large bird species are particularly vulnerable to electrocution by powerlines. Although no mammal species of conservation concern were confirmed during the field surveys, numerous provincially and nationally protected species were recorded throughout the study area, especially in the game camps associated with powerline route alternative C.

The area associated with the solar plant was classified as medium to high ecological sensitivity due to the presence of large populations of various plant species of conservation concern, such as the nationally protected tree species *Acacia erioloba* which was determined to be the dominant woody species within this site. Furthermore, the vegetation associated with the solar plant site is representative of Western Highveld Sandy Grassland ecosystem which is classified as Critically Endangered. As such, it is strongly recommended that the proposed solar plant site is moved to an area immediately north east of the current site, as this area has been modified through agricultural activities and does not support indigenous vegetation or plant species of conservation concern.

Powerline route alternative B is the preferred route from an ecological perspective, although it is recommended that the route does not turn east but continues in a northerly direction to the R375 before turning east to the substation at Mareetsane.

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1 INTRODUCTION

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental practitioners and ecological specialists, was appointed by Kgatelopele Private Equity and Venture Capital (Pty) Ltd (KPEVC) to undertake ecological studies (flora and fauna, including avifauna) for the proposed 30MW Mareetsane Batho-Batho Solar PV Facility and associated powerline in the North West Province, South Africa.

Three (3) alternative powerline routes are being considered. The ecological assessment covered a 100m corridor surrounding each line alternative, 50m on either side of the centre line, which will make provision for any 'shifting' of pylon positions at the final stages of the project.

1.1 Terms of Reference

The terms of reference for the floral and faunal, including avifauna, 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 9th to the 10th of April 2013 and the 21st to the 23rd of May 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 for in Appendix A.

1.3 Limitations

The following limitations were applicable to the study:

- 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 two field surveys conducted in April/May 2013, and a review of available literature;
- The study area received below average rainfall during the summer preceding the field survey resulting in the dormancy of numerous floral species;
- Some floral species which are nationally and provincially protected or species of conservation concern were very abundant in some areas and Geographic Positioning System (GPS) readings therefore indicate the locality of populations and do not necessarily reflect individual plants; and
- Powerline routes have been assessed within 100m of existing powerlines and roads and therefore did not make provision for the powerlines to be constructed outside this buffer, unless otherwise indicated. Additional surveys will be required should the powerlines not be constructed within the 100m area assessed during the present study.

2 BACKGROUND

2.1 Location

The study area is located within the Ngaka Modiri Molema District Municipality (NMMDM) in the North West Province, approximately 40km south west of the town of Mafikeng and falls under the jurisdiction of the Ratlou Local Municipality (RLM). The study area lies within Quarter Degree Grid Cell (QDGC) 2625AB between 26°07'03" – 26°14'16" south and 25°14'47" – 25°24'45" east (Figure 1).

2.2 Climate

The region receives approximately 520mm of rain per year, with rainfall occurring mainly in summer. The region receives the lowest rainfall in July and the highest in January. The average midday temperature ranges from 20°C in June and July to 35°C in December and January. The region is the coldest in June and July when the temperature drops to 2°C on average during the night. Frost occurs frequently in winter (Mucina & Rutherford, 2006).

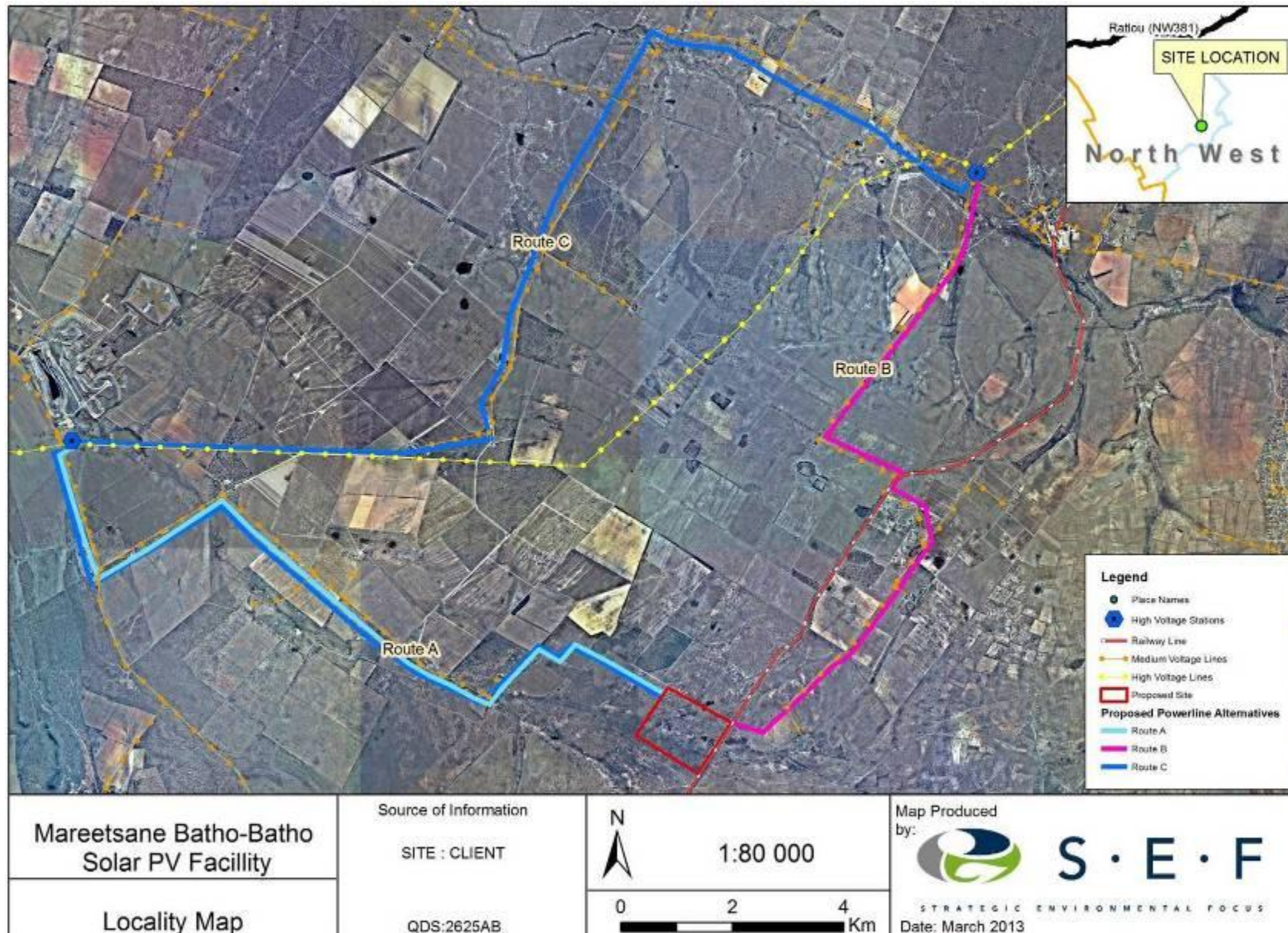


Figure 1: Locality of the study area

2.3 Regional Vegetation

The study site is located within two biomes, namely the Grassland and the Savanna Biomes.

The Grassland Biome (Rutherford & Westfall, 1994) is characterised by high summer rainfall and dry winters. Frequent frost during the winter nights as well as marked diurnal temperature variations is unfavourable for tree growth resulting in the Grassland Biome consisting mainly of grasses and plants with perennial underground storage organs, such as bulbs and tubers. A large number of Rare and Threatened plant species in the summer rainfall regions of South Africa is restricted to high-rainfall grassland, making this the vegetation type in most urgent need of conservation. Frost, fire and grazing within grasslands maintain the herbaceous grass and forb layer and prevent the establishment of thickets (Tainton, 1999). Fire is a natural disturbance caused by lightning, and natural fires (or controlled burning every three years or so) is therefore essential for maintaining the structure and biodiversity of this biome. However, if prevented due to activities such as agriculture and mining, thicket forming tree or alien species eventually dominate the natural vegetation and place an additional burden on already scarce resources such as water.

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

Biomes are further divided into smaller units known as vegetation types. Three such vegetation types were determined to be associated with the study area and included Klerksdorp Thornveld (Grassland biome), Western Highveld Sandy Grassland (Grassland biome) as well as Mafikeng Bushveld (Savanna biome) (Figure 2).

Klerksdorp Thornveld is limited to the North-West Province and is characterised by flat plains or slightly undulating plains with dense *Acacia karroo* bush clumps in grassland. Important floral species in this vegetation type includes *Acacia karroo*, *A.caffra*, *Celtis africana*, *Searsia lancea*, *Ziziphus mucronata*, *Grewia flava*, *Gymnosporia buxifolia* and *Tarchonanthus camphorates* while the grass layer is dominated by species such as *Aristida congesta*, *Cynodon dactylon*, *Eragrostis lehmanniana*, *E.trichophora*, *Panicum coloratum*, *Themeda triandra*, *Brachiaria nigropedata* and *Diheteropogon contortus*. Herbaceous species include *Acalypha angustata*, *Berkheya onopordifolia*, *Helichrysum nudifolium*, *Hermannia lancifolia* and *Salvia radula*. This vegetation type is classified as Vulnerable according to Mucina & Rutherford (2006) with only 2% conserved in statutory reserves and private game parks.

Western Highveld Sandy Grassland is limited to the North-West Province and consists of mostly flat plains with short, dry grassland while woody species occurs in bush clumps. Important grass species in this vegetation type includes *Antheophora pubescens*, *Aristida congesta*, *Eragrostis lehmanniana*, *Pogonarthria squarrosa*, *Setaria sphacelata*, *Themeda triandra*, *Aristida adscensionis*, *Brachiaria serrata*, *Digitaria argyrograpta* and *Melinis nerviglumis*. The herbaceous layer is dominated by *Gazania krebsiana*, *Stachys spathulata*, *Barleria macrostegia*, *Chamaecrista mimosoides*, *Helichrysum callicomum*, *Hermannia depressa*, *Polygala hottentotta* and *Sida dregei*. According to Mucina & Rutherford (2006), this vegetation type is classified as Endangered with only a very small portion statutorily conserved in Baberspan Nature Reserve and more than 60% has been transformed mostly through agriculture.

Mafikeng Bushveld is located in the Savanna Biome and occurs in the North-West Province, west of Mafikeng and south of the Botswana border. The vegetation consists of a well-developed tree layer with dense stands of *Terminalia sericea*, *Acacia luederitzii* and *A.erioloba* while the shrub layer consists of *Acacia karroo*, *A.hebeclada*, *A.mellifera*, *Dichrostachys cinerea*, *Grewia flava*, *Grewia retinervis* and *Ziziphus mucronata*. The grass layer is dominated by *Antheophora pubescens*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis lehmanniana*, *E.pallens*, *Aristida congesta*, *Cynodon dactylon* and various *Eragrostis* spp. This vegetation type is classified as Vulnerable with nothing conserved in statutory conservation areas but a small area is conserved in Mmabatho Recreational Area (Mucina & Rutherford, 2006).

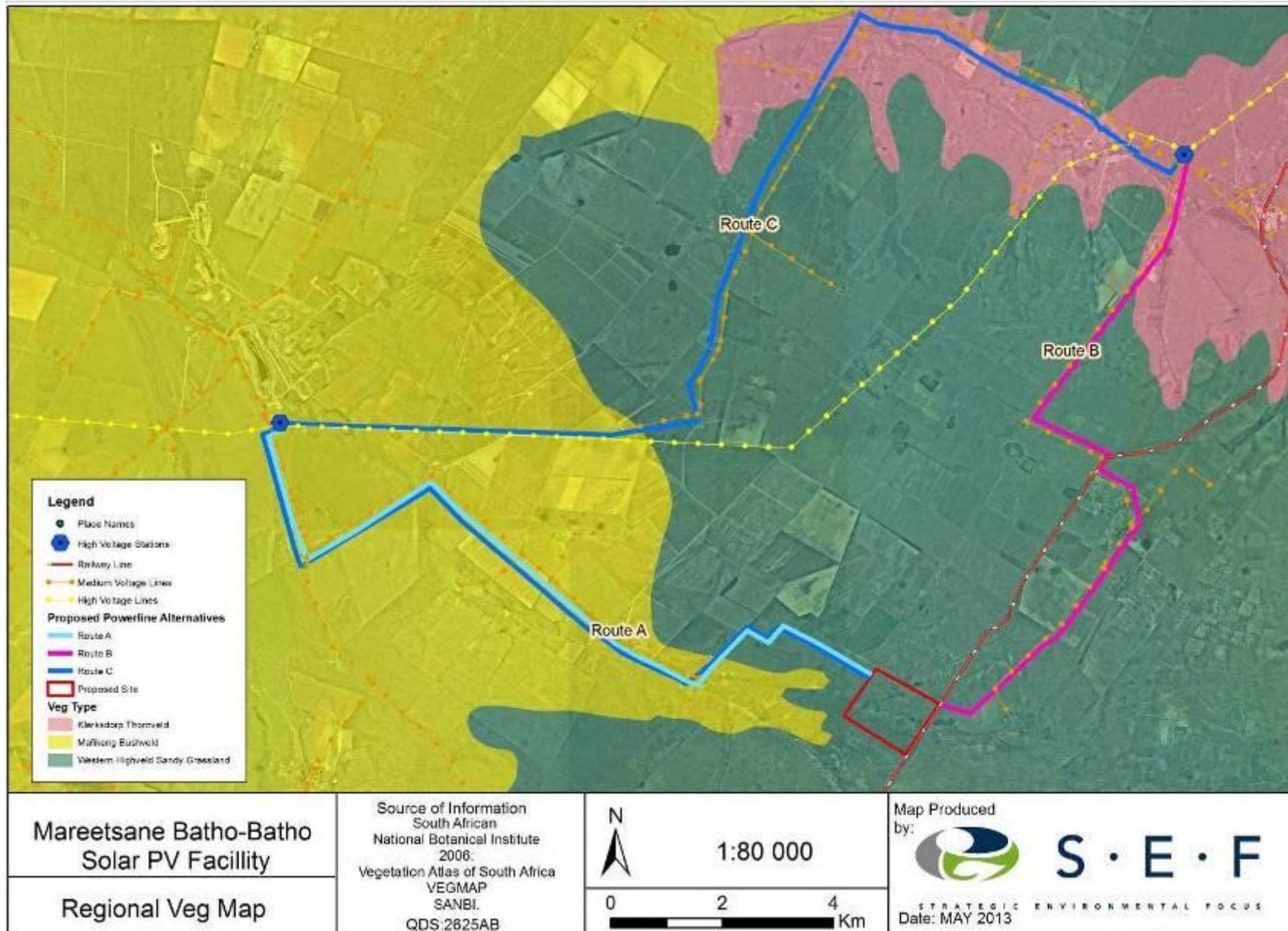


Figure 2: Regional vegetation in relation to the study area

2.4 Listed Ecosystems and Centres of Endemism

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) provides for listing threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (Government Gazette, 2009). The main purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of threatened ecosystems.

