GOD'S WINDOW SKYWALK
ECOLOGICAL ASSESSMENT

SEF Reference No. 505201

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NOVEMBER 2013

Declaration of Independence

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

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

10 January 2015

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Date

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EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd (SEF), as independent environmental consultants and ecological specialists, was appointed by the Industrial Development Corporation (Pty) Ltd to undertake the ecological studies for the proposed Skywalk at God's Window in Mpumalanga. The Mpumalanga Tourism and Parks Association (MTPA) have proposed a glass bottomed, cantilevered Skywalk be built at the God's Window site. This is in order to enhance the tourist experience at the site and to attract a growing number of tourists to the region. The idea of the Skywalk is premised on the existing Skywalk at the Grand Canyon in the United States of America.

The study area is situated within two Biomes, namely Afrotemperate, Subtropical and Azonal Forests Biome and the Grassland Biome. Biomes can further be divided into smaller units known as vegetation types and according to Mucina and Rutherford (2006), three vegetation types, namely Northern Mistbelt Forest, Northern Escarpment Afromantane Fynbos and Northern Escarpment Quartzite Sourveld, are located within the study area. Further, the present study area is located within the Blyde Quartzite Grassland ecosystem which is currently listed as Endangered in terms of Section 52 of NEMBA. The study area is furthermore located within a protected area according to the latest Mpumalanga Biodiversity Sector Plan, namely Blyde River Canyon Provincial Nature Reserve.

A diversity of vegetation communities were recorded within the relatively small study area and included *Passerine montana/Pteridium aquilinum* scrubveld, *Aloe arborescens/Clivia caulescens* cliff edges, vertical cliffs and mistbelt forests. At least eight plant species of conservation concern were recorded during the field survey, namely *Monopsis kowynensis* (Vulnerable), *Streptocarpus fenestra-dei* (Vulnerable), *Schizochilus lilacinus* (Extremely Rare), *Merwilla plumbea* (Declining), *Drimia alata* (Declining), *Clivia caulescens* (Near Threatened), *Alsophila capensis* (Declining) and *Rapanea melanophloeos* (Declining). In addition to this, one nationally protected tree, i.e. *Afrocarpus falcatus* (Small leaved Yellowood), and numerous provincially protected species were also recorded throughout the study area.

At least two faunal species of conservation concern, *Sarothrura affinis* (Striped Flufftail) and *Hadromophryne natalensis* (Natal Cascade Frog), both of which are currently listed as Vulnerable, were confirmed in the study area during the field survey. In addition, at least nine chiropteran (bat) species which are of conservation concern have been recorded from QDGC 2430DD, and all of these are highly likely to occur within the study area based on the presence of suitable roosting sites such as caves and crevices. It is therefore recommended that a detailed chiropteran survey is conducted before commencement of construction to ensure effective mitigation.

Due to the high concentrations of threatened species recorded on the cliff edges, vertical cliffs and mistbelt forests, these areas were classified to be of very high ecological importance and sensitivity. Most of the plant species which were recorded on the vertical cliffs are adapted to moist conditions and since the hydrology of the area (including any possible wetlands located within the current footprint) is not well understood, the remainder of the area was classified to be of high ecological importance and sensitivity. Therefore, in addition to the suggested detailed chiropteran assessment, it is recommended that a detailed wetland study is undertaken for the footprint area to ensure that the proposed development does not influence the wet conditions recorded on the vertical cliffs, since the drying out of these sensitive systems will result in the destruction of numerous threatened species.

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LIST OF ABBREVIATIONS

CBA	Critical Biodiversity Area
CWAC	Coordinated Waterbird Counts
DDD	Data Deficient Distribution
DDT	Data Deficient Taxanomic
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
NT	Near Threatened
PA	Protected Area
POSA	Plants of Southern Africa
SEF	Strategic Environmental Focus
VU	Vulnerable
MTPA	Mpumalanga Tourism and Parks Agency
SABAP	South African Bird Atlas Project
ADU	Animal Demographical Unit
VM	Virtual Museum

1. INTRODUCTION

1.1 Project Description

Strategic Environmental Focus (Pty) Ltd (SEF) as independent environmental consultants and ecological specialists, was appointed by the Industrial Development Corporation (Pty) Ltd to undertake the ecological studies for the proposed Skywalk at God's Window in Mpumalanga. The Mpumalanga Tourism and Parks Association (MTPA) have proposed a glass bottomed, cantilevered Skywalk be built at the God's Window site. This is in order to enhance the tourist experience at the site, and to attract a growing number of tourists to the region. The idea of the Skywalk is premised on the existing Skywalk at the Grand Canyon in the United States of America.

A feasibility study has been completed on the project by AECOM, which indicated that the project is technically feasible and there is a market for such a tourist component in the Blyde River Canyon area.

1.2 Terms of Reference

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

- Provide a description of the dominant floral and faunal species occurring in the study area, including floral composition and structure and faunal habitat;
- Describe the threatened, endemic, rare or protected plant and animal species, and/or potential habitats in the area under investigation;
- Map indicating the locality, extent and sensitivity of floral and faunal habitats;
- List the floral and faunal species identified during the field survey as well as species expected to inhabit the study site;
- List the threatened, rare or protected plant and animal species that could occur on the site and GPS those confirmed to occur and indicate the confirmed localities on a map; and
- Describe impacts likely to affect biodiversity within the study area and recommend mitigation measures to minimize these impacts.

1.3 Methodology

The field surveys were undertaken from the 15th to the 18th of October 2013 as well as the 30th of October to the 1st of November 2013. The methodology entailed the following:

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Desktop analysis and literature review

The desktop studies entailed a literature survey of all plant species occurring in the QDGC 2430DD according to the Plants of Southern Africa online checklist (SANBI, 2009). Additional data such as habitat preference and species descriptions were gathered for all plants of conservation concern which were included in the list. Background information on the regional vegetation was gathered using GIS and Mucina and Rutherford (2006).

Field survey

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

During the site visit, a number of line transects were sampled and additional points where plants of conservation concern, provincially and nationally protected species 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.

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

Avifauna

A list was compiled of the avifaunal species which are likely to occur within QDGC 2430DD by combining data generated from Roberts Multimedia version 7 and the South African Bird Atlas Project 2 (SABAP2). Barnes (2000), Hockey, Dean and Ryan, P.G. (2005), Cillié, Oberprieler and Joubert (2004), Tarboton and Erasmus (1998) and Chittenden (2007) were consulted for identification.

During the field survey, all avifaunal species within the study area, along the cliffs and mistbelt forests below the cliffs, as well as those flying over the study were recorded by sight (with 32x10 Linx binoculars) and sound. Approximately 52 hours were spend within the study area and included the following survey periods:

- Nocturnal surveys;
- Numerous surveys at dusk and dawn; and
- Surveys during daylight hours.

Mammals

Mammal surveys were conducted during the day, at night, at dusk and at dawn with the presence of mammals within the study area noted by sightings, sounds and signs (tracks, dung, diggings and burrows). Nocturnal surveys were conducted by using a Zartek 350 Lumens Led Spotlight which was fitted with a red lens to prevent temporary blindness of encountered faunal species.

Rodent trapping was done by baiting Shearman traps and placing ten traps randomly within different structural vegetation units within the study area. Traps were inspected twice a day (just before dusk and just after dawn) and fresh bait was added if needed. All the traps were removed on the last morning of the survey.

For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner and Chimimba (2005), Cillié, Oberprieler and Joubert (2004), Apps (2000), Walker (1996), Stuart and Stuart (2000) and Liebenberg (1990) were consulted.

Chiroptera (Bats)

All South African Chiroptera species are active at dusk, dawn and throughout the night and will find suitable roosting sites during the day. Chiroptera surveys usually include assessment of the area in terms of suitable roosting sites, surveys at dusk and dawn to determine if areas are used as communal roosting sites as well as the use of bat detectors to record calls of species present within the study area. Chiroptera surveys for this study included dusk and dawn surveys on the cliffs as well as assessing the study area for suitable roosting sites.

Reptiles

A list of reptiles which have been recorded from QDGC 2430DD was obtained from ReptileMAP which is a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012).

During the field survey, different habitat types across the study area were surveyed which included scrubveld, mistbelt forest and vertical cliffs. These surveys were conducted during the warmest parts of the day when reptiles are generally more active. However, high volumes of tourists visiting God's Window during daytime when reptiles are generally more active resulted in disturbance and limited reptile activity. Therefore reptile surveys were conducted in habitat representative of those recorded within the study area but which were located away from tourist areas. The reptile surveys used a combination of the following two techniques:

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

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

Amphibians

A list of amphibian species which are likely to occur in QDGC 2430DD was obtained from FrogMAP which is a continuation of the Southern African Frog Atlas Project. Frog surveys were conducted before and after dark, and the calls were recorded and identified using Du Preez and Carruthers (2009).

Invertebrates

Invertebrates (insects) surveys consisted of visual searches (nocturnal and diurnal) which were conducted to determine invertebrate activity in the study area. Leptidoptera surveys were conducted during the warmest part of the day using a butterfly net to catch various species which were released following identification.

Arachnida includes scorpions, spiders, pseudoscorpions, sunspiders, micro whipscorpions, tailless whipscorpions and ricinuleids. These creatures are often very secretive and spend up to 97% of their time inactive. To increase the probability of finding scorpions, nocturnal searches were conducted with an UV 21 LED torch. Although searches for arachnids were conducted by looking under objects such as rocks, branches and artificial refugia such as building rubble, this study did not include a full invertebrate assessment.

Vertical cliff surveys

Ecological surveys of the vertical cliffs as well as the mistbelt forest below the proposed Skywalk were conducted from the 30th of October to the 1st of November 2013. Access to the cliffs was obtained through ropes and surveys were conducted by qualified rope access technicians. These surveys were conducted during daylight hours, dusk and at dawn.

1.4 Limitations

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

- This study focussed on the area which are likely to be affected by the proposed Skywalk only and did not include the Adventure camp, Skylift or additional viewpoints;
- God's Window is a popular tourist attraction resulting in high noise levels generated by people and vehicles. Furthermore, the constant movement of people within the study area impacted on faunal species activity. Therefore, faunal surveys were mostly conducted outside of the operating hours for God's Window;
- Strong wind, mist and thunderstorms were experienced periodically during the field survey period and this influenced the activity of some faunal species especially avifauna, reptiles and invertebrates.

It should also be noted that 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.

2. BACKGROUND

2.1 Location

The study area is located at God's Window in the Mpumalanga Province approximately 7km north-east of Graskop and falls in Quarter Degree Grid Cell (QDGC) 2430DD between 24°52'31.5" – 24°52'42.7" south and 30°53'19.0" – 30°53'14.3" east (Figure 1).

2.2 Climate

The study area experiences a strong seasonal summer rainfall although orographic effects enhance precipitation (mean annual precipitation is 1176mm). Mist is common along the escarpment although frost is experienced infrequently. Mean annual temperature is 16.6ºC (Mucina and Rutherford, 2006). The area received a total of 30.6mm of rain between the 1st of October 2013 and the 15th of October 2013 (worldweatheronline.com).

2.3 Weather

Weather conditions experienced during the field surveys have a significant influence on faunal activities, with low faunal activity usually associated with windy, rainy, misty or cold conditions. Table 1 summarizes the weather conditions experienced during the field survey period (worldweatheronline.com). Strong wind was recorded during the dawn survey on the 16th of October while dense mist and relatively low temperatures were recorded throughout the day on the 17th of October 2013.

Table 1: Weather conditions recorded during the field survey

Date	Time	Temperature	Rain (mm)	Percentage cloud cover (5)	Wind (km/h)
Tuesday: 15 October	14:00	23ºC	0	7	12
	17:00	21ºC	0	8	12
	20:00	14ºC	0	14	7
Wednesday: 16 October	05:00	9ºC	0	3	12
	08:00	19ºC	0	0	6
	14:00	30ºC	0	3	9
	17:00	26ºC	0	3	13
	20:00	19ºC	0	3	15
Thursday: 17 October	05:00	12ºC	0	17	6
	08:00	17ºC	0	22	8
	14:00	24ºC	0	26	13
	17:00	20ºC	0.1	28	13
	20:00	15ºC	0.2	60	10
Friday: 18 October	05:00	13ºC	0.2	80	7
	08:00	17ºC	0.1	40	9
	14:00	21ºC	0.1	30	10
Wednesday: 30 October	11:00	25ºC	0.1	12	11
	14:00	28ºC	0.6	18	12
	17:00	26ºC	0.7	16	8
	20:00	18ºC	0.7	11	13
Thursday: 31 October	05:00	15ºC	0	5	7
	08:00	24ºC	0	3	10
	11:00	28ºC	0	7	17
	14:00	30ºC	0.1	9	22
	17:00	28ºC	0.2	4	12
	20:00	20ºC	0.2	18	9
Friday: 01 November	05:00	14ºC	1.2	9	5
	08:00	20ºC	0	18	9
	11:00	26ºC	0	7	13

2.4 Regional Vegetation

The study area is situated within two Biomes, namely Afrotemperate, Subtropical and Azonal Forests Biome and the Grassland Biome. The Afrotemperate, Subtropical and Azonal Forests Biome is defined as miltilayered vegegtation which is dominated by trees with overlapping crown cover and the graminoids in the herbaceous layer are generally rare (Mucina & Rutherford, 2006). These forests are limited to regions with high water availability and persist in areas with mean annual rainfall of more than 725mm per annum during summer. The Grassland Biome is characterized 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.

Biomes can further be divided into smaller units known as vegetation types and according to Mucina and Rutherford (2006), three vegetation types namely Northern Mistbelt Forest, Northern Escarpment Afromantane Fynbos and Northern Escarpment Quartzite Sourveld are located within the study area (Figure 2).

Northern Mistbelt Forest occurs in Limpopo, Mpumalanga and Swaziland along the Soutpansberg from Blouberg in the northwest to the Samadou Plateau in the northeast as well as along the Abel Erasmus Pass to Badplaas and Baberton. This vegetation type is also known as the Mpumalanga Afromontane Forest (Ferrar and Lotter, 2007). The vegetation consists of tall, evergreen afrotemperate mistbelt forests on east facing cliffs and sheltered kloofs. The most common canooy trees include *Xymalos monospora, Podocarpus latifolius, Combretum kraussii, Cryptocarya transvaalensis* and *Pterocelastrus galpinii.* The understory consists of species such as *Psycotria zombamontana, Canthium kuntzeanum, Gymnosporia harveyana, Peddiea Africana, Mackaya bella* and *Sclerochiton harveyanus.* Northern Mistbelt Forest is classified as Least threatnened with about 10% statutorily conserved in the Blyde River Canyon, Lekgalameetse, Songimvelo, Barberton and Starvation Creek Nature Reserves.

Northern Escarpment Afromontane Fynbos is located in the Limpopo and Mpumalanga Provinces where it is restricted to the peaks of Thabakgolo Mountains above Penge, southwards along the highest peaks to Mariepskop and Graskop. The dominant vegetation structure is shrubland which consists of sclerophyllous shrubs and herbs. Important taxa include small trees such as *Protea caffra, P.roupelliae,* succulent species such as *Aloe arborescens* and herbaceous species such as *Erica natalitia, Hypericum revolutum, Passerina montana, Cliffortia linearifolia, Erica revoluta, Erica simii, Euryops pedunculatus* and various *Helichrysum* species. Northern Escarpment Afromontane Fynbos is classified as Least Threatened with more than 56% of this vegetation type protected.

Northern Escarpment Quartzite Sourveld occurs in Limpopo and Mpumalanga Provinces where it occurs along the high-altitude crests of the Northern Escarpment from Haenertsburg to Blyde River Canyon and Kaapsehoop. The landscape is characteristically very rugged with steep east-facing cliffs which are dominated by species such as *Protea roupelliae, Faurea galpinii, Faurea rochetiana, Syzygium cordatum, Cyathea dregai, Vernonia myriantha.* Low shrub species includes *Athrixia phylicoides, Clutia monticola, Crotalaria doidgeae, Erica woodii, Euryops pedunculatus, Aloe arborescens, Crassula sarcocaulis* while the diverse herbaceous layer consists of species such as *Berkheya echinacea, Dicoma anomala, Eriosema angustifolium, Gerbera ambigua, Monsonia attenuate* and *Pearsonia sessilifolia.* Northern Escarpment Quartzite Sourveld is classified as Vulnerable with more than 38% transformed mainly by

plantations. It is furthermore noted that this vegetation type coincides with the Wolkberg Centre of Endemism and is rich in endemic plants.

