DIGBY WELLS
ENVIRONMENTAL

Proposed Construction of a Water Treatment Plant and Associated Infrastructure for the Treatment of Mine Affected Water at the Kilbarchan Colliery, KwaZulu Natal

Flora and Fauna Report

Project Number:

ESK5108

Prepared for:

Eskom Holdings SOC Limited (Eskom)

October 2018

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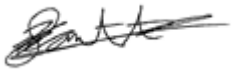
Brett Coutts	Technical Reviewer		July 2018

DECLARATION OF INDEPENDENCE

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I, Rudi Greffrath, as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Eskom Holdings SOC Limited (Eskom) other than fair remuneration for work performed, specifically in connection with the proposed B-DAS Treatment Plant for the Eskom Kilbarchan Colliery.

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EXECUTIVE SUMMARY

Eskom Holdings Limited (Eskom) proposes to construct a Water Treatment Plant and associated infrastructure for the Treatment of mine affected water at the Kilbarchan Colliery, KwaZulu Natal Province. The proposed development forms part of the second phase of a Rehabilitation Plan to rectify pollution caused by mine affected water. Digby Wells was commissioned to complete specialist studies to accompany these processes. This flora and fauna assessment was compiled to assess the current state of terrestrial ecology associated with the B-DAS Treatment Plant for the Kilbarchan site. Further to this, to provide mitigation measures for the potential impacts to flora and fauna.

A site visit was conducted from the 3rd to the 4th of May 2018. Previously delineated vegetation communities were confimred based on similarity of species composition and habitat. A large proportion of the study area had been altered from its natural state due to mining activities and livestock grazing. A single Red Data species was encountered, namely: *Crinum bulbispermum* (Declining and provincially protected).

No mammal or herpetofauna Species of Special Concern (SSC) were recorded on site during the survey. Additional SSC may occur and their absence during this investigation does not infer that they do not occur at all. Two birds SSC of international concern and an additional two birds of national conservation concern were recorded for the Kilbarchan site.

The mine dewatering activities will result in direct impacts to flora and fauna and include moerate negative impacts before mitigation: the removal of vegetation, the clearing of the MWTP and phytoremediation to reduce the impact of wetland deterioration that is caused by excessive mine affected water influx from mine workings.

All activities have the potential to promote the establishment and spread of alien plant species. A monitoring plan has been recommended, with mitigation measures.

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1 Introduction

Kilbarchan Colliery is located 10 km south of Newcastle, KwaZulu-Natal and within the Newcastle Local Municipality (NLM) and Amajuba District Municipality (ADM). Kilbarchan Colliery was commissioned in 1954 and consisted of two underground mining sections: Roy Point in the north and Kilbarchan in the south, as well as open pit areas where the coal seam was less than 20 m below ground level (mbgl). Kilbarchan Colliery supplied coal to the Natal inland market and to the adjacent Eskom Holdings SOC Limited (Eskom) Ingagane Power Station until its decommissioning in 1992. Rehabilitation activities on site were undertaken until 2012, following which Eskom assumed responsibility for the liability of Kilbarchan Colliery.

The current project is the second of 2 phases, where phase 1 consisted of a Closure Plan and Basic Assessment process in accordance with the Environmental Impact Assessment (EIA) Regulations, 2014, of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and was approved to ensure that Kilbarchan Colliery is socially and environmentally safely and sustainably closed. The second phase of the project involves the construction and operation of an B-DAS Water Treatment Dam and associated infrastructure.

This flora and fauna specialist study aims to detail the current baseline environment at the B-DAS treatment dam. Furthermore, to outline the B-DAS treatment dam and associated infrastructure activities to be undertaken and to provide mitigation measures to avoid, prevent and minimise potential impacts associated with the B-DAS treatment dam and associated infrastructure activities, as well as assess any potential impacts to the environment.

1.1 Project Background

Following the decommissioning of Kilbarchan Colliery in 1992, the underground workings, as well as open pit areas, began filling up with water at a rate of approximately 4 000 m^3 per day (Vermeulen and van Zyl, 2011). Decant of mine affected water was first recorded in April 2004 and is predominantly taking place to the south, southeast and east of the discard dump, underground workings and open pit sections (Proxa, 2014). The mine affected water is characterised as having high sodium and sulfate levels resulting in high electrical conductivity (EC) and total dissolved solids (TDS). In addition, there are also elevated levels of chloride, iron and manganese (Proxa, 2014). The mine affected water has a negative impact on the surrounding water courses that it comes into contact with as it does not meet the Interim Water Quality Objectives (IWQO) of the Ngagane Catchment.

Eskom claimed responsibility for the area and applied best practice by commissioning a Rehabilitation Plan, in accordance with the requirements of NEMA and it Regulations. The purpose of the Rehabilitation Plan was to ensure that:

i. The Kilbarchan Colliery is socially and environmentally safe; and

ii. The previously rehabilitated areas are maintained effectively.

After significant investigation, in order to achieve the above goals, the Rehabilitation Plan established a methodology to capture and treat the mine affected water from the Kilbarchan Colliery and prevent any further discharge of mine affected water to the Ingagane River. This was undertaken in two phases. Phase One and phase Two are discussed below.

The **first phase** of the project commenced in 2016 when a Basic Assessment Process was undertaken to obtain environmental authorisation for the proposed phytoremediation plantation and rehabilitation / maintenance of the Kilbarchan Colliery. The plantation aimed to passively treat mine affected water from the Project site. This authorisation was subsequently granted in 2017 (KZN30/5/1/1/2/00078BP).

This report has been compiled in support of the environmental application to obtain environmental authorisation for the **second phase** of the project which involves the construction and operation of a B-DAS treatment dam. The B-DAS treatment dam will be located at the decant point.

The water will be treated to an acceptable standard and discharged in to the surrounding environment which will then eventually make it way to the Ingagane River.

An Integrated Water Use License Application (IWULA) will be submitted to the Department of Water and Sanitation (DWS) for proposed water uses in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). A technical report in the form of an Integrated Water and Waste Management Plan (IWWMP) will be compiled in support of the IWULA together with the recommended specialist studies.

It is important to highlight that as mining commenced in the early 1950's and ceased in 1992, there is no mining right or permit, in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) or the Minerals Act (Act No. 50 of 1991). It is important to highlight, that there is no legal requirement for Eskom to apply for mine closure as the mine was operational, pre-legislation in 1952.

1.1.1 Kilbarchen History

The description of the historic mining activities at Kilbarchan Colliery was predominantly sourced from Hodgson (2006). The historical Mines Works Programme was not available to feed into the Project background.

Kilbarchan Colliery consisted of two underground mining sections: Roy Point in the north and Kilbarchan in the south. Underground mining commenced at the Kilbarchan Colliery in 1954 and utilised the bord and pillar mining method, with an average coal seam height of 3.5 m. Early reports indicated that the extraction rate for the Colliery was 73% to 76%, but more recent reports suggested that the extraction rate was 50%; no detailed plans of the underground workings are available. The lower and more probable extraction rate of 50% is possibly due to the considerably greater depths of mining in the western extent of the Colliery, due to the increase in topography in this area, as well as the angle of the coal seam.

In addition to the predominant bord and pillar method utilised at Kilbarchan Colliery, stooping had been undertaken in selected areas, with the largest of the stooped areas being 25 000 m^2 in size. To extend the life of the mine, open pit mining was implemented where the coal seam was less than 20 mbgl. Five open pit areas were mined as part of the Colliery (open pit 1, 2, 3, 4 and Slangdraai), with open pit 1A and 1B connecting to the underground workings. The areas of each of the above mining methods are summarised in Table 1-1.

Table 1-1: Mining Method Areas

Description	Area (m^2)
Underground workings	12 619 145
Stooped areas	1 183 775
Area connecting the open pit with the underground workings	213 055
Ash-filled areas	1 010 659

The Kilbarchan Colliery mining area is approximately 3 322 ha and its surface consists of a discard dump and an adjacent Pollution Control Dam (PCD) and electrical substation to its north. Remnant infrastructure and derelict buildings, that were once part of the Kilbarchan Colliery, are located west of the PCD and substation. Additional housing is located further west of the remnant infrastructure and are currently occupied. The Kilbarchan Country Club golf course and associated residential area is located to the north east of the discard dump. The N11 national road transects the mining area and is situated to the east of the discard dump, with the Ingagane River flowing northwards alongside the N11 road. An aggregate quarry, owned and operated by Afrisam (Pty) Ltd, transects the most-southern extent of the mining area's northern boundary. The decommissioned Ingagane Power Station is located outside of the mining area and to the east of the Ingagane River, with the Ingagane community located further east. The local setting of the Project site is included as Plan 2, Appendix A.

The mining area fluctuates in elevation with the highest point being located in proximity to the south-western extent at approximately 1 470 m above mean sea level (mamsl), before the elevation reduces towards the N11 national road in the northeast and east (1 220 mamsl). The lowest point in the Project site is the Ingagane River at approximately 1 180 mamsl. The Ingagane Power Station is approximately 1 200 mamsl.

1.2 Project Description

1.2.1 The decant of mine affected water to surface

Decant is predominantly currently taking place to the east, south and southeast of the discard dump. In addition, a number of existing water monitoring locations have become decant locations, three of which have been identified at the southern foot of the discard dump. Decant to the southeast of the discard dump is depicted in Figure 1-1. In an effort to

remove the heavy metals from the mine affected water, Eskom previously set up a pre-treatment facility located at the foot of the discard dump. However this plant was subsequently decommissioned due to the expiration of the WUL. Eskom decided to not renew the licence. Therefore a solution is required to ensure the water currently being released is treated to an acceptable standard prior to discharging it to the environment.

Figure 1-1: Decant emanating southeast of the Discard Dump

1.2.1.1 Phytoremediation Plantation

The proposed passive treatment option which involved the authorisation of a phytoremediation plantation was undertaken as part of a basic assessment process in 2016.

Phytoremediation was proposed to manage the impact of decanting mine affected water on the soil and surface water resources, as well as to lower the volume of water required for active treatment.

It was proposed that the Phytoremediation Plantation be located upstream of the decant locations and within 52 ha of wetland habitat. The tree plantation is expected to absorb approximately 1 Ml of mine affected water per day based on forestry spacing, although it is expected that this quantity can increase should tree spacing be reduced. This reduction in decant volumes, along with water abstraction for active treatment, will aid in the decrease in underground water elevation below the decant elevation of 1 192 m.

An Environmental Authorisation was granted by the DMR to Eskom to establish the plantation on 17 November 2017. However, a WUL is still required to establish the phytoremediation plantation which will be incorporated into this S&EIA process.

1.2.2 Description of the activities to be undertaken

The second phase of the rehabilitation plan includes the construction and operation of a B-DAS Treatment Plant. B-DAS technology refers to a system composed of:

- Alkaline material, which in this system is barium carbonate ($BaCO_3$); and

- A Dispersed Alkaline Substrate (DAS) which includes an inert high-surface medium (in this case wood chips) mixed with fine-grained alkaline material, such as limestone sand.

These elements combine (refer to Figure 1-2) to create a passive or semi-passive system useful for treating contaminants found in mine drainage water, whether it is acidic, neutral or alkaline in nature. The B-DAS system will be installed in an above-ground 2 m deep concrete dam, within which the mine water will be treated. The dam will require regular mechanical cleaning and, as such, the system will be taken offline every three months (Resolution Circle, 2016; Erusmus, et al., 2018).

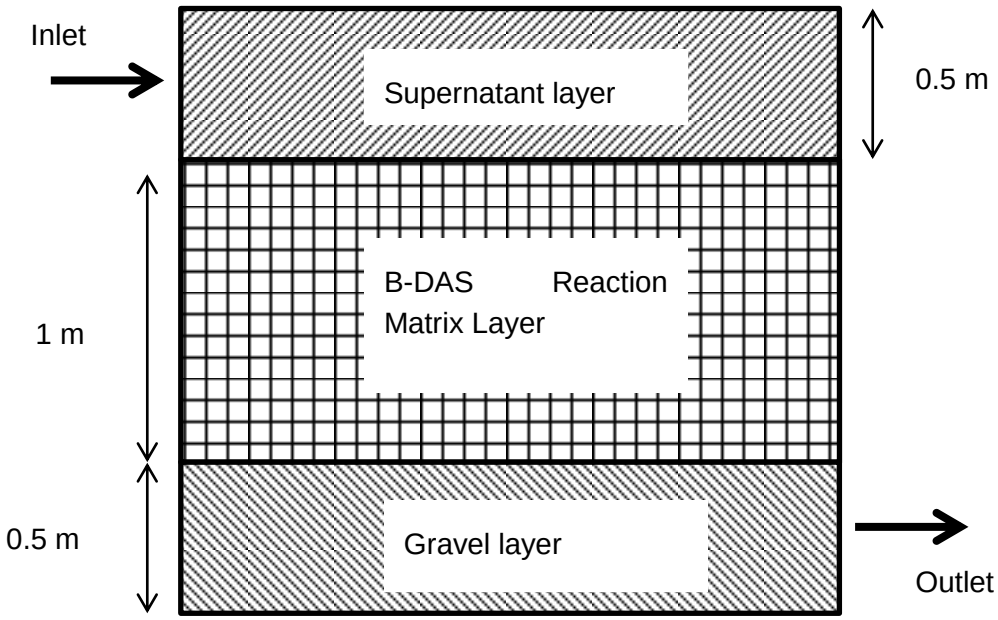

Figure 1-2: Schematic presenting a profile of the proposed B-DAS Treatment Dam layout, adapted from Resolution Circle (2016)

The proposed implementation of the B-DAS dam follows a pilot programme which was implemented between September 2015 and January 2017 at the Kilbarchan Colliery. Tests conducted during the pilot phase indicate that the system is effective within this specific mine-affected context as the B-DAS system in the pilot programme improved the quality of the mine-affected water through removing most of the metals and anions in the water to concentrations accepted by the South African National Standards (SANS) 241: 2006 & 2011 regulation for drinking water (Erusmus, et al., 2018).

1.3 Terms of reference

The agreed Terms of Reference (ToR), for the fauna and flora assessment, include a desktop review, field investigation and report compilation. The precise methodologies employed are elaborated on in Section 4.

- Determine the vegetation communities and faunal habitats occurring within the study area and map;
- Determine the presence of any alien invasive flora species;
- Determine the presence of any Species of Special Concern (SSC) including SA red list, IUCN red list, CITES species, protected trees, nationally protected species and provincially protected species of both plants and animals;
- Determine the ecological sensitivity of the study area and map this;
- Determine the impacts of the proposed project on the flora and fauna of the study area;
- Recommend mitigation measures to reduce the expected impacts of the proposed project on the flora and fauna of the study area.

2 Details of the Specialist

Rudi Greffrath (*Pr.Sci.Nat*.) is Digby Well's Biodiversity Manager and has a National diploma and B-tech in Nature Conservation from Nelson Mandela Metropolitan University's George Campus and is affiliated to the South African Council for Natural Scientific Professions as a *Professional Natural Scientist* in the field of practice *Conservation Science,* registration # *400018/17*. He has eleven years' experience in the environmental consulting field specifically in the terrestrial ecology within the Highveld grasslands and Savanna regions of Southern and Central Africa and the forest regions of central and West Africa. He specialises in fauna and flora surveys, biodiversity surveys, environmental management plans, environmental monitoring and rehabilitation for projects in accordance with the International Finance Corporation (IFC) and World Bank. Rudi has gained experience working throughout Africa specifically DRC, Sierra Leone, Ghana, Mali, Botswana, Namibia and Cote D'Ivoire

3 Aims and Objectives

Information generated from this survey was used to identify the potential impacts that the construction and operational activities will have on the environment. In order to achieve this aim the following objectives were considered for this specialist study:

- To delineate the various vegetation/habitat types and describe their sensitivity, present within the study area;
- To determine if any flora and fauna species or assemblages will be directly impacted upon by the water treatment, this includes flora and fauna communities present, the ecological state of these communities, identification of possible Red Data species

(according to the International Union for the Conservation of Nature (IUCN) as well as considering National and Provincial criteria), and;

- To determine mitigation measures for the identified impacts in order to reduce the severity of these impacts. In cases where impacts cannot be mitigated, areas may be regarded as 'no-go' owing to the presence of critical habitat.

4 Methodology

4.1 Flora

The flora assessment was comprised of both a desktop and a field investigation component.

4.1.1 Desktop Assessment

The desktop component involved the generation of a checklist of expected flora for the site, from available data sources. Potential Species of Special Concern (SSC) were listed, whereby the national red-data lists, as well as the provincially protected plants lists were consulted.

The regional vegetation for the greater study area was accessed (Mucina and Rutherford, 2006) and broad preliminary habitats were identified using aerial imagery, to be ground-truthed when field studies commenced. The phase 1 fauna and flora report, completed by Digby wells in 2016, was also consulterd for background information research, in addition the following literature and databases were consulted:

- PRECIS (PREtoria Computerised Information System). This plant taxonomy database provides information for species that occur in southern Africa and follows the format of Germishuizen and Meyer, 2003. The database is accessed on the Plants Of Southern Africa (POSA) website and is updated every two months (posa.sanbi.org);
- Kwazulu-Natal Nature Conservation Management Amendment Act, 1999. (Act no. 5 of 1999) – Schedule six: protected plant species and,
- Fauna and Flora Specialist report for phase 1, whcich consisted of a Closure Plan and Basic Assessment;
- Vegetation Map of Southern Africa (Mucina and Rutherford, 2012).

4.1.2 Field Investigation

A varied Braun-Blanquet method was used whereby vegetation is studied by means of aerial/satellite imagery based on physiognomic characteristics. Vegetation communities present on the B-DAS Treatment Plant footprint where then surveyed by means of line-point transects for grasses, sedges and forbs, as well as belt transects for shrubs and trees. Data obtained from these surveys where then subject to analysis to establish differences or similarities between observed communities and seasonal variation.

Vegetation communities were already established with previous studies, this survey identified all species found over different seasons within the vegetation communities including Red Data, protected and endemic species. Baseline National Herbarium Pretoria (PRE) Computerised Information System (PRECIS) data from South African National Biodiversity Institute (SANBI) for the project area, and the TOPS list of protected species where used to compile a list of Red Data plant species that may potentially occur within the study area. A sweep of the area was conducted to mark all species of concern found within the proposed B-DAS Treatment Plant. The site was walked along parallel transects by the flora specialist. Species of concern were marked with a GPS.

The Braun-Blanquet floristic-sociological approach recognizes units by the floristic composition and abundance. This methodology is easier and quicker to use than the alternative point-survey or wheel-point methodology, results in a reliable estimate of cover abundance and it is the most widely used approach for vegetation studies.

The Braun-Blanquet method incorporates seven cover-abundance categories as listed in Table 4-1. A general species list was also compiled from random traversing through the site.

For grassland areas, species were recorded for random sample plots throughout the site, where dominance, composition and structure were recorded.

Table 4-1: Braun-Blanquet Analysis cover Abundance

Cover Abundance	Category
One or few individuals.	r
Occasional and less than 5% of total plot area.	+
Abundant and with very low cover, or less abundant but higher cover; in any case less than 5% cover of total plot area.	1
Very abundant and less than 5%, or 5-25% cover, of a total plot area: ▪ 2m – Very abundant ▪ 2a – 5-12.5 % cover, irrespective of number of individuals ▪ 2b – 12.5-25% cover, irrespective of number of individuals	2

4.2 Fauna

As with the flora component, the faunal study included a desktop assessment prior to field studies. This phase is important as expected habitats are identified that require special attention when field investigations take place.

4.2.1 Desktop Assessment

Probability lists were generated for the following animal groups:

- For birds, the South African Bird Atlas Project (SABAP 2) was accessed for expected species lists for the area;

- For mammals, information about species habitat requirements and distribution was obtained from Friedman & Daly (2004). Lists from previous studies from projects in the close vicinity for the area were recorded including SANBI (www.sanbi.org);
- For reptiles, information about the distribution of species is available online on the South African Reptile Conservation Atlas (SARCA) (2010);
- For amphibians, information about the distribution of species is found on FrogMAP on the Animal Demography Unit website (http://vmus.adu.org.za). Species habitat and taxonomy data was accessed from du Preez and Carruthers (2009) and
- For butterflies, species distribution maps are published online by the South African Butterfly Conservation Atlas (SABCA, 2010).

4.2.2 Field Investigation

The B-DAS Treatment Plant study area and surroundings were traversed by foot, noting the presence of animals on site or evidence of animal activity, such as pellets, spoor, nests and burrows. Suitable microhabitats, such as rocky outcrops, were investigated were present. Visual sightings and ecological indications were used to identify the larger mammal inhabitants of the study area; this includes scats, tracks and habitat such as burrows and dens. Scats found were collected (if required), photographed with a scale along with any tracks observed and identified.