Threatened terrestrial ecosystems have been delineated based on the following:

- The South African Vegetation Map;
- National forest types;
- Priority areas identified in a provincial systematic biodiversity plan; or
- High irreplaceability forest patches and clusters.

The criteria used for identifying threatened terrestrial ecosystems was done through extensive stakeholder engagement and based on the best available science. The criteria for thresholds for Critically Endangered, Endangered and Vulnerable ecosystems are summarized in Table 1.

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 four main types of implications of listed ecosystems on development:

- Planning related implications, linked to the requirement in NEM:BA for listed ecosystems to be taken into account in municipal Integrated Development Plans (IDPs) and (Spatial Development Frameworks (SDFs);
- Environmental authorisation implications, especially in terms of the NEMA and the 2010 Environmental Impact Assessment (EIA) Regulations;

- Proactive management implications, in terms of the NEMB:A; and
- Monitoring and reporting implications, in terms of the NEM:BA.

The 2010 EIA Regulations include three lists of activities which require environmental authorisation (EA):

- Listing Notice 1: activities which require a Basic Assessment (BA) process for EA [Government Notice Regulation (GNR) No. 544];
- Listing Notice 2: activities which require Scoping and Environmental Impact Reporting (S&EIR) process for EA [GNR No. 545];
- Listing Notice 3: activities that require a BA process for EA [GNR No. 546] in specific identified geographical areas only.

Activity No. 12 in Listing Notice 3 relates to the clearance of 300m² or more of vegetation, which will trigger a BA within any Critically Endangered or Endangered ecosystem listed in terms of Section 52 of the Biodiversity Act. This means any development that involves loss of natural habitat in a listed Critically Endangered or Endangered ecosystem is likely to require at least a BA in terms of the EIA Regulations.

It is important to note that while the original extent of each listed ecosystem has been mapped, a BA in terms of the EIA Regulations is triggered only when development/activities fall within the remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost, which is the case in the greater study area.

The Western Highveld Sandy Grassland ecosystem is currently listed as Critically Endangered while the Mafikeng Bushveld is listed as Vulnerable in terms of Section 52 of NEM:BA (Government Gazette, 2011). The site of the proposed solar facility is located within the Western Highveld Sandy Grassland and consisted of natural vegetation representative of this ecosystem while sections of powerlines route alternatives A & C are located within both Mafikeng Bushveld and Western Highveld Sandy Grassland ecosystems (Figure 3).

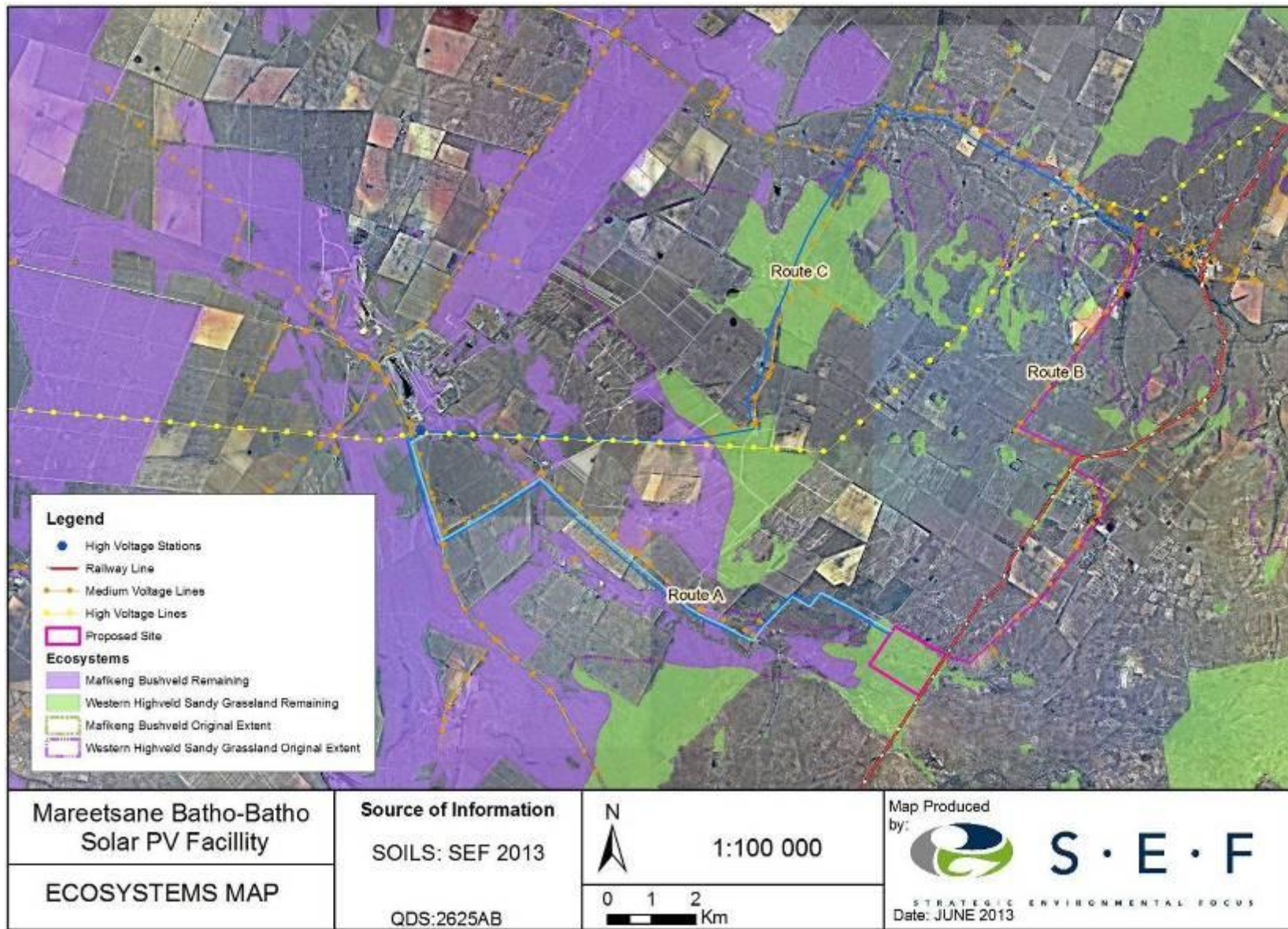


Figure 3: The extent of the two threatened ecosystems, Western Highveld Sandy Grassland and Mafikeng Bushveld within the study area

2.5 Biodiversity Corridors and Critically Important Areas

The North-West Province Biodiversity Conservation Assessment Technical Report [North-West Department of Agriculture, Conservation, Environment and Rural Development (NW DACERD) 2009] outlines a provincial-level biodiversity corridor network with an aim to retain the connectivity between all geographic areas with minimal financial cost and maximum biodiversity preservation. These corridors are interconnected areas through the landscape that were identified as important for conservation through a series of systematic biodiversity assessments. Biodiversity Nodes were also identified through a systematic process to coincide with areas where important or intact biodiversity remains, however, unlike Biodiversity Corridors, these nodes are isolated from each other. These areas were often identified as the last remaining areas for the proclamation of reserves and may contribute significantly to biodiversity conservation goals.

These areas have been identified as areas that are still intact and contain one of the last remaining areas of Western Highveld Sandy Grassland. Core Biodiversity Corridors traverse the southern portion of the study area with a portion of the solar facility site, powerline route alternative A and portions of powerline route alternative C located within the 1500m buffer of this Biodiversity Corridor. The remainder of the solar facility site as well as the southern portion of powerline route alternative B are located within the 3000m and 5000m corridor buffer (Figure 4).

Hyperdiversity is a measure of the areas of overlap in which the highest diversity of fauna occurs in the province. Critically Important Areas are areas where threatened ecosystems which are vulnerable to transformation and should be prioritised for conservation. Several patches of Critically Important Areas, which are highly sensitive hyperdiversity areas, occur within the study area, many of which appear to be associated with riverine and wetland areas (Figure 5). No areas of high or medium-high hyperdiversity hot spots seem to occur within the proposed site itself.