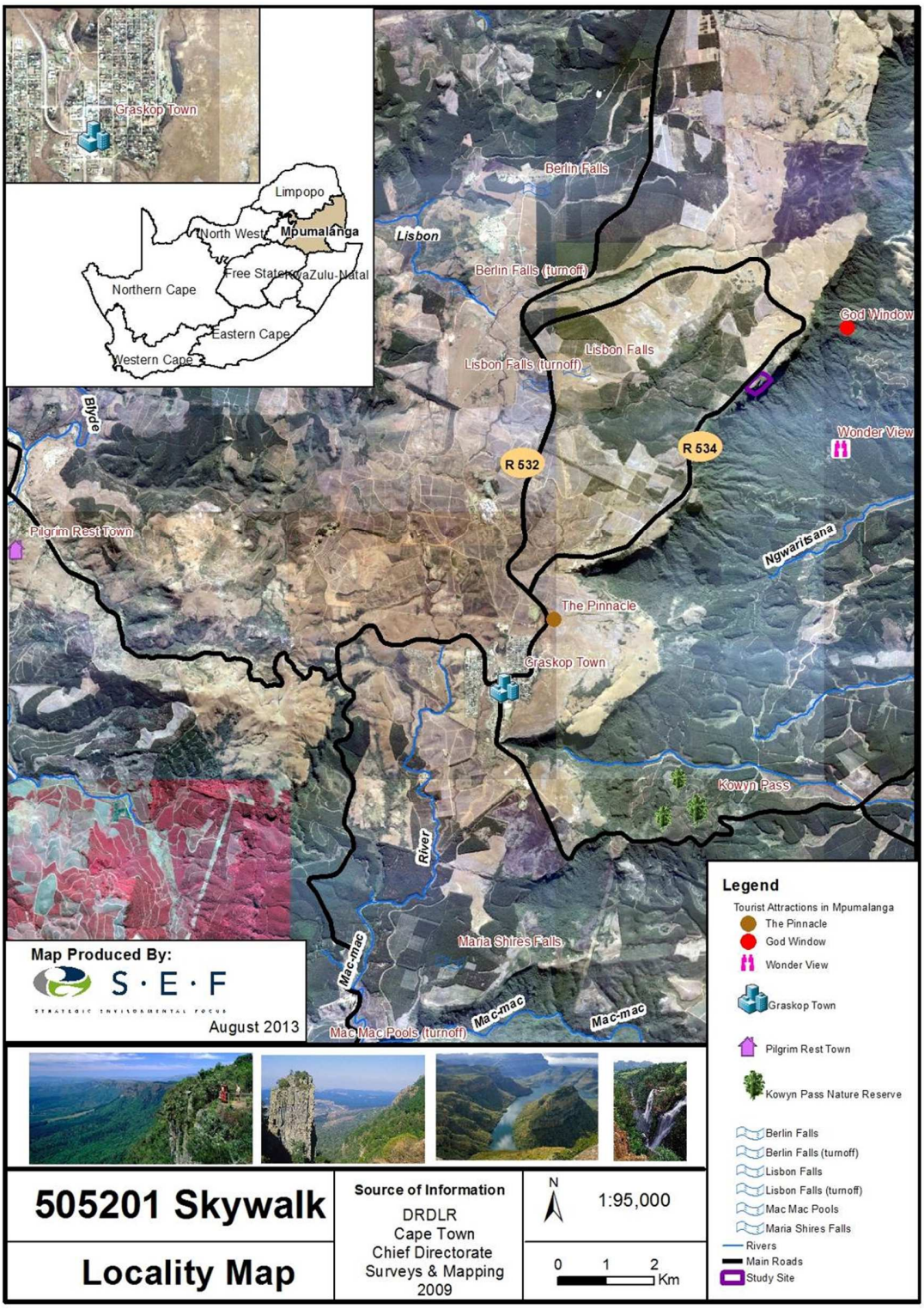


Figure 1: Location of the study site

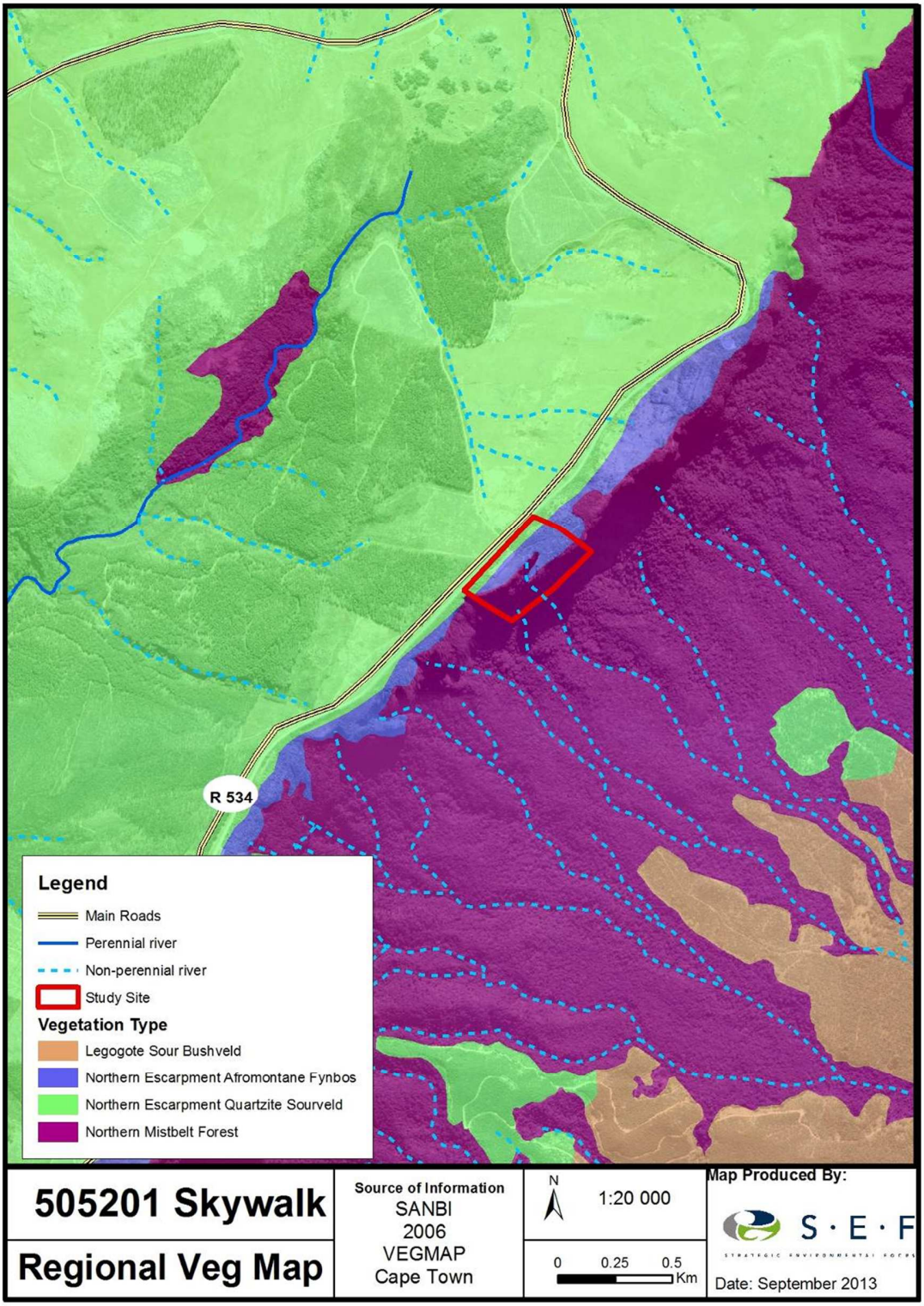


Figure 2: Regional vegetation in relation to the study area

2.5 Listed Ecosystems

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

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

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

Table 2: Criteria used to identify threatened terrestrial ecosystems

Criterion	Critically Endangered	Endangered	Vulnerable
A1: Irreversible loss of natural habitat	Remaining natural habitat ≤ biodiversity target	Remaining natural habitat ≤ biodiversity target + 15%	Remaining natural habitat ≤ 60% of original area
A2: Ecosystem degradation and loss of integrity	≥ 60% of ecosystem significantly degraded	≥ 40% of ecosystem significantly degraded	≥ 20% of ecosystem significantly degraded
C: Limited extent and imminent threat	-	Ecosystem extent ≤ 3000ha and imminent threat	Ecosystem extent ≤ 6000ha and imminent threat
D1: Threatened plant species associations	≥ 80 threatened Red List plant species	≥ 60 threatened Red List plant species	≥ 40 threatened Red List plant species
F: Priority areas for meeting 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 the National Environmental Management Biodiversity Act (NEMBA) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications, especially in terms of NEMA and EIA regulations;
- Proactive management implications, in terms of the Biodiversity Act; and
- Monitoring and reporting implications, in terms of the Biodiversity Act.

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

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

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

The present study area is located within the Blyde Quartzite Grassland ecosystem which is currently listed as Endangered in terms of Section 52 of NEMBA (Government Gazette, 2011) under Criterion F. Originally the Blyde Quartzite Grassland ecosystem covered about 33 000ha and currently 63% of the natural habitat remains. Furthermore, at least 28 threatened or endemic plant and animal species occur within this ecosystem and includes the following: four mammals, three reptiles, five birds and 16 plants. Five vegetation types are represented in this ecosystem and include Northern Escarpment Afromontane Fynbos, Northern Escarpment Quartzite Sourveld, Northern Escarpment Dolomite Grassland, Mpumalanga Afromontane Forest and Subtropical Afromontane forest.

2.6 Mpumalanga Biodiversity Conservation Plan and Biodiversity Sector Plan

A Provincial Conservation Plan aims to build on national plans at the provincial level. It is intended to be used by all who are involved in land-use and development planning, most particularly those specialists who need a comprehensive source of biodiversity information. The plan, and resulting land-use guidelines, are intended to supplement other spatial planning tools such as municipal Integrated Development Plans and Spatial Development Frameworks.

The Mpumalanga Biodiversity Sector Plan (MBSP) is an updated version of The Mpumalanga Biodiversity Conservation Plan (MBCP) and consists of a comprehensive environmental inventory and spatial plan that is intended to guide conservation and land use decisions in support of sustainable development. However, both the Mpumalanga Biodiversity Conservation Plan (MBCP) as well as the updated Mpumalanga Biodiversity

Sector Plan (MBSP) have been created using spatial data and in many cases have not been ground-thruted.

According to the latest Mpumalanga Biodiversity Sector Plan, the study area falls within the Blyde River Canyon Provincial Nature Reserve (Figure 3).

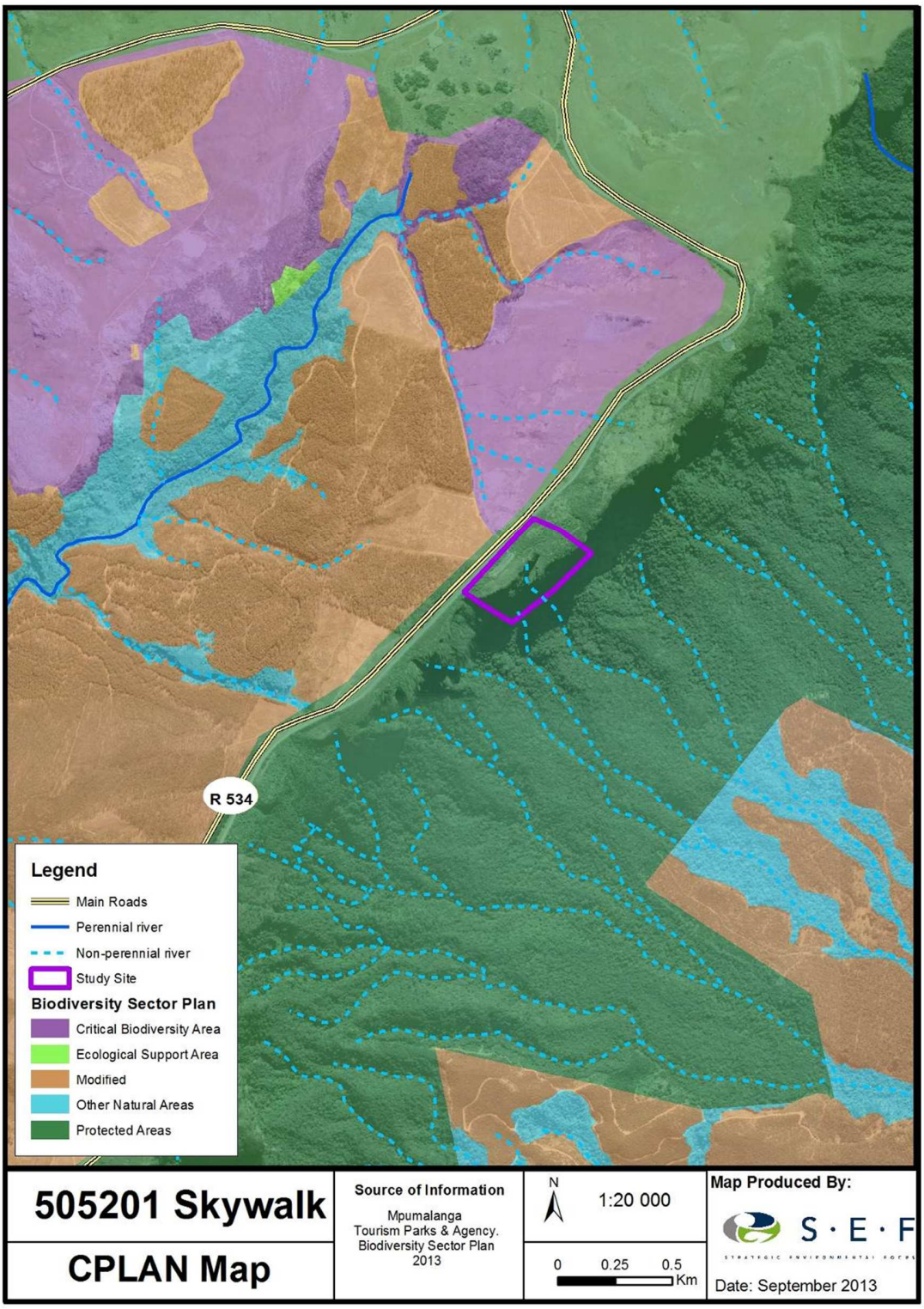


Figure 3: Mpumalanga Biodiversity Sector Plan in relation to the study area

3. RESULTS: FLORA

3.1 Overview

A diversity of vegetation communities were recorded within the relatively small study area and included *Passerine montana/Pteridium aquilinum* scrubveld, *Aloe arborescens/Clivia caulescens* cliff edges, vertical cliffs and mistbelt forests. These vegetation units are described below in more detail.

Passerine montana/Pteridium aquilinum scrubveld

This vegetation unit was recorded south of the parking area and although some disturbances were recorded, the area was dominated by indigenous species such as *Passerine montana, Pteridium aquilinum, Senecio coronatus* (Woolly Grassland Senecio), *Hypericum revolutum* (Curry Bush), *Buddleja salviifolia* (Sagewood) as well as smaller herbaceous species such as *Hypoxis argentea, Crassula* cf. *swaziensis, Cyanotis speciosa* and *Helichrysum* sp. (Photograph 1). Large populations of *Agapanthus inapertus* which are provincially protected, as well as *Drimia elata* which is currently listed as Declining, were also recorded from this vegetation unit. Table 4 summarizes the species recorded in this vegetation unit.

Photograph 1: *Passerine montana/Pteridium aquilinum* scrubveld recorded between the parking area and the cliffs.

Table 3: Summary of the floral species recorded in *Passerine montana/Pteridium aquilinum* scrubveld

Dominant species at the time of the survey:	Herbs: *Hypoxis argentea* *Ledebouria* sp. *Cyanotis speciosus* *Pteridium aquilinum* Trees and shrubs: *Passerine montana* *Myrsine africana* *Hypericum revolutum*

	Buddleja salviifolia
Plants of conservation concern confirmed to occur:	*Drimia elata* (DDT)
Plants of conservation concern for which suitable habitat was observed:	*Pterocelastrus rostratus* (Declining)
Provincially protected plants confirmed to occur:	*Drimia elata* *Agapanthus inapertus*
Provincially protected plants for which suitable habitat was found:	None
Nationally protected tree species confirmed:	None
Alien species:	*Pinus* sp. *Lilium longiflorum*

Aloe arborescens/Clivia caulescens cliff edges

The edges of the cliffs were dominated by large stands of *Aloe arborescens* which provided suitable habitat for *Clivia caulescens,* currently listed as Near Threatened (Photograph 2). These cliff edges were high in species diversity and supported more tree species than the adjacent *Passerine montana/Pteridium aquilinum* scrubveld. Tree species confirmed within this vegetation unit included *Afrocarpus falcatus* (synonym: *Podocarpus falcatus*) (Small-leaved Yellowood) which is nationally protected. Table 5 summarizes the floral species recorded within this vegetation unit.