- For mammals, opportunistic sightings were recorded for small and large mammals. Small mammals were sampled using Sherman traps, placed strategically at intervals within the properties and areas that would potentially harbour animal activity (eg.: rocky outcrops (Figure 4-1). Traps were baited with peanut butter and left for 12-hour intervals. The following field guides were used for identification purposes:
  - Mammals of Southern Africa (Smithers, 1983);
  - The Mammals of the Southern African Sub-region (Skinner & Chimimba, 2005);
  - Red Data Book of the Mammals of South Africa (Friedman & Daly 2004) and
  - The Kingdon field guide to African Mammals (Kingdon, 1997).
- For birds, all opportunistic sightings were recorded and particular attention was focused on those habitats within the project area that have a higher propensity to harbour greater species diversity. Birds were recorded by both call and sight and their identification was confirmed using the guides: Sinclair *et al*. (2012) and Robert's Birds (2009).
- For herpetofauna (reptiles and amphibians), direct and opportunistic observations were conducted along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the project area were identified and recorded. Another method used was refuge examinations using visual scanning of terrains to record smaller herpetofaunal species which often conceal

themselves under rocks and in fallen logs, rotten tree stumps, under rocks, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Amphibians and reptiles were also observed by people residing in the study area were recorded. The following field guides were used for identification purposes:

- Branch (2001);
- Caruthers (2009) for frog calls;
- Du Preez and Caruthers (2009) and Carruthers (2009)

- For invertebrates, butterflies were photographed and recorded using Woodhall (2005).

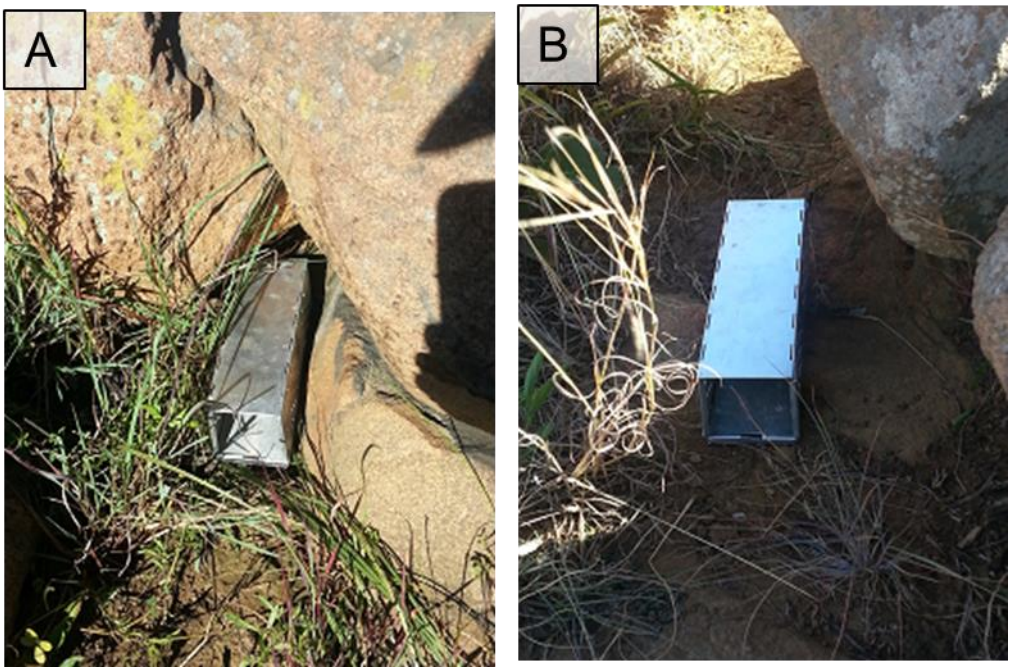

Figure 4-1: Examples of Sherman Traps positioned on Site

5 Consideration of Alternatives

No Project alternatives have been considered in this assessment. There are some potential alternatives with respect to the construction and operation of the B-DAS plant. These alternatives include the shape, size and dimensions of the proposed dam (Resolution Circle, 2016). These alternatives are not foreseen to affect the identification and assessment of potential impacts to heritage resources and are therefore not considered.

The no-go alternative assumes that the proposed activity does not go ahead and implies the status quo remains unchanged. In this case, the no-go alternative refers to a situation in which the decanting mine-affected water is not treated or released into the Ingagane Catchment in a controlled manner. In this instance, the untreated mine-affected water will

have negative impacts on the quality of the water in the Ingagane Catchment, which may have additional negative environmental and social impacts.

6 Assumptions and Limitations

The following limitations were encountered during this study:

- Certain identifying features of plants (such as seeds, flowers and leaves), for certain species, were not present due to the time of sampling and as a result of this, not all plant species were recorded.
- Due to the timing and the brevity of the site investigation (2-4 May) being in early May, the majority of the summer migrant species had already departed southern Africa and this had an impact on the full representative species diversity for the project site; and
- Field investigations did not include a night survey, and for this reason, nocturnal species (specifically bat species) were not recorded.

7 Baseline Environment

7.1 Locality

The study area is located approximately 5km south of the town of Newcastle in the Amajuba District Municipality (DM), northern KwaZulu-Natal Province (Figure 7-1). The site falls within the quarter degree squares (QDS) 2729DD and 2730CC, on the farms: Carrick 7298, Greenwich 8487, Knockbrex 9018, Kilbarchan 2969, Tiger Kloof 3333, Macalman 4254, Chivelston 6742 and Libellaw 12066. The site falls within the Quaternary Catchment V31K, the Ventersprui River Catchment, which has been allocated an ecological sensitivity of low to marginal (DWAF 2005).

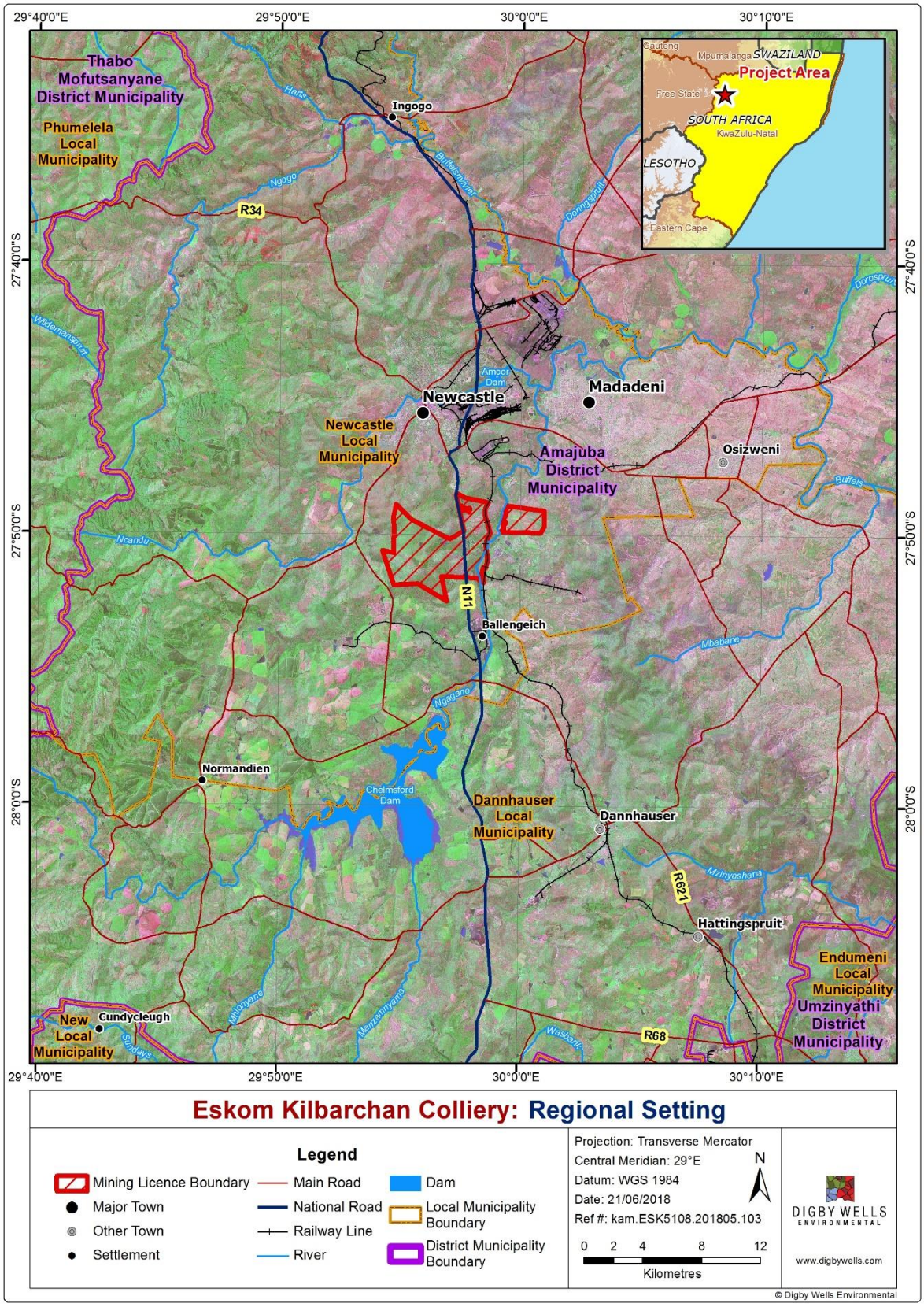

Figure 7-1: Locality of the Study Area within the Regional Setting

7.2 Regional Vegetation

As represented in Figure 7-2, the study area is located within the regional vegetation types: Northern KwaZulu-Natal Moist Grassland, Northern KwaZulu-Natal Shrubland and Kwazulu-Natal Highland Thornveld. The species listed for these vegetation types represent the reference condition for vegetation in the study area and as a consequence, may differ significantly from the reality, post-disturbance. The Mean Annual Participation (MAP) for the region is 840 mm, mainly as thunderstorms. Summers are hot (max 28°C) and frosts are severe (lasting up to 20 days).

7.2.1 Kwazulu-Natal Highland Thornveld

The Kwazulu-Natal Highland Thornveld occurs as scattered patches throughout the central-northern regions of Kwazulu-Natal, where it occurs on both dry valleys and moist uplands. It occupies the eastern areas of the site and the landscape is comprised of hilly, undulating plains and broad valleys of grassland and patches of savanna. Yellow-brown soils over plinthic sub-soil and shallow duplex soils are common. Common and characteristic species of this vegetation unit are represented in Table 7-1.

Acacia Name Change

The International Code of Botanical Nomenclature, the official botanical names authority, made a decision in July 2005 to reserve the name *Acacia* for Australian species only. Both Africa and Australia had been sharing the genus name for two distinctly different groups of species and a final call had become a necessity. The *Acacia* name change has been a matter of dispute for over a decade but it is important to note that the change is now official. The reasons for voting *Acacia* as an Australian type were numerous, primarily owing to the fact that over 1000 *Acacia*'s (many that are endemic) are to be found in Australia, making up the largest genus in the country. In addition, the *Acacia* has significant cultural and traditional value as a symbol in the Australian coat of arms. A taxonomic *revision of African Acacia's* is underway and all species will be renamed into either *Vachellia* or *Senegalia*.

Table 7-1: Plant Species of the Kwazulu-Natal Thornveld

Plant Form	Species
Trees:	*Acacia sieberiana var. woodii (d), A. natallitia, A. nitolica, Cussonia spicata* and *Ziziphus mucronata*.
Tall shrubs:	*Dichrostachys cinerea.*
Low shrubs:	*Barleria obtusa (d), Anthospermum rigidum subsp. pumilum, Chaetecanthus setiger, Gymnosporia heterophylla* and *Thesium costatum.*

Plant Form	Species
Graminoids (grasses and sedges):	*Abiljaardia ovata (d),* ***Andropogon eucomus*** *(d), Aristida bipartita (d), A. congesta (d), Chloris virgate (d),* ***Cynodon dactylon*** *(d), Elionurus muticus (d), Eragrostis capensis (d),* ***E, chloromelas*** *(d),* ***E. plana*** *(d),* ***E. racemosa*** *(d), E. superba (d),* ***Heteropogon contorus*** *(d), Hyparrhenia hirta (d), Setaria sphacelata (d), Themeda triandra (d), Tristachy leucothrix (d), Andropogon appendiculatus, Brachiaria serrata,* ***Cymbopogon caesius****, C. marginatus, C. popschillii, Cyperus obtusiflorus var. obtusiflorus, Digitaria monodactyla, D. tricholeanoides, Diheteropogon amplectens,* ***Eragrostis curvula****,* ***E. gummiflua****, E. patentissima, Harpochloa falx, Microchloa caffra, Panicum natalense, Setaria nigrirostris,* ***Sporobolus africanus****,* and *S. pyramidalis.*
Herbs:	*Hermannia depressa (d), Becium filamentosum, Chamaecrista mimosoides, Euryops transvaalensis subsp. setilobus,* ***Haplocarpha scaposa*** and *Helichrysum rugulosum.*
Creepers and clilmbers:	*Rhynchosia totta.*
Geophytes:	*Haemanthus montanus.*
Succulents:	*Aloe dominella, A. greenii and Orbea woodii.*

Key: ‘d’ denotes dominant species; Bold denotes species that were identified on site during field investigations.

7.2.2 Northern KwaZulu-Natal Moist Grassland

Situated entirely within the catchment of the Thugela River, the Northern KwaZulu-Natal Moist Grassland lies between the drier Kwazulu-Natal Highland Thornveld and the moist upland vegetation. It occupies the western area of the project site and consists of undulating landscapes supporting tall tussock grassland dominated by *Themeda triandra* and *Hyparrhenia hirta*. Common and characteristic species for this vegetation type are listed in Table 7-2.

Table 7-2: Plant species of the Northern KwaZulu-Natal Moist Grassland

Plant Form	Species
Low shrubs:	*Anthospermum rigidum subsp. pumilum, Erica oatesii, Hermannia geniculata.*
Graminoids (grasses and sedges):	*Alloteropsis semialata subsp. eckloniana (d),* ***Aristida congesta*** *(d),* ***Cynodon dactylon*** *(d), Digitaria tricholaenoides (d), Elionurus muticus (d), Eragrostis patentissima (d),* ***E. racemosa*** *(d), Harpochloa falx (d), Hyparrhenia hirta (d) Themeda triandra (d), Tristachya leucothrix (d), Abilgaardia ovata, Andropogon schirensis, A. appendiculatus,* ***A. eucomus****, Aristida junciformis subsp. galpinii, Brachiaria serrata, Cymbopogon caesius, C. popschilii, Cynodon incompletus, Digitaria monodactyla, D. sanguinalis, Diherteropoon amplectens, D. filifolius,* ***Eragrostis chloromelas,*** *E. plana, E. planiculmis, E. sclerantha, Festuca scabra,* ***Heteropogon contortus****, Hyparrhenia dregeana,* ***Melinis nerviglumis****, Michrochloa caffra, Panicum natalense, Paspalum scrobiculatum, Setaria nigrirostris* and ***Sporobolus africanus.***
Herbs/forbs:	***Acanthospermum australe*** *(d), Argyrolobium speciosum (d), Eriosema kraussianum (d), Geranium wakkerstroomianum (d), Pelargonium luridum (d), Acalypha penduncularis, Chaemaecrista mimosoides,* ***Dicoma anomala,*** *Euryops transvaalensis subsp. setilobus, Helichrysum caespitium, H. rugulosum, Hermannia depressa,* ***Ipomoea crassipes,*** *Pearsonia grandiflora, Pentanisia prunelloides subsp. latifolia, Sebaea grandis, Senecio inornatus, Thunbergia atriplicifolia and Zaluzianska microsiphon.*
Geophytes (bulbs):	*Chlorophytum haygarthii (d), Gladiolus auranticus (d), Asclepias aurea, Cyrtanthus tuckii var. transvaalensis, Gladiolus crassifolius, Hypoxis colchicifolia, H. multiceps, Moreae brevistyla, Zantedeschia rehmannii.*
Succulents:	***Aloe ecklonis,*** *Euphorbia pulvinata, Lopholaena segmentata.*

Key: ‘d’ denotes dominant species; Bold denotes species that were identified on site during field investigations.

7.2.3 Northern KwaZulu-Natal Shrubland

The Northern KwaZulu-Natal Shrubland is distributed patchily within the sub-escarpment grasslands from Ladysmith in the west, to Vryheid in the north-east. Large portions of this vegetation unit are found within the surrounds of Newcastle. Small pockets of shrubs are found on scattered dolerite dykes, with minimal grass cover. Dolerite dykes and sills are the parent material for characteristically heavy clay soils in the area. Common and characteristic species for this vegetation unit are listed in Table 7-3.

Table 7-3: Plant Species of the Northern KwaZulu-Natal Shrubland

Plant Form	Species
Trees:	*Acacia caffra (d), A. natalitia (d), A. sieberiana var. woodii,* ***Cussonia paniculata****, Euclea crispa subsp. crispa, Heteromorpha arborescens var. abyssinica, Hippobromus pauncifloru*s*, Scutia myrtina* and *Ziziphus mucronata.*
Tall shrubs:	***Diospyros lycioides subsp. Lycioides*** *(d), Searsia rehmanniana var. rehmanniana (d), Acokanthera oppositifolia, Asparagus setaceus, Canthium mundianum, Cephalanthus natalensis, Clerodendrum glabrum, Diospyros whyteana, Euclea natalensis subsp. angustifolia, Leonotis leonurus, Lippia javanica, Pavetta gardeniifolia var, gardenifolia, Searisa dentata, S. lucida, S. pentheri, S. pyroides, Scolopia zeyheri.*
Low shrubs:	*Barleria obtusa (d), Anthospermum rigidum subsp. pumilum, Artemisia afra, Chaetecanthus burchellii, Euryops pedunculatus, Grewia hispida, Phyllanthus glaucophyllus* and *Pygmaeothamnus chamaedendrum.*
Creepers and climbers:	*Clematis brachiata, Dalbergia obovata, Dioscorea sylvatica, Jasminum breviflorum, Rhoicissus tridenta* and *Sarcostemma viminale.*
Graminoids (grasses and sedges):	***Cymbopogon caesius*** *(d),* ***Eragrostis racemosa*** *(d),* ***Hyparrhenia hirta*** *(d****), Themeda triandra*** *(d), Bothriochloa insculpta, Cymbopogon nardus, Eragrostis curvula, E. plana, Hyparrhenia dregeana* and *Setaria sphacelata.*
Herbs/forbs:	*Acalypha caperonioides, A. punctata, Aster bakerianus,* ***Commelina africana****, Conyza obscura, Corchorus confuses, Crabbea angustifolia,* ***Dicoma anomala****, Eriosema cordatum, Helichrysum rugulosum, Ipomoea oblongata, Monsonia angustifolia, Selago densiflora* and *Stachys natalensis*.
Geophytes (bulbs):	*Cheilanthes hirta, C. quadripinnata, Hypoxis rigidula var. pilossima,* ***Ledebouria ovatifolia****, Oxalis obliquifolia, Pellaea calemelanos* and *Raphionacme hirsuta.*
Succulents:	*Aloe maculata* and ***Crassula alba.***

Key: ‘d’ denotes dominant species; Bold denotes species that were identified on site during field investigations.

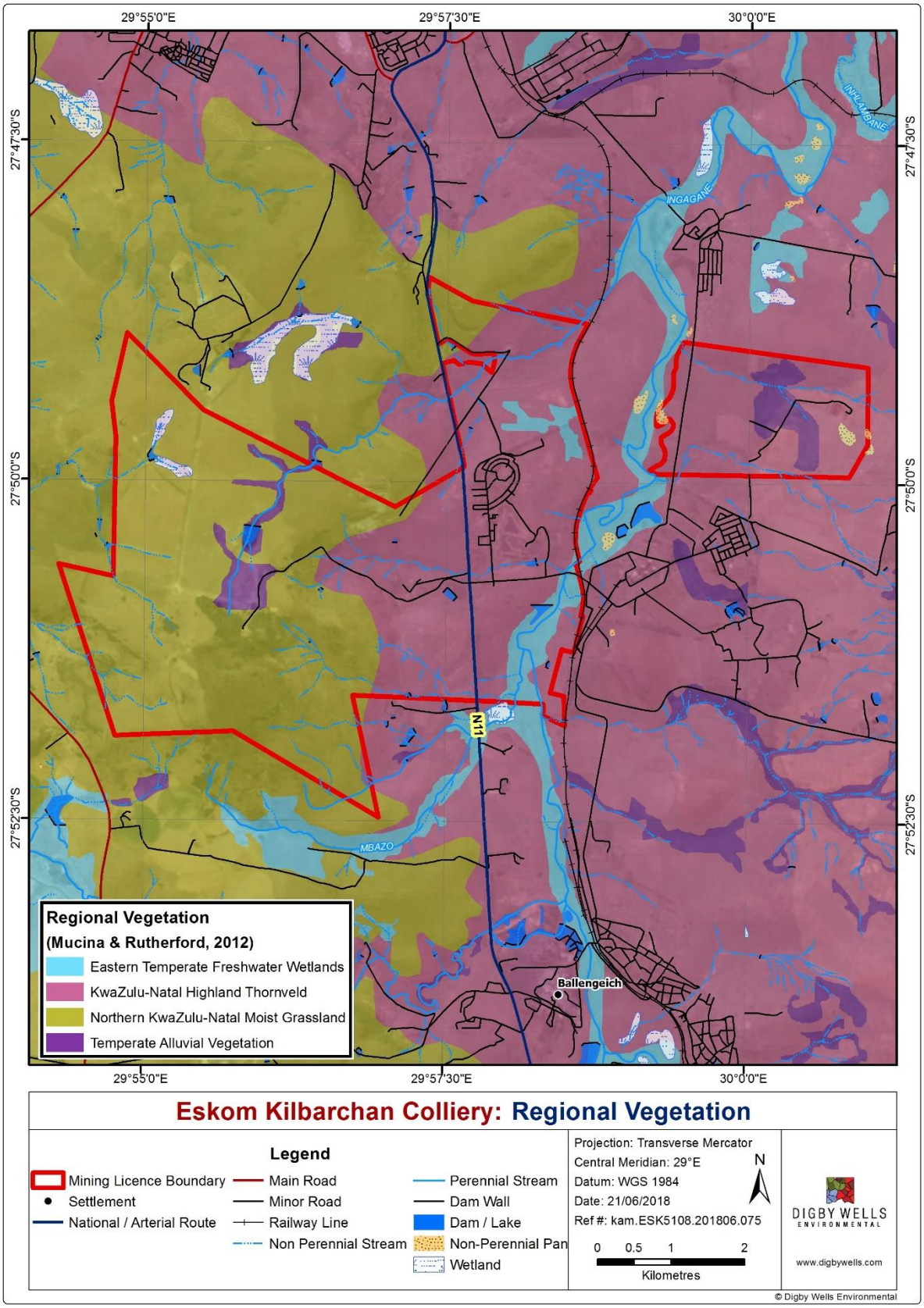

Figure 7-2: Regional Vegetation

7.3 Findings

7.3.1 Flora

7.3.1.1 Expected flora

Vegetation expected to occur on site can be deduced from the regional vegetation data in Section 7.2, the previous specialist report as well as the species recorded to occur within the QDS in which the study area is found. The study area falls within two of South Africa's nine plant biomes (Mucina and Rutherford 2006), namely: Grassland and Savanna.