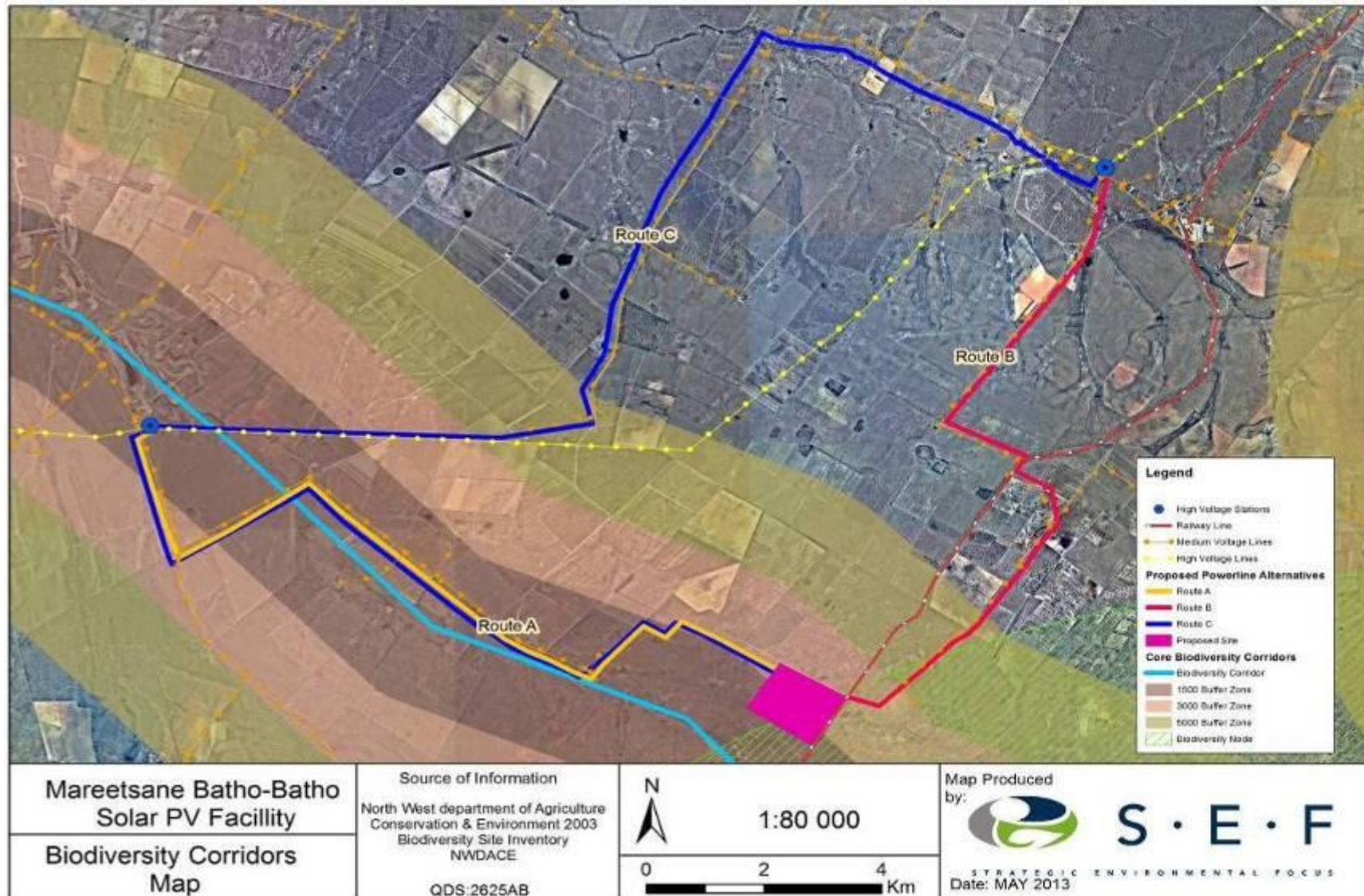


Figure 4: Biodiversity corridors in relation to the study area

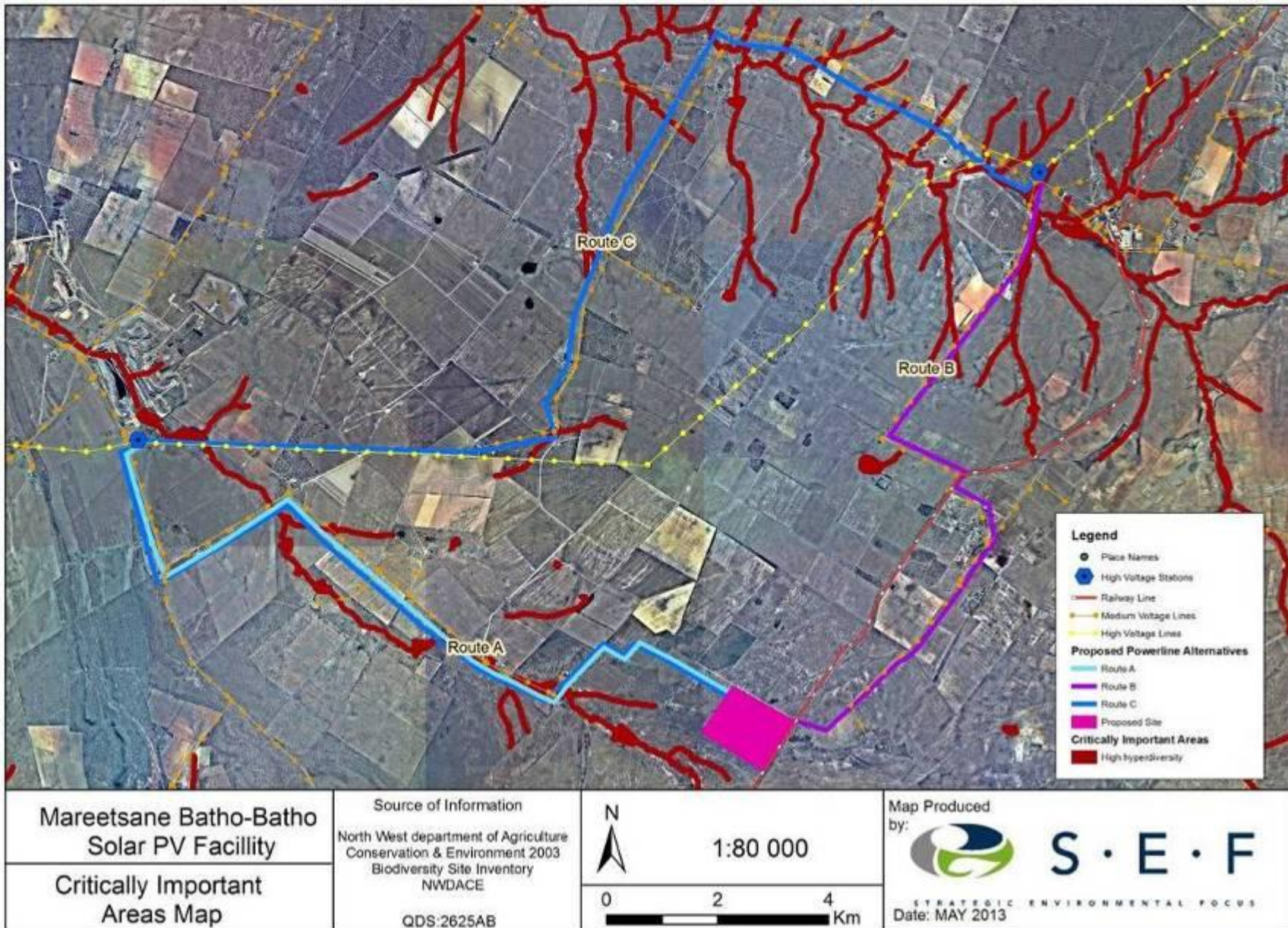


Figure 5: Critically Important Areas in relation to the study area

3 RESULTS: FLORA

3.1 Overview

The study area included the proposed site for the solar facility as well as three (3) powerline route alternatives. The affected areas included natural veld, wetlands, rivers and modified habitat. Numerous nationally and provincially protected plant species as well as species of conservation concern were recorded from both the solar facility site and powerline route alternatives. The solar facility site as well as the three alternative powerline routes are described below and illustrated in Figure 6 while Appendix B lists all the plant species recorded in the study area.

3.1.1 Solar Facility Site

According to the International Finance Corporations (IFC) guidance to Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012), natural habitats are defined as “Areas that composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition”.

The area associated with the proposed solar facility site was classified as natural habitat and consisted of open *Acacia erioloba* (Camel Thorn) Bushveld in the northern portion with *Tarchonanthus camphorates* (Camphor Bush) forming dense stands towards the southern portion (Photograph 1).



Photograph 1: Northern portion of the study area consisted of open Bushveld dominated by *Acacia erioloba* (left) while the southern portion consisted of dense stands of *Tarchonanthus camphorates* (right)

Due to overgrazing and below average rainfall in 2013, basal cover in the area was fairly low at the time of the survey, despite this, at least two species of conservation concern, *Boophone disticha* (Poison Bulb) and *Hypoxis hemerocallidea* (Star Flower), one nationally protected tree species, *Acacia erioloba* and numerous provincially protected species were recorded. Dominant tree species at the solar facility site included *Acacia erioloba* (Camel Thorn), *Acacia hebeclada* (Candle-pod Acacia), *Ziziphus mucronata* (Buffalo Thorn), *Acacia mellifera* (Black Thorn) and *Acacia karroo* (Sweet Thorn). Table 2 summarizes the species recorded at the solar facility site.

Table 2: Summary of species recorded at the solar plant site

Indigenous species at the time of the survey:	<u>Grasses:</u> <i>Aristida bipartita</i> <i>Aristida congesta</i> <i>Digitaria diagonalis</i> <i>Digitaria eriantha</i> <i>Eragrostis gummiflua</i> <u>Herbs</u> <i>Barleria macrostegia</i> <i>Bulbine</i> sp. <i>Delosperma</i> sp. <i>Sansevieria hyacinthoides</i> <u>Trees and shrubs:</u> <i>Acacia erioloba</i> <i>Acacia hebeclada</i> <i>Acacia mellifera</i> <i>Tarchonanthus camphorates</i> <i>Ziziphus mucronata</i>
Plants of conservation concern confirmed to occur:	<i>Boophone disticha</i> (Declining) <i>Hypoxis hemerocallidea</i> (Declining)
Plants of conservation concern for which suitable habitat was observed:	<i>Brachystelma canum</i>
Provincially protected plants confirmed to occur:	<i>Bonatea antennifera</i> <i>Aloe zebrina</i> <i>Huernia</i> sp.
Provincially protected plants for which suitable habitat was found:	<i>Ammocharis coranica</i> <i>Crinum</i> <i>Gladiolus</i> <i>Watsonia</i> <i>Stapeila</i>
Nationally protected tree species confirmed:	<i>Acacia erioloba</i>
Alien species:	<i>Agave americana</i> <i>Agave sisalana</i>

3.1.2 Proposed Powerline Route Alternative A

Powerline route alternative A exits the solar facility in the north-western corner from where it follows existing medium voltage lines. This powerline initially traverses natural vegetation similar to that recorded on the solar facility site, but the majority of the vegetation associated with the powerline route consisted mostly of modified habitat. According to the IFC guidance to Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012), modified (transformed) habitats are defined as:

“Areas that may contain a large proportion of plant and/ or animal species of non-native origin, and / or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include

areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands”.

The modified habitat recorded in the study area included agricultural fields (maize and soybeans). Table 3 summarises the species associated with powerline route alternative A.

Table 3: Summary of species associated with powerline route alternative A

Indigenous species at the time of the survey:	<u>Grasses:</u> <i>Aristida bipartita</i> <i>Aristida congesta</i> <i>Digitaria diagonalis</i> <i>Digitaria eriantha</i> <i>Eragrostis gummiflua</i> <u>Herbs</u> <i>Barleria macrostegia</i> <i>Bulbine</i> sp. <i>Sansevieria hyacinthoides</i> <u>Trees and shrubs:</u> <i>Acacia erioloba</i> <i>Acacia mellifera</i> <i>Tarchonanthus camphorates</i> <i>Ziziphus mucronata</i>
Plants of conservation concern confirmed to occur:	<i>Boophone disticha</i> (Declining)
Plants of conservation concern for which suitable habitat was observed:	<i>Brachystelma canum</i>
Provincially protected plants confirmed to occur:	<i>Aloe zebrina</i>
Provincially protected plants for which suitable habitat was found:	<i>Ammocharis coranica</i> <i>Crinum</i> <i>Gladiolus</i> <i>Watsonia</i> <i>Stapeila</i>
Nationally protected tree species confirmed:	<i>Acacia erioloba</i>
Alien species:	<i>Zea mays</i> (Maize) <i>Clycine</i> sp. (Soyabean)

3.1.3 Proposed Powerline Route Alternative B

Powerline route alternative B exits the solar facility in the eastern corner from where it turns north towards the substation at Mareetsane. The southern portion traverses mostly modified habitat with small portions of natural vegetation which contained the nationally protected tree *Acacia erioloba* (Camel Thorn). At S26°12'00.2; E25°24'14.75, the powerline turns east away from the road and traverses modified habitats (agricultural fields), secondary grassland, a game camp and a river which contained indigenous vegetation (Photograph 2). Table 4 summarises the species associated with powerline route alternative B.



Photograph 2: Powerline route alternative B traverses modified habitat such as agricultural fields (left) as well as secondary grassland (right)

Table 4: Summary of plant species associated with powerline route alternative B

Indigenous species at the time of the survey:	<u>Grasses:</u> <i>Aristida bipartita</i> <i>Aristida congesta</i> <i>Digitaria diagonalis</i> <i>Themeda triandra</i> <i>Hyparrhenia hirta</i> <u>Herbs</u> <i>Ceratotheca triloba</i> <i>Commenlina bengalensis</i> <i>Eriospermum sp.</i> <u>Trees and shrubs:</u> <i>Acacia erioloba</i> <i>Acacia mellifera</i> <i>Tarchonanthus camphorates</i> <i>Ziziphus mucronata</i>
Plants of conservation concern confirmed to occur:	None
Plants of conservation concern for which suitable habitat was observed:	<i>Brachystelma canum</i>
Provincially protected plants confirmed to occur:	<i>Aloe zebrina</i>
Provincially protected plants for which suitable habitat was found:	<i>Ammocharis coranica</i> <i>Crinum</i> <i>Gladiolus</i> <i>Watsonia</i> <i>Stapeila</i>
Nationally protected tree species confirmed:	<i>Acacia erioloba</i>
Alien species:	<i>Zea mays</i> (Maize) <i>Clycine sp.</i> (Soyabean)

3.1.4 Proposed Powerline Route Alternative C

Powerline route alternative C initially follows the same route as alternative A but includes an additional portion between the substation south of Kalgold Gold Mine and the substation at Mareetsane. This portion of powerline route alternative C traverses

mostly natural habitat which included *Acacia erioloba* Bushveld, two game camps, a rocky outcrops, an unchannelled valley-bottom wetland and a river (Photograph 3). These areas are described below while Table 5 summarises the species recorded.



Photograph 3: Natural areas associated with the second portion of powerline route alternative C included two game camps (top left), a rocky outcrops (top right), wetland (bottom left) and a river (bottom right)

Game camps

Two game camps were associated with the second portion of powerline route alternative C. The first game camp located closer to the Kalgold substation was dominated by the protected tree *Acacia erioloba* (Camel Thorn) and also included a small portion of pasture field. Since the game camp was not accessible, a detailed floral study was not conducted within the camp.

The second game camp was located further north and although it was more disturbed than the first, still contained natural indigenous vegetation with numerous *Acacia erioloba* (Camel Thorn) trees.

Rocky outcrops and wetland

A small rocky outcrop and wetland was located east of the Kalgold substation and although species diversity in these areas were lower than what would be expected of rocky areas and wetlands, this could be attributed to the below average rainfall experienced in 2013 as well as overgrazing. Despite this, at least one provincially

protected species, *Ammocharis coranica* (Seeroogblom), was recorded from this area.

Mareetsane River

The northern portion of powerline route alternative C traverses the Mareetsane River. The vegetation associated with the river was impacted on through overgrazing resulting in encroachment by the indigenous *Tarchonanthus camphorates* (Camphor Bush). Despite this, the area supported floral species representative of riverine or moist areas such as *Phragmites australis* (Common Reed), *Imperata cylindrica* (Cottonwool Grass), *Searsia lancea* (Karee), *Cyperus fastigiatus* and *Schoenoplectus* sp. At least one species of conservation concern, *Crinum* c.f. *stuhlmannii*, was also recorded in this area.

Acacia erioloba Bushveld

Large areas of *Acacia erioloba* Bushveld were also recorded along the northern portion of powerline route alternative C and included areas which have been disturbed through overgrazing as well as areas which were in good condition. The nationally protected tree *Acacia erioloba* (Camel Thorn) was the dominant tree in this area while at least one species of conservation concern, *Boophone disticha* (Poison Bulb), and one provincially protected species, *Crinum graminicola*, was also frequently recorded in these areas.