Photograph 2: *Aloe aborescens/Clivia caulescens* cliff edges

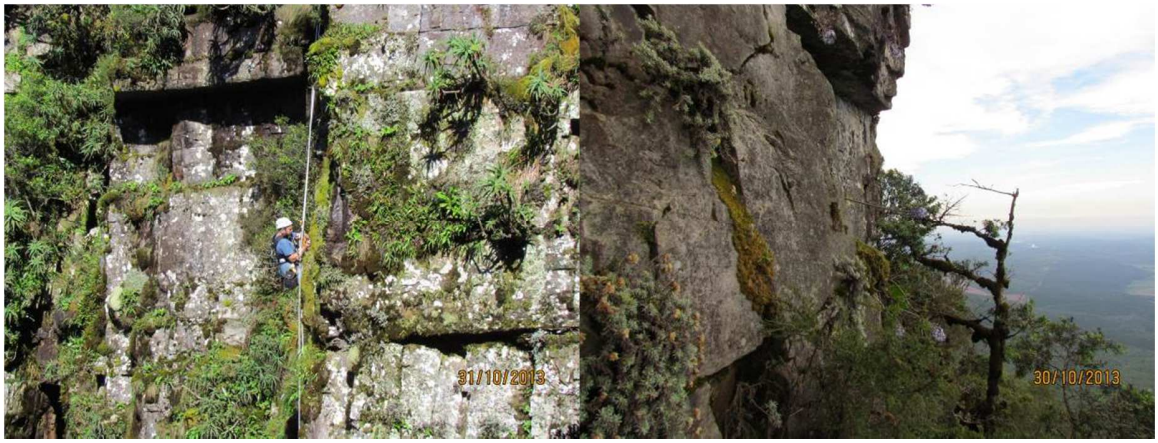
Table 4: Summary of the floral species recorded on the *Aloe aborescens/Clivia caulescens* cliff edges

Dominant species at the time of the survey:	Herbs: *Clivia caulescens* *Agapanthus inapertus* *Selaginella dregei* *Dicranopteris linearis* *Aloe arborescens* Trees and shrubs: *Afrocarpus falcatus*

	Psycotria capensis *Schefflera umbellifera* *Myrsine africana* *Halleria lucida* *Schrebera alata*
Plants of conservation concern confirmed to occur:	*Drimia elata* (DDT) *Clivia caulescens* (NT)
Plants of conservation concern for which suitable habitat was observed:	*Hesperantha brevicaulis* (Rare) *Streptocarpus fenestra-dei* (VU)
Provincially protected plants confirmed to occur:	*Drimia elata* *Clivia caulescens*
Provincially protected plants for which suitable habitat was found:	*Hesperantha brevicaulis* (Rare)
Nationally protected tree species confirmed:	*Afrocarpus falcatus*
Alien species:	*Pinus* sp.

Vertical cliffs

A cliff is defined as a high, steep or overhanging face of rock and due to the extreme nature of cliffs, these habitats have rarely been investigated from an ecological viewpoint. The biotic communities living on vertical cliffs are usually highly adapted to cope with temperature extremes and various moisture regimes (usually very wet or completely dry). The cliffs at God's Window form part of the Drakensberg escarpment range which includes over 250km of cliffs. Numerous rare, provincially protected as well as species of conservation concern were recorded on the cliff face within the study area and included *Schizochilus lilacinus* (Extremely Rare), *Monopsis kowynensis* (Vulnerable), *Aloe nubigena* (provincially protected), *Streptocarpus fenestra-dei* (Rare), *Clivia caulescens* (Near Threatened and provincially protected) as well as large populations of *Merwilla plumbea* (nationally protected and Declining) (Photograph 3). These species are highly sensitive and their fragile roots can easily be dislodged from the sheer rock faces. Table 6 summarises the species recorded on the vertical cliffs.



Photograph 3: Sheer cliffs in the study area (above) providing habitat for specially adapted species such as the extremely rare *Schizochilus lilacinus* (left) and *Mervilla plumbea* (right)

Table 5: Summary of plant species recorded on vertical cliffs

Dominant species at the time of the survey:	Herbs: *Helichrysum galpinii* *Clivia caulescens* *Monopsis kowynensis* *Passerine montana* *Merwilla plumbea* Trees and shrubs: None
Plants of conservation concern confirmed to occur:	*Monopsis kowynensis* (VU) *Clivia caulesens* (NT) *Merwilla plumbea* (Declining) *Streptocarpus fenestra-dei* (Rare) *Schizochilus lilacinus* (Extremely Rare)
Plants of conservation concern for which suitable habitat was observed:	*Hesperantha brevicaulis* (Rare) *Gladiolus saxatilis* (Rare)
Provincially protected plants confirmed to occur:	All species of conservation concern are also provincially protected as well as the following additional species: *Aloe nubigena*
Provincially protected plants for which suitable habitat was found:	*Gladiolus saxatilis*
Nationally protected species confirmed:	*Merwilla plumbea*
Alien species:	*Pinus* sp.

Mistbelt Forests

Mistbelt forests are also referred to as Afromontane forests and are characterised by a closed canopy and several vegetation layers. Within Mpumalanga, these forests occur along mountain ranges above an altitude of 900m and usually receive more than 750mm of rainfall per year. Within the study area, mistbelt forests were recorded directly below

the cliffs and in the deep gorge east of the proposed development (Photograph 4). The closed canopy was made up of large tree species such as *Afrocarpus falcatus* (Yellowood), *Xymalos monospora* (Lemonwood), *Cussonia spicata* (Cabbage Tree), *Schefflera umbellifera* (False Cabbage Tree) and *Psychotria capensis* (Black Bird Berry). The shrub layer consisted of *Obetia tenax* (Nettle Tree) as well as a diversity of fern species including *Cyathea capensis* (Tree Fern) which is currently listed as Declining. Photograph 4 illustrates the mistbelt forest recorded in the study area while Table 7 summarizes the associated species.

Photograph 4: Mistbelt forest viewed from above (left) with the closed canopy providing suitable conditions for various fern species (right)

Table 6: Summary of species recorded in the mistbelt forest

Dominant species at the time of the survey:	Herbs: *Clivia caulescens* *Cyathea capenis* *Streptocarpus fenestra-dei* *Streptocarpus micranthus* *Peperomia* sp. Trees and shrubs: *Afrocarpus falcatus* *Psycotria capensis* *Schefflera umbellifera* *Myrsine africana* *Xymalos monospora* *Obetia tenax*
Plants of conservation concern confirmed to occur:	*Clivia caulescens* (NT) *Cyathea capensis* (Declining)
Plants of conservation concern for which suitable habitat was observed:	*Cryptocarya transvaalensis* (Declining) *Curtisia dentate* (NT) *Ocotea bullata* (EN) *Pterocelastrus rostratus* (Declining)
Provincially protected plants confirmed to occur:	*Clivia caulescens*
Provincially protected plants for which suitable	All species listed under plants of conservation concern

habitat was found:	are also provincially protected
Nationally protected tree species confirmed:	*Afrocarpus falcatus*
Alien species:	*Pinus* sp.

3.2 Plants of Conservation Concern

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

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

A minimum of 39 plant species of conservation concern have been recorded from QDGC 2430DD (Raimondo *et al.,* 2009; POSA, 2011), eight of which were confirmed during the field survey mostly on cliff edges (Photograph 5) and on vertical cliffs (Photograph 6). An additional 10 species are highly likely to occur within the study area based on the presence of suitable habitat. These species, including habitat requirements and likelihood of occurrence in the study area, are listed in Table 8. Removal of these plants will require a permit and should be accompanied by either a rehabilitation plan where the plants will be re-established or if the plants are suitable for relocation, these plants should be rescued and replanted at a suitable site.

Photograph 5: Species of conservation concern recorded in the study area included *Clivia caulescens* (top left), *Merwilla plumbea* (top right), *Drimia elata* (bottom left) and *Rapanea melanophloeos* (bottom right)

Photograph 6: Species of conservation concern recorded from vertical cliffs included *Schizochilus lilacinus* (top), *Streptocarpus fenestra-dei* (bottom left) and *Monopsis kowynensis* (bottom right)

Table 7: Species of conservation concern recorded in the QDGC as well as the likelihood of occurring in the study area

Scientific Name	IUCN conservation	Habitat requirements	Likelihood of occurring within the footprint of the

	Status		development
Clivia caulescens	**NT**	**Forest patches and forest margins**	**Confirmed**
Drimia elata	**DDT**	**Grows in clumps or colonies from grasslands to mountains**	**Confirmed**
Merwilla plumbea	**NT**	**Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m**	**Confirmed**
Rapanea melanophloeos	**Declining**	**On exposed rocky outcrops and in thickets on mountain tops and Afromontane forest**	**Confirmed**
Schizochilus lilacinus	**Extremely Rare**	**Currently known to grow exclusively on ledges of very steep rock faces and cliffs.**	**Confirmed**
Streptocarpus fenestra-dei	**VU**	**Shallow soils in rocky areas in forested gullies at God's Window and Burke's Luck Potholes**	**Confirmed**
Monopsis kowynensis	**VU**	**Misbelt grassland around Graskop**	**Confirmed**
Alsophila (Cyathea) capensis	**Declining**	**Forest, near waterfalls, streams and permanently moist seepages**	**Confirmed**
Ledebouria parvifolia	DDD	Dolomite of the Malmani Formation in the Chuniespoort Group	High
Cryptocarya transvaalensis	Declining	Limited to Afromontane forests in Mpumalanga and KZN and Limpopo	High
Curtisia dentata	NT	Tree in Afromontane forest usually within the mist-belt area.	High
Hesperantha brevicaulis	Rare	In damp moss between rock crevices on steep rocks and cliffs, around 1600 m	High
Hypodematium crenatum	VU	Crevices on dolomite cliffs recorded at Bourkes Luck Potholes and Sudwala Caves in Mpumalanga	High
Ocotea bullata	EN	Mist-belt Afromontane forests along the	High

		escarpment	
Pterocelastrus rostratus	Declining	Erect tree in forest and montane scrub	High
Helichrysum homilochrysum	Rare	Cliff faces and ledges, 1350-1990 m.	High
Adenia gummifera	Declining	Forest and scrub from the coast to 1200m.a.s.l	Low
Argyrolobium muddii	EN	Mistbelt Grassland	Low
Boophone disticha	Declining	Widespread in grasslands	Low
Brachystelma remotum	Rare	Montane grasslands, grows in shallow soils on shale outcrops, 1600-2200 m	Low
Callilepis leptophylla	Declining	Grassland or open woodland, often on rocky outcrops or rocky hill slopes	Low
Disa extinctoria	NT	species only occurs in highly pristine wetlands between 1000 and 1300 masl	Low
Disa maculomarronina	NT	Grows along the edges of vleis and in seasonally flooded grassland or seepages on rock sheets	Low
Erica rivularis	EN	Margins of clear, high altitude perennial streams over quartzitic rocks	Low
Erica subverticillaris	VU	High altitude, short grassland, among rocky outcrops on mountain summits, 1900-2200 m	Low
Hesperantha saxicola	VU	Wet cliffs and seeps among rocks above 2000 m	Low
Pelargonium album	Rare	Grows on humus-rich soils, in shady rock crevices on dolomite hills	Low
Searsia batophylla	VU	Dry bushveld, in low-lying areas and along watercourses, 650-975 m	Low
Tulbaghia coddii	Rare	Montane grassland, on damp, shallow soils over sheet rocks or in open grassland	Low
Zantedeschia pentlandii	VU	On rocky hillsides between Roossenekal	Low

		to Dullstroom	
Aloe thompsoniae	Rare	Montane mistbelt grasslands, rock crevices on steep cliffs, among large boulders, or in seepages or shallow soils at the edges of large exposed rock sheets	Low (occurs north of the Olifant's River)
Lobelia trullifolia subsp. *delicatula*	Rare	Grows in damp, sheltered areas amongst rocks. Only known from Graskop area	Medium
Brachystelma minor	VU	Shallow pockets of dolomite, tolerating both open and shady conditions	Medium
Crocosmia mathewsiana	VU	Damp, shady places along streams and forest margins	Medium
Ilex mitis var. *mitis*	Declining	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes	Medium
Schizochilus crenulatus	VU	Grows in seepages or in running water on flat or sloping rock sheets or in very wet grassland. Southwest of Graskop	Medium
Erica atherstonei	NT	Rocky areas (quartzite) in montane grassland at edge of escarpment or on steep slopes, occasionally in moist areas, 1500-2500 m.	Medium to High
Myrothamnus flabellifolius	DDT	Taxanomic uncertainty	Unknown
Gladiolus saxatilis	Rare	A narrow endemic to the edge of Mpumalanga escarpment between Mariepskop and Graskop (EOO 200 km²). Almost the entire range of this species falls within the Blyde River Canyon Nature Reserve, its habitat is also quite inaccessible	Very high

3.3 Provincially Protected Plants

In addition to the plant species of conservation concern which have been recorded in QDGC 2430DD, 11 plant species are protected under Schedule 11 of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998). The provincially protected plant species are listed in Table 8 together with their level of protection and likelihood of occurring in the study area. A permit will be required from Mpumalanga Tourism and Parks Agency (MTPA) to remove, translocate, destroy or cut any of these species.

Table 8: Provincially protected plant species, their protection level and likelihood of occurring in the study area

Species	Protection Level	Likelihood of occurring in the study area
Aloe	**All Aloe species naturally occurring in Mpumalanga**	**Confirmed:** ***A.aborescens*** ***A.nubigena***
Orchidaceae	**Family**	**Confirmed:** ***Polystachya transvaalensis*** ***Schizochilus lilacinus***
Scilla	**Genus**	**Confirmed:** ***Scilla nervosa*** ***Merwilla plumbea (Scilla natalensis)***
Podocarpus	**Genus**	**Confirmed:** ***Afrocarpus falcatus***
Agapanthus	**Genus**	**Confirmed:** ***Agapanthus inapertus***
Cliva	**Genus**	**Confirmed:** ***Clivia caulescens***
Cyathea	**Genus**	**Confirmed:** ***Cyathea capensis***
Proteaceae	**Genus**	**Confirmed:** ***Faurea galpinii***
Adenia	Genus	High
Brachystelma spp.	Whole genus	High
Cassipourea gerrardii	Species	High
Ceropegia	Genus	High
Dioscorea	Genus	High
Gladiolus	Genus	High
Haemanthus	Genus	High
Olea	Genus	High
Scadoxis	Genus	High
Stapelia	Genus	High
Warburgia salutaris	Species	High
Watsonia	Genus	High
Curtisia dentata	Species	Medium
Dracena	Genus	Medium
Eucomis	Genus	Medium
Hesperantha coccinea	Species	Medium
Huernia	Genus	Medium
Ocotea	Genus	Medium

Orbeanthus	Genus	Medium
Adenium	Genus	Low
Ammocharis coranica	Species	Low
Berchemia zeyheri	Species	Low
Bersama tysoniana	Species	Low
Boophone disticha	Species	Low
Bowiea volubis	Species	Low
Brunsvigia	Genus	Low
Crinum	Genus	Low
Cyrtanthus	Genus	Low
Duvalia	Genus	Low
Encephalartos	Genus	Low
Euphorbia barnardii	Species	Low
Euphorbia grandialata	Species	Low
Kniphofia	Genus	Low
Pachypodium saundersii	Species	Low
Proteaceae	Family	Low
Pterocarpus angolensis	Species	Low
Schizobasis intricata	Species	Low
Siphonochilus aethiopicus	Species	Low
Spirostachys africana	Species	Low
Zantedeschia	Genus	Low

3.4 Alien and Invasive Plants

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

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

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

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

- **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.

Only two alien plant species, *Pinus* sp. and *Lilium longiflorum,* were recorded 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. Many of the plant species recorded within the study area are widely used for medicinal purposes (Table 9).

Table 9: Medicinal plant species recorded in the study area

Scientific Name	Conservation Status	Locality in study area
Afrocarpus falcatus	Genus provincially protected	Cliff edges
Agapanthus inapertus	Provincially protected	Cliff edges
Aloe aborescens	Genus provincially protected	Very common throughout the study area
Clivia caulesens	NT	Common on cliff edges and in forest
Cyanotis speciosa	None	Scrub veld
Drimia elata	Declining	Common on cliff edges
Hypoxis argentea	None	Scrub veld
Leucosidea sericea	None	Forest edges
Merwilla plumbea	Declining	Common close to cliffs and on the cliffs
Rapanea melanophloeos	Declining	Sporadically in forests and on cliff edges

4. RESULTS: FAUNA

4.1 Faunal Habitats

The study area falls within two Biomes, Afrotemperate, Subtropical and Azonal Forests Biome and Grasslands Biome. These biomes can further be divided into vegetation types and within the study area, three vegetation types namely Northern Mistbelt Forest, Northern Escarpment Afromontane Fynbos and Northern Escarpment Quartzite Sourveld have been recorded (for a detailed description of these vegetation types, please refer to the Background section of this report). For the purpose of the faunal assessment, these vegetation types were further separated into structural vegetation units which are likely to support different faunal species. The structural units recorded within the study area are described below an illustrated in Photograph 7:

Vertical cliffs

Vertical cliffs formed a large portion of the study area from which the proposed Skywalk will be protruding. Although these cliffs are mostly inaccessible to most larger faunal species, numerous reptiles and bats are found on vertical cliffs.