A total of 308 plant species were recorded from the expected species lists for the QDS: 2729DD and 2730CC, in which the study site occurs. The Poaceae, Asteraceae and Fabaceae plant families were the most dominant families expected to occur on site. This is in support of what was expected, owing to the occurrence of the site within grassland and savanna (comprised of an upper storey of trees and an understorey of grasses and forbs) habitat.

7.3.1.2 Vegetation Communities

Vegetation communities were delineated based on similarity of species composition and habitat. A large proportion of the larger study area had been altered from its natural state due to mining activities, livestock grazing and grass cutting in the road reserved. The remaining natural vegetation was not managed in a particular way. Owing to the effects of fragmentation, as well as the impacts of grazing cattle, much of the remaining natural vegetation on site had been affected by alien plant species. Further to this, heavy grazing results in a loss of palatable species and an increase in non-palatable ones. A single Red Data species was recorded, namely *Crinum bulbispermum*, which is Declining and listed as provincially Protected.

7.3.1.2.1 Diospyros lycioides – Euphorbia clavarioides Rocky Outcrops

The *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrop community was found on the ridges of hills, where rock was exposed (landscape represented in Figure 7-3). Epilithic plant species that are characteristic of rocky shrublands colonised these areas, including woody plants: *Chrysanthemoides monilifera* (Tick Berry), *Cussonia paniculata* (Mountain Cabbage Tree), *Diospyros lycoides* (Blue Bush) and *Searsia rehmanniana* (Blunt-leaved Current); and an understorey layer comprised of grasses: mostly *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra* (Red Grass) and *Cymbopogon excavatus* (Common Turpentine Grass); and forbs: *Agapanthus caulescens* (Agapanthus), *Pellaea calamelanos* (Hard Fern) in shady crevices, *Euphorbia clavarioides* (Lion's Spore) *Haemanthus humilis* (Rabbit's Ear).

This vegetation was typical of the Kwazulu-Natal Thornveld regional vegetation type described in Section 7.2, covering areas of undulating terrain at the top of hills. Soil depth, where present, was shallow and grasses reached an average height of <1.5cm. Figure 7-4 represents examples of species that are common and characteristic of this vegetation unit. The rocky substrate, as well as the abundance of loose rocks, provided suitable habitat for reptile species. Clumps of *E. clavarioides* (Lion's Spoor) were found throughout this habitat and were found in varying stages of growth (seedlings to well-established adults), which is indicative of healthy population structure and growth. The significance of this is that funnel spiders (from the family: Agelenidae or Dipluridae) were found to make use of the moist, cool stems of *E. clavarioides* or funnel webs (see Section 7.3.2.4).

Figure 7-3: Landscape examples of the *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrops

Figure 7-4: Examples of plant species characteristic of the *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrops (A: *Chrysanthemoides monilifera* (Tick Berry); *Searsia rehmanianna* (Blunt-leaved Current); C: *Cussonia paniculata* (Mountain Cabbage Tree); D: *Pellaea calemelanos* (Hard Fern) and E: *Euphorbia clavarioides* (Lion's Spore))

7.3.1.2.2 Rehabilitated Grassland

Rehabilitated Grassland makes up the majority of the site (485ha) (landscape example in Figure 7-5) and was found to be in varying stages of colonisation. Although basal groundcover was adequate (>30%), species diversity was low. The dominant species comprising Rehabilitated Grasslands unit were: *Sporobolus africanus* (African Dropseed), *Paspalum dilitatum* (Dallis Grass) and *Hyparrhenia hirta* (Common Thatching Grass). The native invasive species, *Seriphium plumosum* (Bankrupt Bush) had colonised areas of rehabilitated grassland nearby to wetland systems. Alien plant species have colonised this unit and were made up of predominantly forb species such as *Gomphrena celesioides* (Balloon Plant) and *Bidens pilosa* (Black Jacks). Figure 7-6 represents examples of species that are common and characteristic of this vegetation unit.

Figure 7-5: Landscape examples of the Rehabilitated Grassland

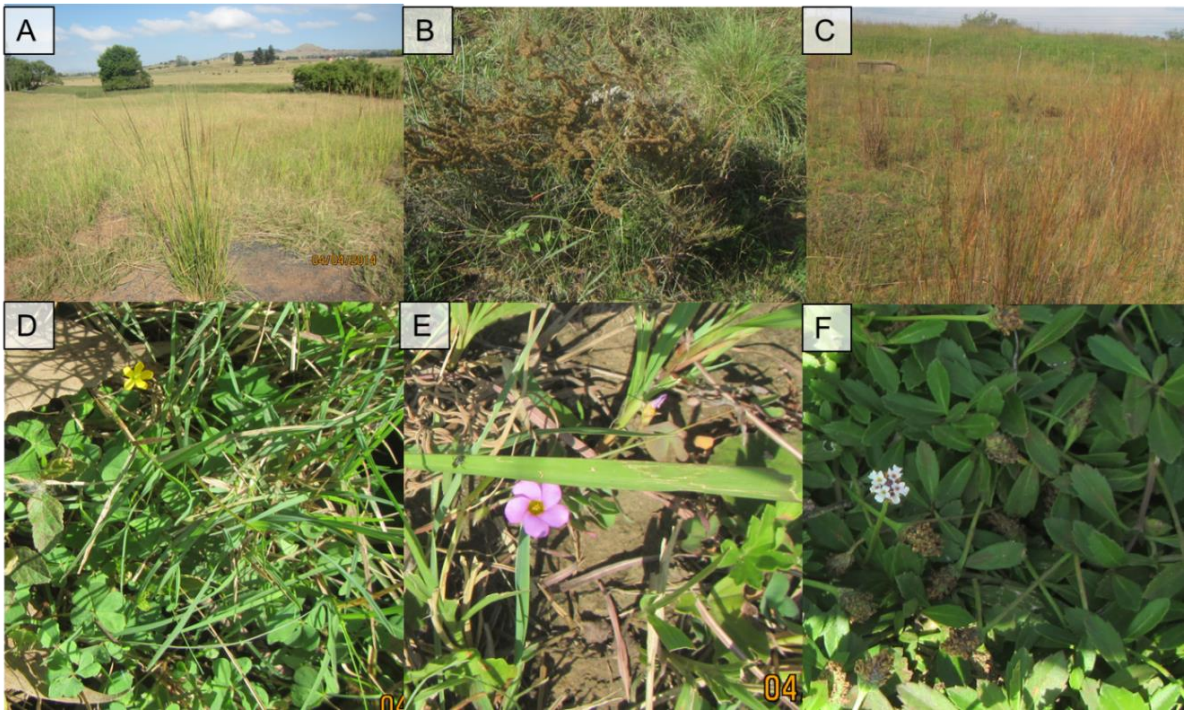

Figure 7-6: Examples of plant species characteristic of the Rehabilitated Grassland (A: *Sporobolus africanus* (African Dropseed); B: *Seriphium plumosum* (Bankrupt Bush); C: *Hyparrhenia hirta* (Common Thatching Grass); D: *Oxalis corniculata* (Creeping Woodsorrel); E: *Oxalis obliquifol*ia (Sorrel) and F: *Pentanisia angustifolia* (Broad-leaved Pentanisia))

7.3.1.2.3 Natural Grassland

Natural grassland covered the lower-lying areas of the site and included an assemblage of grasses, as well as patches of *Vachellia karoo*. Wetland areas were found to occur interspersed throughout the grassland habitat and were comprised of hydromorphic plant species such as *Andropogon eucomus* (Snowflake Grass), *Lipocarpha nana* and *Schoenoplectus* spp. The native invader, *Seriphium plumosum* (Bankrupt Bush) was found in near to monospecific patches adjacent to the wetlands. Examples of common and characteristic plant species of this vegetation unit are found in Figure 7-7.

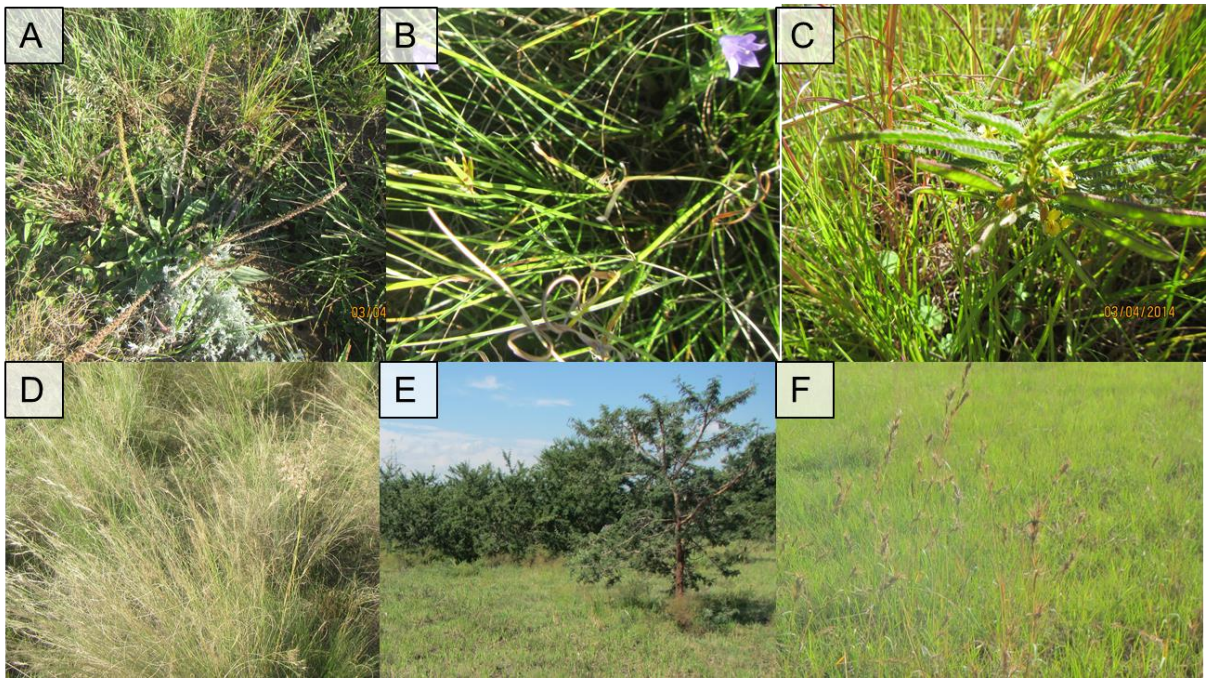

Figure 7-7: Examples of plant species characteristic of the Cymbopogon validus – *Vachellia (Acacia) karoo* Natural Grassland (A: *Plantago major* (Broadleaf Plantain); B: *Wahlenbergia undulata*; C: *Chamaecrista comosa*; D: *Aristida congesta*; E: *Vachellia (Acacia) karoo* (Sweet Thorn) and F: *Cymbopogon excavatus* (Common Turpentine Grass))

The distribution of vegetation units is represented in Figure 7-8.

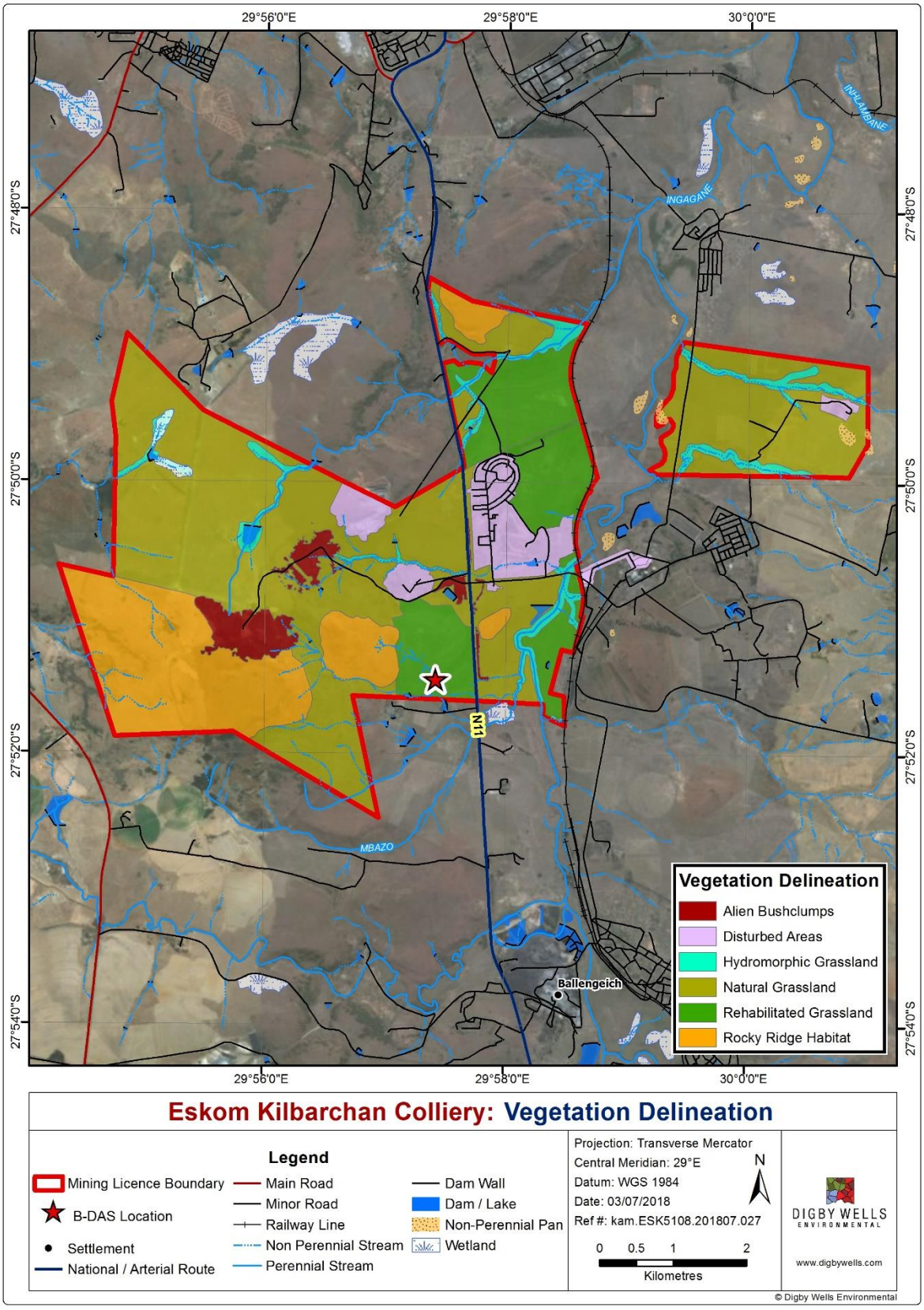

Figure 7-8: Vegetation Habitats

7.3.1.3 Alien Plant Species

Invasion by destructive alien plant species erodes the natural capital of ecosystems, compromises their stability and is a growing problem in South Africa (Richardson and van Wilgen 2004). Alien invasion for the Kilbarchan study area was extensive and well-established in disturbed areas, including alien bushclumps of <6m in height along the national roads, as well as an abundance of alien forbs.

Alien species in South Africa are categorised according to the Alien and Invasive Species Lists, 2014 (GN R599 in *GG* 37886 of 1 August 2014) of the NEMBA (Act 10 of 2004).

The national list of invasive plant species listed in NEMBA represents the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and
- Category 3: Invasive species controlled by activity.

Certain species have different alien invasive categories for different provinces in South Africa. Table 7-4 lists the alien species identified on site as well as their respective alien categories, some examples of the aliens recorded from the site can be seen in Figure 7-9, Three Category 2 plants and six Category 1b plants were recorded on site, the most prominant of which was *Eucalyptus camuldulensis*.

Table 7-4: Alien Plant Species listed for the Study Site

Family	Species	Common Name	Category
Amaranthaceae	*Gomphrena celesioides*	Bachelor's Button	
Asteraceae	*Acanthospermum australe*	Paraguayan Starbur	
	Berkheya rigida	Disseldoring	
	Bidens bipinnata	Black Jacks	
	Cirsium vulgare	Scotch Thistle	1b
	Conyza bonariensis	Flax-leaf Fleabane	
	Cosmos bipinnata	Cosmos	
	Schkuria pinnata	Dwarf Marigold	
	Tagetes minuta	Khakibos	
Convolvulaceae	*Ipomoea purpurea*	Common Morning Glory	1b
Fabaceae	*Acacia dealbata*	Silver Wattle	1b
	Acacia decurrens	Green Wattle	2

Family	Species	Common Name	Category
	Acacia mearnsii	Black Wattle	2
Myrtaceae	*Eucalyptus camuldulensis*	Red River Gum	
Pinaceae	*Pinus patula*	Cluster Pine	2
Solanaceae	*Datura ferox*	Thorn Apple	
	Solanum mauritanum	Bugweed	1b
	Solanum sysimbriifolium	Dense-thorned Bitter Apple	1b
Verbenaceae	*Lantana camara*	Lantana	1b
	Verbena brasiliensis	Brazilian Verbena	
	Verbena officianalis	Common Vervain	

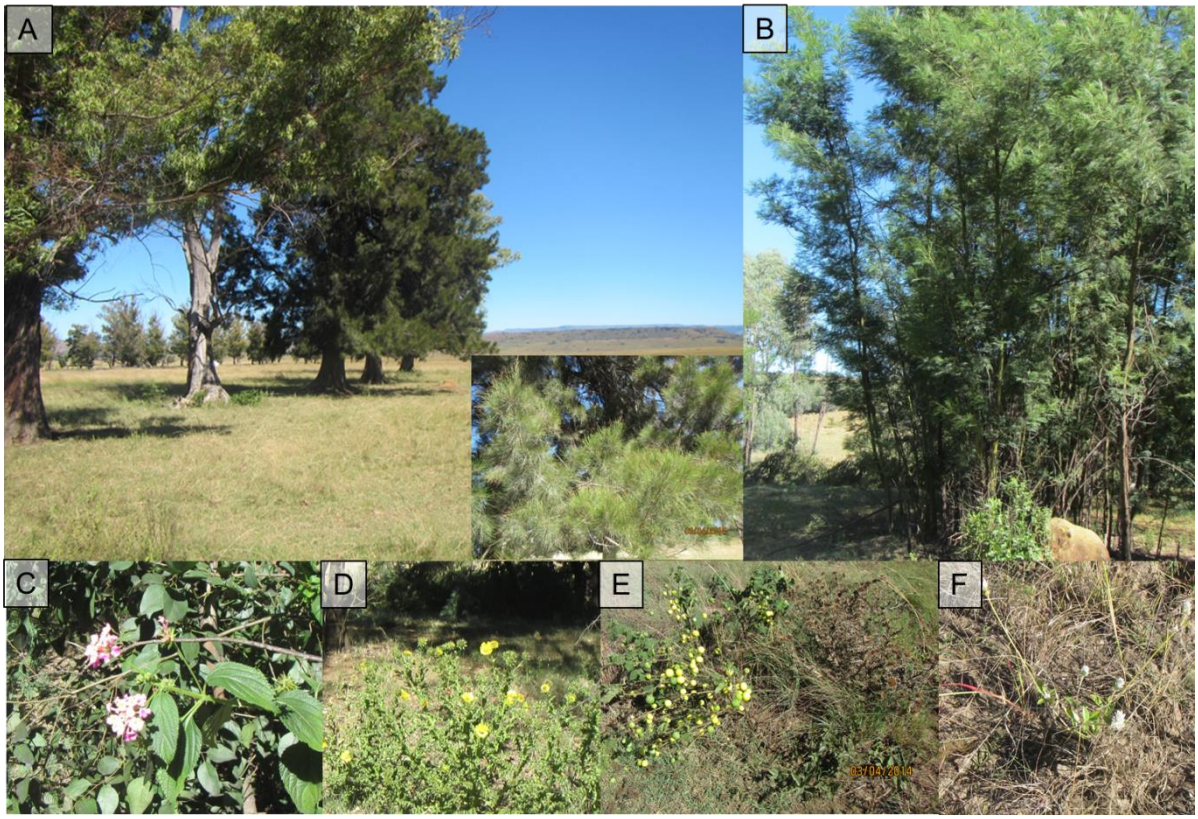

Figure 7-9: Examples of alien plant species identified on site (A: *Eucalyptus* sp. (left) and *Pinus patula* (Cluster-leaf Pine) (right); B: *Acacia decurrens* (Green Wattle); C: *Lantana camara* (Tick-berry Bush); D: *Berkeya rigida* (African Thistle); E: *Solanum sisymbriifolium* (Dense-thorned Bitter Apple) and F: *Gomphrena celesioides* (Bachelor's Button))

7.3.2 Fauna

7.3.2.1 Mammals

Actual sightings, spoor, calls, dropping and nesting sites were used to establish the presence of mammals on the proposed project site. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. The observations of local land owners were used to supplement the findings of the mammal survey. No small mammals such as rodents were caught in the Sherman traps, however some of the traps had been disturbed possibly from larger species.