Table 5: Summary of plant species associated with powerline route alternative C

Indigenous species at the time of the survey:	<p><u>Grasses:</u> <i>Aristida bipartita</i> <i>Aristida congesta</i> <i>Digitaria diagonalis</i> <i>Themeda triandra</i> <i>Hyparrhenia hirta</i> <i>Phragmites australis</i> <i>Imperata cylindrica</i></p> <p><u>Herbs</u> <i>Artemisia afra</i> <i>Gomphocarpus fruticosa</i> <i>Lantana rugosa</i> <i>Sansevieria hyacinthoides</i></p> <p><u>Trees and shrubs:</u> <i>Acacia erioloba</i> <i>Acacia mellifera</i> <i>Tarchonanthus camphorates</i> <i>Ziziphus mucronata</i> <i>Searsia lancea</i> <i>Gymnosporia senegalensis</i></p>
Plants of conservation concern confirmed to occur:	<p><i>Boophone disticha</i> <i>Crinum</i> c.f. <i>stuhlmannii</i></p>
Plants of conservation concern for which suitable habitat was observed:	<p><i>Brachystelma canum</i></p>

Provincially protected plants confirmed to occur:	<i>Aloe zebrina</i> <i>Ammocharis coranica</i> <i>Crinum graminicola</i>
Provincially protected plants for which suitable habitat was found:	<i>Crinum</i> <i>Gladiolus</i> <i>Watsonia</i> <i>Stapeila</i>
Nationally protected tree species confirmed:	<i>Acacia erioloba</i>
Alien species:	<i>Zea mays</i> (Maize) <i>Glycine</i> sp. (Soyabean) <i>Melia azedarach</i> <i>Xanthium strumarium</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 NEM:BA. 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 localised and visible for only a few weeks in the year when they flower (Ferrar & 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.

According to Plants of Southern Africa (2011) and Raimondo *et al.* (2009), only one species of conservation concern, namely *Brachystelma canum* has been recorded in QDGC 2625AB. This species is currently listed as Critically Endangered and is known from one locality around Mafikeng and although it was not recorded in the study area at the time of the survey, suitable habitat within the area exists for the species. Three additional species of conservation concern was recorded in the study area, these are summarised in Table 6 and illustrated in Photograph 4.

Table 6: Summary of plant species of conservation concern recorded in the study area

	<i>Boophone disticha</i>	<i>Hypoxis hemerocallidea</i>	<i>Crinum</i> c.f. <i>stuhmannii</i>
Species description	Deciduous species with the bulb half above ground. Leaves in a conspicuous fan with flat or wavy margins	The large tuber is located completely underground. Leaves are distinctly three ranked, hairy on lower surface	The leaves are broad and flat, spreading and are finely hairy. Flowers in inflorescence, stems arching upwards, stalks are 50mm long
Flowering time	July to October	August to April	October to November

Threats	Habitat destruction and harvesting	Habitat destruction and harvesting	Habitat destruction
Conservation Status	Declining, Provincially Protected	Declining, Provincially Protected	Declining, Genus is provincially protected
Locality in the study area	Solar plant, powerline route alternative A & C	Solar plant	Solar plant, powerline route alternative C
Approximate size of population (total in study area)	More than 100	10 - 15	20-30



Photograph 4: Species of conservation concern recorded in the study area included *Boophone disticha* (left), *Hypoxis hemerocallidea* (middle) and *Crinum c.f. stuhlmannii* (right)

3.3 Provincially Protected Plants

A number of plants identified on the study site are not threatened, but are protected by Schedule 7 of the Bophutatswana Nature Conservation Act, 1973 (Act No. 3 of 1973). These plants are listed in Table 7 and illustrated in Photograph 5 and may not be removed, picked, pruned or destroyed. Provincially protected species which are also of conservation concern are described above.

Table 7: Provincially protected plant species recorded in the study area

	<i>Aloe zebrina</i>	<i>Ammocharis coranica</i>	<i>Bonatea antennifera</i>	<i>Crinum graminicola</i>	<i>Huernia sp.</i>
Species description	Plants often forms dense groups, leaves are in small dense rosette. Inflorescences are branched and carry dull pink flowers	Leaves are in two rows, flat on the ground, grey green in colour with a blunt tip. Flowers are glossy pink on stalks	Erect unbranched herbaceous plant. Leaves are flat forming a sheath at the base. Usually grows in shade of shrubs and trees	Bulb is buried and about 140mm in diameter. Leaves are broad, spreading, margins with brown hair	Succulent herb 30-70mm high. Stems are 9-13mm wide, 5 angled, swollen tubercles tipped with hard tooth
Flowering time	Nov, Dec and Jan – March	Oct - Jan	Autumn	Oct - Feb	April
Threats	Habitat destruction	Habitat destruction	Habitat destruction	Habitat destruction	Habitat destruction

Conservation Status	Genus is provincially protected	Species is provincially protected	Genus is provincially protected	Genus is provincially protected	Genus is provincially protected
Locality in the study area	Common throughout	Powerline route alternatives A & C	Solar Facility Site	Sporadically throughout the study area, especially powerline route alternative C	Solar Facility Site
Approximate population size (total in study area)	More than 100	20-40	5-10	20-40	2 clumps



Photograph 5: Provincially protected species recorded in the study area included *Aloe zebra* (top left), *Ammocharis coranica* (top right), *Bonatea antennifera* (middle left), *Crinum graminicola* (middle right) and *Huernia* sp. (bottom)

3.4 Nationally Protected Trees

The National Forest Act, 1998 (Act No. 84 of 1998) enforces the protection of a number of indigenous trees. The removal, thinning or relocation of protected trees will require a permit from the Department of Agriculture, Forestry & Fisheries (DAFF). One nationally protected tree species, *Acacia erioloba* (Camel Thorn) (Photograph 6) was recorded throughout the study area and in most instances was the dominant species within the vegetation communities, thus each individual was not recorded.



Photograph 6: *Acacia erioloba* in 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. Plants species with know medicinal uses recorded in the study area is summarised in Table 8.

Table 8: Medicinal plant species recorded in the study area

Scientific Name	Conservation Status	Locality in study area
<i>Acacia karroo</i>	LC	Common throughout study area
<i>Aloe zebrina</i>	Provincially Protected	Throughout study area
<i>Ammocharis coranica</i>	Provincially Protected	Throughout study area
<i>Artemisia afra</i>	LC	Mareetsane River, powerline route alternative C
<i>Boophone disticha</i>	Declining, Provincially Protected	Recorded throughout the study area
<i>Crinum graminicola</i>	Genus is Provincially Protected	Sporadically throughout study area
<i>Elephantorrhiza elephantina</i>	LC	Sporadically throughout study area
<i>Gomphocarpus fruticosus</i>	LC	Common in disturbed areas
<i>Hypoxis hemerocallidea</i>	Declining, Provincially Protected	Solar Facility Site
<i>Lantana rugosa</i>	LC	Rocky area close to Kalgold substation
<i>Sansevieria hyacinthoides</i>	LC	Sporadically throughout study area
<i>Tarchonanthus camphoratus</i>	LC	Common throughout study area
<i>Ziziphus mucronata</i>	LC	Recorded throughout study area

3.6 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) (CARA) 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 CARA and the NEM:BA:

- **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.

Although thirteen different alien species were recorded throughout the study area, the infestations were not dense and mostly associated with modified habitat and the Mareetsane River (Photograph 7). Despite this, some of these species are known to rapidly spread into areas containing natural vegetation resulting in the loss of natural habitat. Table 9 summarises the alien species recorded in the study area.



Photograph 7: Alien species recorded in the study area included *Agave americana* (top left), *Opuntia ficus-indica* (top right), *Xanthium strumarium* (bottom left) and *Melia azedarach* (bottom right)

Table 9: Alien species recorded in the study area, the species in red should be prioritised for control

Scientific name	Common name	Category	Proposed CARA/ NEM:BA	Occurrence in study area
<i>Agave americana</i>	Spreading century plant	None	2	Solar facility site
<i>Agave sisalana</i>	Sisal hemp	Invader:2	2	Powerline route alternative C, Solar facility site
<i>Cirsium vulgare</i>	Spear Thistle	Weed: 1	1b	Sporadically throughout study area in disturbed areas
<i>Bidens pilosa</i>	Black Jack	Weed	None	Sporadically throughout study area in disturbed areas
<i>Eucalyptus</i> species	Blue Gum Trees	Invader: 2	2	Powerline route alternative C
<i>Zea mays</i>	Maize / Corn	Agricultural species	None	Agricultural fields associated with all the powerline routes
<i>Glycine</i> sp.	Soybean	Agricultural species	None	Agricultural fields associated with all the powerline routes
<i>Melia azedarach</i>	Syringa	Invader: 3	1b	Powerline route alternative C in the Mareetsane River
<i>Flaveria bidentis</i>	Smelter's Bush	Weed	None	In the wetland associated with powerline route alternative C

<i>Gomphrena celasioides</i>	Bathelor's Button	Weed	None	Sporadically throughout the study area
<i>Opuntia ficus-indica</i>	Prickly Pear	Weed: Category 1	None	Solar facility site and powerline route alternative C
<i>Salix babylonica</i>	Weeping Willow	Invader: Category 2	None	Powerline route alternative C in the Mareetsane River
<i>Xanthium strumarium</i>	Large Cocklebur	Weed	1	Wetland associated with powerline route alternative C

4 RESULTS: FAUNA

4.1 Faunal Habitats

Faunal habitat within the study area included patches of savanna bushveld with open grassy and sandy areas, a few small watercourses with associated riparian vegetation, non-perennial pans, game camps, the Mareetsane River and areas which have been modified through agriculture (Photograph 8). The highest faunal activity was observed in the savanna bushveld areas and in the dense foliage around the drainage lines and water courses. Besides the agricultural fields, other transformed areas included farm infrastructure, roads, powerlines and small stands of exotic trees. For a full description of vegetation communities within the study area please refer to the floral section.



Photograph 8: Faunal habitat in the study area included open bushveld (top left), the Mareetsane River (top right), game camps (bottom left) and modified habitat such as agricultural fields (bottom left)

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 Mareetsane River in the northern section of the study area.

4.2 Faunal Species Occurrence

4.2.1 Avifauna

Approximately 359 bird species have been confirmed to occur within QDGC 2625AB. Of this total, approximately 346 species (96.4%) are associated with a savanna / farmland mosaic (including terrestrial water systems), as is the character of the study area. A total of 62 bird species were identified in the study area during the field surveys (Appendix C).

A high level of endemism exists in the area as is typical of the western and central regions of the country, with 66 endemic bird species occurring in QDGC 2625AB. A smaller proportion of species of conservation concern occur in the QDGC with a total of 27 bird species listed either nationally (Barnes, 2000) or globally [International Union for Conservation of Nature (IUCN), 2012]] as having a status higher than Least Concern (Appendix D).

A total of 18 species endemic to southern Africa were recorded in the study area during the field surveys (Appendix C). Two species of conservation concern, *Gyps africanus* (White-backed Vulture) which is currently listed as Endangered and *Sagittarius serpentarius* (Secretarybird) currently listed as Vulnerable, were confirmed at various locations throughout the study area (Photograph 9).



Photograph 9: Species of conservation concern recorded in the study area included *Gyps africanus* (White-backed Vulture) (left) and *Sagittarius serpentarius* (Secretarybird) (right)

Although not recorded during the field survey a further seven species of conservation concern were given a high probability of occurring in the study area due to the presence of suitable breeding and/or foraging habitat. Such species included *Polemaetus bellicosus* (Martial Eagle), *Ardeotis kori* (Kori Bustard) and *Aquila rapax* (Tawny Eagle) which are currently listed nationally as Vulnerable; *Certhilauda chuana* (Short-clawed Lark) and *Falco biarmicus* (Lanner Falcon), currently listed nationally as Near Threatened; and *Coracias garrulus* (European Roller) and *Falco vespertinus* (Red-footed Falcon) which are non-breeding migrants currently listed globally as Near Threatened (Appendix D).

Appropriate habitat was marginal to the study area or existed in the area for a further four bird species of conservation concern. However, due to the level of transformation and disturbance of the surroundings (farming and settlement), these species are unlikely to occur there and were given a medium probability of occurring in the study area (Appendix D).

The majority of bird species identified on the study site are not threatened, but are provincially protected by various schedules within the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983), the Bophutatswana Nature Conservation Act, 1973 (Act No. 3 of 1973), and/or the Cape Nature and Environmental Conservation Ordinance, 1974 (Ordinance No. 19 of 1974). These species are listed in Appendix C and may not be hunted, removed, wilfully disturbed or destroyed without a permit. This includes species such as the endemic *Afrotis afroides* (Northern Black Korhaan) and *Lophotis ruficrista* (Red-crested Korhaan). These species are particularly susceptible to habitat destruction as they are ground-dwelling, ground-nesting, large bodied and territorial in the case of the former.

4.2.2 Mammals

Approximately 69 terrestrial mammal species are expected to occur within the geographical area associated with the study area 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 & Daly, 2004; DEAT, 2007) and global (IUCN, 2012) conservation status. Twenty 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) (Photograph 10). While none of these were of conservation concern, eight species are protected by Schedule 1 and Schedule 2 of the Bophutatswana Nature Conservation Act, 1973 (Act No. 3 of 1973) while an additional two species are nationally protected by the NEM:BA (Table 10).

A further 22 species were given a high probability of occurring in the study area due to the presence of suitable habitat, four of which are species of conservation concern. These include *Mellivora capensis* (Honey Badger), *Atelerix frontalis* (Southern African Hedgehog), *Rhinolophus clivosus* (Geoffroy's Horseshoe Bat) and *Rhinolophus darlingi* (Darling's Horseshoe Bat), all of which are currently listed nationally as Near Threatened. A further nine mammal species were given a medium probability of occurring on the study site (Appendix E). While suitable habitat existed

either marginally or on the site for these species, the level of disturbance of the surrounding landscape (farming and settlement) suggests that they are unlikely to be present.