Mistbelt Forests

Mistbelt forests were recorded on steep slopes directly below the cliffs and consisted of a closed canopy system dominated by large forest tree species such as *Afrocarpus falcatus, Xymalos monospora, Psychotria capensis* and *Rapanea melanophloeos.* This structural unit provides suitable habitat for numerous faunal species which are restricted to forests.

Scrubland

The area between the current parking lot and cliffs consisted of tall scrubland dominated by species such as *Passerine montana* and *Pteridium aquilinum* (Bracken Fern) and was classified as scrubland.

Buildings

The infrastructure in the study area currently consists of buildings (bathrooms and old store rooms), huts which are used by the curio sellers to display their products and a tarred parking area. Outdoor buildings such as the store room which are not used every day are likely to be used as shelter by various reptile and bat species.

Photograph 7: Structural vegetation units recorded in the study area included cliffs (top left), mistbelt forest (top right), scrubland (bottom left) and buildings (bottom right)

Since most faunal species are mobile and likely to traverse various habitat structures, the faunal surveys were not limited to the study area but included all habitat types within a 5km radius of the study area. Three additional structural vegetation units were recorded in the 5km radius which is described below an illustrated in Photograph 8.

Rocky outcrops within grassland

Rocky grasslands were recorded approximately 4km south of the study area just north of the Pinnacle viewpoint, as well as north of the study area between the Wonderview viewpoint and the study area.

Wetland

A fairly large wetland was recorded immediately north west of the study area and north of the R534. High amphibian activity was recorded from this wetland area during nocturnal surveys.

Pine plantations

Extensive pine plantations were recorded south west of the study area and although these plantations are generally considered to be extremely low in biodiversity, it often provides a refuge for faunal species during the day.

Photograph 8: Vegetation units recorded within a 5km radius of the study area included rocky outcrops (left), a wetland (middle) and pine plantations (right)

4.2 Faunal Species Occurrence

4.2.1 Mammals

The region displays a high diversity of mammals with approximately 134 species expected to occur within the geographical area associated with QDGC 2430DD (IUCN distribution data and Mpumalanga Tourism and Parks Agency data). These species are listed in Appendix B along with the probability of each species occurring in the study area as well as their provincial (MTPA), national (Friedmann and Daly, 2004) and global (IUCN; 2013) conservation status. Twenty six of the species expected to occur within the area are of conservation concern to Mpumalanga Tourism and Parks Agency (pers.comm, M.Lotter, 2013).

Shearman traps were baited with meat, fruit and seed to attract various rodent species, with only one species, *Rhabdomys pumilio* (Four-striped Grass Mouse), confirmed in the mistbelt forest patch close to the edge of the cliffs (Photograph 9). Although trapping success was generally considered low, meat was removed from four of the traps during the night without engaging the trap and it is therefore concluded that small, insectivorous or carnivorous rodents were also present within the area. An *Otomys* species which was active during the day was also recorded during the survey period (Photograph 9).

Photograph 9: Ten baited Shearman traps were placed throughout the study area (left) with an *Otomys* sp. recorded at viewpoint 2 (right)

Faunal sightings included *Papio ursinus* (Chacma Baboons) and *Chlorocebus pygerythrus* (Vervet Monkeys) while *Sylvicapra grimmia* (Common Duiker) and *Lepus saxatilis* (Scrub Hares) were frequently recorded during nocturnal surveys. *Genetta genetta* (Common Genet) was also confirmed in the study area by tracks and dung. A total of seven mammal species were confirmed during the field surveys with another 33 species given a high probability of occurring in the study area and immediate surroundings based on the presence of suitable habitat. However, only three of these are directly associated with the habitat recorded within the study area, namely *Cricetomys gambianus* (Gambian Rat) which is currently listed as Vulnerable, *Ceropithecus mitis* (Samango Monkey) which is currently listed as Endangered, and *Dasymys incomtus* (Marsh Rat) which is currently listed as Near Threatened.

Chiroptera (Bats)

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

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

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

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

- **Foliage-roosting species:** Most Pteropodidae, which includes fruit bats hang or cling onto surfaces in trees or shrubs;
- **Hollow-roosting and Crevice-roosting species**: These species occupy underground caves, hollows in trees, and anthropogenic hollows such as roofs and basements of houses, tunnels or other cavities such as abandoned mine shafts; and
- **Specialised roost sites**: Night roosts or feeding stations which provide temporary shelter are often used by cave-dwelling bats and this usually includes open structures such as garages, outhouses, thatched game hides, culverts under roads and eaves of buildings.

According to the IUCN as well as records obtained from Mpumalanga Tourism and Parks Agency (2013), the study area falls within the distribution range of 33 bat species. Nine of these species are of conservation concern and all of the species of conservation concern are likely to use the study area based on the presence of suitable habitat which included numerous crevices and caves (Appendix C) (Photograph 10).

Photograph 10: Numerous caves and crevices which are likely to provide roosting sites for various chiroptera species were recorded on the cliffs associated with the proposed development

4.2.2 Avifauna

The area is high in avifaunal diversity with approximately 466 bird species confirmed within QDGC 2430DD and in the region of the study area (Roberts Multimedia version 7, 2012 and SABAP1). During the field survey, 29 bird species were confirmed to occur within the study area and immediate surroundings (Appendix C). This is however not considered to be a true reflection of the avifaunal diversity likely to be present within the study area since many common species were not recorded during the survey period. It

is possible that the low avifaunal activity could have been caused by disturbance caused by high tourist volumes.

Forty nine avifaunal species of conservation concern have been recorded from the QDGC, with one species, *Sarothrura affinis* (Striped Flufftail) which is currently listed as Vulnerable, recorded early in the evening from the scrubveld east of the parking area. An additional seven species of conservation concern were given a high probability of using the study area based on the presence of suitable habitat in the scrubland, vertical cliffs and mistbelt forests, these are listed in Appendix D.

4.2.3 Reptiles

According to ReptileMAP, a continuation of the Southern African Reptile Conservation Assessment (SARCA) (ADU, 2012), 57 reptile species have been confirmed to occur within QDGC 2430DD (Appendix F). Twenty one of these species are considered likely to occur within the study area based on the presence of suitable habitat, one of which is of provincial conservation importance, namely *Bradypodion transvaalense* (Wolkberg Dwarf Chameleon). Although no reptile species were recorded during the survey period, this is not considered a true reflection of the reptile diversity likely to be present within the study area. Low reptile activity during the survey periods may have been caused by unsuitable weather conditions as well as high tourist numbers during the survey periods.

4.2.4 Amphibians

According to Minter et al. (2004), 19 amphibian species have been confirmed to occur within QDGC 2430DD including at least one species of conservation concern, *Hadromophryne natalensis* (Natal Ghost Frog) which is currently listed as Vulnerable (Appendix G). During the nocturnal surveys three species, namely *Strongylopes grayii* (Clicking Stream Frog), *Amietophrynus gutturalis* (Guttural Toad) and *Hadromophryne natalensis* (Natal Cascade Frog), were confirmed within the study area and immediate surroundings. *Hadromophryne natalensis* (Natal Cascade Frog) is currently listed as Vulnerable in Mpumalanga and was calling from the stream between Viewpoint 2 and 3 (Photograph 11).

Photograph 11: Amphibians recorded in the study area included *Amietophrynus gutturalis* (left) and the stream from which *Hadromophryne natalensis* (Natal Cascade Frog) was recorded (right)

4.2.5 Lepidoptera

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

According to Henning *et al*. (2006), 367 Lepidoptera species have been recorded in Mpumalanga Province of which 11 species are of conservation concern. Those species of conservation concern, together with the likelihood of occurring in the study area, are listed in Appendix H. One of the species of conservation concern, *Lepidochrysops irvingi* (Irving's Blue) has been confirmed to occur within QDGC 2430DD. *Lepidochrysops irvingi* (Irving's Blue) is globally classified as Endangered and occurs in localised colonies along the escarpment from Malolotja in the south to Graskop in the north where it has been recorded in montane, fire-prone grassland with short sward. This species is restricted to two to five locations and use the plant *Ocimum obovatum* as its larval host. Although short sward grassland was recorded close to the study area, no suitable habitat for *Lepidochrysos irvingi* (Irving's Blue) was confirmed within the study area. Low butterfly activity was recorded during the survey period and this is likely due to strong wind and mist experienced during the surveys.

5. ECOLOGICAL IMPORTANCE AND SENSITIVITY

Ecological sensitivity and importance of the site was assessed and based on the following criteria, Figure 4 illustrates the ecological sensitivities.

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

High – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.

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

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

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

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

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

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

5.1 Areas of Very High Sensitivity

The cliff edges and vertical cliffs were all classified to be of very high ecological sensitivity. Plant species of conservation concern as well as protected species such as *Clivia caulescens, Afrocarpus falcatus, Drimia elata* and *Merwilla plumbea* were recorded from the cliff edges. The vertical cliffs were considered highly sensitive due populations of rare plant species such as *Schizochilus lilacinus* and *Streptocarpus fenestra-dei* as well as *Monopsis kowynensis* which is currently listed as Vulnerable. Numerous caves and crevices were furthermore recorded on the cliffs and these are highly likely to provide suitable roosting sites for various bats species, many of which are of conservation concern. Due to the extreme conditions on vertical cliffs, the biological

communities are highly sensitive to any form of disturbance and can easily be dislodged by falling objects.

5.2 Areas of High Sensitivity

The scrubland located between the current parking area and cliff edges were classified as high ecological sensitivity. Although these areas have been slightly disturbed, it was dominated by indigenous species. This area also plays a vital role in the hydrology of the area and any development on this area could adversely affect the hydrology on the cliffs possibly altering the sensitive system. Species relying on the moist conditions on the cliffs such as *Streptocarpus fenestra-dei, Schizochilus lilacinus* and *Monopsis kowynensis* are highly likely to die should the cliffs dry out. This area is therefore considered to be of high ecological sensitivity until a detailed hydrological study, which includes drilling for core smaples, has been conducted.

The mistbelt forest below the cliffs were also classified as highly sensitive due to the high species diversity associated with forests as well as the likelihood of various threatened faunal and floral species likely to be present within the area. In addition to this, the vertical habitat is very sensitive to disturbances. These mistbelt forests are likely to be impacted on by falling objects during the construction and operational phases.

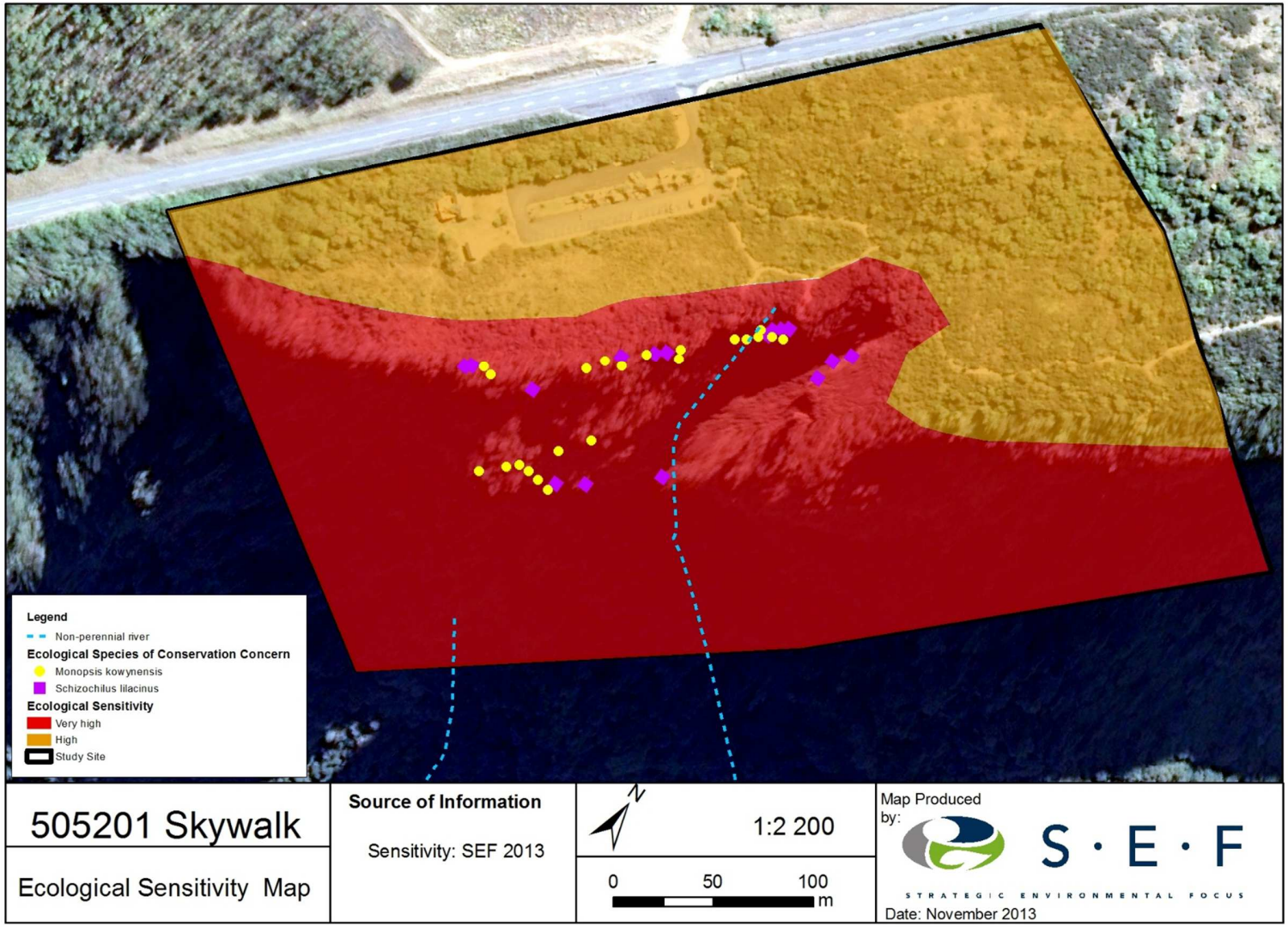


Figure 4: Ecological sensitivity associated with the proposed Skywalk Complex

6. IMPACT ASSESSMENT AND MITIGATION

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

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

- **Direct Impacts**: These impacts are directly as a result of the construction of the development and include habitat destruction, destruction of species of conservation concern and displacement;
- **Indirect Impacts**: These impacts are not directly associated with this proposed development but affects the species recorded within the area and include impacts resulting due to a change in the hydrology and effecting species on a population level especially for species of conservation concern;

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

> Mitigation measures should aim to achieve "no net loss" of biodiversity which is defined by the International Finance Corporation (IFC) as *"the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimise the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale".*

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

1. Avoid or prevent loss to biodiversity and ecosystem services: This is the first option and refers to project location and layout of the project, phasing to avoid impacts on biodiversity. These areas need to be identified early in the development's lifecycle so that impacts can be avoided;
2. Minimise impacts on biodiversity and ecosystem services: The location, layout, technology and phasing of the project should minimise the impacts on biodiversity. This should be considered even in areas where the environmental constraints are not particularly high and every effort should be made to minimise these impacts;
3. Rehabilitate concurrently or progressively with the activity and on cessation of the activity: This refers to the rehabilitation of areas where impacts were

unavoidable and impacted areas should be returned to a condition ecologically similar to their "pre-development natural state". Unfortunately, rehabilitation is a limited process that usually falls short of replicating the diversity of natural systems. Rehabilitation should occur progressively; and

4. Offset significant residual negative impacts on biodiversity or ecosystem services: This refers to the compensation for the remaining and unavoidable negative impacts on biodiversity.