Although Sherman traps were set in a number of strategic areas they unfortunately did not yield any results as no rodent species were caught. The majority of the farms in the area are involved in agriculture and cattle grazing, and the local farmers were able to give an indication on a number of larger mammal species that are found in the area. Appendix C lists the mammals expected for the area. Mammal activity is most prominent in the Natural Grassland habitat, although it is expected that small mammal activity will be high in the Rehabilitated Grassland habitat as well. *Atilax paludinosus* (Water Mongoose), *Sylvicapra grimmia* (Common Duiker) and *Alcelaphus caama* (Red Hartebeest) were recorded during the field investigations. Evidence of mole activity was also observed, although identification was not possible as individuals were not seen. Examples of evidence of faunal activity on site can be found in Figure 7-10.

The *A. caama* (Red Hartebeest) is not a naturally occurring species and has been introduced to the site. These large antelope occur naturally in the transition zone between grassland and woodland habitat, which is similar to some of the natural area on site (Kingdon 1997). They are known to stay within proximity to water sources and move down drainage lines for grass and water in the dry season. The individual recorded on site was found adjacent to a wetland pan.

The *S. grimmia* (Common Duiker) was found in the Natural Grassland vegetation. These small antelope flourishes in a range of different habitats in woodlands and savanna (Kingdon 1997). They benefit from reduced predation and patches of low secondary growth, even in urban areas.

A. paludinosus (Water mongoose) was observed immediately downstream of the pan, in the Natural Grassland, located on the upper western section of the property. Signs of this species were also identified on the eastern section of the site, within the grassland system and associated steams (Figure 7-10). The Water mongoose is an avid carnivore, consuming any form of aquatic meat it can catch. This mongoose will frequently swim along river banks, its head above the water, patiently and methodically sifting through underwater holes and crevices looking for aquatic animals to eat. The Water mongoose has been observed throwing crabs and snails against rocks in order to break open the shells. It is the remnants of these shells that can be regularly found along the streams within the Kilbarchan project area.

Figure 7-10: Examples of evidence of mammal activity on site (A: *Sylvicapra grimmia* (Common Duiker) droppings located in the eastern grassland section of the property; B: *Atilax paludinosus* (Water Mongoose) droppings and C: mole digging activity)

7.3.2.2 Avifauna

Although the properties owned by Eskom fall within areas where industrial, residential and historic mining activities have taken place, it is the surrounding habitat that shows signs of avifaunal interest. The surrounding areas of Memel (to the west), Chelmsford Nature Reserve (to the south) and Wakkerstroom (to the north-east) have recently gained recognition for bird areas of international importance. Many of the grassland, wetland and rocky outcrop habitats associated with the mining licence area relating to Kilbarchan are similar to the above mentioned Important Bird Areas (IBA's). A total of 66 bird species were recorded on site during the field investigation. Photographic examples of the Red Data species observed are represented in Figure 7-13.

7.3.2.3 Herpetofauna

Amphibians are viewed to be good indicators of changes to the whole ecosystem because they are sensitive to changes in the aquatic and terrestrial environments. Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb 1986). Additionally, amphibians are sensitive to water quality and Ultra-violet (UV) radiation because of their permeable skin (Gerlanc and Kaufman 2005, Taylor *et al.* 2005). Activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006). According to Carruthers (2001), a number of factors influence the distribution of amphibians but because amphibians have porous skin, they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area should provide a number of different species of amphibians.

According to Carruthers (2001), frogs occur throughout every habitat type in southern Africa. A number of factors influence their distribution, and they are generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore, a collection of amphibians associated with the Grassland Biome will all choose to breed under the prevailing biotic and abiotic features present. Within the study area further niche

differentiation is encountered by means of geographic location, this differentiation includes, banks of pans, open water, inundated grasses, rocky outcrops, reed beds, trees, rivers and open ground. Red Data amphibian species are expected to occur on site, especially in and around the pan system on the upper western section of the project area.Table 7-5 represents amphibians associated with the study area. Three frog species were identified on site, namely: *Anhydrophryne hewitti* (Natal Chirping Frog), *Tomopterna marmorata* (Natal Sand Frog) and *Amietia angolensis* (Common River Frog) (as represented in Figure 7-11).

The project site has the propensity to harbour a number of different species due to the type of habitat located within the area. *A. hewitti* (Natal Chirping Frog) and the *T. marmorata* (Natal Sand Frog) have both been identified in the area, and the habitats on site are conducive to harbour both of these species, both of which are listed as Least Concern according to the Red Data Book of Amphibians of Southern Africa.

The *A. hewitti* (Natal Chirping Frog) lives in pockets of dense vegetation in the Drakensberg and the midlands in Kwa-Zulu Natal. It breeds in wet mossy areas in riverine bush and dense vegetation near exposed rocks and rapids. Clutches of 14-40 eggs are laid in moss and leaf-litter on edges of streams. The eggs develop directly without a larval stage (Minter *et al*. 2004).

The *T. marmorata* (Natal Sand Frog) occurs mainly in northern and eastern South Africa, extending into Swaziland and southern Mozambique. It is likely to occur in Lesotho. It ranges from sea level to 2,000 masl. It lives in grassland and savannah, and it can also be found in agricultural habitats. It breeds in shallow temporary, semi-permanent and permanent streams, furrows or vleis, also in still water (but it favours slow-flowing water).

The Common River Frog or Angola River Frog is a widespread and common species occurring mainly on the eastern half of South Africa. However, care needs to be taken when identifying this species as it may be confused with *A. fusigula* (Cape River Frog) or even the rarer *A. dracomontan* (Drakensberg Frog). It is highly unlikely that either of these species would have a distribution overlapping the Kilbarchan site. This species tolerates some habitat disturbance and is frequently associated with human habitation, taking up residence in ditches and ponds often where reed or aquatic vegetation is present. The adults spend most of the day floating amongst the vegetation or basking on rocks at the water's edge. They are skittish and will move quickly from any disturbance with a single jump into the closest deep water area. Breeding takes place all year round, although they are common they are very susceptible to acid pollution and is have been proven that mining has impacted on this species. Individual Common River Frogs where found in two areas of the project site, the stream system to the east and the upper western pan system on the edge of the property.

Table 7-5: Expected and Identified Frog Species for the Study Area

Family	Species	Common Name	Threat Status	Recorded on site
Bufonidae	*Bufo gutturalis*	Guttural Toad	LC	
	Schismaderma carens	Red Toad	LC	
	Heleophryne natalensis	Natal Ghost Frog	LC	
	Kassina senegalensis	Bubbling Kasina	LC	
	Semnodactylus wealii	Rattling Frog	LC	
Pipidae	*Xenopusa laevis*	Common Platanna	LC	
Pyxicephalidae	*Amietia angolensis*	Common River Frog	LC	
	Amietia fuscigula	Cape River Frog	LC	x
	Cacosternum boettgeri	Common Caco	LC	
	Strongylopus fasciatus	Striped Stream Frog	LC	
	Strongylopus grayii	Clicking Stream Frog	LC	
	Anhydrophryne hewitti	Natal Chirping Frog	LC	x
	Tomopterna marmorata	Natal Sand Frog	LC	x
	Tomopterna cryptotis	Tremelo's Sand Frog	LC	
Ranidae	*Ptychadena porosissima*	Striped Grass Frog	LC	

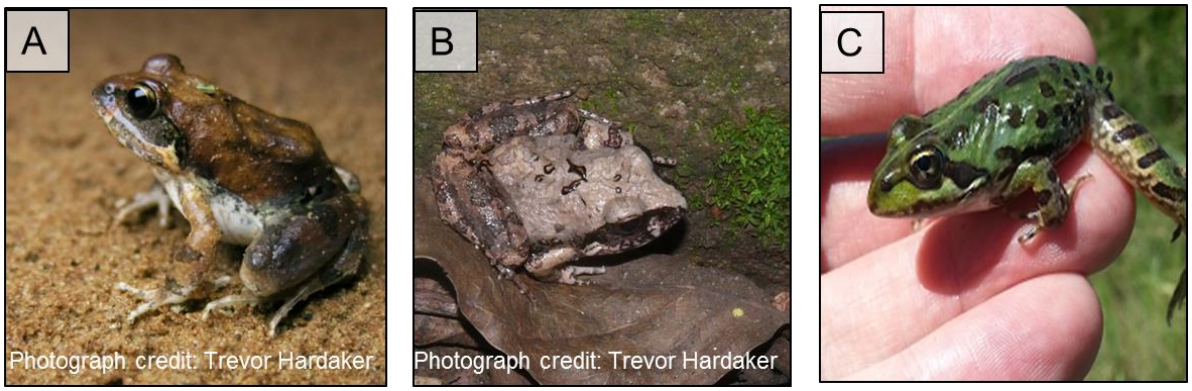

Figure 7-11: Examples of frogs identified on site (A: Natal Sand Frog (Tomopterna natalensis); B: Natal Chirping Frog (Anhydrophryne hewitti) and C: Common River Frog (Amietia angolensis))

Similarly to the amphibians, the reptiles within the project area will prefer certain habitats over others and they are important ecological indicators. Due to amphibians (frogs and toads) being a major food source for a number of reptile species the investigation on the microhabitats can be beneficial in understanding the propensity for both *Class's* to occur.

Reptiles are ectothermic (cold-blooded), meaning they are organisms that control body temperature through external means. As a result reptiles are dependent on environmental heat sources (Savage, 2005). Due to this many reptiles regulate their body temperature by basking in the sun, or in warmer areas. According to Carruthers (2007) substrate is an important factor determining which habitats are suitable for which species of reptile. The presence of and limited availability of rocky out crops within the lower lying regions of the Kilbarchan study area may indicate that only a few reptile species are present.

Reptiles have been recorded previously from the area in which the study site occurs, and are thus expected to occur on site are listed below (. (Alexander and Marais, 2007).

Southern African Python (*Python natalensis*) is listed as "vulnerable" and is by far the largest snake species in Sothern Africa, reaching a maximum length of 5m and a mass of 60kg. The Southern African Python can be found in a variety of micro habitats including tree plantations, rocky outcrops and vlei areas all of which occur on the Kilbarchan site. Although no sign of a Python was observed, the remoteness and surrounding habitat is conducive for the survival of this species.

It is rated as vulnerable in the latest Red Data Book for South Africa and Swaziland mainly because it is exploited for human consumption. It is unlikely that this species will retain this threat classification using the latest IUCN criteria since it appears to be relatively common in protected areas and widespread. Outside the protected areas, the species seems to be on the decline.

Table 7-6: Expected Reptile Species for the Study Area

Family	Species	Common Name
Agamidae	*Agama aculeata*	Ground agama
Colubridae	*Psammophylax tritaeniatus*	Three-lined grass snake
Cordylidae	*Cordylus giganteus*	Giant girdled lizard
	Pseudocordylus melanotus	Drakensberg crag lizard
Gekkonidae	*Lygodactylus ocellatus*	Spotted dwarf gecko
Colubridea	*Psammophylax rhombeatus*	Spotted skaapsteker
Scincidae	*Acontias gracilicauda*	Slendertail lance skink
Pythonidae	*Python natalensis*	Southern African python (V)
Typhlopidea	*Typhlops bibronii*	Bibrons blind snake
Leptotyphlopidae	*Leptotyphlops scutifrons*	Peters thread snake
Aparallactus	*Aparallactus capensis*	Black Headed centipede-eater
Homoroselaps	*Homoroselaps lacteus*	Spotted harlequin snake
Colubridea	*Lycodonomorphus rufulus*	Common water snake
	Lamprophis capensis	Brown house snake
	Lamprophis inornatus	Olive house snake
	Lamprophis guttatus	Spotted rock snake
	Lamprophis aurora	Aurora house snake
	Lycophidion capensis	Common wolf snake
	Duberria lutrix	Common slug eater
	Pseudaspis cana	Mole snake
	Dasypeltis inornata	Southern brown egg-eater
	Crotaphopeltis hotamboeia	Herald snake
Elapidea	*Elapsoidea sundevalli*	Sundevall's garter snake
	Hemachatus haemachatus	Rinkhals
Viperidea	*Causus rhombeatus*	Rhombic night adder
	Bitis arietans	Puff adder
Varanidea	*Veranus niloticus*	Water monitor
Scincidea	*Acontias breviceps*	Short headed legless skink
	Trachylepsis varia	Variable skink
	Trachylepsis striata	Striped skink

Family	Species	Common Name
Pelomedusidae	*Pelomedusa subrufa*	Marsh terrapin

7.3.2.4 Invertebrates

Insects are the most abundant macroscopic organisms in terrestrial and aquatic habitats (Picker *et al.* 2004). Human threats pose significant threats to insect populations. Threats to butterflies in South Africa include: the establishment of alien invasive vegetation, changing fire regimes (either increased or reduced frequency), agricultural activities, urbanisation, plantation forestry, increased grazing and road construction (Ball 2006). The Kilbarchan study site was found to be in butterfly species during the field investigation. Thirteen butterfly species were recorded for the QDS' in which the study occurs, according to the Southern African Butterfly Conservation Assessment (SABCA), 2011.

Figure 7-12 represents examples of invertebrates that were recorded on site and includes a newly developing or previously undocumented relationship between the Agelenidae or Dipluridae family (commonly known as the 'funnel spiders') and the succulent plant, *Euphorbia clavarioides* (Lion's Spore). Owing to the location of the study area in northern Kwazulu-Natal, the funnel spider in question is likely to be *Agelena zuluana*. The funnel spider is known to use abandoned animal burrows and tufts of grass in order to spin/suspend a funnel-web to capture prey. *E. clavarioides* is a secure retreat for the spider, as it has a secure base and many projecting branches for spinning/suspending a funnel-web. The brightly coloured flowers of *E. clavarioides* may further aid in attracting pollinating insects that may fall prey to the funnel spiders.

Table 7-7: Invertebrates Recorded on Site

Family	Species Name	Common Name	Threat Status
Acraenae	*Acraea satis*	Chirinda Acraea	LC
	Acraea rahira rahira	Marsh Acraea	LC
	Acraea natalica natalica	Natal Acraea	LC
Nymphaliidae	*Danaus chrysippus aegyptius*	African Monarch	LC
	Hypolimnas misippus	Diadem	LC
	Junonia hierta cebrene	Yellow pansy	LC
	Junonia orithya madagascariensis	Ox-eyed pansy	LC
	Lachnoptera ayresii	Blotched leopard	LC

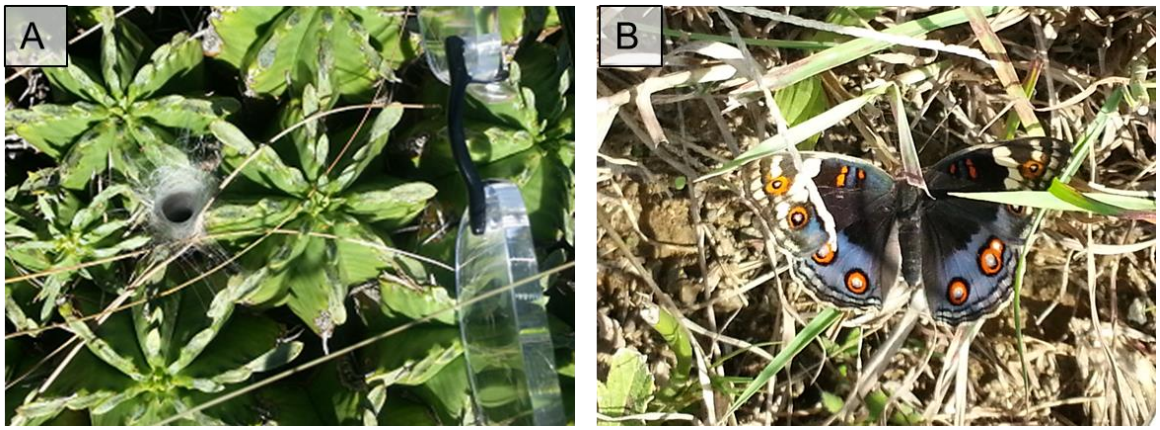

Figure 7-12: Examples of invertebrate sightings (A: funnel spider web (belonging to either of the family Agelenidae or Dipluridae) on *Euphorbia clavarioides* individual and B: *Junonia orithya madagascariensis* (Ox-eyed Pansy))

7.3.3 Species of Special Concern

The International Union of Conservation Networks (IUCN) is the international authority for Red Data species. In South Africa, the Threatened Species Programme (TSP) undertakes this role, in collaboration with the South African National Biodiversity Institute (SANBI). SSC for the purpose of this report, include any Red Data, Nationally Protected and Provincially Protected species recorded on site. The Red Data listed flora and fauna species are identified on site were classified according to the following categories:

- Extinct (EX) – No known individuals remaining;
- Extinct in the Wild (EW) – Known only to survive in captivity, or as a naturalized population outside its historic range;
- Critically Endangered (CR) – Extremely high risk of extinction in the wild;
- Endangered (EN) – High risk of extinction in the wild;
- Vulnerable (VU) – High risk of endangerment in the wild;
- Near Threatened (NT) – Likely to become endangered in the near future;
- Least Concern (LC) – Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category;
- Data Deficient (DD) – Not enough data to make an assessment of its risk of extinction and

- Not Evaluated (NE) – Has not yet been evaluated against the criteria.

7.3.3.1 Flora SSC

The POSA online checklist provides a reliable indication of plant species expected to occur in any given area, using QDS data. A total of ten plant SSC are expected to occur within the QDS 2729DD and 2730CC, three of which, were listed as Declining, and nine of which were Provincially Protected. According to the seventh schedule of the Kwazulu-Natal Nature Conservation Act (Act no. 5 of 1999), all members of the Amaryllidaceae family and *Gladiolus* genus are protected. Table 7-8 lists plant SSC for the Kilbarchan study area. Whilst not all of these were recorded during the field investigations, this does not necessarily infer that these and additional species do not occur.

Table 7-8: Expected Plant SSC for the Kilbarchan Study Area

Family	Species	Status (SA)
Amaryllidaceae	*Brunsvigia grandiflora*	LC; Protected
	*Crinum bulbispermum**	Declining; Protected
	Cyrtanthus breviflorus	LC; Protected
	Haemanthus humilis Jacq. subsp. hirsutus	LC; Protected
	Scadoxus puniceus	LC; Protected
Hypoxidaceae	*Hypoxis hemerocallidea**	Declining
Iridaceae	*Gladiolus crassifolius*	LC; Protected
	Gladiolus papilio	LC; Protected
	Gladiolus permeabilis	LC; Protected

* Denotes species that were recorded on site

7.3.3.1.1 Medicinal Plants

Ethnobotany is a branch of botany that places focus on the use of plants for medicines and other practical purposes. The use of native plants for ethnobotanical uses can be detrimental to populations that are overexploited.

South Africa has a rich diversity of medicinal plants that not only have a global significance, but also have a cultural and historical role (van Wyk *et al.* 2009). There is a rapidly growing concern for conservation of medicinal plants that are dwindling in number due to illegal harvesting (Institute of Natural Resources 2003). This is particularly apparent in rural areas where medicinal plants are overexploited by traditional doctors. Table 7-9 represents the medicinal species recorded on site. Seven medicinal plants have been identified.