Photograph 10: Mammal species recorded in the study area included large herbivores in the game camps (left) as well as smaller species such as *Cynictis penicillata* (Yellow Mongoose) (right)

Table 10: Provincially and nationally protected mammal species recorded in the study area

Scientific Name	Common Name	Protection	Locality in study area
<i>Aepyceros melampus</i>	Impala	Provincially Protected (Schedule 2)	Game camp 2 associated with powerline route alternative C
<i>Alcelaphus buselaphus</i>	Red Hartebeest	Nationally (Section 56(1)(d) and Provincially Protected (Schedule 1)	Game camp 1 associated with powerline route alternative C
<i>Antidorius marsupialis</i>	Springbok	Provincially Protected (Schedule 2)	Game camp 1 associated with powerline route alternative C
<i>Orycteropus afer</i>	Aardvark	Provincially Protected (Schedule 1)	Powerline alternative B
<i>Oryx gazella</i>	Gemsbok	Nationally and Provincially Protected (Schedule 1)	Game camp 1 associated with powerline route alternative C
<i>Otocyon megalotis</i>	Bat-eared Fox	Nationally Protected (Section 56(1)(d)	Powerline alternative C
<i>Phacochoerus aethiopicus</i>	Warthog	Provincially Protected (Schedule 2)	Sporadically throughout area associated with powerline route alternative C
<i>Raphicerus campestris</i>	Steenbok	Provincially Protected (Schedule 1)	Throughout the study area
<i>Sylvicarpa grimmia</i>	Grey Duiker	Provincially Protected (Schedule 2)	Throughout the study area
<i>Taurotragus oryx</i>	Eland	Provincially Protected (Schedule 1)	Game camp 1 associated with powerline route alternative C
<i>Tragelaphus strepsiceros</i>	Kudu	Provincially Protected (Schedule 2)	Game camp 1 associated with powerline route alternative C

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), only six amphibian species have been confirmed to occur within QDGC 2625AB, while a further seven species possibly occur in the QDGC according to IUCN species distribution ranges (Appendix F). While no amphibian species were identified during the field surveys, 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). Appropriate habitat was marginal to the study area or existed in the area for a further four amphibian species however, due to the level of transformation and disturbance of the surroundings (farming and settlement), these species are unlikely to occur there and were given a medium probability of occurring in the study area (Appendix F).

Reptiles

A QDGC search on ReptileMAP, a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012), revealed few reptile species have thus far been recorded in QDGC 2625AB, and as such the number recorded is believed to be an underestimate. Therefore a search on the half a degree grid cell (HDGC) 2526A was performed which revealed that 19 reptile species have been confirmed to occur within that area (Appendix G). While no reptile species were observed in the study area during the field survey, nine 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 (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), 37 butterfly species have been confirmed to occur within QDGC 2625AB, none of which are of conservation concern. Very low Lepidopteron activity was observed at the time of the survey which can be attributed to the fact that the surveys were conducted outside the flight times for most species.

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 6).

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 to High Sensitivity

The northern portion of the solar facility site was classified as medium to high ecological sensitivity due to the presence of vegetation representative of the Western Highveld Sandy Grassland ecosystem which is classified as Critically Endangered. Furthermore, this area supported a high concentration of nationally and provincially protected plant species, as well as species of conservation concern. The rocky outcrops and wetland associated with powerline route alternative C were also classified as medium to high sensitivity.

The game camps supported numerous mammal species which are provincially and nationally protected, while the Endangered *Gyps africana* (White-backed Vulture) was recorded in high numbers within all the game camps associated with powerline route alternatives B and C. The Vulnerable *Sagittarius serpentarius* (Secretarybird) was recorded in open grassy areas, the southern game camp as well as modified areas (agricultural fields) associated with powerline route alternatives B and C. These areas were therefore marked as medium to high ecological sensitivity.

5.3 Areas of Medium Sensitivity

The remainder of the solar plant site, as well as all the areas associated with the powerlines were marked as medium sensitivity. All areas that were not modified by agriculture, supported indigenous vegetation which was representative of either Western Highveld Sandy Grassland ecosystem (CR), or Mafikeng Bushveld ecosystem (EN). Where areas had been modified through agriculture (maize fields), faunal activity was fairly high, with species of conservation concern such as *Sagittarius serpentarius* (Secretarybird) recorded in the agricultural fields.

5.4 Areas of Low Sensitivity

Due to the presence of faunal species within modified areas (such as agricultural fields), no areas of low ecological sensitivity were identified within the study area.

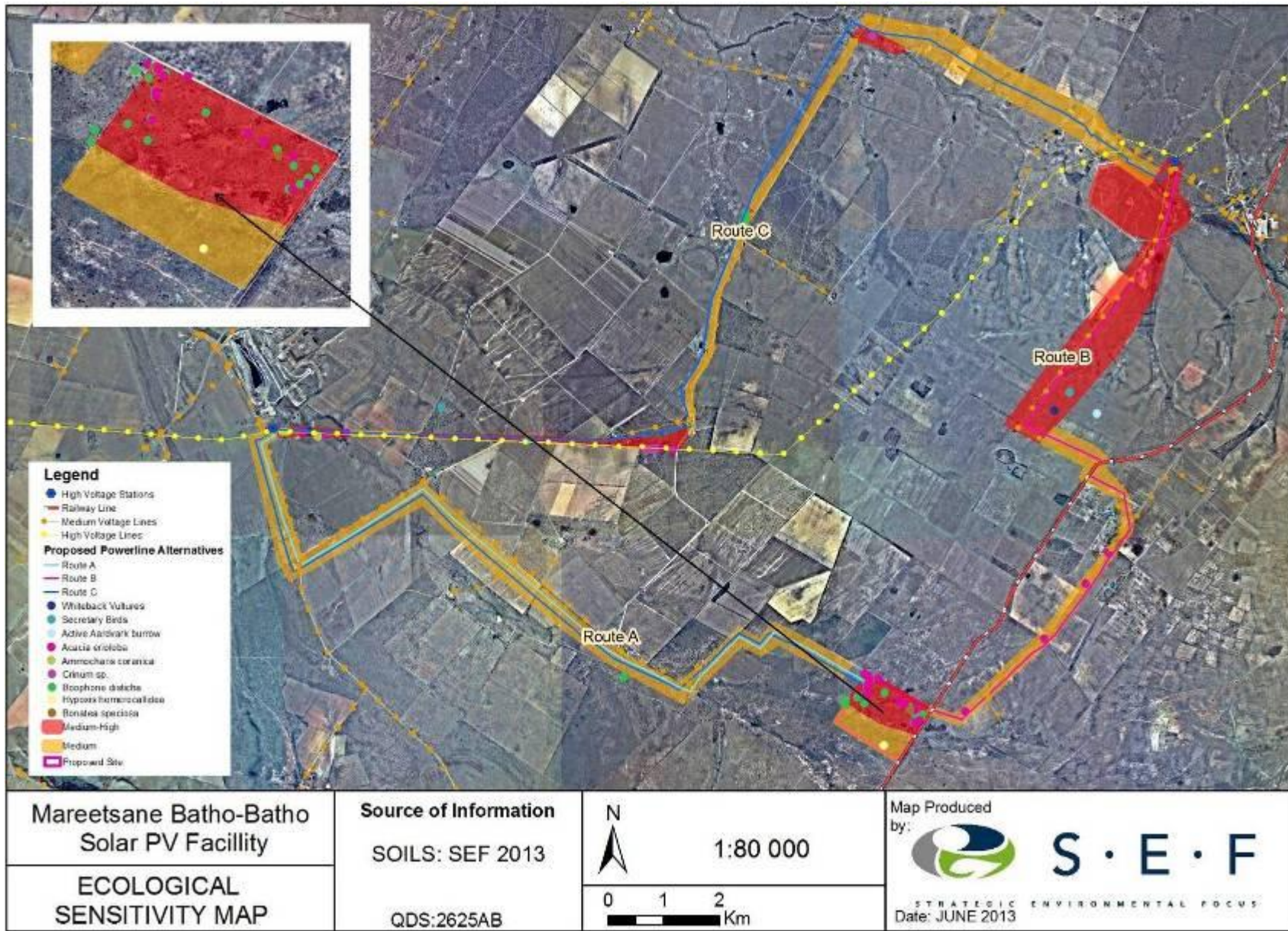


Figure 6: Ecological sensitivity

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 11 (solar plant) and Table 12 (powerlines). Some of the impacts are relevant during more than one phase and have therefore only been described once under the initial phase.

Table 11: Possible impacts associated with the solar plant

Possible impact	Source of impact	Area to be affected
Destruction of natural vegetation including the destruction of species of conservation concern as well as nationally and provincially protected species	Ground clearing and construction of the solar plant and roads	Solar facility site, access roads
Destruction of faunal habitat	Ground clearing and construction of the solar plant and roads	Solar facility site, access roads
Introduction and spread of invasive vegetation	Disturbance / destruction of indigenous vegetation making ecosystem vulnerable to invasions	Solar facility site
Interference with fauna and faunal behavioural activities	Construction workers, construction activity and construction vehicles	Solar facility site

Table 12: Possible impacts associated with the three powerline route alternative

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
Destruction and fragmentation of natural habitat	Power pylons	Areas where powerline pylons are constructed

6.2.1 Solar Facility Site

a) *Destruction of natural vegetation*

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

Description of Impact

The proposed site for the solar facility is located within a medium to highly ecologically sensitive area due to the presence of numerous plant species of conservation concern as well as nationally and provincially protected plant species. It should be noted that the relocation of plant species which are of conservation concern or provincially protected are often unsuccessful since relocated plants seldom survive to become sustainable populations. The relocation of these species is therefore not often considered or accepted as a mitigation measure for development.

It is also important to note that a permit will be required to destroy, cut, relocate or remove any species which are provincially or nationally protected. Furthermore, the proposed site is located within the Western Highveld Sandy Grassland ecosystem which is currently listed as Critically Endangered and also located within the 1000m buffer of an ecological corridor. It is therefore strongly recommended that the proposed solar facility site is moved to the modified area immediately north-east of the site which is currently proposed for the solar facility. This modified area does not support any floral species of conservation concern and does not represent the Western Highveld Sandy Grassland vegetation type. In addition to this, the following mitigations are recommended:

Mitigation measures:

- All plant species of conservation concern or species which are nationally or provincially protected which will not be directly affected by the developments should be cordoned off as no go areas during construction. These areas which are cordoned off should however not prevent movement of indigenous fauna;
- An independent Environmental Control Officer (ECO) should be appointed to oversee all construction activities;
- No open fires should be allowed in areas containing natural vegetation, especially during the dry season;
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas; and
- A rubble clean-up plan must be implemented throughout the duration of the construction phase.

b) *Destruction of faunal habitat*

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

Description of impact

The construction of the solar facility will result in the destruction of natural vegetation and associated faunal habitat leading to the possible mortality of faunal species. Bird species particularly at risk are territorial, ground-dwelling, ground-nesting, large-bodied species such as the endemic *Afrotis afroides* (Northern Black Korhaan). Since solar plants are a new concept in South Africa, the impact of these plants on local faunal species have not yet been studied, but it is possible that some faunal species might be able to persist within these areas. In order to minimize the impact of this solar facility on the faunal species, it is strongly recommended that the solar facility is moved north-east into the area which has been modified by agricultural activities. The following is also recommended to reduce the impact on faunal species:

Mitigation measures:

- Indigenous vegetation should be retained as far as possible in the state / structure that occurs naturally on the site;
- Construction should commence in the winter months in order to minimise the impacts on the breeding activities of faunal species;
- Permits must be obtained from the Issuing Authority (North West Department of Economic Development, Environment, Conservation and Tourism [DEDECT]) if the habitat of provincially protected species such as *Afrotis afroides* (Northern Black Korhaan) is to be destroyed. The males of this species hold territories of 200-300m and it is highly likely that such territories exist on the site;
- The solar plant site should ideally not be fenced to enable larger faunal species to move through the area and use the plant for shelter and feeding;
- Should a fence prove to be essential, this fence should be designed to enable the movement of faunal species and should therefore not include electrified or barbed wire fences which result in faunal injury and mortality; and
- A monitoring programme should be developed to determine and document the effect of the solar plant on faunal species. This monitoring programme should include detailed baseline information indicating the species and numbers within the solar plant site as well as immediate surroundings. Monitoring should furthermore be conducted by a suitably qualified ecologist.

c) *Potential increase in invasive vegetation*

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

Description of impact

During construction, vegetation will be removed and soil disturbed. The seed of alien invasive species that occur on and in the vicinity of the construction area could spread into the disturbed and stockpiled soil and into adjacent areas. In addition, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site.

Mitigation measures

- During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation;
- Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation;

- All alien seedlings and saplings must be removed as they become evident for the duration of construction and operational phase;
- Manual / mechanical removal is preferred to chemical control;
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction site. This should be verified by the ECO; and
- An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational phase.

d) *Interference with fauna and faunal behavioural activities*

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

Description of impact

The presence of the construction site may result in negative faunal interactions that could be associated with construction personnel including poaching, trapping and hunting of faunal species, as well as possible collisions of fauna with construction vehicles. Furthermore, construction will result in high levels of noise, vibrations and the operation of floodlights, should construction continue at night. This will disturb the fauna utilising the surrounding vegetation, especially nocturnal species, and could result in a localised decrease in biodiversity as faunal species move away from the disturbance into the surrounding areas. Food and rubbish left by construction workers can attract wildlife to the area, increasing risk of negative interactions.