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

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 following risk assessment was used to determine the significance of impacts:

Significance = (Magnitude + Duration + Scale) x Probability

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

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

Table 12 illustrates the scale used to determine the overall ranking:

Table 10: Scale used to determine significance ranking

Magnitude (M)		Duration (D)	
Description	**Numerical value**	**Description**	**Numerical value**
Very high	10	Permanent	5
High	8	Long-term (ceases at end of operation)	4
Moderate	6	Medium-term	3
Low	4	Short-term	2
Minor	2	Immediate	1
Scale (S)		**Probability (P)**	
Description	**Numerical value**	**Description**	**Numerical value**
International	5	Definite (or unknown)	5
National	4	High	4

Regional	3	Medium	3
Local	2	Low	2
Site	1	Improbable	1
None	0	None	0

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

Nature of the Impact

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

Scale of the Impact

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

Duration of the Impact

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

Probability of Occurrence

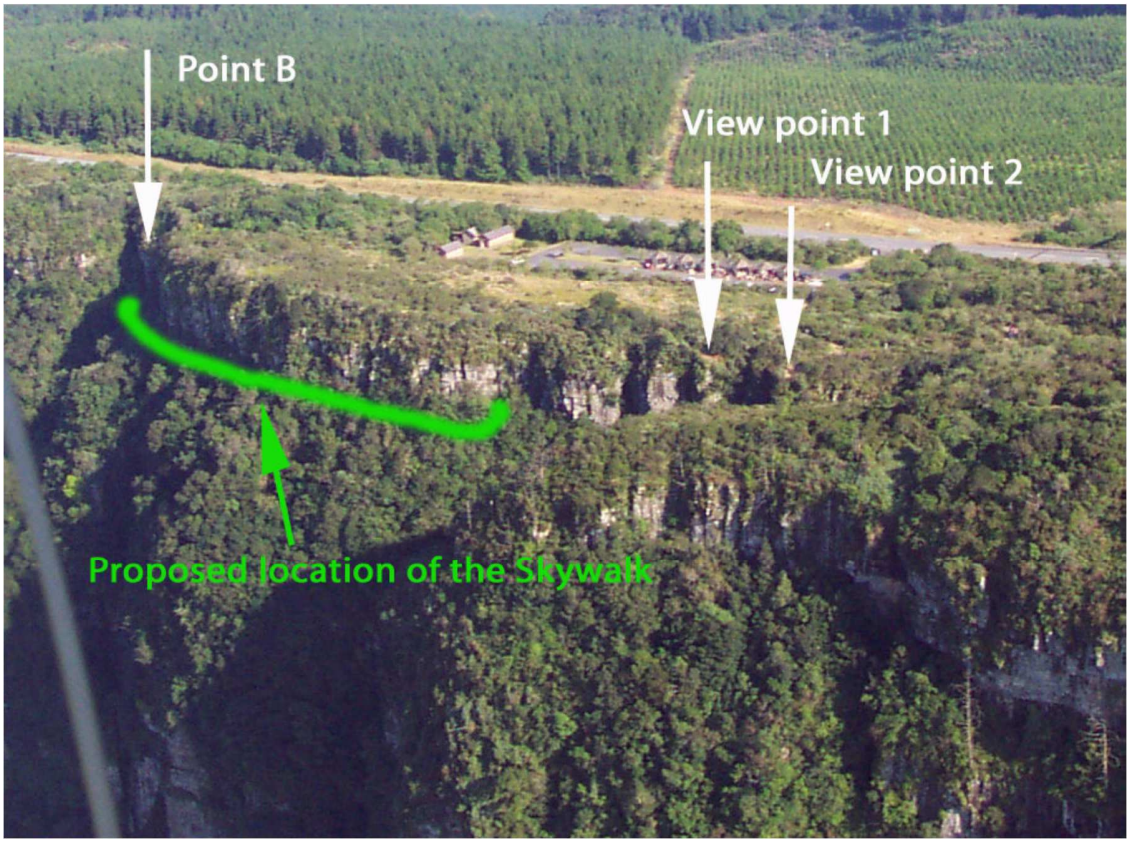
This describes the probability of the impact actually occurring. This is rated as none, improbable (low likelihood), low, medium, high and definite.

Significance.

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

6.2 Impact Assessment

Impacts described below are based on two ecological surveys which were conducted in October and November 2013 and only considers the proposed Skywalk complex which includes the Skywalk, a restaurant/venue, ablutions and a heritage museum, and does not include the Skylift, adventure centre or any other viewpoints (Photograph 12).



Photograph 12: Proposed location of the Skywalk complex in relation to the existing facilities at God's Window

Possible impacts and their sources are provided in Table 13 (direct impacts) and Table 14 (indirect impacts). Some impacts might be relevant during more than one phase and are therefore only discussed under the initial phase.

Table 11: Direct impacts likely to affect biodiversity at the Skywalk complex

Impact description	Source of impact	Area to be affected	Relevant phase

Destruction of natural vegetation including species of conservation concern	Ground clearing for infrastructure	Study area	Construction phase
Disturbance of faunal species	Ground clearing activities, construction crew, contractors and disruptions caused during the operational phase	Study area and immediate surroundings	Construction and operational phases
Introduction and spread of alien invasive plant species	Ground clearing activities and introduction of alien species by vehicles and people	Study area and immediate surroundings	Construction and operational phases
Falling objects impacting on sensitive ecosystems such as the vertical cliffs and mistbelt forests	Materials used during the construction phase and rubbish and rubble generated during the operational phase	Study area including the vertical cliffs and mistbelt forest	Construction and operational phases

Table 12: Indirect impacts likely to affect biodiversity at the Skywalk complex

Impact description	Source of impact	Area to be affected	Relevant phase
Change in hydrology impacting the water regimes especially on the vertical cliffs	Destruction of natural vegetation above the cliffs, sewage systems	Site and immediate surroundings	Construction and operational phases
Increase in faunal mortalities due to an increase in traffic volumes on the R534	Construction vehicles, vehicles and busses	Site and immediate surroundings	Construction and operational phase

6.2.1 Impacts relevant during the developmental phase

6.2.1a Destruction of natural vegetation including species of conservation concern

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	High (8)	Definite (5)	High (70)	High
WMM	Site (1)	Permanent (5)	Moderate (4)	Definite (5)	Medium (50)	High

Description of impact

The construction of the proposed Skywalk complex will cause the destruction of indigenous vegetation. Although the scrubland between the current parking area and

cliff edges has been impacted on, the area is dominated by indigenous vegetation. The cliff edges are also classified as highly sensitive with a high number of plant species recorded from these areas including large populations of species of conservation concern such as *Clivia caulescens, Drimia elata* and *Merwilla plumbea.* The nationally protected tree, *Afrocarpus falcatus* (Small leaved Yellowood) was also recorded within the footprint of the proposed development while *Aloe arborescens* which is provincially protected was the dominant species on the cliff edges. Destruction of these species will require a permit from Mpumalang Tourism and Parks Agency as well as the Department of Agriculture, Forestry and Fisheries.

Mitigation measures

- Plant species of conservation concern should be removed before any construction activities. It is recommended that the removal of these species are undertaken by the Lowveld National Botanical Garden in Nelspruit and that these plants are used for the landscaping of the complex;
- Only plant species that occur naturally within the area at God's Window should be used for landscaping of the complex. No exotic species or species indigenous to other parts of South Africa should be used;
- The area which will be impacted on by the proposed development should be fenced off and no people or vehicles should be allowed into the natural areas surrounding the construction area; and
- Building material, ablution facilities or construction vehicles should not be stored in areas containing natural vegetation but the existing parking area and ablutions should be used.

6.2.1b Disturbance of faunal species

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	High (8)	High (5)	High (60)	High
WMM	Site (1)	Short term (2)	Low (4)	Medium (3)	Low (21)	High

Description of impact

The construction of the proposed Skywalk complex is likely to have a significant impact on faunal species recorded within the study area and immediate surroundings. Noise, lights and other disturbances generated during the construction phase are likely to result in faunal species avoiding the area during this phase while the operational phase can also have a significant impact on faunal species should mitigation measures not be strictly enforced. :

Mitigation Measures:

Preconstruction and construction phase:

- Numerous caves and crevices were recorded on the vertical cliffs and with more than 30 chiropteran (bat) species confirmed in the QDGC, it is highly likely that some of these species will use the caves and crevices as daily roosting sites. Since bats enter a state of torpor during the day (lower heart rate and metabolic rate), they are highly sensitive to any form of disturbance such as the noise generated by construction activities. At least nine of these bat species are of conservation concern (within Mpumalanga), and it is therefore recommended that a detailed bat survey using bat detectors are conducted before commencement of construction activities in order to obtain a complete list of bat species directly associated with the study area. This will then ensure that species specific mitigation measures can be applied to reduce the impact on bats;
- During the survey period it was noted that faunal activity increased once all human activity (curio sellers and tourists) has ceased. Since the presence of humans appears to have a rather significant impact on faunal species, no construction workers or contractors should be allowed to remain within the area between the hours of 17:00 and 07:00. This will also limit the possibility of poaching;
- No artificial lights are currently present within the study area and the use of artificial lights during the construction phase should therefore be prohibited;
- Construction workers and contractors should not leave any food within the study area, and all rubbish should be removed from site at the end of each day to prevent animals from being attracted to any food left within the area;

Operational phase:

- The construction of the Skywalk complex is likely to attract a higher number of tourists to the area which could increase the impact on faunal species through disturbances. In order to minimize the impact of this proposed development during the operational phase operating hours should be restricted to daylight hours from 07:00 to 17:00. No people should be allowed to remain on the premises after operating hours;
- No artificial lights should be left on after operating hours;
- Two mammal species, *Chlorocebus pygerythrus* (Vervet Monkeys) and *Papio ursinus* (Chacma Baboon) were confirmed within the study area. These species often become "problem animals" when they get accustomed to humans and attracted to food left within the area (Photograph 13). Since a restaurant is part of the proposed complex, no food should be made available under any circumstances and all refuge produced by the restaurant should be removed from site. Refuge bins with baboon proof lids should be used throughout the study area to prevent the attraction of faunal species (Photograph 13). Areas where food can be consumed should be limited to the restaurant area and

tourists should not be allowed to take any food onto the Skywalk or any of the existing viewpoints.

Photograph 13: *Chlorocebus pygerythrus* (Vervet Monkey) on the dustbin at God's Window (left) with baboon proof dustbins recommended to prevent these animals from becoming "problem animals" (right)

6.2.1c Potential increase in invasive vegetation

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Local (2)	Permanent (5)	High (8)	Medium (3)	Medium (45)	High
WMM	Site (1)	Short term (2)	Low (4)	Low (2)	Low (14)	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 within the protected area. Only two alien species, *Pinus patula* and *Lilium longiflorum* were recorded in the study area at the time of the survey.

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;
- An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning.

6.2.1d Objects falling from the Skywalk complex during construction and operational phases impacting on sensitive ecosystems

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Site (1)	Permanent (5)	High (8)	Definite (5)	High (70)	High
WMM	Site (1)	Short term (2)	Moderate (6)	Medium (3)	Low (27)	High

Description of impact:

Construction phase:

The most significant impact on the vertical cliffs and mistbelt forest below the cliffs is anticipated during the construction phase when building material is likely to be dropped from the construction site onto these sensitive systems. Since the plants growing on the vertical cliffs are not securely anchored, it is highly likely that these plants will be dislodged if objects are dropped from the construction site.

Mitigation measures

It is important that nets should be placed under the construction site before commencement of any construction activities to catch any building material that might fall down the cliffs. The erection of these nets should however be overseen by a suitably qualified botanist to ensure that the various threatened plants that have been recorded on the cliffs are not damaged.

Operational phase:

Fairly large amounts of rubbish were noted at the bottom of the cliffs in the mistbelt forest during the field survey. It is likely that this rubbish which included cans, bottles, packets, clothes and plastic sheets were thrown from the viewpoint by visitors. This pollution is likely to increase during the operational phase of the Skywalk complex since more visitors will be attracted to the area. In order to minimize the impact the following mitigation measures are recommended:

Mitigation measures

- Visitors should not be allowed to take any food or beverages onto the Skywalk, this will limit the possibility of rubbish thrown into the cliffs and mistbelt forest below the walk; and
- The area below the Skywalk complex should be cleaned every four (4) months from any rubbish by qualified rope access technicians;

6.2.2 Indirect impacts on biodiversity

6.2.2a Change in hydrology impacting on moisture regimes, especially on vertical cliffs

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Regional (3)	Permanent (5)	High (8)	High (4)	High (64)	High
WMM	Site (1)	Short term (2)	Minor (2)	Medium (3)	Low (15)	High

Description of impact

Several types of wetlands were observed on site. Although the wetlands were not studied, described and classified (outside the scope of this study) the wetlands would be classified as Mesic Highveld Grassland Group 9 according to their wetland vegetation type (SANBI, 2012). All of the wetlands on site though were affiliated with either cliffs or mistbelt forest habitat with grassland associated wetlands to be found only further west of the study site. These forest and escarpment edge wetland ecosystems are therefore likely to be very unique and unknown to science.

Wetland soils differed in various localities within the study area. Soil profiles from seepage wetlands just south of the existing parking area consisted of dark gleyed soils exhibiting redoximorphic reactions. Shallow soils discovered within overhanging cliff and shallow cave formations that supported "suspended" wetlands, exhibited organic/humic soils which could potentially be classed as peat soils (to be confirmed) (Photograph 14). Peat soils are unique in South Africa, with most peatlands in South Africa being *Phragmites* generated driven peat systems while *Sphagnum* type moss peat generated systems being rarer. Wetland plants associated with the potential peat formations on site seems to be *Selaginella* species driven and acting as the water retention agent, making these systems potentially even more unique and undescribed.

Photograph 14: Potential fibrous peat soil found in a vegetated cave seep (left) and gleyed soils exhibiting redoximorphic reactions directly south of the proposed Skywalk complex (right)

Numerous plant species such as *Streptocarpus micranthus, Streptocarpus fenestra-dei, Monopsis kowynensis* (Photograph 15) and *Schizochilus lilacinus* growing on the vertical cliffs are dependent on the wet conditions of some of the cliffs. The wet conditions of these cliffs are most probably caused by wetlands on the top of the escarpment and it is therefore likely that disturbance caused to these wetlands will impact the water regimes on the vertical cliffs which will cause the moisture dependant species to die.

Photograph 15: Plant species of conservation concern such as *Streptocarpus fenestra-dei* (left) and *Monopsis kowynensis* (right) are dependent on the moist conditions on the vertical cliffs

Further, the design of sewage systems including septic tanks, soak aways and waste water drainage systems should be given serious consideration. The recommended geo-hydrological investigation will help to facilitate appropriate design and layout of the sewage infrastructure and prevent negative impacts on potentially receiving sensitive environs. Potential mitigation measures, pending further investigations, could for

example include that ablution facilities are placed as far west in the layout as possible (as it is located on a catchment divide). This would allow placement of septic tanks and other related sewage infrastructure across the road to the west within the considerable less sensitive plantation areas (a spill/ blockage/ long term nutrient load issues are likely to have significant less impact on the plantation areas)

Mitigation measures

The hydrology of the area seems interconnected and important in terms of regulating different moisture regimes in different areas, many areas serving as habitat harbouring a multitude of species of conservation concern (depended on different moisture regimes). Lateral water movement seems likely to be an important component of the geohydrology of the area with groundwater fed seeps occurring in several locations within and surrounding the study area. It is hypothesized that the high lying patches of mistbelt forest's act as an important recharge areas as indicated through a highly gleyed G-horizon in the soil profile which represent permanent wet conditions. An unknown portion of water generated within these recharge areas are likely to undergo lateral movement through the weathered and fractured geology to daylight at seeps on top of the escarpment within the study area as well slightly lower down on the cliff faces as springs and seeps of varying sizes and different hydroperiods

Since the wet conditions recorded on the cliffs are likely to be linked to nearby wetlands on top of the cliffs, it is recommended that a detailed wetland study is conducted to ensure that the construction of the Skywalk complex does not change the hydrology of the area leading to the drier conditions on the vertical cliffs which will result in numerous populations of species of conservation concern dying.

6.2.2 Indirect impacts on biodiversity

6.2.2b Increase in traffic volumes on the R534

	Scale	Duration	Magnitude	Probability of occurrence	Significance	Confidence
WOMM	Regional (3)	Permanent (5)	Medium (6)	High (4)	Medium (56)	High
WMM	Site (1)	Short term (2)	Minor (2)	Medium (3)	Low (15)	High

Description of impact

The new Skywalk complex is likely to attract a higher number of visitors to the area resulting in higher traffic volumes on the R534 which is a loop road from the R532. Since the R534 is only used to access viewpoints such as Pinnacle, God's Window and Wonder View, no traffic is present outside normal operating hours of these areas. During periods of no traffic, faunal species cross this road to forage in nearby natural

areas. An increase in traffic volumes are therefor likely to impact on faunal species by disrupting faunal activities and increase mortalities on the road. In order to minimize the impact of increasing traffic volumes on faunal species, the following mitigation measures are recommended:

Mitigation measures:
No traffic should be allowed on the R532 between 17:00 and 07:00 and it is therefore also recommended that the Skywalk complex is closed between these hours.

7. CONCLUSION

The study area is situated within two Biomes, namely Afrotemperate, Subtropical and Azonal Forests and the Grassland Biome. Biomes can further be divided into smaller units known as vegetation types and according to Mucina and Rutherford (2006), three (3) vegetation types namely Northern Mistbelt Forest, Northern Escarpment Afromantane Fynbos and Northern Escarpment Quartzite Sourveld are located within the study area.

The present study area is located within the Blyde Quartzite Grassland ecosystem which is currently listed as Endangered in terms of Section 52 of NEMBA. The study area is furthermore located within a protected area according to the latest Mpumalanga Biodiversity Sector plan.