Table 7-9: Medicinal Plants Identified on Site and their Uses (van Wyk *et al.* 2009)

***Acacia karroo* (Sweet Thorn) LC**
Bark and leaves are a Cape remedy for diarrhoea and dysentery. The gum, bark and leaves have also been used as an emollient and astringent for colds, conjunctivitis and haemorrhage. The gum is used as a remedy for oral thrush.
Asparagus spp.
Used for the treatment of tuberculosis, kidney ailments and rheumatism.
***Centella asiatica* (Pennywort) LC**
Used for the treatment of leprosy wounds and skin cancer. Widely used for the treatment of fever, syphilis and as a diuretic and purgative.
***Datura stramonium* (Thornapple) Alien**
Leaves are used in traditional medicine for pain relief. Fresh warm leaves may be used as a poultice to relieve the pain of rheumatism, gout, abscesses and boils. Fresh fruit often applied locally to relieve toothache.
Olea europoea (Wild Olive) LC
The primary medicinal use for this plant is as a hypertensive for low blood pressure and to enhance renal function. A bark infusion is also taken to relieve colic, while a leaf infusion is used as an eye lotion.
Pellaea calamelanos* (Hard Fern) *LC
Leaves are smoked for head colds, chest colds and asthma. Decoctions of rhizomes are used traditionally for the treatment of boils, abscesses and internal parasites.
***Scabiosa columbaria* (Wild Scabiosa) LC**
Used as a remedy for colic and heartburn. Dried roots used to treat wounds after being roasted.

7.3.3.2 Fauna SSC

No mammal or herpetofauna SSC were recorded on site during the survey in April 2014. Additional SSC may occur and their absence during this investigation does not infer that they do not occur at all. Two bird SSC of international concern and an additional two birds of national conservation concern were recorded for the Kilbarchan site (as represented in Figure 7-13). Twenty six birds have the potential to occur on site. Sixteen potentially occurring mammal SSC have been listed, five of which are bat species. Table 7-10 lists all faunal species expected and recorded on site.

Table 7-10: Faunal SSC

Full Name	*Scientific Name*	Global Red List Status_2013	South Africa Status_2014	Identified on site
Avifauna				
Wattled Crane	*Bugeranus carunculatus*	VU	CR	
White-winged Flufftail	*Sarothrura ayresi*	CR	CR	
Botha's Lark	*Spizocorys fringillaris*	EN	EN	
Cape Vulture	*Gyps coprotheres*	VU	EN	
Grey Crowned Crane	*Balearica regulorum*	EN	EN	x
Black Harrier	*Circus maurus*	VU	EN	
Rudd's Lark	*Heteromirafra ruddi*	VU	EN	
African Marsh-Harrier	*Circus ranivorus*	LC	EN	x
Black Stork	*Ciconia nigra*	LC	VU	
Denham's Bustard	*Neotis denhami*	NT	VU	
Bush Blackcap	*Lioptilus nigricapillus*	NT	VU	
Crowned Eagle	*Stephanoaetus coronatus*	NT	VU	
African Grass-Owl	*Tyto capensis*	LC	VU	
Southern Bald Ibis	*Geronticus calvus*	VU	VU	x
White-bellied Korhaan	*Eupodotis senegalensis*	LC	VU	
Yellow-breasted Pipit	*Anthus chloris*	VU	VU	
Verreauxs' Eagle	*Aquila verreauxii*	LC	VU	
Lanner Falcon	*Falco biarmicus*	LC	VU	
Secretarybird	*Sagittarius serpentarius*	VU	VU	
African Snipe	*Gallinago nigripennis*	LC	VU	x
Pallid Harrier	*Circus macrourus*	NT	NT	
African Rock Pipit	*Anthus crenatus*	LC	NT	
European Roller	*Coracias garrulus*	NT	NT	
Abdim's Stork	*Ciconia abdimii*	LC	NT	
Blue Crane	*Anthropoides paradiseus*	VU	NT	
Maccoa Duck	*Oxyura maccoa*	NT	NT	

Full Name	*Scientific Name*	Global Red List Status_2013	South Africa Status_2014	Identified on site
Mammals				
Marley's Golden Mole	*Amblysomus marleyi*	EN	EN	
Rough-haired Golden Mole	*Chrysospalax villosus*	EN	CE	
Short-eared Trident Bat	*Cloeotis percivali*	EN		
Large-eared Free-tailed Bat	*Otomops martiensseni*	NT	NT	
Natal Free-Tailed Bat	*Mormopterus acetabulosus*	VU	VU	
Lesser long-fingered Bat	*Miniopterusftaterculus*	VU	VU	
Greater Musk Shrew	*Crocidura flavescens*	VU	VU	
Water Rat	*Dasymys incomtus*	NT	NT	
White Tailed Rat	*Mystromys albicaudatus*	VU	VU	
Aardwolf	*Proteles cristata*	VU	VU	
Aardvark	*Orycteropus afer*	VU	LC	
African striped weasel	*Poecilogale albinucha*	VU	LC	
Oribi	*Ourebia ourebia*	EN	LC	
Brown Hyaena	*Hyaena brunnea*	NT	NT	
Serval	*Leptailurus serval*	NT	LC	
Spotted necked otter	*Lutra maculicollis*	NT	-	

Figure 7-13: Examples of avifauna recorded on site (A: African Marsh Harrier (*Circus ranivorous*); B: Southern Bald Ibis (*Geronticus calvus*); C: African Snipe (*Gallinago nigripennis*) and Grey Crowned Crane (*Balearica regulorum*) identified in wetland areas adjacent to the study site)

8 Sensitivity Analysis and No-Go Areas

8.1 Important Bird Areas

The current study area is not situated within an Internationally Important Bird Area (IBA), but is located approximately 17km north of the Chelmsford IBA (Figure 8-1). The Chelmsford IBA is characterised by the Chelmsford Dam, as well as the Ngagane River. Birds that are regarded as trigger species in the area include: *Geronticus calvus* (Southern Bald Ibis) (identified on site), *Circus maurus* (Black Harrier), *Eupodotis caerulescens* (Blue Bustard), *Crex crex* (Corncrake), *Anthropoides paradiseus* (Blue Crane) and *Geolaptes olivaceus* (Ground Woodpecker) (Birdlife International, 2014). These species are likely to make use of habitat on site.

The Important Bird and Biodiversity Areas (IBA) Programme is one of BirdLife International's most important conservation initiatives. The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that:

- are globally threatened;
- have a restricted range; and
- are restricted to specific biomes/vegetation types.

A fourth category is sites that have significant populations; for example, 20 000 waterbirds or 10 000 pairs of a species of seabird. South Africa has 101 Global IBAs and an additional 21 Regional IBAs. South Africa is a large country, supporting eight biomes and c. 841 bird species, of which more than 700 are resident or annual visitors, 74 of which are endemic or near-endemic and 125 of which are listed in The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

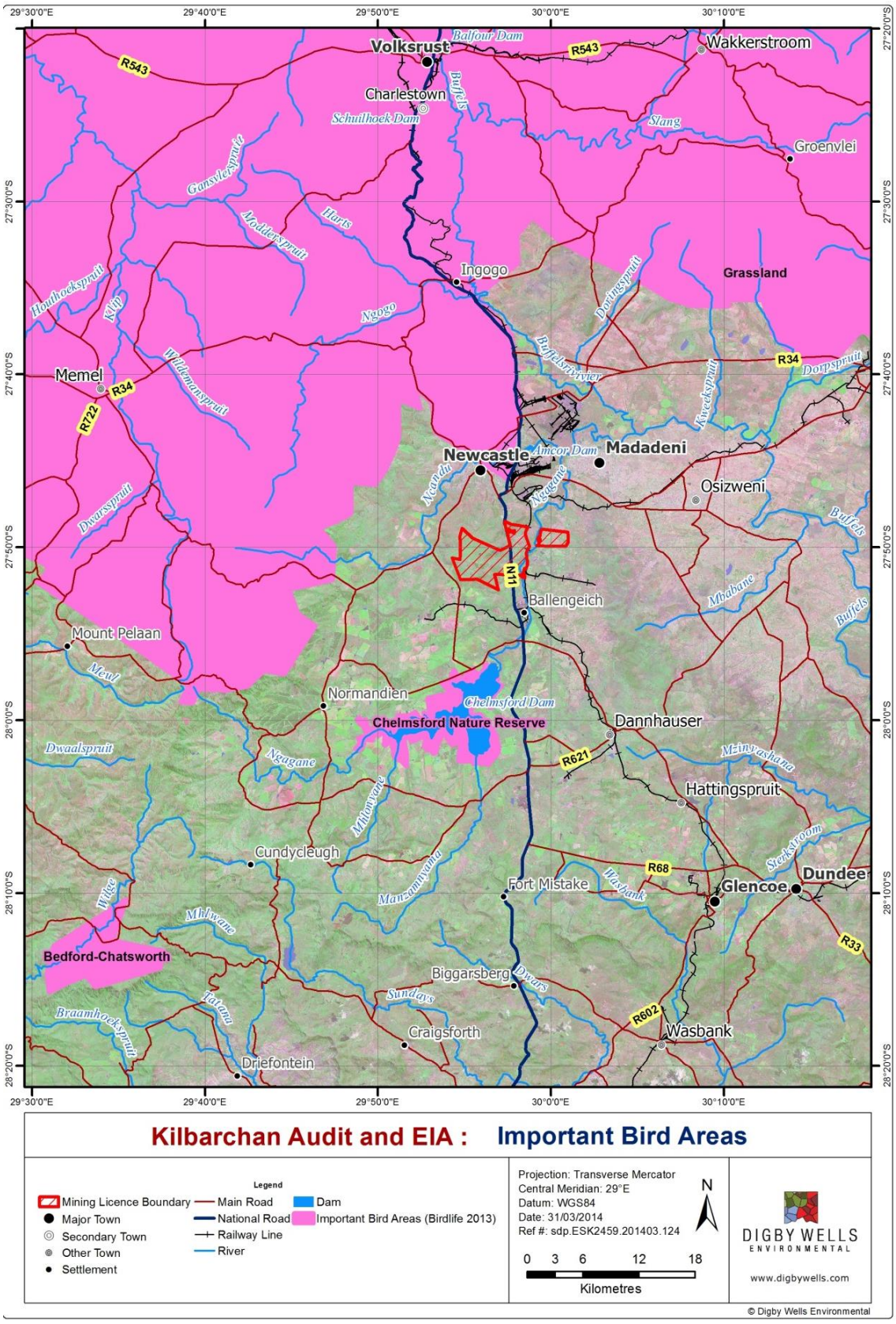

Figure 8-1: Study Site in relation to the Important Bird Areas in the Region

8.2 Threatened Ecosystems

The Threatened Ecosystems programme is aimed at meeting explicit biodiversity targets as defined in a systematic biodiversity plan. The Study area coincides with the Chelmsford North Grasslands Threatened Ecosystem to the south of the site, as indicated in Figure 8-2. This Threatened Ecosystem is regarded as Vulnerable and is a priority area for meeting explicit biodiversity targets as defined in a systematic biodiversity plan (Goodman 2007).

The Biodiversity Act (Act 10 of 2004) provides for list of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value. The ecosystems listed make up 9.5% of the country, with Critically Endangered and Endangered ecosystems together accounting for 2.7% and Vulnerable ecosystems a further 6.8%.

The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process. This includes the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011).

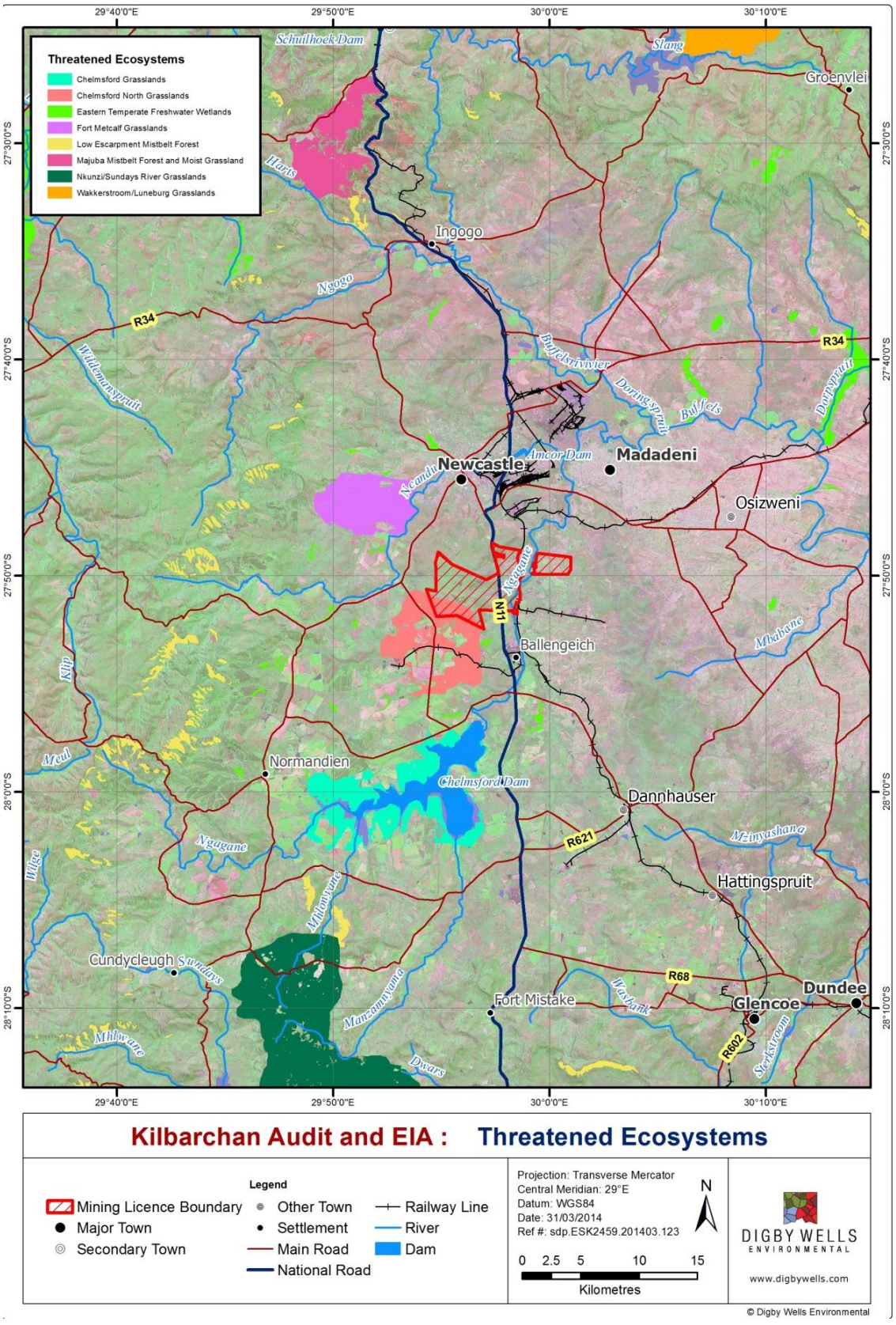

Figure 8-2: Study Site in relation to the Threatened Ecosystems in the Region

8.3 Site-Specific Biodiversity Value Assessment

Very High sensitivity is traditionally assigned to areas occurring within a Threatened Ecosystem, and those areas that were pristine or close to pristine with low or no anthropogenic impacts. The only areas considered to be sensitive within the Kilbarchan project site are the rocky ridges and Hydromorphic Grassland.

Areas of medium sensitivity include those natural areas with some anthropogenic change or degradation, with high numbers of species of special concern and moderate rocky slopes.

Low sensitivity is usually assigned to areas completely transformed or heavily degraded, on relatively flat ground. The current study area was found to be in different states of disturbances, with grassland areas designated as medium low being encountered. The significance of this for the project is that the project activities may go ahead with adequate mitigation measures in place.

The study area does not occur within any formally protected areas or any areas that have been allocated future protected status. The sensitivity assessment for the site is represented in Figure 8-3.

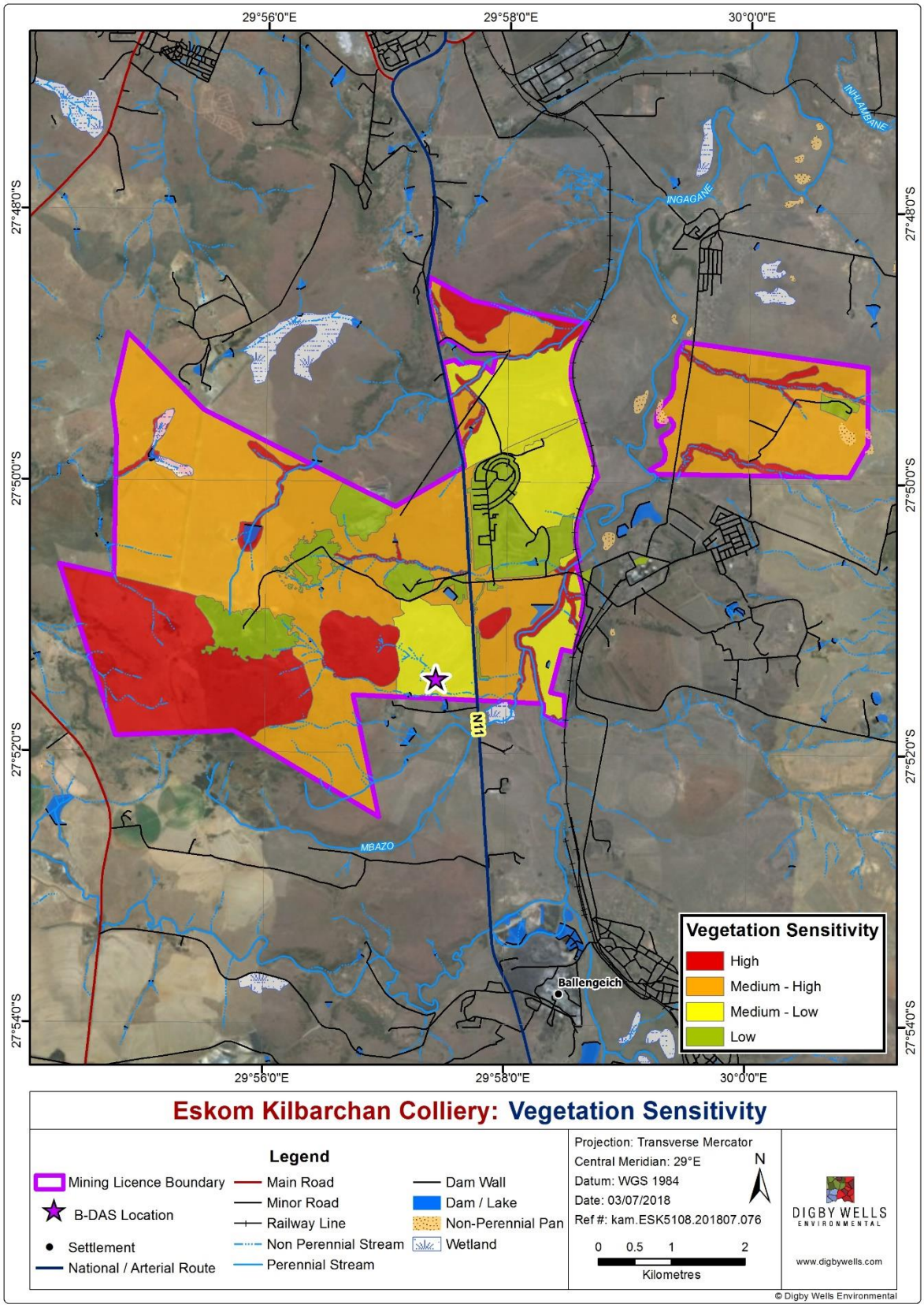

Figure 8-3: Sensitivity Assessment

9 Impact Assessment

9.1 Methodology and Approach

The impacts are assessed based on the impact's magnitude as well as the receiver's sensitivity, culminating in an impact significance which identifies the most important impacts that require management.

Based on international guidelines and South African legislation, the following criteria are taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/ negative);
- Duration (short/medium/long-term, permanent (irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 9-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this EIA/EMP Report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 9-2, which is extracted from Table 9-1. The description of the significance ratings is discussed in Table 9-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 9-1: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and / or social order.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and / or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and / or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	**Positive impacts**			
4	On-going serious natural and / or social issues. Significant changes to structures / items of natural or social significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.
3	On-going natural and / or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and / or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 9-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
	Consequence																																					

Table 9-3: Significance Rating Description[1]

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Substantial (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Major (positive)
36 to 72	An positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Major (negative)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Substantial (negative)

[1] It is generally sufficient to only monitor impacts that are rated as negligible or minor

It is expected that the construction of the mine water treatment plant will result in loss of vegetation and faunal habitat due to clearing for the facility. Since this is expected to take place in the rehabilitated grassland area, the impact on biodiversity is expected to be medium to low.

9.2 No Go Alternative

Should a no go approach be considered, the current state of Kilbarchan Colliery will continue to deteriorate resulting in continued environmental impacts. The mine will continue to decant and mine affected water will continue to be discharged directly into the Ngagane Catchment causing significant degradation of aquatics, wetlands, fauna and flora, surface and groundwater resources. This may have a significant economic impact on the surrounding communities and downstream water users that rely on the Ingagane River for their livelihoods.

The Kilbarchan Colliery will continue to pose a health and safety risk to the community and the surrounding landowners du to the ddecant of mine affected water. The no-go option is not considered viable due to the health and safety implications and impacts occurring on the environment.

9.3 Construction Phase

9.3.1 Activity 1: Site Clearance

The exact locations of the treatment plant will be subjected to vegetation clearance to facilitate the construction of the B-DAS plant and anciliery infrastructure.