Mitigation Measures

- Construction should commence in the winter months (April – August) in order to minimise the impacts on the breeding activities of faunal species;
- The provincially protected *Afrotis afroides* (Northern Black Korhaan) breeds year round (although less commonly during the winter months April – August). Before construction commences the site must be checked for the breeding activity and any nests of this species. This must be done by a suitably qualified ecologist;
- Permits must be obtained from the Issuing Authority (North West Department of Economic Development, Environment, Conservation and Tourism [DEDECT]) if any provincially protected faunal species are to be removed or relocated;
- As far as possible, construction should be limited to the daylight hours in order to minimise the need for lights;

- An education programme should be compiled for all contractors, subcontractors and workers to ensure compliance to all aspects of the Environmental Management Programme (EMPr) as well as educating personnel in the safe and proper conduct within areas of natural habitat;
- No wild animal may under any circumstance be handled, removed or be interfered with by construction workers;
- No wild animal may be fed on site;
- No wild animal may under any circumstance be hunted, snared, captured, injured or killed. This includes animals perceived to be vermin. Checks of the surrounding natural vegetation must be regularly undertaken to ensure no traps have been set. Any snares or traps found on or adjacent to the site must be removed and disposed of;
- No domesticated animals must be allowed on site;
- To prevent possible collisions with animals, drivers of construction vehicles must remain vigilant to the possibility of animals crossing their paths and a strict speed limit of 30 km/h should be adhered to; and
- All food should be securely stored away to prevent attraction of faunal species and all rubbish should be disposed off away from the site. Bins located around the infrastructure should have tightly fitting lids to prevent faunal species raiding the bins and thereby becoming habituated to humans.

6.2.2 Powerlines

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 & 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 falcons), storks and herons. A number of these species were confirmed to occur in the study area including the globally Endangered *Gyps africanus* (White-backed Vulture) as well as the Vulnerable *Sagittarius serpentarius* (Secretarybird). Both species have also confirmed to be breeding 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 earth 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

- 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;
- Streams and drainage lines should not be crossed perpendicularly with powerlines where possible;
- Powerlines should be routed alongside existing infrastructure such as existing powerlines, roads, buildings, and railway lines where possible; 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 Endangered Wild Trust (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 occur in the study area include korhaans, raptors and doves.

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. For example, 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). In the case of the study area, the nearest large body of water is at Barberspan and Leeupan which is an Important Bird Area (IBA ZA019; Barnes, 1998) situated approximately 35 km south east of the study area. It is unlikely that the proposed development will have an impact on the birds utilising this area due to the existing powerline infrastructure in the area.

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

- In terms of the impact in discussion, powerline route alternative B will offer the least impact from an avifaunal perspective and should be considered the 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 EWT;
- Streams and drainage lines should not be crossed perpendicularly with powerlines where possible;
- Only pole structures that are approved as “bird friendly” by Eskom’s ENVIROTECH Forum should be used; and

- Most importantly, powerlines should be routed alongside existing infrastructure such as existing powerlines, roads, buildings, and railway lines.

c) *Degradation and fragmentation of natural habitat by powerlines*

	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 (including species of conservation concern or provincially protected species) for pylons and servitudes will have a negative impact on the faunal communities through destruction and degradation 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 site, areas that may be impacted on include patches of *Acacia erioloba* Bushveld and riparian habitat associated with drainage lines and rivers such as the Mareetsane River in the north of the study area.

Mitigation Measures

- Powerlines should be constructed as close to the road and existing powerlines as possible;
- A qualified botanist should be present at the time when powerlines are constructed to identify any plant species which are of conservation concern, nationally or provincially protected and where possible pylons should be moved to prevent the destruction of these species; and
- Where possible, powerline servitudes should not be cleared of vegetation to ensure that indigenous species still occurring within these areas are maintained

6.3 Preferred Powerline Route Alternative

Based on the ecological surveys, powerline route alternative B would be the preferred alternative since this route traversed only small patches which contained indigenous vegetation. Furthermore, *Acacia erioloba* (Camel Thorn) which is a nationally protected tree species was not as prolific along this alternative when compared to powerline route alternative A and C. However, it is strongly recommended that powerline route alternative B does not turn east at approximately S26°12'00.3"; E25°24'14.7" but continues due north following the existing road (Figure 7). The original route proposed for powerline route alternative B traversed areas which have been classified as medium to high ecological sensitivity due to the presence of breeding pairs of *Sagittarius serpentarius* (Secretarybird) and *Gyps africanus* (White-backed Vulture) which are both species of conservation concern. Furthermore, due to their large body size, these species are exceptionally vulnerable to electrocution by and collision with powerlines.

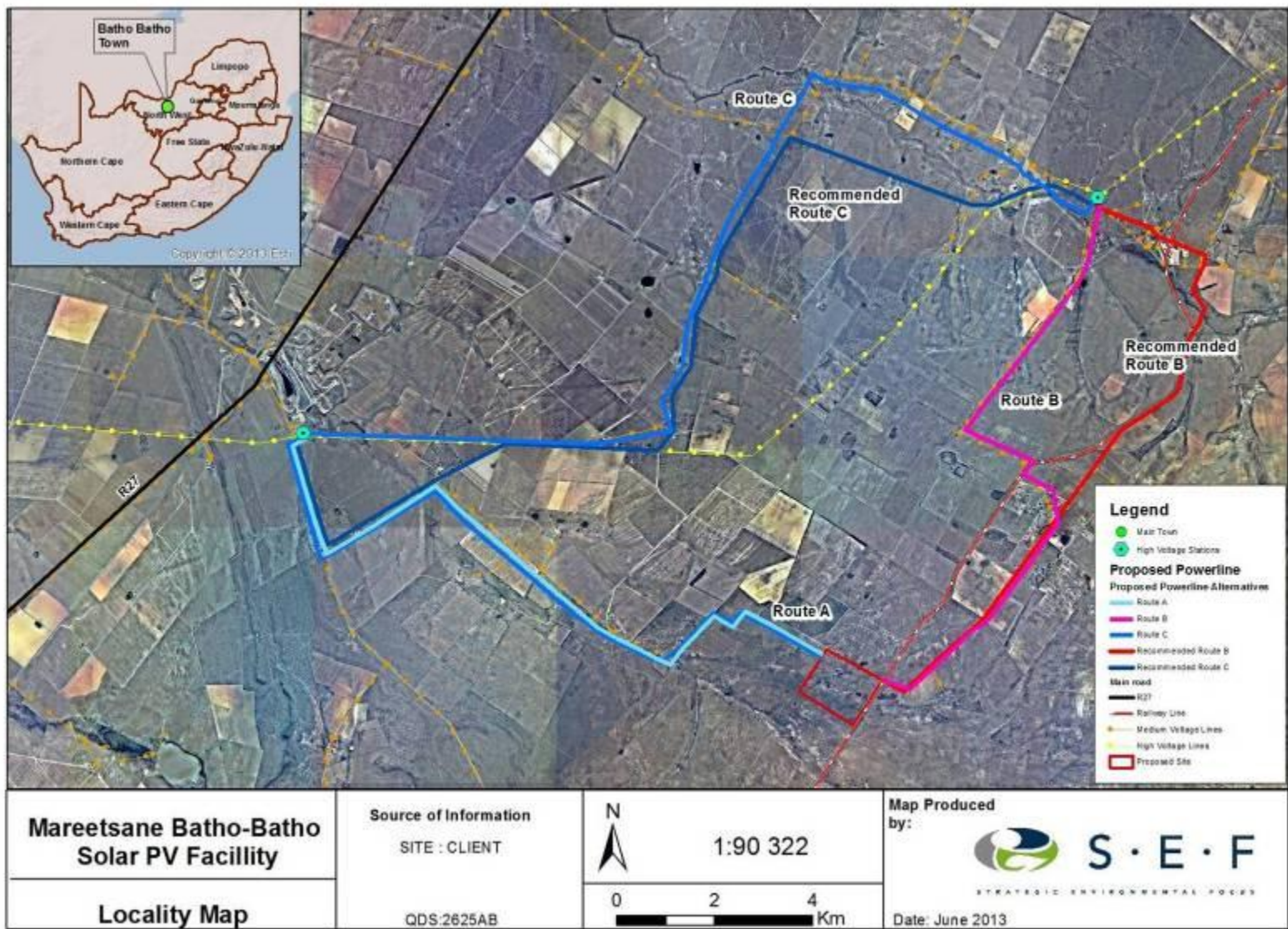


Figure 7: Recommended powerline route alternatives B (preferred) and C

7 CONCLUSION

The study area occurs within the Savanna and Grassland Biomes, more specifically within the Klerksdorp Thornveld, Mafikeng Bushveld and Western Highveld Sandy Grassland vegetation types. The Western Highveld Sandy Grassland is currently listed as Critically Endangered while Mafikeng Bushveld is listed as Vulnerable in terms of Section 52 of NEM:BA (Government Gazette, 2009). The vegetation associated with the study area, especially the solar facility site was largely in a natural state and represented the Western Highveld Sandy Grassland vegetation type.

The study area included a proposed solar plant site as well as three powerline route alternatives. Vegetation communities recorded within these areas included *Acacia erioloba* Bushveld, rocky areas, a wetland, numerous game camps, the Mareetsane River and modified areas. Numerous plant species of conservation concern such as *Boophone disticha*, *Hypoxis hemerocallidea* and *Crinum c.f. stuhlmannii* were recorded in the study area. One nationally protected tree species, *Acacia erioloba* was very common throughout the study area.

At least two avifaunal species which are of conservation concern, namely *Gyps africanus* (White-backed Vulture) and *Sagittarius serpentarius* (Secretarybird) were confirmed to be breeding at various localities in the study area. These large bird species are particularly vulnerable to electrocution by powerlines. Although no mammal species of conservation concern were confirmed during the field surveys, numerous provincially and nationally protected species were recorded throughout the study area, especially in the game camps associated with powerline route alternative C.

The area associated with the solar facility site was classified as medium to high ecological sensitivity due to the presence of large populations of various plant species of conservation concern and since the nationally protected tree species, *Acacia erioloba* is the dominant woody species within this site. Furthermore, the vegetation associated with the solar plant is representative of Western Highveld Sandy Grassland which is classified as a Critically Endangered ecosystem.

It is strongly recommended that the proposed solar plant site is moved to an area immediately north-east of the current site. This area has been modified through agricultural activities and does not support indigenous vegetation or plant species of conservation concern.

Powerline alternative B is the preferred route; although it is recommended that the route does not turn east but continues in a northerly direction to the R375 before turning east to the substation at Mareetsane.

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GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity.
Biodiversity	Biodiversity is the variability among living organisms from all sources including <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 & 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 provincial, national and global conservation status
- APPENDIX D** Bird species of conservation concern occurring within QDGC 2625AB as well as their national and global conservation status, probability of occurring on site and habitat preference
- APPENDIX E** Mammal species occurring within QDGC 2625AB, provincial, national and global conservation status, probability of occurring on site and habitat preference
- APPENDIX F** Amphibian species occurring within QDGC 2625AB, national and global conservation status, probability of occurring on site and habitat preference
- APPENDIX G** Reptile species occurring within QDGC 2625AB, national and global conservation status, probability of occurring on site and habitat preference

APPENDIX A: METHODOLOGY

FLORA

Desktop analysis and literature review

The desktop studies entailed a literature survey of all plant species occurring in QDGC 2625AB 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

Field surveys were undertaken on the 9th and 10th of April and the 21st to the 23rd of May 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 & Rutherford (2006). Plant names follow Van Wyk & Malan (1997), Van Wyk & Van Wyk (1997), Van Wyk & 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 & 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 & Chimimba (2005), Stuart & Stuart (2007) and Monadjem *et al.* (2010).

Herpetofauna & 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 & Stuart (2000 & 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 & Marais (2010) while amphibians were identified using Du Preez & 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	
		Solar Facility Site	Powerlines
Herbs			
<i>Aloe zebrina</i> (P)(M)		X	X
<i>Ammocharis coranica</i> (P)(M)			X
<i>Artemisia afra</i> (M)	African Wormwood		X
<i>Asparagus laricinus</i>		X	X
<i>Barleria macrostegia</i>		X	
<i>Bonatea antennifera</i> (P)		X	
<i>Boophone disticha</i> (D)(M)	Poison Bulb	X	X
<i>Bulbine</i> sp.		X	
<i>Ceratotheca triloba</i>	Wild Foxglove	X	X
<i>Commelina benghalensis</i>		X	
<i>Crinum graminicola</i>			X
<i>Crinum</i> c.f. <i>stuhlmannii</i> (P)(M)		X	X
<i>Cyperus fastigiatus</i>			X
<i>Delosperma</i> sp.		X	
<i>Dipcardi</i> sp.			X
<i>Elephantorrhiza elephantina</i> (M)			X
<i>Eriospermum</i> sp.		X	X
<i>Gomphocarpus fruticosa</i> (M)	Milkweed	X	X
<i>Hermannia</i> sp.			X
<i>Huernia</i> sp. (P)		X	
<i>Hypoxis hemerocallidea</i> (D)(M)		X	
<i>Jatropha</i> sp.			X
<i>Lantana rugosa</i> (M)		X	X

<i>Ledebouria</i> sp.			
<i>Schoenoplectus</i> so.			X
<i>Sansevieria hyacinthoides</i> (M)			
<i>Tribulus terrestris</i>	Devil's Thorn		X
Trees and shrubs			
<i>Acacia erioloba</i> (P)	Camel Thorn	X	X
<i>Acacia hebeclada</i>	Candle-pod Acacia	X	X
<i>Acacia karroo</i> (M)	Sweet Thorn	X	X
<i>Acacia luderitzii</i>	Fat Thorned Acacia	X	
<i>Acacia mellifera</i>	Black Thorn	X	X
<i>Boscia foetida</i> subsp.minima		X	X
<i>Diospyros lycioides</i>	Blue Bush		X
<i>Grewia flava</i>	Velvet Raisin	X	
<i>Gymnosporia senegalensis</i>			X
<i>Lycium</i> sp.		X	X
<i>Ozoroa</i> sp.			X
<i>Searsia chirindensis</i>	Red Current	X	X
<i>Searsia lancea</i>	Common Karee	X	X
<i>Tarchonanthus camphorates</i> (M)	Camphor bush	X	X
<i>Terminalia sericea</i>	Vaalbos		X
<i>Ziziphus mucronata</i> (M)	Buffalo Thorn	X	X
Grass			
<i>Aristida bipartita</i>		X	X
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	Spreading Three Awn	X	X
<i>Bromus catharticus</i>	Rescue Grass		X
<i>Chloris pycnothrix</i>	Spiderweb Grass	X	
<i>Cymbopogon plurinodis</i>	Narrow-leaved Turpentine Grass		X
<i>Cynodon dactylon</i>	Couch Grass	X	X
<i>Digitaria diagonalis</i>	Brown Seed Finger Grass	X	
<i>Digitaria eriantha</i>	Common Finger Grass	X	X
<i>Echinochloa holubii</i>	Kalahari Water Grass	X	