A diversity of vegetation communities were recorded within the relatively small study area and included *Passerine montana/Pteridium aquilinum* scrubveld, *Aloe arborescens/Clivia caulescens* cliff edges, vertical cliffs and mistbelt forests. At least eight (8) plant species of conservation concern, *Monopsis kowynensis* (Vulnerable), *Streptocarpus fenestra-dei* (Rare), *Schizochilus lilacinus* (Extremely Rare), *Merwilla plumbea* (Declining), *Drimia alata* (Declining), *Clivia caulescens* (Near Threatened), *Alsophila capensis* (Declining) and *Rapanea melanophloeos* (Declining) were recorded during the field survey. In addition to this, one nationally protected tree, *Afrocarpus falcatus* (Small leaved Yellowood) and numerous provincially protected species were also recorded throughout the study area.

At least two faunal species of conservation concern, *Sarothrura affinis* (Striped Flufftail) and *Hadromophryne natalensis* (Natal Cascade Frog) both currently listed as Vulnerable were confirmed in the study area. At least nine (9) chiroptera (bat) species which are of conservation concern have been recorded from QDGC 2430DD and all of these are highly likely to occur within the study area based on the presence of suitable roosting sites such as caves and crevices. It is therefore recommended that a detailed bat survey is conducted before commencement of construction to ensure effective mitigation.

Due to the high concentrations of threatened plant species recorded on the cliff edges, vertical cliffs and mistbelt forests these areas were classified to be of very high ecological sensitivity. Most of the plant species which were recorded on the vertical cliffs are adapted to moist conditions and since the hydrology of the area, including any possible wetlands located within the current footprint of the study area are not well understood, the remainder of the area was classified to be of high ecological sensitivity. It is recommended that a detailed wetland study is undertaken of the footprint area to ensure that the proposed development does not influence the wet conditions recorded on the vertical cliffs since the drying out of these sensitive systems will result in the destruction of numerous threatened species.

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GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity.
Biodiversity	Biodiversity is the variability among living organisms from all sources including *inter alia* terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Climax community	The presumed end point of successional sequence; a community that has reached a steady state, the most mature and fully developed vegetation that an ecosystem can achieve under the prevailing conditions. It is reached after a sequence of changes in the ecosystem, known as succession. Once climax vegetation develops, the changes are at a minimum and the vegetation is in dynamic equilibrium with its environment. Very few places show a true climax because physical environments are constantly changing so that ecosystems are always seeking to adjust to the new conditions through the process of succession.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are Declining are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Correspondence Analysis	Correspondence Analysis simultaneously ordinates species and samples.

Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al.*, 2009).
Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible.
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution.
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.
Fauna	The animal life of a region.
Flora	The plant life of a region.
Forb	A herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live.
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas.
Least Concern	A taxon is Least Concern when it has been evaluated against five IUCN criteria and does not qualify for the Threatened or Near threatened Categories (Raimondo *et al.*, 2009).
Mitigation	The implementation of practical measures to reduce adverse impacts.

Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al.*, 2009).
Plant community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance.
Protected Plant	According to Provincial Nature Conservation Ordinances, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations and species which have been reduced to small (often unsustainable) population by man's activities.
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. Now termed Plants of Conservation Concern.
Species diversity	A measure of the number and relative abundance of species.
Species richness	The number of species in an area or habitat.
Succession	Progressive change in the composition of a community of plants, e.g. from the initial colonisation of a bare area, or of an already established community towards a largely stable climax. The complete process of succession may take hundreds or thousands of years and entails a number of intermediate communities - each called a seral community. The replacement of one seral community by another in most cases leads to the eventual formation of a climax community, a relatively stable community of plants and animals.
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition".
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al.*, 2009).
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and is therefore facing a high risk of extinction in the wild in the future (Raimondo *et al.*, 2009).

APPENDICES

APPENDIX A	**Plant species identified within the study area**
APPENDIX B	**Mammal species occurring within QDGC 2430DD, with provincial, national and global conservation status, and probability of occurring on site and habitat preference**
APPENDIX C	**Chiroptera (Bat) species which have been recorded in QDGC 2430DD, provincial, national and global conservation status, and probability of occurring on site and habitat preference**
APPENDIX D	**Bird species observed in the study area as well as their provincial, national and global conservation status**
APPENDIX E	**Bird species of conservation concern occurring within QDGC 2430DD, national and global conservation status, habitat preference and probability of occurring on site**
APPENDIX F	**Reptile species occurring within QDGC 2430DD, provincial, national and global conservation status, probability of occurring within the study area and habitat preference**
APPENDIX G	**Amphibian species occurring within QDGC 2430DD, national conservation status, habitat preference and probability of occurring within the study area**
APPENDIX H	**Threatened butterflies occurring in Mpumalanga, their conservation status, habitat requirements and likelihood of occurring in the study area**

APPENDIX A: PLANTS IDENTIFIED WITHIN THE STUDY AREA

APPENDIX B:

Plants in **RED** = Species of conservation concern and/or nationally or provincially protected species

Scientific Name	Common Name	Conservation Status	Vegetation community			
			Scrubveld	*Aloe aborescens/Clivia caulensens* cliff edge	Mistbelt Forest	Vertical Cliffs
Trees						
Afrocarpus flacatus	Yellow Wood	Nationally Protected		X	X	
Buddleja salviifolia	Sagewood		X	X		
Cussonia spicata					X	
Faurea galpinii	Escarpment Beechwood	Provincially protected	X		X	
Greyia sutherlandii	Golossy Bottlebrush		X			
Halleria lucida	Tree Fuchsia		X	X	X	
Hypericum revolutum	Curry Bush		X			
Leucosidea sericea	Ouhout		X		X	
Myrsine africana	Cape Myrtle		X	X	X	
Obetia tenax	Nettle Tree				X	
Passerina montana			X			X
Psychotria capensis	Black Bird-berry		X	X	X	
Pterocelastrus rostratus					X	
Rapanea melanophloeos	Cape Beech	Nationally Protected	X	X	X	
Schefflera umbellifera	False Cabbage Tree			X	X	
Schrebera alata	Wing-leaved wooden pear			X		
Searsia chirindensis	Red Currant		X			
Stoebe sp.A			X			
Xymalos monospora	Lemonwood				X	
Herbaceous species						

Scientific Name	Common Name	Conservation Status	Vegetation community			
			Scrubveld	*Aloe aborescens/Clivia caulensens* cliff edge	Mistbelt Forest	Vertical Cliffs
Acalypha sp.			X			
Agapanthus inapertus		Provincially protected	X	X		
Aloe arborescens	Krantz Aloe	Genus is provincially protected	X	X		
Aloe nubigena		Provincially protected				X
Asplenium sp.1				X	X	
Asplenium sp.2				X	X	
Cliffortia sp.			X			
Clivia caulescens		Near threatened Provincially protected		X	X	X
Crassula cf.*swaziensis*			X			
Crassula pellucida						X
Cyanotis speciosa			X			
Cyathea capensis	Tree Fern	Declining Provincially protected			X	
Dicranopteris linearis				X		
Drimia elata		Data Deficient Provincially protected	X	X		X
Helichrysum cf. *galpinii*						X
Hypoxis argentea			X			
Impatiens hochstetteri				X	X	
Merwilla plumbea		Near Threatened, nationally and provincially protected	X	X		X
Monopsis kowynensis		Vulnerable				X
Pellaea calomelanos			X			
Peperomia sp.					X	

Scientific Name	Common Name	Conservation Status	Vegetation community			
			Scrubveld	*Aloe aborescens/Clivia caulensens* cliff edge	Mistbelt Forest	Vertical Cliffs
Piper capense					X	
Plectranthus sp.				X		X
Polystachya transvaalensis	Tree Orchid	All Orchids are provincially protected		X	X	
Pteridium aquilinum subsp.*capense*	Bracken Fern		X			
Rubus sp.			X			
Schizochilus lilacinus		Very rare Provincially protected				X
Selaginella dregei	Mat Fern		X	X	X	X
Senecio coronatus	Wooddly Grassland Senecio		X			
Streptocarpus fenestra-dei		Vulnerable			X	X
Streptocarpus micranthus					X	X
Tetradenia riparia	Ginger Bush		X	X		
Todea barbara					X	
Alien species						
Lilium longiflorum	St.Joseph's Lilly		X			
Pinus patula			X	X		X

APPENDIX B: MAMMAL SPECIES OCCURRING IN QDGC 2430DD, WITH PROVINCIAL, NATIONAL AND GLOBAL CONSERVATION STATUS, WITH THEIR HABITAT PREFERENCE AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

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

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Chlorocebus pygerythrus	**Vervet Monkey**		**LC**	**LC**	**Savanna, forest, riparian vegetation, forest edge, omnivore**	**Confirmed**
Genetta genetta	**Common Genet**		**LC**	**LC**	**Forest, savanna, omnivorous**	**Confirmed**
Lepus saxatilis	**Scrub Hare, Savannah Hare**		**LC**	**LC**	**Arable land, savanna, grassland, desert, grazer**	**Confirmed**
***Otomys* sp.**	**Vlei Rat**					**Confirmed**
Papio ursinus	**Chacma Baboon**		**LC**	**LC**	**Savanna and grassland, forest edges, omnivore**	**Confirmed**
Rhabdomys pumilio	**Four-striped Grass Mouse**		**LC**	**LC**	**Temperate, grassland with good cover, diurnal**	**Confirmed**
Sylvicapra grimmia	**Common Duiker, Grey Duiker**		**LC**	**LC**	**Widespread, thickets, savanna, widespread, karroid, forest and savanna**	**Confirmed**
Atilax paludinosus	Marsh Mongoose, Water Mongoose		LC	LC	Coastline, rocky shores, intertidal, estuarine, brackish, bogs, marshes, swamps, freshwater and saltwater, eats invertebrates and small vertebrates	High
Civettictis civetta	African Civet		LC	LC	Forest, savanna, omnivorous, mainly roots, shoots and fruits	High
Cricetomys gambianus	Gambian Rat		VU	LC	Evergreen forest and moist woodland	High
Crocidura cyanea	Reddish-grey musk shrew	DD			This species occurs in a wide variety of montane grasslands and temperate and subtropical forests. In Namibia, a population has been found inhabiting a cave, where they feed on cave invertebrates and possibly dead bats (Marais and Irish 1990).	High

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Crocidura flavescens	Greater Red musk shrew	DD			This species occurs mainly in grassland and grassland savanna but it also found in gardens.	High
Crocidura fuscomurina	Tiny musk shrew	DD			In southern part of its range, this species tends to prefer drier regions and occurs in dry savanna, grasslands and the Kalahari. In the eastern part of its range it is found in woodland and moist bush savanna.	High
Crocidura hirta	Lesser red musk shrew	DD			This species is found in grassland, savanna and bush savanna. The Nambian subspecies Crocidura hirta deserti occurs in arid areas	High
Elephantulus brachyrhynchus	Short-snouted Elephant Shrew		DD	LC	Heavy cover in grass and scrubs	High
Felis silvestris	Wild Cat, Wildcat		LC	LC	Savanna, shrubland, desert, broad habitat, small mammals, reptiles, birds and invertebrates	High
Genetta maculata	Central African Large Gennet		0	LC	A variety of habitats, rainforest, thickets, swamps, grassy savanna but not extremely dry savanna.	High
Ichneumia albicauda	White-tailed Mongoose		LC	LC	Savanna, urban areas, grasslands, invertebrates an small vertebrates	High
Ictonyx striatus	Zorilla, Striped Pole Cat		LC	LC	Savanna, grasslands, desert, forest, insects and mince, reptiles	High
Lemniscomys rosalia	Single-striped Grass Rat		DD	LC	Savanna, grassland, good cover, fallow fields	High
Mastomys coucha	Southern African Mastomys		LC	LC	Widespread, nocturnal	High
Mastomys natalensis	Natal Mastomys		LC	LC	Cosmopolitan, nocturnal	High
Mus musculus	House Mouse		0	LC	Widespread	High

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Otolemur crassicaudatus	Thick-tailed Greater Galago/ Bushbaby		LC	LC	Forest and woodland, coastal and lowveld but also afromontane forest, gummivore	High
Potamochoerus larvatus	Bushpig		LC	LC	Forests, shrub dominated wetlands, afromontane and coastal forests, thickets, reedbeds and wetland associated grassland.	High
Raphicerus campestris	Steenbok		LC	LC	Savanna, shrubland, grassland, drier areas	High
Rattus rattus	Black Rat, House Rat		0	LC	Widespread	High
Suncus lixus (Thomas 1898)	Greater dwarf shrew	DD			Occurs in damp situations in riverine forest.	High
Thallomys paedulcus	Acacia Rat		LC	LC	Widespread	High
Tragelaphus scriptus	Bushbuck		LC	LC	Closed canopy forests, thickets and woodlands, coastal sand forests	High
Canis adustus	Side-striped Jackal		NT	LC	Savanna, desert, urban areas, invertebrates and small vertebrates	High*
Canis mesomelas	Black-backed Jackal		LC	LC	Savanna, shrubland, grassland, drier areas, omnivore, extreme generalist	High*
Cercopithecus mitis labiatus	Samango monkey	EN	EN		Shows an affinity for Afromontane forests and seldom strays from this. Widespread in all types of evergreen forests, primary and secondary to riverine areas.	High
Chrysospalax villosus	Rough-haired golden mole	VU	VU	RSA	Grassland, prefering dry, sandy ground on the fringes of marshes and vleis. Also in gardens and golf courses	High*
Crocidura silacea (Thomas 1895)	Lesser grey-brown musk shrew	DD			This species occurs in montane forest, savanna, bush, grassland and coastal forest. It appears to tolerate a wide range of habitats.	High*
Dasymys incomtus	African Marsh Rat /Water Rat		NT	LC	Bogs, marshes, swamps, fens, peatlands, nocturnal, semi-aquatic	High*

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Dendromus melanotis	Gray African Climbing Mouse		LC	LC	Tall grass and bushes in bogs, marshes, swamps, fens, peatlands	High*
Lutra maculicollis	Spotted-necked Otter		NT	LC	Aquatic areas, natural and man-made, fish, crab, frogs, in low densities	High*
Otomys irroratus	Southern African Vlei Rat		LC	LC	Mesic grassland and mountain fynbos habitat	High*
Otomys laminatus (Thomas &	Laminate vlei rat	LC	LC	LC	Grassland species occurring in submontane as well as coastal areas.	High*
Aethomys namaquensis	Namaqua Rock Rat		LC	LC	Rocky outcrops and koppies	Low
Dendromus mystacalis	Chestnut Climbing Mouse		LC	LC	Grassland with rank vegetation with high coarse grasses	Low
Helogale parvula	Common Dwarf Mongoose		LC	LC	Savanna, eats invertebrates	Low
Heterohyrax brucei	Bush Hyrax, Hoggar Hyrax		LC	LC	Rocky barren areas, specialist browser	Low
Hyaena brunnea	Brown Hyaena		NT	NT	Savanna, grasslands, urban areas, scavenger	Low
Neamblysomus julianae	Juliana's Golden Mole (Pretoria)		CR	CR	Subteranean, Rocky Highveld Grassland, gardens	Low
Oreotragus oreotragus	Klipspringer		LC	LC	Throughout most biomes, rocky outcrops, hillsides and scree sclopes	Low
Orycteropus afer	Aardvark, Antbear		LC	LC	Savanna, shrubland, grassland, vital association between ants and termites	Low
Phacochoerus africanus	Common Warthog		LC	LC	Savanna areas with water, short-grass grazer	Low
Pronolagus saundersiae	Hewitt's Red Rock Hare		LC	LC	Grassland, restricted to the top of rocky outcrops	Low
Proteles cristatus (Sparrman 1783)	Aardwolf	LC	LC		Occur in Nama-Karoo, Succulent Karoo, Grassland and Savanna biomes. Associated with diverse habitats.	Low

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Redunca arundinum	Southern Reedbuck		LC	LC	Savannas with tall grasses, some herbaceous cover and woody species, reedbeds close to water, grazer	Low
Redunca fulvorufula	Southern Mountain Reedbuck		LC	LC	Temperate grassland habitats, selective grazer	Low
Smutsia temminckii	Cape Pangolin		VU	LC	Grassland, shrubland, savanna, dry, woody, scrub, associated with termites and ants	Low
Steatomys pratensis (Peters 1846)	Fat mouse	LC			Fringes of rivers and swamps with sparse to tall and dense grass cover. Common on cultivated land suggesting they prefer loose, sandy substrates.	Low
Suncus varilla (Thomas 1895)	Lesser dwarf shrew	DD			Particularly associated with mounds of snouted harvester termites but have also been recorded in areas without termite mounds	Low
Tragelaphus strepsiceros	Greater Kudu		LC	LC	Savanna woodlands with high shrub/tree density, grasslands, desert	Low
Acomys spinosissimus	Spiny mouse	LC			This species is found on rocky outcrops in savanna woodland (Brachystegia, Mopane, Miombo, Terminalia, etc.). It is an insectivorous species. It is not known if the species can persist in disturbed or modified habitats.	Medium
Aethomys ineptus	Tete Veld Aethomys		LC	LC	Rocky crevices and piles of boulders	Medium
Caracal caracal	Caracal, African Caracal		LC	LC	Savanna, shrubland, eats small mammals and birds	Medium
Elephantulus myurus	Eastern Rock Elephant Shrew		LC	LC	Shrubland, grassland, crevices and crannies	Medium
Galago moholi	Southern Lesser Galago		LC	LC	Arboreal, savanna woodlands, coast to inland plateau	Medium