9.3.1.1 Impact Description

9.3.1.1.1 Vegetation and Habitat destruction

The construction of the B-DAS plant will take place in area which will affect the current habitat and vegetation types present. There are three main types of habitat found on site, grassland areas (of which 3 differentiations were encountered, and will occur in Rehabilitated Grassland), wetland areas and agricultural/alien vegetation. Construction will constitute the complete removal of Rehabilitaed vegetation on the footprint of the B-DAS plant. This will remove the remaining habitat that the existing vegetation type currently provides.

The partial degradation of habitat for animal life has already taken place within the general environment due to current land use practices this includes mining (and associated impacts) and agriculture (and associated impacts) and uncontrolled grazing.

The plant species *Hypoxis hemerocallidea* (Star Flower) (provincially protected, nationally Declining) was encountered in the grassland vegetation type, but was not encountered in the footprint of the B-DAS plant. The protected species listed under 7.3.3 are expected to occur within the grassland habitat type and must be managed appropriately, this includes the

rehabilitated grassland. Mitigation measures should include obtaining permits and translocating these plants if encountered.

With the clearing of vegetation, open areas will occur, here indigenous vegetation will be replaced by fast growing alien and weed vegetation. This impact can be greatly reduced with the correct implementation of alien vegetation management plan

9.3.1.1.2 Alien plant species invasion

As detailed in section 7.3.1.3, alien plant species degrade the natural state of habitat. Species that may establish are listed in Table 7-4.

The risk of spread of alien plant species can be managed through regular monitoring and removal of alien plants as seedlings/juveniles before they reach seed-bearing maturity.

9.3.1.1.3 Disturbance to fauna due to increased vehicular movement on site

Fauna on site may be scared away due to increase activity associated with construction activities. In addition, breeding species within proximity of the activities may be disturbed.

9.3.1.2 Management Objectives

Management objectives will be to prevent the loss of important/protected landscapes, species of plants and animals (such as those with Red Data Status, National and Provincial). This is achieved by avoiding destruction of areas where these species are located or could possibly occur. In the case of plants, if this is not possible relocation permits are required. The current location of the B-DAS plant does not occur within sensitive landscapes.

Within the B-DAS plant footprint, and surrounds, the destruction of the vegetative cover must be limited, this can be achieved by restricting the removal and disturbance of vegetation to those areas absolutely essential for the infrastructure placements.

The ecosystem present must be preserved, this includes areas not directly affected by project activities, and can be achieved by limiting project activities to areas where they are essential.

The risk of habitat fragmentation must be reduced through preservation of natural corridors, therefore the rehabilitation of areas disturbed must commence withn 1 week of disturbance. Rehabilitation plans must be initiated during construction to minimise disturbed areas. Habitat/vegetation degradation must be prevented through the implementation of an alien invasive plant management strategy.

The objective of alien plant management is to ensure that no additional alien plant species are established as a result of disturbance from rehabilitation activities. Further to this, existing alien plant stands should be removed and controlled.

The objective of managing noise and general disturbance on site is to reduce the impact on faunal communities, particularly breeding individuals.

9.3.1.3 Management Actions and Targets

Red Data Status plants located in the general project area of development *Hypoxis hemerocallidea* (Star Flower) will not be disturbed. However if encountered, should be marked prior to construction and the necessary permits for relocations of these protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities (Ezemvelo KZN Wildlife) prior to relocation to a safe place to avoid destruction and stipulations made by Ezemvelo KZN Wildlife, must be followed. A nursery should be developed on site for this purpose. No protected plant species can be disturbed without authorisation.

Three basic rules of conservation apply to populations of Red List Plant Species, as set out hereunder, according to Red List Plant Guidelines (2012).

- All populations of Near Threatened and Threatened plant taxa must be conserved *in situ*.
- All populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines.
- An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red List Plant Species, and such Ecological Management Plans must conform to the Guidelines set out for buffer zone widths.

Vehicular movement should be restricted to existing roads and no vehicles should access the site at night, this will curb the impact on night dwelling animal species.

An alien plant management strategy must be implemented whereby a qualified vegetation ecologist will monitor the disturbed areas biannually for 2-5 years for alien plants. Monitoring should preferably take place between November and March. All alien plant species should be identified, demarcated and removed. Such a strategy will entail the identification of areas where such infestation occurs and what the extent of it is. Thereafter specific eradication measures can be prescribed for species present. The alien invasive plant strategy must reduce the number of these plant species that occur in the project area, this can be measured against the number of plants that were identified in this and previous studies. Current mapped alien invasive plant infestations must therefore be removed, the aim will be to reduce this infestation to 0 ha.

Illegal waste dumping, including building waste and rubble, should be prohibited. Such illegal dumping sites are prone to alien vegetation recruitment. The environmental manager must ensure that after each building site is rehabilitated, there are no rubble piles remaining.

Training should be given to onsite staff on which plants and animals have red data status and how they may be identified. Thereafter the Environmental Officer must initiate the red data management plan. The incidence of plant or animal red data removal or death must be quantified and records kept, this will ensure that management actions are adapted of they are not successful.

Destruction of vegetation should be limited to the areas essential for the development, if construction is finalised the environmental officer must ensure the construction areas are rehabilitated. Areas of erosion must be marked and attended to before the following wet season starts.

Rehabilitation of disturbed areas should take place within a week of construction, all bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly, and prevent erosion and alien vegetation establishing.

9.3.1.4 Impact Ratings

The impact of construction of infrastructure on vegetation and fauna habitat associated with the site is rated in table Table 9-4.

Table 9-4: Potential Impacts due to construction of Infrastructure

Activity and Interaction: Construction of infrastructure require vegetation clearing			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct loss of floral species/vegetation types and biodiversity			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Total loss of of floral species/vegetation will occur.	Moderate (negative) – 84
Extent	Local (3)	Removal of vegetation could occur without planning affecting the development site area.	
Intensity x type of impact	Moderate(-3)	The plant footprint covers mine rehabilitated areas, that offers habitat to faunal species.	
Probability	Definite (7)	It is likely that total destruction of vegetation types will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only, preferably the already disturbed areas. Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation. ▪ Avoid sensitive landscapes such as riparian areas, and wetland areas. ▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation are controlled so that no open areas occur.			
Post- mitigation			
Duration	Permanent (2)	Short Term, mitigation measures prescribed will ensure this.	Negligable (negative) – 24
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity x type of impact	Minor (-2)	Dependent on sensitivity of the specific site.	
Probability	Probable (4)	This impact will occur	
Nature	Negative		

Table 9-5: Loss of Species of Special Concern

Activity and Interaction (Construction of infrastructure require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of species of special concern (protected species)			
Prior to mitigation/ management			
Duration	Project Life (5)	Loss floral species/vegetation will occur within the footprints of infrastructure, with no management.	Minor (negative) – 60
Extent	Local (3)	Species/habitat loss will only occur within the project site.	
Intensity x type of impact	High (-2)	Sensitive sites occur throughout the general projet area, such as ridges and grasslands, containing sensitive species. The BDAS plant does not coincide with these.	
Probability	Almost Certain (6)	It is likely that destruction of protected species will occur without management measures.	
Nature	Negative		
Mitigation/ Management actions			
▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation. ▪ Avoid known areas of faunal and floral SSC that does occur within the general project footprint. ▪ Avoid sensitive landscapes such as riparian and ridge areas that were encountered on site. ▪ Applications for permits for removal of certain plants, where required by provincial authorities. If plant SSC are to be removed, they should be either translocated to a similar habitat to the donor site or relocated to a nursery.			
Post management			
Duration	Medium term (3)	With vegetation management including rehabilitation, vegetation can recover.	Negligible (negative) – 24
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity x type of impact	Moderate - negative (-3)	Dependent on sensitivity of the specific site.	

Activity and Interaction (Construction of infrastructure require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Unlikely (3)	It is unlikely that compaction will have an effect after rehabilitation	
Nature	Negative		

Table 9-6: Alien vegetation establishment

Activity and Interaction (Construction of infrastructure require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Alien vegetation establishment			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Alien vegetation will colonise any area that is available (open areas), with ni mitigation this problem will persist and spread.	Moderate (negative) – 75
Extent	Municipal area (4)	Such an infestation can easily spread to the entire municipal area, and infest water sources.	
Intensity x type of impact	Serious Loss (-5)	Serious loss of sensitive habitats and species due to alien vegetation colonisation.	
Probability	Likely (5)	It is unlikely that without mitigation measures, alien vegetation will establish	
Nature	Negative		
Mitigation/ Management actions			
▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation are controlled so that no open areas occur. ▪ If alien vegetation is encountered, remove these plants, in the correct way and timeously. Alien plants should be removed as seedlings before they reach seed-bearing age. Alien plants can establish on a site after removal for up to 2-5 years, therefore appropriate monitoring must take place.			
Post management			
Duration	Short term (2)	Alien vegetation colonisation will be eradicated through Management Plan.	Negligible (negative) – 18

Activity and Interaction (Construction of infrastructure require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Limited (2)	An infestation will not be allowed to spread.	
Intensity x type of impact	Minor (-2)	Only limited areas will experience this for a short duration.	
Probability	Unlikely (3)	It is unlikely that alien vegetation will establish, if mitigation is adhered to.	
Nature	Negative		

9.4 Operational Phase

Activity: Operation of the B-DAS plant.

Operational activities will not lead to direct impacts to fauna and flora.

9.5 Cumulative Impacts

The only construction and subsequent removal of vegetation that will occur is within the footprint of the B-DAS plant, with negligible (after mitigation) impacts occurring from these. These two pose impacts the greatest cumulative impacts to the general area.

10 Unplanned Events and Low Risks

The activities taking place in the Kilbarhen project area have the potential to result in unplanned events that may have significant impacts to the natural vegetation and habitat types of the area. These are described in Table 10-2Table 10-1.

Table 10-1: Unplanned events and impacts to fauna and flora

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Hydrocarbon spillage	Natural vegetation and habitat types will be adversely affected.	Vehicles must only be serviced within designated service bays. Hydrocarbon spill kits must be available on site at all locations where hydrocarbon spills could occur.
Decant water.	Natural vegetation and habitat types will be adversely affected. Sensitive habitat include wetlands	Install emergency shut off valves to help in the case of pipe bursts.

B-DAS plant leak	Natural vegetation and habitat types will be adversely affected.	Engineering design of the B-DAS plant must consider the prevention of any spillage from entering natural vegetation or habitats. This will include catering for the 1:100 year floods, designing an overflow catchment dam

10.1 Summary of Mitigation and Management

Table 10-2 provides a description of the mitigation and management options for the environmental impacts anticipated during the construction, operational and decommissioning and closure phases. Table 10-2 provides a summary of the proposed project activities, environmental aspects and impacts on the receiving environment. Information on the frequency of mitigation, relevant legal requirements, recommended management plans, timing of implementation, and roles / responsibilities of persons implementing the EMP.

Table 10-2: Impacts

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Kilbarchen					
Construction of B-DAS plant.	Pre-construction and construction		Red Data Status plants located in areas of development should be marked prior to construction and the necessary permits for relocations of protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities prior to relocation to a safe place to avoid destruction. A nursery should be developed on site for this purpose Illegal waste dumping should be prohibited Training should be given to onsite staff on which plants have Red Data Status and how to identify them Destruction of vegetation should be limited to the areas essential for the development All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly Rehabilitation of disturbed areas should take place as soon as possible	South African National Biodiversity Institute (SANBI) Red List of South African plants version 2017.1 National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species; National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; KZN Wildlife Protected Plants.	Continually, specifically construction

10.2 Monitoring Plan

The fauna and flora monitoring program should be initiated pre-construction and continue through construction thereafter conducted annually during the growing season (December to March) as close to the same time of year as possible. Should the monitoring results indicate the additional presence of red data species, or threatened species, this may necessitate the need to undergo monitoring for that particular species more frequently, especially during the breeding season and birthing season for that species.

Monitoring will include sites in the undisturbed vegetation which will act as control plots, plots within the disturbed infrastructure areas which will have baseline data and then be monitored during the rehabilitation phase. The same plots will be monitored with each survey so as to ensure collected data is comparable and trends are identified.

Where rehabilitation is conducted, additional plots will be included to monitor the efficacy of the re-vegetation.

Aspects that will be monitored in the annual surveys will include, species richness, vegetation composition i.e. proportion grasses, forbs and woody species, canopy height, cover percentage, presence of Red Data or protected species, and presence of alien invasive species.

10.2.1 Flora

10.2.1.1 Vegetation Cover Monitoring

The vegetation cover established on the disturbed areas needs to be monitored annually for the first two years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to disturbance (and on adjacent undisturbed areas) (Dawson, 2007).

Various parameters need to be measured, both on the rehabilitation sites and in the adjacent undisturbed areas, to determine the success or otherwise of the establishment of the rehabilitation vegetation cover, and how this compares with the undisturbed vegetation in the area.

This assessment needs to be undertaken by a botanist / environmental scientist trained and experienced in vegetation assessments of this nature.

Vegetation cover of rehabilitated areas should be assessed during the summer growing season, at least a month after rain has fallen (so that there has been an opportunity for fresh plant growth to have occurred). It is recommended that this should be done annually for the first two years. Thereafter, visual spot-checking with photographic recording by an experienced field botanist / rehabilitation practitioner every three years will suffice,

depending on results found. Remote sensing information and aerial photos will also be used to determine impacts and management plans.

The environmental indicators which will demonstrate whether the rehabilitation has been successful or not include:

- Increasing similarity between rehabilitated and undisturbed areas in terms of species composition and vegetation structure;
- Increasing species diversity of desired (local) species in rehabilitation cover over time;
- Reduction in presence of weed species over time;
- Increase in woody plant growth, and achievement of reproductive status and production of reproductive propagules (seed);
- Ability of the rehabilitation species populations to reproduce, indicated by the presence of seedlings of the rehabilitation species once the original generation has reached sexual maturity ("population recruitment");
- Increase in vegetation basal cover and biomass;
- Increase in soil organic matter.

In the event that the vegetation cover remains static, or should deteriorate; additional seeding, with locally harvested species, and possibly fertilisation would be required as a mitigation measure.

10.2.1.2 Alien Vegetation Monitoring

During vegetation monitoring, the presence of alien species should also be detected. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that any weeds encroaching because of the disturbed conditions are controlled by means appropriate to the species.

Species likely to be problematic include those identified during the fauna and flora study of the site, namely *Datura stramonium* and *D. ferox* and *Opuntia ficus-indica*.

The environmental indicator assessed in this instance is the reduction in presence of weed species over time, to the point where no invasive weed species are present and no further population recruitment occurs.

10.2.2 Fauna

The fauna monitoring will be closely linked to the flora monitoring to enable solid scientific conclusions and comparisons; also, the strong ecological link between vegetation and animals can only be measured if monitoring is similar (e.g. in terms of monitoring points) for both disciplines.

Monitoring faunal and floral biodiversity, needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present

and faunal communities found in the same areas during various stages of construction and operation of the proposed project.

10.2.2.1 Mammals

Small mammals will be surveyed by using small mammal live traps – line transects will be used to gather repeatable quantitative data with regards to species richness and population dynamics. Tracks and ecological indicators will be used to assess the presence of larger free-roaming mammals – frequencies of such observations will be used for quantitative comparisons. The nesting sites, burrows and possible home ranges of these species will be recorded, marked, monitored and actively avoided.

10.2.2.2 Birds

Line transects will be used to compile quantitative lists of birds present in the areas surveyed; both sounds and visual observations will be used. Nesting sites of threatened birds, will be marked and the area preserved with an adequate buffer zone. The authorities will be informed of any sites found and Eskom will abide by their recommendations. It is recommended that the more detailed avifaunal monitoring is conducted in the breeding season between October and January.

Surveys for terrestrial birds must be conducted in summer, but only once the vegetation layer has recovered sufficiently from winter fires to allow for assessment of available habitat.

Surveys for aquatic birds must also be conducted in summer. For species associated with rivers, the assessment must coincide with average flow conditions (i.e. not dry and not in flood) and preferably within the breeding season. For species associated with wetlands, the assessment must follow good summer rains i.e. standing water must be present and the vegetation must have recovered sufficiently from winter fires to allow for assessment of available habitat.

10.2.2.3 Reptiles & Amphibians

Active searches for both reptiles and amphibians will be used to assess species richness of these groups in the area; due to the difficulty in recording occurrence of these groups data gathering will be limited to species counts.

10.2.2.4 Invertebrates

Invertebrate biodiversity will be measured by using pitfall trap lines. This method concentrates on ground-living invertebrates – the groups found in pitfall traps are good indicator groups for general biodiversity. Pitfall traps can be repeated exactly and works well in areas where vegetation cover at ground level is low (open habitat) as is found in the study area. In addition sweep net sampling will be conducted to provide an indication of airborne and canopy dwelling species.

11 Reasoned opinion

The impacts as described rated and mitigated in this document do not pose a risk to large natural areas of Medium high or Medium sensitivity, neither is SSC with restricted ranges being threatened with destruction. All vegetation, habitat and species present on site that could be affected by the activities proposed are of stable populations. With strict adherence to the mitigation measures prescribed in this document, the impacts have been rated as acceptable and the proposed project can go ahead.

12 Consultation Undertaken

No consultation was undertaken by the specialists at this stage, if comments are received, this section will be required to be updated.

13 Comments and Responses

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the EIA process. The objectives of the Stakeholder Engagement Process (SEP) include the following:

- To ensure that the I&APs are informed of the Project;
- To provide the I&APs with an opportunity to engage and provide comment on the Project;
- To draw on local knowledge by identifying environmental and social concerns associated with the Project;
- To involve the I&APs in identifying methods in which concerns can be addressed;
- To verify stakeholder comments have been recorded accurately; and
- To comply with legal requirements.

No comments relating to fauna and flora were received during the SEP undertaken during the original EIA process.

14 Conclusion and Recommendation

The Kilbarchan study area falls within three regional vegetation types, namely: Northern KwaZulu-Natal Moist Grassland, Kwazulu-Natal Highland Thornveld and Northern Kwazulu-Natal Shrubland. A total of 308 plant species were recorded for the QDS 2729DD and 2730CC, in which the study site occurs. Since the majority of the area has been altered from its natural state, vegetation did not represent these three vegetation types. Remnants of the Kwazulu-Natal Shrubland and Northern KwaZulu-Natal Moist Grassland, however were found in the western and northern portion of the site in the Rocky Ridge habitat.

Vegetation on site was classified as: Alien Bushclumps, Hydromorphic Grassland, *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrops, Rehabilitated Grassland, Natural Grassland and disturbed areas. The majority of the site was comprised of Rehabilitated and

Natural Grassland, with relatively low plant diversity. Alien plant invasion was extensive, with a large monospecific stand of *Eucalyptus camuldulensis* occupying the valley towards the centre of the site. A total of 21 alien plant species were recorded, nine of which have been allocated alien invasive categories according to NEMBA. The presence of alien trees was considered to be the greatest current impact on biodiversity as stands covered a large surface area and have outcompeted native species to a large extent. Further to this, the substrate under the canopy receives little sunlight and no forbs are able to grow. No plant SSC were recorded, although 7 medicinal plants do occur, that are regarded as important species.

From a fauna diversity perspective, the majority of the study site was not regarded to be highly diverse, due to industrial, residential and historic mining land-use in the area. The surrounding areas, however, such as Memel (to the west), Chelmsford Nature Reserve (to the south) and Wakkerstroom (to the north-east) have been highlighted for their importance in maintaining avifaunal diversity. The Hydromorphic Grassland and *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrops habitats represent similar habitat to these areas of avifaunal diversity considered to be sensitive areas. A total of 66 bird species were recorded on site during the field investigation. Four avifaunal SSC were recorded on site, namely: African Marsh Harrier (*Circus ranivo*rous) - Endangered; Southern Bald Ibis (*Geronticus calvus*) - Vulnerable; African Snipe (*Gallinago nigripennis*) - Vulnerable and Grey Crowned Crane (*Balearica regulorum*) – Endangered.

Mammal activity was most prominent in the Natural Grassland habitat, although it is expected that small mammal activity will be high in the Rehabilitated Grassland habitat as well. *Atilax paludinosus* (Water Mongoose), *Sylvicapra grimmia* (Common Duiker) and *Alcelaphus caama* (Red Hartebeest) were recorded during field investigations. Red Hartebeest does not occur naturally in the area and is an introduced species.

Three frog species were recorded on site, namely: *Amietia fuscigula* (Cape River Frog), *Anhydrophyrne hewitti* (Natal Chirping frog) and *Tomopterna marmorata* (Natal Sand Frog). Eight butterflies were recorded as part of the invertebrate assessment, none of which were SSC.

The B-DAS plant construction activities will result in loss of vegetation due to clearing, however this will be rehabilitated as per the mitigation and management prescribed in this document. Of more concern is the establishment and spread of alien plant species, a strict AIP management plan is prescribed in this report. Rehabilitation efforts must be completed as soon as possible after disturbance. Since rehabilitation should be aimed at mimicking the natural scenario as far as possible, only indigenous grass species must be considered.

15 Impact Statement

An impact statement is requitred as per NEMA regulations with regards to the proposed project. To this end it is evident from the results contained in this document as well as the impact assessment based on these results, that the project must be favourably considered,

as impacts that will persist otherwise is not acceptable. Howevever, all mitigation measures must be strictly adhered to.