<i>Eragrostis gummiiflua</i>	Gum Grass	X	X
<i>Eragrostis obtusa</i>	Dew Grass	X	X
<i>Eragrostis superba</i>	Saw Tooth Love Grass		X
<i>Eragrostis trichophora</i>	Hairy Love Grass	X	
<i>Eragrostis viscosa</i>	Sticky Love Grass		X
<i>Imperata cylindrica</i>	Cottonwool Grass		X
<i>Melinis repens</i>	Natal Red Top	X	X
<i>Panicum sp.</i>		X	
<i>Phragmites australis</i>	Common Reed		X
<i>Themeda triandra</i>	Red Grass	X	X
Alien Species			
<i>Agave americana</i>		X	
<i>Agave sisilana</i>		X	X
<i>Bidens pilosa</i>	Black Jack	X	X
<i>Cirsium vulgare</i>	Spear Thistle	X	X
<i>Eucalyptus sp.</i>			X
<i>Flaveria bidentis</i>	Smelter's Bush		X
<i>Glycine sp.</i>	Soyabeans		X
<i>Gomphrena celasioides</i>	Bathelor's Button		
<i>Melia azedarach</i>			X
<i>Opuntia ficus-indica</i>	Prickly Pear	X	X
<i>Salix babylonica</i>	Weeping Willow		X
<i>Xanthium strumarium</i>			X
<i>Zea mays</i>	Cultivated maize		X

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

Scientific name	Common name	Conservation Status		
		NW	RSA	IUCN
<i>Struthio camelus</i>	Common Ostrich	Pr	LC	LC
<i>Pternistis swainsonii</i>	Swainson's Spurfowl	Pr	LC; En	LC
<i>Numida meleagris</i>	Helmeted Guineafowl	Pr	LC	LC
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet	Pr	LC; En	LC
<i>Trachyphonus vaillantii</i>	Crested Barbet	Pr	LC	LC
<i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill	Pr	LC; En	LC
<i>Tockus nasutus</i>	African Grey Hornbill	Pr	LC	LC
<i>Upupa africana</i>	African Hoopoe	Pr	LC	LC
<i>Phoeniculus purpureus</i>	Green Wood-Hoopoe	Pr	LC	LC
<i>Merops pusillus</i>	Little Bee-eater	Pr	LC	LC
<i>Merops apiaster</i>	European Bee-eater	Pr	LC	LC
<i>Colius colius</i>	White-backed Mousebird		LC; En	LC
<i>Urocolius indicus</i>	Red-faced Mousebird		LC	LC
<i>Chrysococcyx caprius</i>	Diderick Cuckoo	Pr	LC	LC
<i>Corythaixoides concolor</i>	Grey Go-away-bird	Pr	LC	LC
<i>Spilopelia senegalensis</i>	Laughing Dove	Pr	LC	LC
<i>Streptopelia capicola</i>	Cape Turtle-Dove	Pr	LC	LC
<i>Streptopelia semitorquata</i>	Red-eyed Dove	Pr	LC	LC
<i>Oena capensis</i>	Namaqua Dove	Pr	LC	LC
<i>Lophotis ruficrista</i>	Red-crested Korhaan	Pr	LC; En	LC
<i>Afrotis afraoides</i>	Northern Black Korhaan	Pr	LC; En	LC
<i>Elanus caeruleus</i>	Black-shouldered Kite	Pr	LC	LC
<i>Gyps africanus</i>	White-backed Vulture	Pr	VU; Pr	EN
<i>Melierax canorus</i>	Southern Pale Chanting Goshawk	Pr	LC; En	LC
<i>Micronisus gabar</i>	Gabar Goshawk	Pr	LC	LC
<i>Sagittarius serpentarius</i>	Secretarybird	Pr	VU	VU
<i>Bubulcus ibis</i>	Cattle Egret	Pr	LC	LC
<i>Bostrychia hagedash</i>	Hadeda Ibis	Pr	LC	LC
<i>Lanius minor</i>	Lesser Grey Shrike	Pr	LC	LC
<i>Lanius collaris</i>	Common Fiscal	Pr	LC	LC
<i>Urolestes melanoleucus</i>	Magpie Shrike	Pr	LC	LC
<i>Corvus albus</i>	Pied Crow	Pr	LC	LC
<i>Dicrurus adsimilis</i>	Fork-tailed Drongo	Pr	LC	LC
<i>Tchagra australis</i>	Brown-crowned Tchagra	Pr	LC	LC
<i>Laniarius atrococcineus</i>	Crimson-breasted Shrike	Pr	LC; En	LC
<i>Bradornis mariquensis</i>	Marico Flycatcher	Pr	LC; En	LC
<i>Erythropygia paena</i>	Kalahari Scrub-Robin	Pr	LC; En	LC
<i>Myrmecocichla formicivora</i>	Ant-eating Chat	Pr	LC; En	LC
<i>Lamprotornis nitens</i>	Cape Glossy Starling	Pr	LC	LC
<i>Creatophora cinerea</i>	Wattled Starling	Pr	LC	LC
<i>Acridotheres tristis</i>	Common Myna		LC; Intro	LC
<i>Anthoscopus minutus</i>	Cape Penduline-Tit	Pr	LC; En	LC

Scientific name	Common name	Conservation Status		
		NW	RSA	IUCN
<i>Riparia paludicola</i>	Brown-throated Martin	Pr	LC	LC
<i>Cecropis semirufa</i>	Red-breasted Swallow	Pr	LC	LC
<i>Cisticola fulvicapilla</i>	Neddicky	Pr	LC	LC
<i>Prinia subflava</i>	Tawny-flanked Prinia	Pr	LC	LC
<i>Prinia flavicans</i>	Black-chested Prinia	Pr	LC; En	LC
<i>Cameroptera brachyura</i>	Green-backed Cameroptera	Pr	LC	LC
<i>Sylvietta rufescens</i>	Long-billed Crombec	Pr	LC	LC
<i>Sylvia subcaerulea</i>	Chestnut-vented Tit-Babbler	Pr	LC; En	LC
<i>Calendulauda sabota</i>	Sabota Lark	Pr	LC; En	LC
<i>Certhilauda semitorquata</i>	Eastern Long-billed Lark	Pr	LC; En	LC
<i>Cinnyris mariquensis</i>	Marico Sunbird	Pr	LC	LC
<i>Sporopipes squamifrons</i>	Scaly-feathered Finch	Pr	LC; En	LC
<i>Plocepasser mahali</i>	White-browed Sparrow-Weaver	Pr	LC	LC
<i>Ploceus velatus</i>	Southern Masked-Weaver		LC	LC
<i>Quelea quelea</i>	Red-billed Quelea	Pr	LC	LC
<i>Lagonosticta senegala</i>	Red-billed Firefinch	Pr	LC	LC
<i>Uraeginthus angolensis</i>	Blue Waxbill	Pr	LC	LC
<i>Uraeginthus granatinus</i>	Violet-eared Waxbill	Pr	LC	LC
<i>Ortygospiza fuscocrissa</i>	African Quailfinch	Pr	LC	LC
<i>Crithagra flaviventris</i>	Yellow Canary	Pr	LC; En	LC

APPENDIX D: Bird species of conservation concern occurring within 2625AB, national and global conservation status (EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; En = 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>Gyps africanus</i>	White-backed Vulture	VU; Pr	EN	Confirmed	Lightly wooded arid savanna, including Mopane <i>Colophospermum mopane</i> woodland
<i>Sagittarius serpentarius</i>	Secretarybird	VU	VU	Confirmed	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
<i>Polemaetus bellicosus</i>	Martial Eagle	VU	NT	High	Open woodland, arid and mesic savanna, forest edges
<i>Ardeotis kori</i>	Kori Bustard	VU; Pr	LC	High	Fairly dry, open savanna with rainfall 100-600 mm and occasionally western grasslands, typically close to tree-lined watercourses, which provide cover when disturbed and shade during heat of day; also dry grassy pan edges
<i>Aquila rapax</i>	Tawny Eagle	VU	LC	High	Lightly wooded savanna; absent from dense forests and highlands
<i>Certhilauda chuana</i>	Short-clawed Lark	NT; En	LC	High	Semi-arid <i>Acacia</i> savanna, sparsely vegetated with short grass and scattered low bushes; bare ground ave 78% in br territories
<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>Coracias garrulus</i>	European Roller	LC; NBM	NT	High	Open, broadleaved and <i>Acacia</i> woodlands with grassy clearings
<i>Falco vespertinus</i>	Red-footed Falcon	LC; NBM	NT	High	Open, grassy, arid woodland; roosts in small stands of trees, often in alien <i>Eucalyptus</i> spp, in suburbs of small towns
<i>Gyps coprotheres</i>	Cape Vulture	VU; En	VU	Medium	Wide habitat range; cliffs
<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, including croplands in fynbos and renosterveld of W Cape
<i>Leptoptilos crumeniferus</i>	Marabou Stork	NT	LC	Medium	Both aquatic and terrestrial habitats, favouring open and semi-arid areas; largely absent from forest areas and true desert; common at wetlands, including dams, pans and rivers, and in wildlife reserves and ranching areas
<i>Anthropoides paradiseus</i>	Blue Crane	VU; En	VU	Low	Open grassland and grassland/Karoo ecotone; wetlands, cultivated pastures and crop lands; tolerant of intensively grazed and burnt grassland
<i>Circus ranivorus</i>	African Marsh-Harrier	VU	LC	Low	Almost exclusively inland and coastal wetlands

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Mirafra cheniana</i>	Melodious Lark	NT; En	NT	Low	Grassland dominated by <i>Themeda triandra</i> ; avoids wet lowlands, favouring fairly short grassland (< 0.5 m), with open spaces between tussocks, at 550-1750 m altitude, with annual rainfall 400-800 mm
<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>Phoeniconaias minor</i>	Lesser Flamingo	NT	NT	Low	Primarily open, eutrophic, shallow wetlands; breeds on saline lakes and salt pans
<i>Ciconia nigra</i>	Black Stork	NT	LC	Low	Dams, pans, floodplains, flooded grassland, associated with mountainous areas
<i>Circus macrourus</i>	Pallid Harrier	NT; NBM	NT	Low	Grasslands associated with pans or floodplains; also croplands
<i>Glareola nordmanni</i>	Black-winged Pratincole	NT; NBM	NT	Low	Open grassland, edges of pans and cultivated fields, but most common in seasonally wet grasslands and pan systems
<i>Mycteria ibis</i>	Yellow-billed Stork	NT; NBM	LC	Low	Wetlands, including alkaline and freshwater lakes, rivers, dams, pans, flood plains, marshes, flooded grassland and small pools or streams
<i>Hydroprogne caspia</i>	Caspian Tern	NT	LC	Low	Along coast, mostly in sheltered bays and estuaries; inland, at large water bodies, both natural and man-made, with preference for saline pans and large impoundments
<i>Pelecanus onocrotalus</i>	Great White Pelican	NT	LC	Low	Shallow lakes, flood plain pans, estuaries and dams; sheltered coastal bays and lagoons; roosts on dry land in open areas, usually on islands or peninsulas where access by terrestrial predators limited
<i>Buphagus erythrorhynchus</i>	Red-billed Oxpecker	NT	LC	Low	Open savanna, up to 3 000 m; dependent on presence of host ungulates
<i>Phoenicopterus roseus</i>	Greater Flamingo	NT	LC	Low	Large, shallow, eutrophic wetlands, salt pans, saline lakes, coastal mudflats
<i>Rostratula benghalensis</i>	Greater Painted-snipe	NT	LC	Low	Waterside habitats with substantial cover
<i>Oxyura maccoa</i>	Maccoa Duck	LC	NT	Low	Permanent wetlands in open grassland and semi-arid country