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Gerbilliscus leucogaster	Bushveld Gerbil		DD	LC	Sandy soils	Medium
Grammomys cometes	Mozambique Thicket Rat		DD	LC	Terrestrial, arboreal	Medium
Grammomys dolichurus	Woodland Thicket Rat		DD	LC	Riverine forest, thickets and woodland, terrestrial-arboreal	Medium
Graphiurus microtis	Small-eared Dormouse		0	LC	Savanna and woodland habitats	Medium
Graphiurus murinus	Woodland Dormouse		LC	LC	Woodland, terrestrial arboreal	Medium
Graphiurus platyops	Rock Dormouse		DD	LC	Temperate, rocky areas	Medium
Herpestes sanguineus	Slender Mongoose		LC	LC	Savanna, desert, urban areas, invertebrates and small vertebrates	Medium
Mellivora capensis	Honey badger	NT	NT		Widespread, only absent from dune deserts. Seems to be absent from the Free State	Medium
Mungos mungo	Banded Mongoose		LC	LC	Savanna, social, termites and beeetle larvae, other invertebrates	Medium
Poecilogale albinucha	African Striped Weasel		DD	LC	Grassland, savanna, shrubland, birds and eggs	Medium
Procavia capensis	Rock Hyrax, Rock Dassie		LC	LC	Krantzes and rocky outcrops throughout the fynbos, karroid habitats, generalist herbivore	Medium
Raphicerus sharpei	Sharpe's Grysbok		NT	LC	Shrublands, savanna woodlands, mixed feeders, low growing vegetation, avoids tall vegetation	Medium
Saccostomus campestris	Pouched Mouse		LC	LC	Savanna, shrubland, grassland, temperate, nocturnal seed eater	Medium
Thryonomys swinderianus	Greater Cane Rat		LC	LC	Savanna, Grassland, Seasonally wet or flooded wetlands, usually near water	Medium
Cephalophus natalensis	Natal Red Duiker		LC	LC	Subtropical/tropical dry, sand forests and coastal bushveld.	Medium*

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Crocidura mariquensis	Swamp Musk Shrew		DD	LC	Bogs, marshes, swamps, peatleands, marshy areas in savannas, terrestrial, nocturnal	Medium*
Dendromus mesomelas (Brants 1827)	Brants' climbing mouse	LC			Associated with rank vegetation but have also been recorded in suburban gardens	Medium*
Myosorex cafer (Sundevall 1846)	Dark-footed forest shrew	DD			Confined to moist, densely vegetated habitat, usually associated with damp areas fringing mountain streams.	Medium*
Myosorex varius (Smuts 1832)	Forest shrew	DD			Moist densely vegetgated habitat, usually close to streams or dams.	Medium*
Ourebia ourebi	Oribi		EN	LC	Grassland, Lowlands and montane grasslands, open grasslands with gentle topography at lower altitudes, selective feeders.	Medium*
Panthera pardus	Leopard		LC	NT	Forest, savanna, desert, predates small to medium mammals	Medium*
Pelea capreolus	Grey Rhebok, Common Rhebok		LC	LC	Savanna, grassveld and renosterveld, hilly and mountainous terrain, ecotonal	Medium*
Amblysomus hottentotus meesteri	Meester's golden mole	NE	NE	MP	Favours vleis and montane forests. Subsurface runs are about 30mm below the surface, burrows are 500mm deep.	Medium-High*
Aonyx capensis	African Clawless Otter		LC	LC	Permanent streams and rivers, coastline, rocky shores,, frshwater and marine, crustaceans and fish	Medium-High*
Hystrix africaeaustralis	Cape Porcupine		LC	LC	Arable land, savanna, grassland, temperate, desert, throughout southern Africa	Very high
Leptailurus serval	Serval	NT	NT		Wide distribution range but restricted by habitat requirements. Proximity to water essential as well as availability of adequate cover	Very high

Scientific Name	Common name	Conservation Status			Habitat	Likelihood of occurring in the study area
		MTPA	SA	IUCN		
Aepyceros melampus	Common Impala		LC	LC	Light woodlands and savanna, open acicia savannas with nutrient rich soils, water-dependent	Zero
Ceratotherium simum	Southern White Rhino		LC	NT	Temperate grasslands, short rass areas in savanna and busgveld, prefers woody cover, water, bulk grazer	Zero
Connochaetes taurinus	Common Wildebeest		LC	LC	Savanna, short grass grazer, prefers open savanna woodlands/bushveld	Zero
Crocuta crocuta	Spotted Hyaena		NT	LC	Savanna, semi-desert shrubs, predator/scavenger	Zero
Damaliscus lunatus	Tsessebe		EN	LC	Grassland and grassland/woodland ecotones, Kimberely thornveld, mopane bushveld, selective grazer.	Zero
Diceros bicornis	Southern-central Black Rhino		VU	CR	Savanna, bushveld habitats of Limpopo, Mpumalanga and KZN, prefers dense cover and permanent water, browser	Zero
Equus quagga	Plains Zebra, Burchells Zebra		0	LC	Savanna, temperate grasslands, grasslands or open woodlands near water. Prefers short grasses and flat to gentle hills.	Zero
Giraffa camelopardalis	Giraffe		LC	LC	Savanna woodlands, high level browser	Zero
Hippotragus equinus	Roan Antelope		VU	LC	Open savanna woodlands, selective feeder requiring medium to tall grasses and permanent water	Zero
Hippotragus niger	Sable Antelope		VU	LC	Woody savanna, water dependent grazer	Zero
Kobus ellipsiprymnus	Common Waterbuck		LC	LC	Savanna, riverine ecotones, savanna grasslands and open woodlands	Zero
Syncerus caffer	African Buffalo		LC	LC	Savanna, temperate shrublands, bulk feeder occuring throughout savannas lowveld and Eastern Cape thickets	Zero
Tragelaphus oryx	Common Eland, Eland		LC	LC	Woodlands and woodland mosaics, grassslands and thickets	Zero

* Species recorded in areas surrounding the study area

APPENDIX C: CHIROPTERA (BAT) SPECIES OF CONSERVATION CONCERN RECORDED IN QDGC 2430DD, THEIR CONSERVATION STATUS, HABITAT PREFERENCE AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

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

Scientific Name	Common Name	Conservation Status		Habitat requirements	Likelihood of occurring in the study area
		SA	IUCN		
Cloeotis percivali	Percival's Trident Bat	VU	LC	Caves and subteranean habitats, mixed woodland savanna, aerial insectivore	High
Miniopterus natalensis	Natal long-fingered bat	NT	NT	This species has been recorded from semi-desert, dry and moist savanna, and mediterranean-type shrubby vegetation. It is generally a cave roosting species also found in similar habitats such as disused mines.	High
Myotis tricolor	Temminck's myotis	NT	LC	In general, animals have been reported from dry and moist savanna, and mediterranean-type shrubby vegetation. It seems possible that the species is also found in tropical moist forest in Liberia and the Virunga National Park (the Democratic Republic of the Congo), however, this needs confirmation. The species roosts in caves and abandoned mines. It appears to prefer larger caves that are relatively undisturbed, usually ones that contain large pools of water.	High
Pipistrellus anchietae	Anchieta's Pipistrell	NT	LC	Savanna, coastal and scrub forest, bushveld, near open water, aerial insectivore	Medium*
Pipistrellus rusticus	Rusty pipistrelle	NT	LC	This species has been recorded from savanna woodland, and both dry and moist savanna habitats. Animals have been reported roosting in tree crevices, under bark and in old buildings.	High

Scientific Name	Common Name	Conservation Status		Habitat requirements	Likelihood of occurring in the study area
		SA	IUCN		
Rhinolophus darlingi	Darling's horseshoe bat	NT	LC	Generally associated with savanna and savanna-woodland type habitats. It is dependant on caves, mines, broken rocky areas, buildings and similar structures as roost sites	High
Rhinolophus fumigatus	Ruppell's horseshoe bat	NT	LC	This species has been recorded from dry forest, and dry and moist savanna habitats. Colonies are generally associated with caves. Not found in forests but might occur around the fringes	High
Rhinolophus landeri	Lander's Horseshoe Bat	NT	LC	Grassland, caves and subterranean habitats, savanna, dry woodland, aerial insectivore.	High
Rhinolophus swinnyi	Swinny's Horseshoe Bat	NT	LC	Grassland, caves and subterranean habitats, shrubland, mixed bushveld, aerial insectivore	High

APPENDIX D: BIRD SPECIES RECORDED IN THE STUDY AREA

Scientific Name	English Name
Andropadus importunus	Sombre Greenbul
Apalis thoracica	Bar-throated Apalis
Ardea melanocephala	Black-headed Heron
Batis capensis	Cape Batis
Bostrychia hagedash	Hadeda Ibis
Bubo africanus	Spotted Eagle-Owl
Buteo rufofuscus	Jackal Buzzard
Chrysococcyx caprius	Diderick Cuckoo
Chrysococcyx cupreus	African Emerald Cuckoo
Cinnyris chalybeus	Southern Double-collared Sunbird
Circaetus pectoralis	Black-chested Snake-Eagle
Cisticola textrix	Cloud Cisticola
Columba arquatrix	African Olive-Pigeon
Cossypha caffra	Cape Robin-Chat
Cossypha dichroa	Chorister Robin-Chat
Cuculus solitarius	Red-chested Cuckoo
Delichon urbicum	Common House-Martin
Emberiza capensis	Cape Bunting
Falco rupicolus	Rock Kestrel
Laniarius ferrugineus	Southern Boubou
Merops apiaster	European Bee-eater
Micronisus gabar	Gabar Goshawk
Passer domesticus	House Sparrow
Prinia subflava	Tawny-flanked Prinia
Sarothrura affinis	Striped Flufftail
Saxicola torquatus	African Stonechat
Tachymarptis melba	Alpine Swift
Tauraco corythaix	Knysna Turaco
Zosterops capensis	Cape White-eye

APPENDIX E: BIRD SPECIES OF CONSERVATION CONCERN RECORDED IN 2430DD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific	English Name	Regional conservation	IUCN	Habitat requirements	Likelihood of occurring in study area
Sarothrura affinis	**Striped Flufftail**	**VU**	**LC**	**Dry upland grassland, including sites with bracken and brambles, with woody vegetation such as *Protea* spp, *Leucosidea sericea* and *Buddleja* spp, or close to forest edges**	**Confirmed**
Aquila rapax	Tawny Eagle	VU	LC	Lightly wooded savanna; absent from dense forests and highlands	High
Coracias garrulus	European Roller	LC; NBM	NT	Open, broadleaved and Acacia woodlands with grassy clearings	High
Falco biarmicus	Lanner Falcon	NT	LC	Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs favour habitats where cliffs available as nest and roost sites, but will use alternative sites (eg trees, electricity pylons, buildings) if cliffs absent	High
Falco peregrinus	Peregrine Falcon	NT	LC	Resident birds mostly restricted to mountainous, riparian or coastal habitats, where high cliffs provide br and roosting sites; breeding pairs prefer habitats that favour specialised, high-speed, aerial hunting, e.g. high cliffs overlooking vegetation with raised and/or discontinuous canopy, or expanses of open water	High
Hieraaetus ayresii	Ayres's Hawk-Eagle	NT	LC	Dense woodland and forest edge, often in hilly country	High
Stephanoaetus coronatus	African Crowned Eagle	NT	NT	Forest, including gallery forest, dense woodland and forested gorges in savanna and grassland. Also in Eucalyptus and pine plantations.	High

Zoothera gurneyi	Orange Ground-Thrush	NT	LC	Moist Afromontane evergreen forest; favours small linear escarpment forest patches along deeply incised drainage lines with perennial streams; avoids areas of dense undergrowth; does not range into adjacent woodland or softwood plantations	High
Alcedo semitorquata	Half-collared Kingfisher	NT	LC	Clear, fast-flowing perennial streams, rivers and estuaries, usually narrow and secluded, with dense marginal vegetation; often near rapids	Low
Anastomus lamelligerus	African Openbill	NT	LC	Wetlands, including flood plains, temporarily flooded pans, marshes, swamps, ponds, river shallows, streams, rice fields, dams, lake edges, lagoons and intertidal flats; occasionally in ploughed fields; mainly < 1 500 m	Low
Anthropoides paradiseus	Blue Crane	VU; En	VU	Open grassland and grassland/Karoo ecotone; wetlands, cultivated pastures and crop lands; tolerant of intensively grazed and burnt grassland	Low
Anthus brachyurus	Short-tailed Pipit	VU	LC	Fairly short, open grassland, usually on hill slopes when breeding; winters in or adjacent to seasonally flooded grassland	Low
Ardeotis kori	Kori Bustard	VU	LC	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	Low
Balearica regulorum	Grey Crowned Crane	VU	EN	Breeds in marshes, pans and dams with fairly tall emergent vegetation; forages in short to medium-height open grassland, sometimes lightly wooded areas; also extensively in cultivated fields and pastures	Low

Botaurus stellaris	Eurasian Bittern	CR	LC	Tall, dense emergent vegetation in interior of seasonal and permanent large wetlands	Low
Bucorvus leadbeateri	Southern Ground-Hornbill	VU	VU	Inhabits wide range of grassland, savanna and woodland, from montane grassland at 2 000 m with forest patches and gorges in which to roost and nest, to extensive stands of tall broad-leaved woodlands, where understorey fairly open. Absent from extensive treeless areas of low bush and scrub, and from dense thickets and forest	Low
Buphagus erythrorhynchus	Red-billed Oxpecker	NT	LC	Open savanna, up to 3 000 m; dependent on presence of host ungulates	Low
Ciconia nigra	Black Stork	NT	LC	Dams, pans, floodplains, flooded grassland, associated with mountainous areas	Low
Circus macrourus	Pallid Harrier	NT; NBM	NT	Grasslands associated with pans or floodplains; also croplands	Low
Circus ranivorus	African Marsh-Harrier	VU	LC	Almost exclusively inland and coastal wetlands	Low
Crex crex	Corn Crake	VU; NBM	LC	Rank grassland and savanna, grassland bordering marshes and streams incl long grass areas of seasonally flooded grassland and occasionally wet clay patches and soft mud fringing ponds	Low
Ephippiorhynchus senegalensis	Saddle-billed Stork	EN	LC	Large rivers in open savanna, freshwater marshes, freshwater and alkaline lake shores, pans and flood plains	Low

Falco naumanni	Lesser Kestrel	VU; NBM	LC	Warm, dry, open or lightly wooded environments; concentrated in grassy Karoo, w fringes of grassland biome and se Kalahari; generally avoids foraging in transformed habitats but occurs in some agricultural areas, incl croplands in fynbos and renosterveld of W Cape	Low
Geronticus calvus	Southern Bald Ibis	VU; En	VU	High-altitude (1 200-1 850 m), high-rainfall (> 700 mm/yr), sour and alpine treeless grasslands, characterised by short, dense grass sward; favours recently burnt, ploughed, mowed or heavily grazed fields, also cultivated land with short grass or stubble	Low
Glareola pratincola	Collared Pratincole	NT; NBM	LC	Sandbanks, mudflats, grassy flood plains, ploughed fields, burnt grass and overgrazed veld, always near water, including estuaries, coastal lakes, pans, large rivers and dams	Low
Gorsachius leuconotus	White-backed Night-Heron	VU	LC	Clear and slow-flowing perennial rivers and streams with overhanging vegetation, in woodland and forest. Sometimes along vegetated watercourses in open country. Also lakes, dams and marshes with overhanging vegetation, mangrove swamps and, occasionally, reedbeds	Low
Gyps africanus	White-backed Vulture	VU	EN	Lightly wooded arid savanna, including *Colophospermum mopane* woodland	Low
Gyps coprotheres	Cape Vulture	VU; En	VU	Wide habitat range; cliffs	Low
Hirundo atrocaerulea	Blue Swallow	CR	VU	High-rainfall (> 1 000 mm/yr) montane grassland with streams forming shallow valleys, potholes and dongas; also marsh edges.	Low

Leptoptilos crumeniferus	Marabou Stork	NT	LC	Both aquatic and terrestrial habitats, favouring open and semi-arid areas; largely absent from forest areas and true desert; common at wetlands, incl dams, pans and rivers, and in wildlife reserves and ranching areas	Low
Lissotis melanogaster	Black-bellied Bustard	NT	LC	Tall dense grassland and grassy savanna, in both hilly and flat country, where rainfall > 600 mm; often at wetland margins and occasionally in cultivated pastures, fields and fallow lands	Low
Mycteria ibis	Yellow-billed Stork	NT; NBM	LC	Wetlands, including alkaline and freshwater lakes, rivers, dams, pans, flood plains, marshes, flooded grassland and small pools or streams	Low
Neotis denhami	Denham's Bustard	VU	NT	High-lying, open, sour grassland, often in rocky areas and on plateau grassland; occasionally uses cultivated fields, especially in winter and during droughts; attracted to burnt ground, especially in winter; avoids heavily grazed grassland	Low
Nettapus auritus	African Pygmy-Goose	NT	LC	Prefers inland wetlands, mainly in savanna, with clear water and floating and emergent vegetation, especially water lilies (*Nymphaea* spp)	Low
Oxyura maccoa	Maccoa Duck	Rare	DD	Prefers permanent wetlands in open grassland and semi-arid country (incl fynbos, succulent Karoo, Nama Karoo) that support rich concentrations of benthic invertebrates. Breeding habitat usually contains stands of young, emergent vegetation, mainly rushes and sedges48. In KwaZulu-Natal, br recorded only at farm dams.	Low
Phoeniconaias minor	Lesser Flamingo	NT	NT	Primarily open, eutrophic, shallow wetlands; breeds on saline lakes and saltpans	Low
Phoenicopterus roseus	Greater Flamingo	NT	LC	Large, shallow, eutrophic wetlands, slat pans, saline lakes, coastal mudflats	Low

Podica senegalensis	African Finfoot	VU	LC	Mostly quiet, wooded streams and rivers flanked by thick riparian vegetation and overhanging trees. Also dam verges, especially with sufficient overhanging vegetation and reed cover	Low
Rostratula benghalensis	Greater Painted-snipe	NT	LC	Waterside habitats with substantial cover	Low
Sagittarius serpentarius	Secretarybird	VU	VU	Open grassland (< 0.5 m) with scattered trees, shrubland, open *Acacia* and *Combretum* spp savanna; absent from dense woodland and rocky hills	Low
Schoenicola brevirostris	Broad-tailed Warbler	NT	LC	Rank grassland in poorly drained areas; also grassy hillsides and tall, coarse grasses along drainage lines	Low
Torgos tracheliotus	Lappet-faced Vulture	VU	VU	Open woodland in arid- and semi-arid regions, including *Acacia* spp, *Boscia albitrunca, Terminalia prunioides* and *Colophospermum mopane*	Low
Turnix nanus	Black-rumped Buttonquail	EN	LC	Short, open grassland with bare ground between grass tufts on dark, clay soils; also open savanna and cultivated fields	Low
Tyto capensis	African Grass-Owl	VU	LC	Treeless areas associated with damp substrata, mainly marshes and vleis. Favours patches of tall, rank grass, sedges or weeds. Also areas with dense ground cover in scattered thorn scrub, low fynbos and renosterveld, usually close to water and among thick stands of grass (Stenotaphrum sp) and sedge (Juncus sp)	Low
Vanellus albiceps	White-crowned Lapwing	NT	LC	Sand- and mudbanks in large rivers, less often along shores of lakes and dams. During floods, on smaller streams, pans and lagoons	Low

Vanellus melanopterus	Black-winged Lapwing	NT	LC	Highland plateaux and slopes, fallow fields, meadows, pastures, coastal flats and mown grass areas, incl golf courses	Low
Macheiramphus alcinus	Bat Hawk	NT	LC	Low-lying moist woodland and major river valleys in which there are suitable roosting sites for bats, such as caves, old mine workings *Adansonia digitata* trees	Medium
Polemaetus bellicosus	Martial Eagle	VU	NT	Open woodland, arid and mesic savanna, forest edges	Medium
Terathopius ecaudatus	Bateleur	VU	NT	Savanna, open- and closed-canopy woodland, including arid *Acacia* savanna, *Colophospermum mopane* and *Brachystegia*, favouring broad-leaved woodland with long grass	Medium

APPENDIX F: REPTILE SPECIES RECORDED IN QDGC 2430DD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Most reptile species haven't had their conservation status evaluated

Scientific Name	Common Name	Conservation Status			Habitat requirements	Likelihood of occurring in the study area
		RSA	IUCN	MTPA		
Amblyodipsas concolor	Natal Purple-glossed Snake	0	0		Moist forested areas	High
Amblyodipsas polylepis	Common Purple-glossed Snake	0	0		Savannas	High
Aparallactus capensis	Black-headed Centipede-eater	0	0		Varied, highveld, montane grassland, savanna and coastal bush	High
Python natalensis	Southern African Python	0	0		Open savanna, rocky areas and riverine scrub	High
Bradypodion transvaalense	Wolkberg Dwarf Chameleon	LC	LC	VU	Wet forest of escarpment kloofs	High
Chamaeleo dilepis	Common Flap-neck Chameleon	0	0		Prefers savanna	High
Dispholidus typus	Boomslang	0	0		Widely distributed throughout much of southern Africa excluding the central Highveld and drier western half of South Africa	High
Lycodonomorphus inornatus	Olive House Snake	0	0		Limited to temperate parts of the subregion and occur in moist savanna, lowland forest, grassland and fynbos	High
Lycophidion capense	Cape Wolf Snake	LC	NE		Variety of habitats including lowland forest, fynbos, moist savanna, grassland and karoo scrub	High
Philothamnus hoplogaster	South Eastern Green Snake	0	0		Varied, coastal bush, fynbos, arid and mesic savanna	High

Philothamnus natalensis	Western Natal Green Snake	0	0		Varied, wet montane and dry forest, miombo woodland	High
Philothamnus semivariegatus	Spotted Bush Snake	0	0		Open forest or savanna, arid regions	High
Prosymna stuhlmannii	East African Shovel-snout	0	0		Savanna and wooded hills	High
Elapsoidea sundevallii	Highveld Garter Snake	0	0		Eastern parts of southern Africa from Mozambique to the Eastern Capre Province	High
Homopholis wahlbergii	Wahlberg's Velvet Gecko	0	0		Varied	High
Lygodactylus capensis	Common Dwarf Gecko	0	0		Prefers well wooded savanna	High
Acontias plumbeus	Giant Legless Skink	0	0		Forested areas	High
Trachylepis punctatissima	Speckled Rock Skink	0	0		Prefers rocky areas	High
Trachylepis sp. (Transvaal varia)	Skink sp. 1	0	0		Habitat generalist, widespread and common throughout SA	High
Trachylepis striata	Striped Skink	0	0		Varied, from mangrove swamp to arid savanna	High
Trachylepis varia	Variable Skink	LC	NE		Varied, grassland to arid and mesic savanna	High
Agama aculeata	Distant's Ground Agama	LC	NE	#N/A	Semi-desert and sanded savanna	Low
Agama atra	Southern Rock Agama	0	0		Lives in colonies on rocky outcrops throughout SA except in sandy areas in the Northern Cape, some parts of Gauteng, Mpumalanga and KwaZulu-Natal	Low
Amplorhinus multimaculatus	Many-spotted Snake	0	0		Mountain streams and vleis	Low

Lycodonomorphus laevissimus	Dusky-bellied Water Snake	0	0		Pools in slow-moving, well-wooded streams, grassland streams in Swaziland	Low
Lycodonomorphus rufulus	Brown Water Snake	0	0		Small streams, pans and vleis	Low
Psammophylax rhombeatus	Spotted Grass Snake	0	0		Highveld grassland, mesic thicket, fynbos, karroid areas	Low
Chamaesaura aenea	Coppery Grass Lizard	0	0		Very habitat specific and restricted to montane and highveld grassland and fynbos on rocky hillsides. Limited to the eastern and southern parts of Africa	Low
Chamaesaura anguina	Cape Grass Lizard	0	0		Grassy or fynbos covered gentle slopes in Cape, KwaZulu-Natal and Mpumalanga	Low
Pseudocordylus melanotus	Common Crag Lizard	0	En		Rock outcrops on mountain plateaus and rolling grassland	Low
Smaug vandami	Van Dam's Girdled Lizard	0	0		Prefers rocky outcrops in mesic savanna	Low
Naja annulifera	Snouted Cobra	0	0		Very common in bushveld and Lowveld areas	Low
Pachydactylus affinis	Transvaal Gecko	0	0		Rocky outcrops and termite mounds in grassland	Low
Tetradactylus breyeri	Breyer's Long-tailed Seps	0	0		Montane and highveld grassland	Low
Nucras lalandii	Delalande's Sandveld Lizard	0	En		Montane and temperate grassland	Low
Scelotes mirus	Montane Dwarf Burrowing Skink	0	0		Rocky montane grassland	Low
Causus defilippii	Snouted Night Adder	0	0		Common in Lowveld	Low
Crotaphopeltis hotamboeia	Red-lipped Snake	0	0		Savanna and open woodland	Medium
Dasypeltis scabra	Rhombic Egg-eater	0	LC		Absent only from closed canopy and desert areas	Medium

Duberria lutrix	South African Slug-eater	0	0		Savanna, coastal bush and fynbos	Medium
Inyoka swazicus	Swazi Rock Snake	0	0		Rock outcrops in savanna	Medium
Psammophis brevirostris	Short-snouted Grass Snake	0	0		Habitat generalist, widespread and common throughout SA	Medium
Psammophis crucifer	Cross-marked Grass Snake	0	0		Highveld and montane grassland, entering fynbos	Medium
Pseudaspis cana	Mole Snake	0	0		Sandy scrubland in SW Cape, highveld grassland, mountainous and desert areas	Medium
Cordylus vittifer	Common Girdled Lizard	0	0		Lives in cracks on small rocky outcrops	Medium
Dendroaspis polylepis	Black Mamba	0	0		Savanna	Medium
Lygodactylus nigropunctatus	Black-spotted Dwarf Gecko	0	0		Wet and dry savanna	Medium
Lygodactylus ocellatus	Spotted Dwarf Gecko	0	0		Prefers rocky outcrops above 1500masl	Medium
Pachydactylus vansoni	Van Son's Gecko	0	LC		Mesic and arid savanna	Medium
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	0	0		Varied, montane and highveld grassland, savanna, bushveld and coastal forest	Medium
Nucras holubi	Holub's Sandveld Lizard	LC	NE		Broken rocky ground in mesic savanna	Medium
Nucras ornata	Ornate Sandveld Lizard	0	0		Broken montane grassland and mesic savanna on sandy soils	Medium
Leptotyphlops scutifrons	Eastern Thread Snake	0	0		Varied, grassland, coastal bush, mesic and arid savanna	Medium
Afroablepharus wahlbergii	Wahlberg's Snake-eyed Skink	0	0		Restricted to the northern and eastern parts of southern Africa (Limpopo)	Medium
Afrotyphlops bibronii	Bibron's Blind Snake	0	0		Found mainly in the eastern half of southern Africa	Medium
Afroedura nov sp. 2 (mariepi)	Flat Gecko sp. 2 (mariepi)	0	0		0	Unknown

APPENDIX G: AMPHIBIAN SPECIES RECORDED IN QDGC 2430DD, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Common Name	Conservation Status			Habitat requirements	Likelihood of occurring in the study area
		RSA	IUCN	MTPA		
Amietophrynus gutturalis	**Guttural Toad**	**LC**	**LC**	**0**	**Around open pools, dams, vleis and other semi-permanent bodies of water in grassland, thicket and savanna; suburban gardens and farmland**	**Confirmed**
Hadromophryne natalensis	**Natal Ghost Frog**	**LC**	**LC**	**VU**	**Low and high altitudes in cold, clear, fast flowing, densely vegetated mountain streams in kloofs, forest and grassland**	**Confirmed**
Strongylopus grayii	**Clicking Stream Frog**	**LC**	**LC**	**0**	**Winter and summer rainfall areas in fynbos, succulent Karoo, Nama Karoo, savanna, grassland, thicket and forest from sea level to 3000m**	**Confirmed**
Breviceps mossambicus	Mozambique Rain Frog	LC	LC	0	Summer-rainfall savanna and grassland preferring shallow, well-drained, humus-rich, rocky soils	High
Breviceps verrucosus	Plaintive Rain Frog	LC; En	LC	0	Breed in forest and adjacent grassland along the eastern escarpment, also found in suburban gardens	High
Amietophrynus rangeri	Raucous Toad	LC	LC	0	Rivers and streams in grassland and fynbos; frequently in gardens and farmland	High
Schismaderma carens	Red Toad	LC	LC	0	Widespread in savanna and woodland, readily adapts to human habitation	High
Hyperolius marmoratus	Painted Reed Frog	LC	LC	0	Reeds and other vegetation types around edges of a wide variety of waterbodies in savanna, grassland and forest; occasionally in fynbos	High
Semnodactylus wealii	Rattling Frog	LC	LC	0	Summer and winter rainfall areas in well-vegetated areas around pans and vleis in grassland or fynbos heath in south of range	High

Phrynobatrachus natalensis	Snoring Puddle Frog	LC	LC	0	Margins of permanent and temporary water bodies including shallow marshes, lakes, rivers, streams and pools; also semi-desert scrub, arid and humid savanna, agricultural land and forest clearings	High
Ptychadena porosissima	Striped Grass Frog	LC	LC	0	Variety of vegetation types from sea level to 2300m including subtropical coastal areas, temperate and wooded grassland along escarpment and highveld	High
Amietia angolensis	Common or Angola River Frog	LC	LC	0	Banks of slow-moving streams or other permanent bodies of water in a wide variety of wetland habitats in grassland, savanna and forest edge	High
Cacosternum nanum	Bronze Caco	LC	LC	0	Areas with relatively high rainfall in a variety of vegetation types including fynbos, savanna, grassland, thicket and forest; breeds in small ponds, dams, vleis, streams, roadside pools or flooded grassland	High
Xenopus laevis	Common Platanna	LC	LC	0	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland	Low
Breviceps adspersus	Bushveld Rain Frog	LC	LC	0	Sandy to sandy-loam soils in semi-arid habitats in savanna and grassland, absent from forest	Medium
Amietophrynus garmani	Olive Toad	LC	LC	0	Vleis and pans in bushveld savanna with relatively high rainfall > 600mm pa; suburban gardens	Medium
Kassina senegalensis	Bubbling Kassina	LC	LC	0	Grassland around vleis and pans; breeds in temporary and permanent water bodies including vleis, marshes, pans, ponds and dams	Medium
Strongylopus fasciatus	Striped Stream Frog	LC	LC	0	Open, grassy areas near dams, ponds or streams in forest, thicket, grassland and savanna, sometimes parks and gardens	Medium

Tomopterna natalensis	Natal Sand Frog	LC	LC	0	Variety of habitats in savanna and grassland; breeds in shallow permanent furrows, canals or streams in grassland and agricultural land	Medium

APPENDIX H: THREATENED BUTTERFLY SPECIES OF MPUMALANGA PROVINCE, THEIR CONSERVATION STATUS, HABITAT REQUIREMENTS AND LIKELIHOOD OF OCCURRING IN THE STUDY AREA

Scientific Name	Conservation Status	Habitat requirements	Likelihood of occurring in study area
Aloeides barbarae	Endangered	Known only from type locality around the town of Baberton where it is found in grassy hilltops with sparsely strewn rocks in remnant Baberton Montane Grassland	Low
Aloeides nubilus	Endangered	Found on the Longtom Pass (Sabie) and Mount Sheba Nature Reserve where it is recorded on ridges on mist-belt fire-climax grassland in Lydenburg Montane Grassland	Low
Aloeides rossouwi	Endangered	Known from only a single surviving colony in the vicinity of Stoffberg where adults are flying in rocky gullies in Sekhukhune Montane Grassland	Low
Chrysoritis aureus	Vulnerable	Near Heidelberg. Species require a very stable environment consisting of south facing well-drained slopes	Low
Dingana fraterna	Endangered	Known only from type locality which is south west of Stoffberg where it is found between 1600 and 1700m in grassy patches amongst *Protea* species	Low
Lepidochrysops irvingi	Vulnerable	Found in a few patches of montane grassland in northern Swaziland and northeastern Mpumalanga near Graskop, Sabie and Nelshoogte where it utilizes Baberton Montane Grassland	Low (suitable habitat was observed north of the R534, not within the study area)
Lepidochrysops jefferyi	Endangered	Known only from the Baberton district of Mpumalanga where it is found in remnant patches of Baberton Montane Grassland	Low
Lepidochrysops rossouwi	Vulnerable	Found on the grassy escarpment in Lydenburg and Stoffberg areas where it is found in Lydenburg Montane Grassland	Low
Lepidochrysops swanepoeli	Vulnerable	Occurs in Baberton districts of Mpumalanga where it is found on grassy peaks with residual Baberton Montane Grassland Biome	Low
Metisella meninx	Vulnerable	Species inhabits marshes in wetlands located in open grasslands. The presence of the host plant, *Leersia hexandra* is essential	Low
Platylesches dolomitica	Vulnerable	In Gauteng recorded from Carletonville and Hillshaven and is a habitat specialist of dolomite ridges in Bushveld and Sour Highveld Grassland	Low