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Appendix A: Expected Plant Species List

Family	Species	Threat status
ACANTHACEAE	*Blepharis integrifolia (L.f.) E.Mey. ex Schinz var. integrifolia*	LC
ACANTHACEAE	*Blepharis subvolubilis C.B.Clarke*	LC
ACANTHACEAE	*Ruellia cordata Thunb.*	LC
AMARANTHACEAE	*Alternanthera pungens Kunth*	Not Evaluated
AMARYLLIDACEAE	*Brunsvigia grandiflora Lindl.*	LC
AMARYLLIDACEAE	*Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.*	Declining
AMARYLLIDACEAE	*Cyrtanthus breviflorus Harv.*	LC
AMARYLLIDACEAE	*Haemanthus humilis Jacq. subsp. hirsutus (Baker) Snijman*	LC
AMARYLLIDACEAE	*Scadoxus puniceus (L.) Friis & Nordal*	LC
ANACARDIACEAE	*Searsia dentata (Thunb.) F.A.Barkley*	LC
ANACARDIACEAE	*Searsia gerrardii (Harv. ex Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia pentheri (Zahlbr.) Moffett*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. gracilis (Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. integrifolia (Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. pyroides*	LC
ANACARDIACEAE	*Searsia rigida (Mill.) F.A.Barkley var. dentata (Engl.) Moffett*	LC
ANEMIACEAE	*Mohria vestita Baker*	LC
ANTHERICACEAE	*Chlorophytum cooperi (Baker) Nordal*	LC
ANTHERICACEAE	*Chlorophytum fasciculatum (Baker) Kativu*	LC
APIACEAE	*Berula thunbergii (DC.) H.Wolff*	LC
APIACEAE	*Sanicula elata Buch.-Ham. ex D.Don*	LC
APOCYNACEAE	*Asclepias aurea (Schltr.) Schltr.*	LC
APOCYNACEAE	*Asclepias eminens (Harv.) Schltr.*	LC
APOCYNACEAE	*Asclepias meyeriana (Schltr.) Schltr.*	LC
APOCYNACEAE	*Asclepias multicaulis (E.Mey.) Schltr.*	LC
APOCYNACEAE	*Asclepias stellifera Schltr.*	LC
APOCYNACEAE	*Gomphocarpus fruticosus (L.) Aiton f. subsp. fruticosus*	LC

Family	Species	Threat status
APOCYNACEAE	*Miraglossum pulchellum (Schltr.) Kupicha*	LC
APOCYNACEAE	*Orbea variegata (L.) Haw.*	LC
APOCYNACEAE	*Pachycarpus dealbatus E.Mey.*	LC
APOCYNACEAE	*Schizoglossum atropurpureum E.Mey. subsp. atropurpureum*	LC
APOCYNACEAE	*Schizoglossum nitidum Schltr.*	LC
APOCYNACEAE	*Stenostelma umbelluliferum (Schltr.) S.P.Bester & Nicholas*	NT
APOCYNACEAE	*Xysmalobium parviflorum Harv. ex Scott-Elliot*	LC
APOCYNACEAE	*Xysmalobium undulatum (L.) Aiton f. var. undulatum*	LC
APONOGETONACEAE	*Aponogeton junceus Lehm.*	LC
ARACEAE	*Zantedeschia rehmannii Engl.*	LC
ASPARAGACEAE	*Asparagus ramosissimus Baker*	LC
ASPHODELACEAE	*Aloe maculata All.*	LC
ASPHODELACEAE	*Kniphofia baurii Baker*	LC
ASPHODELACEAE	*Trachyandra asperata Kunth var. nataglencoensis (Kuntze) Oberm.*	LC
ASTERACEAE	*Acanthospermum australe (Loefl.) Kuntze*	Not Evaluated
ASTERACEAE	*Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt*	
ASTERACEAE	*Tagetes minuta L.*	Not Evaluated
ASTERACEAE	*Aster harveyanus Kuntze*	LC
ASTERACEAE	*Berkheya echinacea (Harv.) O.Hoffm. ex Burtt Davy subsp. echinacea*	LC
ASTERACEAE	*Berkheya onopordifolia (DC.) O.Hoffm. ex Burtt Davy var. glabra Bohnen ex Roessler*	LC
ASTERACEAE	*Callilepis laureola DC.*	LC
ASTERACEAE	*Cotula australis (Spreng.) Hook.f.*	LC
ASTERACEAE	*Denekia capensis Thunb.*	LC
ASTERACEAE	*Euryops transvaalensis Klatt subsp. setilobus (N.E.Br.) B.Nord.*	LC
ASTERACEAE	*Euryops transvaalensis Klatt subsp. transvaalensis*	LC
ASTERACEAE	*Felicia quinquenervia (Klatt) Grau*	LC
ASTERACEAE	*Helichrysum aureonitens Sch.Bip.*	LC

Family	Species	Threat status
ASTERACEAE	*Helichrysum dregeanum Sond. & Harv.*	LC
ASTERACEAE	*Helichrysum monticola Hilliard*	LC
ASTERACEAE	*Helichrysum pallidum DC.*	LC
ASTERACEAE	*Helichrysum rugulosum Less.*	LC
ASTERACEAE	*Helichrysum setosum Harv.*	LC
ASTERACEAE	*Hilliardiella aristata (DC.) H.Rob.*	LC
ASTERACEAE	*Nolletia rarifolia (Turcz.) Steetz*	LC
ASTERACEAE	*Schistostephium crataegifolium (DC.) Fenzl ex Harv.*	LC
ASTERACEAE	*Senecio anomalochrous Hilliard*	LC
ASTERACEAE	*Senecio byrnensis Hilliard*	LC
ASTERACEAE	*Senecio cathcartensis O.Hoffm.*	LC
ASTERACEAE	*Senecio erubescens Aiton var. crepidifolius DC.*	LC
ASTERACEAE	*Senecio erubescens Aiton var. erubescens*	LC
ASTERACEAE	*Senecio hieracioides DC.*	LC
ASTERACEAE	*Senecio isatidioides E.Phillips & C.A.Sm.*	LC
ASTERACEAE	*Senecio othonniflorus DC.*	LC
ASTERACEAE	*Senecio rhomboideus Harv.*	LC
ASTERACEAE	*Senecio subcoriaceus Schltr.*	LC
ASTERACEAE	*Tripteris aghillana DC. var. aghillana*	LC
ASTERACEAE	*Vernonia gerrardii Harv.*	LC
AYTONIACEAE	*Asterella bachmannii (Steph.) S.W.Arnell*	
BARTRAMIACEAE	*Philonotis falcata (Hook.) Mitt.*	
BEGONIACEAE	*Begonia sutherlandii Hook.f. subsp. sutherlandii*	LC
BORAGINACEAE	*Myosotis sylvatica Hoffm.*	Not Evaluated
BRASSICACEAE	*Nasturtium officinale R.Br.*	Not Evaluated
BRASSICACEAE	*Rorippa nudiuscula Thell.*	LC
BRYACEAE	*Bryum pycnophyllum (Dixon) Mohamed*	
CAPPARACEAE	*Cleome monophylla L.*	LC
CARYOPHYLLACEAE	*Cerastium arabidis E.Mey. ex Fenzl*	LC
CARYOPHYLLACEAE	*Corrigiola litoralis L. subsp. litoralis var. litoralis*	LC
CARYOPHYLLACEAE	*Silene undulata Aiton*	LC

Family	Species	Threat status
CHRYSOBALANACEAE	*Parinari capensis Harv. subsp. capensis*	LC
COMMELINACEAE	*Commelina subulata Roth*	LC
COMMELINACEAE	*Cyanotis speciosa (L.f.) Hassk.*	LC
CONVOLVULACEAE	*Convolvulus natalensis Bernh. ex Krauss*	LC
CONVOLVULACEAE	*Ipomoea crassipes Hook. var. crassipes*	LC
CONVOLVULACEAE	*Ipomoea obscura (L.) Ker Gawl. var. obscura*	LC
CRASSULACEAE	*Crassula nudicaulis L. var. nudicaulis*	LC
CRASSULACEAE	*Crassula umbraticola N.E.Br.*	LC
CUCURBITACEAE	*Cucumis hirsutus Sond.*	LC
CUCURBITACEAE	*Cucumis myriocarpus Naudin subsp. leptodermis (Schweick.) C.Jeffrey & P.Halliday*	LC
CYPERACEAE	*Carex zuluensis C.B.Clarke*	LC
CYPERACEAE	*Cyperus albostriatus Schrad.*	LC
CYPERACEAE	*Cyperus keniensis Kük.*	LC
CYPERACEAE	*Fimbristylis complanata (Retz.) Link*	LC
CYPERACEAE	*Fimbristylis dichotoma (L.) Vahl subsp. dichotoma*	LC
CYPERACEAE	*Pycreus cooperi C.B.Clarke*	LC
CYPERACEAE	*Pycreus macranthus (Boeckeler) C.B.Clarke*	LC
CYPERACEAE	*Schoenoplectus muriculatus (Kük.) Browning*	LC
DIPSACACEAE	*Scabiosa columbaria L.*	LC
DRYOPTERIDACEAE	*Cyrtomium luctuosum J.P.Roux*	
EBENACEAE	*Diospyros lycioides Desf. subsp. lycioides*	LC
ERIOSPERMACEAE	*Eriospermum cooperi Baker var. cooperi*	LC
EUPHORBIACEAE	*Acalypha caperonioides Baill. var. caperonioides*	DDT
EUPHORBIACEAE	*Acalypha depressinerva (Kuntze) K.Schum.*	LC
EUPHORBIACEAE	*Clutia monticola S.Moore var. monticola*	LC
EUPHORBIACEAE	*Clutia natalensis Bernh.*	LC
FABACEAE	*Acacia sieberiana DC. var. woodii (Burtt Davy) Keay & Brenan*	LC
FABACEAE	*Argyrolobium harveyanum Oliv.*	LC
FABACEAE	*Argyrolobium speciosum Eckl. & Zeyh.*	LC

Family	Species	Threat status
FABACEAE	*Elephantorrhiza elephantina (Burch.) Skeels*	LC
FABACEAE	*Eriosema cordatum E.Mey.*	LC
FABACEAE	*Eriosema salignum E.Mey.*	LC
FABACEAE	*Erythrina latissima E.Mey.*	LC
FABACEAE	*Indigofera cryptantha Benth. ex Harv. var. cryptantha*	LC
FABACEAE	*Indigofera evansiana Burtt Davy*	LC
FABACEAE	*Indigofera hedyantha Eckl. & Zeyh.*	LC
FABACEAE	*Indigofera hilaris Eckl. & Zeyh. var. hilaris*	LC
FABACEAE	*Indigofera torulosa E.Mey. var. torulosa*	LC
FABACEAE	*Indigofera tristis E.Mey.*	LC
FABACEAE	*Indigofera zeyheri Spreng. ex Eckl. & Zeyh.*	LC
FABACEAE	*Lessertia thodei L.Bolus*	LC
FABACEAE	*Rhynchosia reptabunda N.E.Br.*	LC
FABACEAE	*Rhynchosia sordida (E.Mey.) Schinz*	LC
FABACEAE	*Tephrosia capensis (Jacq.) Pers. var. capensis*	LC
FABACEAE	*Tephrosia semiglabra Sond.*	LC
FABACEAE	*Vigna luteola (Jacq.) Benth. var. luteola*	LC
FABACEAE	*Vigna oblongifolia A.Rich. var. parviflora (Baker) Verdc.*	LC
FISSIDENTACEAE	*Fissidens borgenii Hampe*	
FISSIDENTACEAE	*Fissidens sciophyllus Mitt.*	
FOSSOMBRONIACEAE	*Fossombronia crispa Nees*	
GERANIACEAE	*Pelargonium alchemilloides (L.) L'Hér.*	LC
GERANIACEAE	*Pelargonium luridum (Andrews) Sweet*	LC
GERANIACEAE	*Pelargonium schlechteri R.Knuth*	Not Evaluated
GESNERIACEAE	*Streptocarpus gardenii Hook.*	LC
GESNERIACEAE	*Streptocarpus pusillus Harv. ex C.B.Clarke*	LC
HYACINTHACEAE	*Dipcadi marlothii Engl.*	LC
HYACINTHACEAE	*Drimia calcarata (Baker) Stedje*	LC
HYACINTHACEAE	*Drimia depressa (Baker) Jessop*	LC
HYACINTHACEAE	*Drimiopsis burkei Baker subsp. burkei*	LC
HYACINTHACEAE	*Ledebouria cooperi (Hook.f.) Jessop*	LC

Family	Species	Threat status
HYACINTHACEAE	*Ledebouria ovatifolia (Baker) Jessop*	LC
HYACINTHACEAE	*Ledebouria revoluta (L.f.) Jessop*	LC
HYACINTHACEAE	*Merwilla plumbea (Lindl.) Speta*	NT
HYACINTHACEAE	*Ornithogalum capillare J.M.Wood & M.S.Evans*	LC
HYACINTHACEAE	*Schizocarphus nervosus (Burch.) Van der Merwe*	LC
HYDROCHARITACEAE	*Lagarosiphon muscoides Harv.*	LC
HYPERICACEAE	*Hypericum lalandii Choisy*	LC
HYPOXIDACEAE	*Empodium elongatum (Nel) B.L.Burtt*	LC
HYPOXIDACEAE	*Hypoxis angustifolia Lam. var. angustifolia*	LC
HYPOXIDACEAE	*Hypoxis filiformis Baker*	LC
HYPOXIDACEAE	*Hypoxis galpinii Baker*	LC
HYPOXIDACEAE	*Hypoxis hemerocallidea Fisch., C.A.Mey. & Avé-Lall.*	Declining
HYPOXIDACEAE	*Hypoxis kraussiana Buchinger*	LC
HYPOXIDACEAE	*Hypoxis multiceps Buchinger ex Baker*	LC
HYPOXIDACEAE	*Hypoxis obtusa Burch. ex Ker Gawl.*	LC
HYPOXIDACEAE	*Hypoxis rigidula Baker var. rigidula*	LC
IRIDACEAE	*Aristea montana Baker*	LC
IRIDACEAE	*Aristea torulosa Klatt*	LC
IRIDACEAE	*Crocosmia paniculata (Klatt) Goldblatt*	LC
IRIDACEAE	*Gladiolus crassifolius Baker*	LC
IRIDACEAE	*Gladiolus papilio Hook.f.*	LC
IRIDACEAE	*Gladiolus permeabilis D.Delaroche subsp. edulis (Burch. ex Ker Gawl.) Oberm.*	LC
IRIDACEAE	*Gladiolus sericeovillosus Hook.f. subsp. sericeovillosus*	LC
IRIDACEAE	*Hesperantha baurii Baker subsp. baurii*	LC
IRIDACEAE	*Hesperantha coccinea (Backh. & Harv.) Goldblatt & J.C.Manning*	LC
IRIDACEAE	*Moraea natalensis Baker*	LC
JUNCACEAE	*Juncus dregeanus Kunth subsp. dregeanus*	LC
JUNCACEAE	*Juncus effusus L.*	LC
JUNCACEAE	*Juncus oxycarpus E.Mey. ex Kunth*	LC

Family	Species	Threat status
LAMIACEAE	*Scutellaria racemosa Pers.*	Not Evaluated
LAMIACEAE	*Ajuga ophrydis Burch. ex Benth.*	LC
LAMIACEAE	*Plectranthus hadiensis (Forssk.) Schweinf. ex Spreng. var. tomentosus (Benth.) Codd*	LC
LAMIACEAE	*Rotheca hirsuta (Hochst.) R.Fern.*	LC
LAMIACEAE	*Stachys hyssopoides Burch. ex Benth.*	LC
LAMIACEAE	*Stachys hyssopoides Burch. ex Benth.*	LC
LAMIACEAE	*Stachys sessilis Gürke*	LC
LAMIACEAE	*Syncolostemon concinnus N.E.Br.*	LC
LAMIACEAE	*Syncolostemon pretoriae (Gürke) D.F.Otieno*	LC
LESKEACEAE	*Pseudoleskeopsis claviramea (Müll.Hal.) Thér.*	
LOBELIACEAE	*Lobelia flaccida (C.Presl) A.DC. subsp. mossiana (R.D.Good) Thulin*	LC
LOBELIACEAE	*Monopsis decipiens (Sond.) Thulin*	LC
MALVACEAE	*Corchorus confusus Wild*	LC
MALVACEAE	*Corchorus schimperi Cufod.*	LC
MALVACEAE	*Grewia hispida Harv.*	LC
MALVACEAE	*Grewia occidentalis L. var. occidentalis*	LC
MALVACEAE	*Hermannia coccocarpa (Eckl. & Zeyh.) Kuntze*	LC
MALVACEAE	*Hermannia cristata Bolus*	LC
MALVACEAE	*Hermannia depressa N.E.Br.*	LC
MALVACEAE	*Hermannia oblongifolia (Harv.) Hochr.*	LC
MALVACEAE	*Hibiscus aethiopicus L. var. ovatus Harv.*	LC
MALVACEAE	*Sida chrysantha Ulbr.*	LC
MARCHANTIACEAE	*Marchantia debilis K.I.Goebel*	
MOLLUGINACEAE	*Psammotropha mucronata (Thunb.) Fenzl var. mucronata*	LC
OLEACEAE	*Jasminum breviflorum Harv. ex C.H.Wright*	LC
OLEACEAE	*Menodora africana Hook.*	LC
ORCHIDACEAE	*Disa stachyoides Rchb.f.*	LC
ORCHIDACEAE	*Eulophia hians Spreng. var. nutans (Sond.) S.Thomas*	LC
ORCHIDACEAE	*Habenaria clavata (Lindl.) Rchb.f.*	LC

Family	Species	Threat status
ORCHIDACEAE	*Habenaria dives Rchb.f.*	LC
ORCHIDACEAE	*Habenaria kraenzliniana Schltr.*	NT
ORCHIDACEAE	*Satyrium longicauda Lindl. var. longicauda*	LC
OROBANCHACEAE	*Alectra vogelii Benth.*	LC
OROBANCHACEAE	*Cycnium adonense E.Mey. ex Benth.*	LC
OROBANCHACEAE	*Cycnium tubulosum (L.f.) Engl. subsp. tubulosum*	LC
OROBANCHACEAE	*Graderia scabra (L.f.) Benth.*	LC
PAPAVERACEAE	*Argemone mexicana L. forma mexicana*	Not Evaluated
PAPAVERACEAE	*Argemone ochroleuca Sweet subsp. ochroleuca*	Not Evaluated
PHYLLANTHACEAE	*Phyllanthus glaucophyllus Sond.*	LC
PHYLLANTHACEAE	*Phyllanthus maderaspatensis L.*	LC
PITTOSPORACEAE	*Pittosporum viridiflorum Sims*	LC
PLAGIOCHILACEAE	*Plagiochila heterostipa Steph.*	
POACEAE	*Paspalum dilatatum Poir.*	Not Evaluated
POACEAE	*Paspalum notatum Flüggé*	Not Evaluated
POACEAE	*Poa annua L.*	Not Evaluated
POACEAE	*Alloteropsis semialata (R.Br.) Hitchc. subsp. semialata*	LC
POACEAE	*Andropogon appendiculatus Nees*	LC
POACEAE	*Andropogon eucomus Nees*	LC
POACEAE	*Andropogon schirensis Hochst. ex A.Rich.*	LC
POACEAE	*Aristida congesta Roem. & Schult. subsp. barbicollis (Trin. & Rupr.) De Winter*	LC
POACEAE	*Aristida congesta Roem. & Schult. subsp. congesta*	LC
POACEAE	*Aristida junciformis Trin. & Rupr. subsp. junciformis*	LC
POACEAE	*Aristida recta Franch.*	LC
POACEAE	*Arundinella nepalensis Trin.*	LC
POACEAE	*Brachiaria serrata (Thunb.) Stapf*	LC
POACEAE	*Brachypodium flexum Nees*	LC
POACEAE	*Cymbopogon nardus (L.) Rendle*	LC
POACEAE	*Digitaria monodactyla (Nees) Stapf*	LC
POACEAE	*Digitaria ternata (A.Rich.) Stapf*	LC

Family	Species	Threat status
POACEAE	*Digitaria ternata (A.Rich.) Stapf*	LC
POACEAE	*Digitaria tricholaenoides Stapf*	LC
POACEAE	*Elionurus muticus (Spreng.) Kunth*	LC
POACEAE	*Eragrostis capensis (Thunb.) Trin.*	LC
POACEAE	*Eragrostis chloromelas Steud.*	LC
POACEAE	*Eragrostis curvula (Schrad.) Nees*	LC
POACEAE	*Eragrostis gummiflua Nees*	LC
POACEAE	*Eragrostis heteromera Stapf*	LC
POACEAE	*Eragrostis planiculmis Nees*	LC
POACEAE	*Eragrostis racemosa (Thunb.) Steud.*	LC
POACEAE	*Festuca costata Nees*	LC
POACEAE	*Harpochloa falx (L.f.) Kuntze*	LC
POACEAE	*Hyparrhenia anamesa Clayton*	LC
POACEAE	*Hyparrhenia dregeana (Nees) Stapf ex Stent*	LC
POACEAE	*Hyparrhenia filipendula (Hochst.) Stapf var. pilosa (Hochst.) Stapf*	LC
POACEAE	*Hyparrhenia hirta (L.) Stapf*	LC
POACEAE	*Hyparrhenia quarrei Robyns*	LC
POACEAE	*Hyparrhenia tamba (Steud.) Stapf*	LC
POACEAE	*Microchloa caffra Nees*	LC
POACEAE	*Microchloa kunthii Desv.*	LC
POACEAE	*Miscanthus junceus (Stapf) Pilg.*	LC
POACEAE	*Panicum natalense Hochst.*	LC
POACEAE	*Paspalum scrobiculatum L.*	LC
POACEAE	*Setaria incrassata (Hochst.) Hack.*	LC
POACEAE	*Setaria nigrirostris (Nees) T.Durand & Schinz*	LC
POACEAE	*Setaria pumila (Poir.) Roem. & Schult.*	LC
POACEAE	*Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. torta (Stapf) Clayton*	LC
POACEAE	*Sporobolus africanus (Poir.) Robyns & Tournay*	LC
POACEAE	*Sporobolus fimbriatus (Trin.) Nees*	LC

Family	Species	Threat status
POACEAE	*Sporobolus pyramidalis P.Beauv.*	LC
POACEAE	*Sporobolus sanguineus Rendle*	LC
POACEAE	*Stiburus conrathii Hack.*	LC
POACEAE	*Tristachya leucothrix Trin. ex Nees*	LC
POLYGALACEAE	*Polygala leendertziae Burtt Davy*	LC
POLYGONACEAE	*Rumex acetosella L. subsp. angiocarpus (Murb.) Murb.*	
POLYGONACEAE	*Persicaria decipiens (R.Br.) K.L.Wilson*	LC
POLYPODIACEAE	*Pleopeltis polypodioides (L.) E.G.Andrews & Windham subsp. ecklonii (Kunze) J.P.Roux*	LC
POLYTRICHACEAE	*Pogonatum capense (Hampe) A.Jaeger*	
PORTULACACEAE	*Talinum caffrum (Thunb.) Eckl. & Zeyh.*	LC
PTERIDACEAE	*Adiantum capillus-veneris L.*	LC
PTERIDACEAE	*Pteris catoptera Kunze var. catoptera*	LC
PTERIDACEAE	*Pteris cretica L.*	LC
RHAMNACEAE	*Ziziphus zeyheriana Sond.*	LC
ROSACEAE	*Cotoneaster pannosus Franch.*	Not Evaluated
ROSACEAE	*Cliffortia linearifolia Eckl. & Zeyh.*	LC
RUBIACEAE	*Cephalanthus natalensis Oliv.*	LC
RUBIACEAE	*Kohautia amatymbica Eckl. & Zeyh.*	LC
RUBIACEAE	*Pachystigma thamnus Robyns*	LC
RUBIACEAE	*Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. chamaedendrum*	LC
RUBIACEAE	*Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. setulosus Robyns*	LC
RUBIACEAE	*Spermacoce senensis (Klotzsch) Hiern*	LC
SALICACEAE	*Scolopia zeyheri (Nees) Harv.*	LC
SANTALACEAE	*Thesium pallidum A.DC.*	LC
SCROPHULARIACEAE	*Mimulus moschatus Douglas var. moschatus*	Not Evaluated
SCROPHULARIACEAE	*Diclis reptans Benth.*	LC
SCROPHULARIACEAE	*Hebenstretia comosa Hochst.*	LC
SCROPHULARIACEAE	*Hebenstretia dura Choisy*	LC
SCROPHULARIACEAE	*Jamesbrittenia montana (Diels) Hilliard*	LC

Family	Species	Threat status
SCROPHULARIACEAE	*Limosella longiflora Kuntze*	LC
SCROPHULARIACEAE	*Lindernia parviflora (Roxb.) Haines*	LC
SCROPHULARIACEAE	*Manulea rhodantha Hilliard subsp. aurantiaca Hilliard*	LC
SCROPHULARIACEAE	*Nemesia umbonata (Hiern) Hilliard & B.L.Burtt*	LC
SCROPHULARIACEAE	*Selago cucullata Hilliard*	LC
SINOPTERIDACEAE	*Cheilanthes eckloniana (Kunze) Mett.*	LC
SINOPTERIDACEAE	*Cheilanthes viridis (Forssk.) Sw. var. viridis*	LC
SINOPTERIDACEAE	*Pellaea calomelanos (Sw.) Link var. calomelanos*	LC
SOLANACEAE	*Solanum capense L.*	LC
SOLANACEAE	*Solanum lichtensteinii Willd.*	LC
SOLANACEAE	*Solanum retroflexum Dunal*	LC
SOLANACEAE	*Solanum rigescens Jacq.*	Not Evaluated
THYMELAEACEAE	*Gnidia caffra (Meisn.) Gilg*	LC
THYMELAEACEAE	*Gnidia kraussiana Meisn. var. kraussiana*	LC
VERBENACEAE	*Verbena officinalis L.*	Not Evaluated
VERBENACEAE	*Lantana rugosa Thunb.*	LC
VITACEAE	*Cissus cussonioides Schinz*	LC

Appendix B: Plant Species List

Family	Species	Threat
Agapanthaceae	*Agapanthus caulescens*	LC
Amaranthaceae	*Gomphrena celesioides*	Alien
Amaryllidaceae	*Crinum bulbispermum*	Declining/Provincially Protected
Anacardiaceae	*Searsia rehmanianna*	LC
Apiaceae	*Centella asiatica*	LC
Araliaceae	*Cussonia paniculata*	LC
Asparagaceae	*Asparagus sp.*	
Asphodelaceae	*Aloe ecklonis*	LC
Asteraceae	*Acanthospermum australe*	Alien
Asteraceae	*Berkheya rigida*	LC
Asteraceae	*Bidens bipinnata*	Alien
Asteraceae	*Chrysanthemoides monilifera*	LC
Asteraceae	*Cirsium vulgare*	Alien
Asteraceae	*Conyza bonariensis*	Alien
Asteraceae	*Cosmos bipinnata*	Alien
Asteraceae	*Haplocarpha scaposa*	LC
Asteraceae	*Heliophila sp.*	
Asteraceae	*Schkuria pinnata*	Alien
Asteraceae	*Seriphium plumosum*	LC
Asteraceae	*Tagetes minuta*	Alien
Campanulaceae	*Wahlebergia sp.*	LC
Caryophyllaceae	*Silene burchellii*	LC
Commelinaceae	*Commelina africana*	LC
Convolvulaceae	*Ipomoea purpurea*	LC
Crassulaceae	*Crassula alba*	LC
Cyperaceae	*Cyperus esculentus*	LC
Dipsacaceae	*Scabiosa columbaria*	LC
Ebenaceae	*Diospyros lycioides*	LC
Ebenaceae	*Diospyros whyteana*	LC
Euphorbiaceae	*Euphorbia clavarioides*	LC
Fabaceae	*Acacia dealbata*	Alien

Family	Species	Threat
Fabaceae	*Acacia decurrens*	Alien
Fabaceae	*Acacia karroo*	LC
Fabaceae	*Acacia mearnsii*	Alien
Fabaceae	*Chamaecrista comosa*	LC
Fabaceae	*Crotalaria sp.*	
Fabaceae	*Indigofera sp.*	LC
Fabaceae	*Vachellia erubescens*	LC
Lobeliaceae	*Monopsis decipiens*	LC
Malvaceae	*Hermannia depressa*	LC
Malvaceae	*Hibiscus trionum*	Alien
Myrtaceae	*Eucalyptus camuldulensis*	Alien
Oleaceae	*Olea europoea*	LC
Orobanchaceae	*Sopubia cana*	LC
Orobanchaceae	*Striga asiatica*	LC
Oxalidaceae	*Oxalis corniculata*	Alien
Oxalidaceae	*Oxalis obliquifolia*	LC
Pinaceae	*Pinus patula*	Alien
Plantaginaceae	*Plantago major*	LC
Poaceae	*Andropogon eucomus*	LC
Poaceae	*Aristida congesta subsp. Barbicollis*	LC
Poaceae	*Aristida congesta subsp. Congesta*	LC
Poaceae	*Aristida junciformis*	LC
Poaceae	*Chloris virgata*	LC
Poaceae	*Cymbopogon caesius*	LC
Poaceae	*Cymbopogon excavatus*	LC
Poaceae	*Cynodon dactylon*	LC
Poaceae	*Eragrostis chloromelas*	LC
Poaceae	*Eragrostis curvula*	LC
Poaceae	*Eragrostis gummiflua*	LC
Poaceae	*Eragrostis racemosa*	LC
Poaceae	*Heteropogon contortus*	LC

Family	Species	Threat
Poaceae	*Hyparrhenia hirta*	LC
Poaceae	*Imperata cylindrica*	LC
Poaceae	*Melinis repens*	LC
Poaceae	*Monocymbium ceresiiforme*	LC
Poaceae	*Paspalum dilatatum*	LC
Poaceae	*Paspalum distichum*	LC
Poaceae	*Pennesetum clandestinum*	Alien
Poaceae	*Perotis patens*	LC
Poaceae	*Phragmites australis*	LC
Poaceae	*Pogonarthria squarrosa*	LC
Poaceae	*Setaria spacelata*	LC
Poaceae	*Sporobolus africanus*	LC
Poaceae	*Sporobolus pyramidalis*	LC
Poaceae	*Themeda triandra*	LC
Polygalaceae	*Polygala hottentotta*	LC
Portulaceae	*Portulacca oleracea*	LC
Ranunculaceae	*Ranunculus multifidus*	Alien
Rubiaceae	*Pentanisia angustifolia*	LC
Rubiaceae	*Richardia brasiliensis*	Alien
Salicaceae	*Salix babylonica*	Alien
Sinopteridaceae	*Pellaea calemanos*	LC
Solanaceae	*Datura stramonium*	Alien
Solanaceae	*Solanum mauritanum*	Alien
Solanaceae	*Solanum sysimbriifolium*	Alien
Typhaceae	*Typha capensis*	LC
Verbenaceae	*Lantana camara*	Alien
Verbenaceae	*Verbena brasiliensis*	Alien
Verbenaceae	*Verbena officianalis*	Alien

Appendix C: Mammal List

Common Name	SA Red Data Status	IUCN status	Likelihood of occurrence
Grey /Common Duiker	Least concern	Least Concern	Highly likely
Steenbok	Least concern	Lower Risk - least concern	Possible
Red Hartebeest	Least Concern	Least Concern	Re-introduced
Warthog	Least concern	Lower Risk - least concern	Possible
Bushpig	Least concern	Lower Risk - least concern	Highly likely
Grey Rhebok	Least concern	Least Concern	Possible
Mountain Reedbuck	Least concern	Least Concern	Possible
Reedbuck	Least concern	Lower Risk - conservation dependent	Unlikely
Bushbuck	Least concern	Lower Risk - least concern	Unlikely
Kudu	Least concern	Lower Risk - conservation dependent	Possible
Slender Mongoose	Least concern	Lower Risk - least concern	Highly likely
Striped Polecat	Least concern	Lower Risk - least concern	Highly likely
Small-spotted Genet	Least concern	Lower Risk - least concern	Highly likely
Large-spotted Genet	Least concern	Lower Risk - least concern	Highly likely
Yellow Mongoose	Least concern	Lower Risk - least concern	Highly likely
Banded Mongoose	Least concern	Lower Risk - least concern	Unlikely
White-tailed Mongoose	Least concern	Lower Risk - least concern	Highly likely
Black-backed Jackal	Least concern	Least Concern	Highly likely
Honey Badger	Near Threatened	Lower Risk - least concern	Possible
African Wild Cat	Least concern	Least Concern	Possible
Leopard	Least concern	Least Concern	Possible
Serval	Near Threatened	Least Concern	Possible
Banded Mongoose	Least concern	Lower Risk - least concern	Possible
Caracal	Least concern	Least Concern	Possible
Aardwolf	Least concern	Lower Risk - least concern	Possible
African Weasel	Data deficient	Lower Risk - least concern	Possible
Brown Hyaena	Near Threatened	Lower Risk - near threatened	Possible

Common Name	SA Red Data Status	IUCN status	Likelihood of occurrence
Water Mongoose	Least concern	Lower Risk - least concern	Possible
Spotted-necked Otter	Near Threatened	Least Concern	Unlikely
Cape Clawless Otter	Least concern	Least Concern	Unlikely
Bushveld Horseshoe Bat	Least concern	Least Concern	Likely
Mauritian Tomb Bat	Least concern	Least Concern	Likely
Egyptian Slit-faced Bat	Least concern	Least Concern	Likely
Wahlberg's Epauletted Fruit Bat	Least concern	Least Concern	Likely
Schreiber's Long-fingered Bat	Near Threatened	Near Threatened	Possible
Darling's Horseshoe Bat	Near Threatened	Least Concern	Possible
Egyptian Free-tailed Bat	Least concern	Least Concern	Possible
Lesser Yellow House Bat	Least concern	Least Concern	Possible
Yellow House Bat	Least concern	Least Concern	Possible
Geoffroy's Horseshoe Bat	Near Threatened	Least Concern	Possible
Temminck's Hairy Bat	Near Threatened	Least Concern	Possible
Rusty Bat	Near Threatened	Least Concern	Possible
African Pipistrelle	Least concern		Possible
Sundevall's Leaf-nosed Bat	Data deficient	Least concern	Unlikely
Welwitsch's Hairy Bat	Near Threatened	Least Concern	Unlikely
Short-eared Trident Bat	Critically endangered	Vulnerable	Unlikely
Reddish-grey Musk Shrew	Data deficient	Least Concern	Highly likely
South African Hedgehog	Near Threatened	Lower Risk - least concern	Possible
Lesser Red Musk Shrew	Data deficient	Least Concern	Likely
Tiny Musk Shrew	Data deficient	Least Concern	Possible
Lesser Grey-browned Musk Shrew	Data deficient	Least Concern	Possible
Least Dwarf Shrew	Data deficient	Least Concern	Possible
Greater Dwarf Shrew	Data deficient		Possible
Forest Shrew	Data deficient	Least Concern	Possible

Common Name	SA Red Data Status	IUCN status	Likelihood of occurrence
Swamp Musk Shrew	Data deficient	Least Concern	Possible
Lesser Dwarf Shrew	Data deficient	Least Concern	Possible
Cape/desert Hare	Least concern	Lower Risk - least concern	Likely
Scrub/Savannah Hare	Least concern	Lower Risk - least concern	Possible
Jameson's Red Rock Rabbit	Least concern	Lower Risk - least concern	Unlikely
Short-snouted Elephant-shrew	Data Deficient	Least concern	Possible
Rock Elephant Shrew	Least concern	Least Concern	Possible
Vervet Monkey	Least concern	Lower Risk - least concern	Likely
Southern Lesser Galago	Least concern	Lower Risk - least concern	Possible
Common Mole-rat	Least concern	Least Concern	Highly likely
Multimammate Mouse	Least concern	Least Concern	Highly likely
Porcupine	Least concern	Least Concern	Likely
Pygmy mouse	Least concern	Least Concern	Likely
Pouched mouse	Least concern	Least Concern	Likely
Highveld Gerbil	Data deficient	Least Concern	Likely
Tree Rat	Least concern	Least Concern	Likely
Spiny Mouse	Least concern	Least Concern	Possible
Striped Mouse	Least concern	Least Concern	Possible
Fat Mouse	Least concern	Least Concern	Possible
Woodland Dormouse	Least concern	Least Concern	Possible
Springhare	Least concern	Least Concern	Possible
Tree Squirrel	Least concern	Least concern	Possible
Single-striped Mouse	Data deficient	Least Concern	Possible
Chestnut Climbing Mouse	Least concern	Least Concern	Possible
Rock Dormouse	Data deficient	Least Concern	Possible
Greater Cane Rat	Least concern	Least Concern	Possible
Angoni Vlei Rat	Least concern	Least Concern	Possible
Water Rat	Near Threatened	Least Concern	Possible
Grey Climbing mouse	Least concern	Least Concern	Possible

Common Name	SA Red Data Status	IUCN status	Likelihood of occurrence
Vlei Rat	least concern	Least Concern	Possible
Rock Hyrax/Dassie	Least concern	Least Concern	Likely
Aardvark/Ant bear	Least concern	Least Concern	Possible

Appendix D: Bird Species List

No.	Common Name	Scientific Name	Comments
6	Great Crested Grebe	*Podiceps cristatus*	Potential Breeding Pair upper west dam
8	Little Grebe	*Tachybaptus ruficollis*	
58	Reed Cormorant	*Microcarbo africanus*	
60	African Darter	*Anhinga rufa*	
62	Grey Heron	*Ardea cinerea*	
71	Cattle Egret	*Bubulcus ibis*	
91	African Sacred Ibis	*Threskiornis aethiopicus*	
92	Southern Bald Ibis	*Geronticus calvus*	Flying overhead in eastern grassland
94	Hadeda Ibis	*Bostrychia hagedash*	
95	African Spoonbill	*Platalea alba*	
99	Whitefaced Duck	*Dendrocygna viduata*	
102	Egyptian Goose	*Alopochen aegyptiaca*	
103	South African Shelduck	*Tadorna cana*	
104	Yellowbilled Duck	*Anas undulata*	
106	Cape Teal	*Anas capensis*	
116	Spurwinged Goose	*Plectropterus gambensis*	
127	Blackshouldered Kite	*Elanus axillaris*	
165	African Marsh Harrier	*Circus ranivorus*	Hawking in southern section adjacent to rehabilitate area
180	Amur Falcon	*Falco amurensis*	
181	Rock Kestrel	*Falco tinnunculus*	
203	Helmeted Guineafowl	*Numida meleagris*	
209	Grey Crowned Crane	*Balearica regulorum*	
228	Redknobbed Coot	*Fulica cristata*	
255	Crowned Lapwing	*Vanellus coronatus*	
258	Blacksmith Lapwing	*Vanellus armatus*	
260	Wattled Lapwing	*Vanellus senegallus*	
286	African Snipe	*Gallinago nigripennis*	Mating pair upper dam
348	Rock Dove	*Columba livia*	
349	Speckled Pigeon	*Columba guinea*	

No.	Common Name	Scientific Name	Comments
352	Redeyed Dove	*Streptopelia semitorquata*	
354	Cape Turtle-Dove	*Streptopelia capicola*	
355	Laughing Dove	*Spilopelia senegalensis*	
415	Whiterumped Swift	*Apus caffer*	
424	Speckled Mousebird	*Colius striatus*	Residential area
451	African Hoopoe	*Upupa epops*	
452	Green Woodhoopoe	*Phoeniculus purpureus*	
464	Blackcollared Barbet	*Lybius torquatus*	Residential area
473	Crested Barbet	*Trachyphonus vaillantii*	
489	Redthroated Wryneck	*Jynx ruficollis*	Residential area
520	Whitethroated Swallow	*Hirundo albigularis*	
530	Common House-Martin	*Delichon urbicum*	
534	Banded Martin	*Riparia cincta*	
545	Blackheaded Oriole	*Oriolus larvatus*	
550	Whitenecked Raven	*Corvus albicollis*	
568	Darkcapped Bulbul	*Pycnonotus barbatus*	
580	Groundscraper Thrush	*Psophocichla litsitsirupa*	
595	Anteating Chat	*Myrmecocichla formicivora*	
666	Cloud Cisticola	*Cisticola textrix*	
677	Levaillant's Cisticola	*Cisticola rufilatus*	
713	Cape Wagtail	*Motacilla capensis*	
716	Grassveld (Richard's) Pipit	*Anthus cinnamomeus*	
732	Common Fiscal	*Lanius collaris*	
746	Bokmakierie	*Telophorus zeylonus*	Residential area
758	Common Myna	*Acridotheres tristis*	Residential area
759	Pied Starling	*Spreo bicolor*	Residential area
801	House Sparrow	*Passer domesticus*	
814	Southern Masked-Weaver	*Ploceus velatus*	
821	Redbilled Quelea	*Quelea quelea*	
824	Southern Red Bishop	*Euplectes orix*	
832	Longtailed Widowbird	*Euplectes progne*	

No.	Common Name	Scientific Name	Comments
846	Common Waxbill	*Estrilda astrild*	
852	African QuailFinch	*Ortygospiza fuscocrissa*	flock flying overhead in rehabilitated area

Appendix E: Invertebrates

Family	Species Name	Common Name
Hesperiidae	*Gegenes niso niso*	Common Hottentot
	Spialia spio	Mountain Sandman
Lycaenidae	*Azanus natalensis*	Natal Babul Blue
	Danaeus chryssipus orientis	African Monarch
	Eicochrysops messapus mahallakoaena	Cupreous Blue
	Leptotes pirithous pirithous	Common Zebra Blue
Nymphalidae	*Catacroptera cloanthe cloanthe*	Pirate
	Hypolimnas misippus	Common Diadem
	Junonia orithya madagascariensis	Eyed Pansy
	Telchiia rahira rahira	Marsh Acraea
	Vanessa cardui	Painted Lady
Papilionidae	*Papilio demodocus*	Citrus Swallowtail
Pieridae	*Belenois aurota*	Brown-veined White