APPENDIX E: Mammal species occurring within QDGC 2625AB as well as their provincial, 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
		NW	RSA	IUCN		
<i>Alcelaphus buselaphus</i>	Red Hartebeest	Pr	LC; Pr	LC	Confirmed	Open grasslands and semi-arid bush savanna and open woodland
<i>Oryx gazella</i>	Gemsbok	Pr	LC; Pr	LC	Confirmed	Savanna, grassland, temperate, semi arid and arid bushveld and grassland of the Kalahari
<i>Otocyon megalotis</i>	Bat-eared Fox		LC; Pr	LC	Confirmed	Open country with short scrub, grassveld and sparsely wooded areas
<i>Sylvicapra grimmia</i>	Common Duiker	Pr	LC	LC	Confirmed	Spoor; droppings / Wide range of habitats preferring areas with dense vegetation for cover
<i>Orycteropus afer</i>	Aardvark	Pr	LC	LC	Confirmed	Open woodland, sparse scrub and grassland
<i>Tragelaphus oryx</i>	Eland	Pr	LC	LC	Confirmed	Arid scrub, savanna woodland, montane grassland
<i>Aepyceros malampus</i>	Impala	Pr	LC	LC	Confirmed	In the game camp
<i>Phacochoerus africanus</i>	Common Warthog	Pr	LC	LC	Confirmed	Savannas
<i>Tragelaphus strepsiceros</i>	Kudu	Pr	LC	LC	Confirmed	Savannas
<i>Hystrix africaeaustralis</i>	Cape Porcupine		LC	LC	Confirmed	Digs; droppings; quills / Occurs in all habitat types except true desert
<i>Raphicerus campestris</i>	Steenbok		LC	LC	Confirmed	Droppings / Open country with some cover; in arid areas inhabit dry river beds
<i>Xerus inauris</i>	Southern African Ground Squirrel		LC	LC	Confirmed	Burrows / Grassland, savanna, desert, sparse bush cover on hard substrate in arid and semi-arid areas
<i>Cryptomys hottentitus</i>	Common Mole-rat		LC	LC	Confirmed	Mounds / Wide habitat tolerance; grassland; savanna; wide range of soils except heavy clay
<i>Tatera leucogaster</i>	Bushveld Gerbil		LC	LC	Confirmed	Burrow / Wide variety of habitats with sandy soils
<i>Galerella sanguinea</i>	Slender Mongoose		LC	LC	Confirmed	Droppings / From forest to open savanna as long as there is adequate cover
<i>Cynictis penicillata</i>	Yellow Mongoose		LC	LC	Confirmed	Open habitats in short grassland and arid scrub
<i>Canis mesomelas</i>	Black-backed Jackal		LC	LC	Confirmed	Dry, open grasslands or savannas
<i>Felis silvestris</i>	African Wild Cat		LC	LC	Confirmed	Wide habitat tolerance but requires cover
<i>Lepus saxatilis</i>	Scrub Hare		LC	LC	Confirmed	Woodland and grassland with scrub cover; often seen in agricultural land
<i>Atilax paludinosus</i>	Water Mongoose		LC	LC	Confirmed	Rivers, marshes, dams, lakes and estuaries with good cover
<i>Mellivora capensis</i>	Honey Badger		NT; Pr	LC	High	Found in most habitat types; absent from desert

Scientific name	Common name	Conservation Status			Probability of occurring on site	Evidence / Habitat preference
		NW	RSA	IUCN		
<i>Atelerix frontalis</i>	Southern African Hedgehog	Pr	NT	LC	High	Savanna woodland
<i>Rhinolophus clivovus</i>	Geoffroy's Horseshoe Bat		NT	LC	High	Variety of habitats including savanna, woodland and riparian forest; roosts in caves and mine adits
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat		NT	LC	High	Variety of habitats including arid savanna and woodland; roosts in caves, mine audits, crevices and road culverts
<i>Caracal caracal</i>	Caracal		LC	LC	High	Semi-desert, open grasslands and savanna woodland
<i>Genetta genetta</i>	Small-spotted Genet		LC	LC	High	Dry savanna woodland
<i>Graphiurus murinus</i>	Woodland Dormouse		LC	LC	High	Woodland savanna
<i>Ictonyx striatus</i>	Striped Polecat		LC	LC	High	Found in all habitat types including agricultural land
<i>Mastomys coucha</i>	Southern Multimammate Mouse		LC	LC	High	Wide habitat tolerance
<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>Rhabdomys pumilio</i>	Four-striped Grass Mouse		LC	LC	High	Wide range of habitats preferring short, dense grass cover
<i>Saccostomus campestris</i>	Pouched Mouse		LC	LC	High	Savanna, shrubland, grassland, temperate, nocturnal
<i>Steatomys krebsii</i>	Kreb's Fat Mouse		LC	LC	High	Sandy soils in savanna
<i>Suricata suricatta</i>	Suricate		LC	LC	High	Savanna, shrubland, grassland, desert
<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 and under bark, and roofs of houses
<i>Thallomys paedulus</i>	Acacia Rat		LC	LC	High	Arboreal species associated with <i>Acacia</i> savanna
<i>Lemniscomys rosalia</i>	Single-striped Grass Mouse		DD	LC	High	Savanna habitats, tall grass essential
<i>Mus musculus</i>	House Mouse		LC; Intro	LC	High	Widespread
<i>Lepus capensis</i>	Cape Hare	Pr	LC	LC	Medium	Open, arid habitat with grass and scrub
<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil		LC	LC	Medium	Hard ground with grass or karroid bush
<i>Tatera brantsii</i>	Highveld Gerbil		LC	LC	Medium	Open or lightly wooded grasslands on consolidated sands
<i>Gerbillurus paebe</i>	Hairy-footed Gerbil		LC	LC	Medium	Sandy soils in arid areas extending into moister southern coastal zone
<i>Mus indutus</i>	Desert Pygmy Mouse		LC	LC	Medium	Semi-arid savannas
<i>Pedetes capensis</i>	Springhare		LC	LC	Medium	Sandy soils, edges of vleis, floodplain grassland
<i>Crociodura cyanea</i>	Reddish-grey Musk Shrew		DD	LC	Medium	Dry terrain
<i>Poecilogale albinucha</i>	African Striped Weasel		DD	LC	Medium	Wide habitat tolerance but prefers grassland or open woodland

Scientific name	Common name	Conservation Status			Probability of occurring on site	Evidence / Habitat preference
		NW	RSA	IUCN		
<i>Mystromys albicaudatus</i>	White-tailed Mouse		EN; En	EN	Low	Grassland and shrubland, vleis with black loam
<i>Manis temminckii</i>	Ground Pangolin	Pr	VU; Pr	LC	Low	Open grassland, woodland and rocky hills
<i>Hyaena brunnea</i>	Brown Hyaena		NT; Pr	NT	Low	Desert; open savanna
<i>Rhinolophus denti</i>	Dent's Horseshoe Bat		NT; En	DD	Low	Arid habitats with suitable roost sites; caves; rocky outcrops
<i>Felis nigripes</i>	Small Spotted Cat		LC; Pr	VU	Low	Specialist of dry open, short grass areas with an abundance of small rodents and ground-roosting birds
<i>Vulpes chama</i>	Cape Fox		LC; En; Pr	LC	Low	Open areas in grassland and arid scrub
<i>Onych capensis</i>	Cape Clawless Otter		LC; Pr	LC	Low	Rivers, marshes, dams and lakes
<i>Connochaetes gnou</i>	Black Wildebeest	Pr	LC; Pr	LC	Low	Temperate grasslands, selective grazer in open areas with short grass, open plains
<i>Antidorcas marsupialis</i>	Springbok	Pr	LC	LC	Low	Karoo, arid and semi-arid desert scrub and grassland
<i>Proteles cristatus</i>	Aardwolf	Pr	LC	LC	Low	Wide habitat tolerance with a preference for open areas
<i>Aethomys ineptus</i>	Tete Veld Rat		LC	LC	Low	Wide range of habitats from grassland to savanna including rocky outcrops
<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse		LC	LC	Low	Rocky habitats
<i>Connochaetes taurinus</i>	Blue Wildebeest		LC	LC	Low	Open savanna woodland and open grassland; drinking water essential
<i>Elephantulus myurus</i>	Eastern Rock Sengi		LC	LC	Low	Rocky environments
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat		LC	LC	Low	Close to rivers, or in a range of surrounding habitats including montane grassland, marshland and well-wooded banks
<i>Malacothrix typica</i>	Gerbil Mouse		LC	LC	Low	Nama karoo, succulent karoo, grassland, temperate, fringes of pans, short grass on hard sandy soils
<i>Papio cynocephalus</i>	Savanna Baboon		LC	LC	Low	Savanna and grassland, forest edges
<i>Sauromys petrophilus</i>	Flat-headed Free-tailed Bat		LC	LC	Low	Rocky areas roosting in narrow rock fissures and crevices
<i>Suncus varilla</i>	Lesser Dwarf Shrew		DD	LC	Low	Grassland with termitaria
<i>Diceros bicornis</i>	Black Rhinoceros	Pr	EN; Pr	CR	Zero	Restricted to conservation areas
<i>Acinonyx jubatus</i>	Cheetah	Pr	VU	VU	Zero	Savanna, grassland, desert
<i>Ceratotherium simum</i>	White Rhinoceros	Pr	NT; Pr	NT	Zero	Restricted to conservation areas
<i>Crocuta crocuta</i>	Spotted Hyaena		NT; Pr	LC	Zero	Mostly restricted to conservation areas
<i>Giraffa camelopardalis</i>	Giraffe	Pr	LC; Pr	LC	Zero	Restricted to conservation areas
<i>Equus quagga</i>	Plains Zebra	Pr	LC	LC	Zero	Grassland and open grassy savanna
<i>Syncerus caffer</i>	African Buffalo	Pr	LC	LC	Zero	Restricted to conservation areas

APPENDIX F: Amphibian species occurring within QDGC 2625AB as well as their national and global conservation status (LC = Least Concern; Pr = Protected), probability of occurring on site and habitat preference. Species are listed in order of probability of occurring on site

Scientific name	Common name	Conservation Status		Probability of occurring on site	Habitat preference
		RSA	IUCN		
<i>Schismaderma carens</i>	Red Toad	LC	LC	High	Widespread in savanna and woodland, readily adapts to human habitation
<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	LC	LC	High	Hot, semi-arid to subtropical environments; savanna woodland, grassland and wide variety of bushveld vegetation types; also agriculturally developed areas
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	LC	LC	High	Variety of habitats in savanna and grassland
<i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC	LC	High	Nama Karoo, grassland and savanna; breeds in small streams, pans and farm dams as well as temporary rain pools
<i>Amietophrynus gutturalis</i>	Guttural Toad	LC	LC	High	Around open pools, dams, vleis and other semi-permanent bodies of water in grassland, thicket and savanna; suburban gardens and farmland
<i>Breviceps adspersus</i>	Bushveld Rain Frog	LC	LC	High	Sandy to sandy-loam soils in semi-arid habitats in savanna and grassland, absent from forest
<i>Amietophrynus garmani</i>	Eastern Olive Toad	LC	LC	Medium	Vleis and pans in bushveld savanna with relatively high rainfall > 600mm pa; suburban gardens
<i>Amietophrynus poweri</i>	Western Olive Toad	LC	LC	Medium	Around vleis and pans in thornveld savanna where rainfall is relatively low < 600mm pa
<i>Amietia angolensis</i>	Common River Frog	LC	LC	Medium	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>Xenopus laevis</i>	Common Platanna	LC	LC	Medium	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	LC; Pr	LC	Low	Fossorial, breeding in seasonal, shallow, grassy pans, vleis and other rain-filled depressions in open, flat areas of grassland or savanna; Nama Karoo and thicket at the limits of its range
<i>Kassina senegalensis</i>	Bubbling Kassina	LC	LC	Low	Grassland around vleis and pans; breeds in temporary and permanent water bodies including vleis, marshes, pans, ponds and dams
<i>Cacosternum boettgeri</i>	Boettger's Caco	LC	LC	Low	Variety of habitats in Nama Karoo, succulent Karoo, grassland and thicket favouring open areas and especially abundant in grassland areas; occasionally forest clearings

APPENDIX G: Reptile species occurring within QDGC 2625AB as well as their national and global conservation status (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	CITES		
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	LC		High	Absent only from closed canopy and desert areas
<i>Psammophylax tritaeniatus</i>	Striped Skaapsteker	LC	LC		High	Open grassland and savanna
<i>Agama aculeata</i>	Ground Agama	LC	NE		High	Semi-desert and sanded savanna
<i>Crotaphopeltis hotamboeia</i>	Herald Snake	LC	NE		High	Savanna and open woodland
<i>Telescopus semiannulatus</i>	Common Tiger Snake	LC	NE		High	Savanna and sandveld
<i>Ichnotropis squamulosa</i>	Common Rough-scaled Lizard	LC	NE		High	Arid and mesic savanna
<i>Panaspis walbergii</i>	Wahlberg's Snake-eyed Skink	LC	NE		High	Arid and mesic savanna
<i>Trachylepis capensis</i>	Cape Skink	LC	NE		High	Habitat generalist; widespread and common
<i>Trachylepis varia</i>	Variable Skink	LC	NE		High	Varied, grassland to arid and mesic savanna
<i>Psammobates oculiferus</i>	Kalahari Tent Tortoise	LC	NE	*CITES App II	Medium	Arid savanna, scrub desert
<i>Stigmochelys pardalis</i>	Leopard Tortoise	LC	NE	*CITES App II	Medium	Varied, montane grassland, fynbos, mesic thicket, arid and mesic savanna
<i>Xenocalamus bicolor</i>	Bicoloured Quill-snouted Snake	LC; En	NE		Medium	Kalahari and alluvial sand
<i>Lamprophis capensis</i>	Brown House Snake	LC	NE		Medium	Highveld grassland, karroid regions and tolerant in urban areas
<i>Psammophis trinasalis</i>	Kalahari Sand Snake	LC	NE		Medium	Kalahari thornveld
<i>Nucras holubi</i>	Holub's Sandveld Lizard	LC	NE		Medium	Broken rocky ground in mesic savanna
<i>Lycophidion capense</i>	Common Wolf Snake	LC	NE		Low	Variety of habitats including lowland forest, fynbos, moist savanna, grassland and karoo scrub
<i>Pseudaspis cana</i>	Mole Snake	LC	NE		Low	Sandy scrubland in SW Cape, highveld grassland, mountainous and desert areas
<i>Pachydactylus capensis</i>	Cape Gecko	LC	NE		Low	Varied, karroid veld, grassland
<i>Trachylepis sp.(Transvaalvaria)</i>	Skink sp. 1		Not listed			

*CITES Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival