TERRESTRIAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED KATHU SUPPLIERS PARK IN THE NORTHERN CAPE PROVINCE.

Prepared for

SLR Consulting (Pty) Ltd

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Declaration

This report has been prepared according to the requirements of Section 32 (3b) of the Environmental Impact Assessments (EIA) Regulations, 2010 (GNR 543). We (the undersigned) declare the findings of this report free from influence or prejudice.

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed Kathu suppliers park, on the farm Sekgame 461 in the Northern Cape Province, hereafter referred to as the 'subject property'. The subject property is located directly to the south of the R380 roadway, adjacent to a residential area presently being developed as part of the town of Kathu.

DESKTOP ASSESSMENT

The following general conclusions were drawn on completion of the desktop assessment:

- According to the Northern Cape Provincial Spatial Development Framework (PSDF, 2012) the subject property is located within the Succulent Karoo Region of Endemism in the Northern Cape Province and is located within an area of high vulnerability with regards to biodiversity sensitivity;
- According to the National land cover database (2009), the majority of the subject property is indicated to be natural land with urban development located adjacent to the north western border;
- According to the National List of Threatened Terrestrial Ecosystems the subject property does not fall within a threatened terrestrial ecosystem; and
- According to the National Biodiversity Assessment (NBA, 2011) the subject property is not located within either a formal or informal protected area.

VEGETATION ASSESSMENT

The following general conclusions were drawn on completion of the floral assessment:

- Four vegetation habitat units were identified within the subject property. These habitat units include:
    - The *Acacia erioloba* woodland habitat unit;
    - The Kathu bushveld habitat unit;
    - The transformed habitat unit; and
    - The wetland habitat unit (The wetland habitat unit is discussed in detail in the wetland report (SAS, 2014)).
- The Vegetation Index Score (VIS) for each of the habitat units was calculated and is listed below:
    - The *Acacia erioloba* woodland and Kathu Bushveld habitat units calculated a moderate score which falls within Class C – Moderately modified with few modifications;
    - The transformed habitat unit calculated a low score which falls within Class E- Loss of natural habitat is extensive;
    - The vegetation Present Ecological State (PES) of the natural pan has been assessed as part of the wetland report (SAS, 2014).
- The majority of the grass species encountered within the subject property are indicative of past disturbance and only six species found are listed as indicators of the Kathu bushveld vegetation type (Musina and Rutherford, 2006);
- An assessment considering the presence of any floral Species of Conservation Concern (SCC) and protected plant species was undertaken:
    - Floral SCC identified within the study area at the time of the assessment include *Acacia erioloba* (declining) and *Boophone disticha* (declining);
    - Four protected species were also encountered within the subject property. These include the SCC *Acacia erioloba* (National Forests Act (NFA), 1998) and *Boophone disticha* (Northern Cape Nature Conservation Act (NCNCA, 2009) as well as *Nerine laticoma* (NCNCA, 2009) and *Aloe grandidentata* (NCNCA, 2009);
    - *Acacia erioloba* densities increased significantly within the *Acacia erioloba* woodland habitat unit. Additional scattered individuals of *Acacia erioloba* were also encountered within the Kathu bushveld and transformed habitat unit;
    - *Boophone disticha* was encountered within the *Acacia erioloba* woodland habitat unit;
    - *Nerine laticoma* was encountered scattered throughout the Kathu bushveld habitat unit. A single individual was also encountered within the transformed habitat unit at the time of the assessment and additional individuals may therefore be present; and
    - *Aloe grandidentata* was encountered within the *Acacia erioloba* woodland habitat unit.

- It is therefore recommended that, where possible, development within the *Acacia erioloba* woodland is avoided in order to avoid impacts associated with the loss of large numbers of floral SCC and protected floral species;
- ;
- SCC and protected bulb and *Aloe* species which will be disturbed as a result of development activities must be rescued and relocated with the assistance of a suitably qualified specialist;
- Should protected and indigenous species to be cut, disturbed, damaged or destroyed, applications for such activities must be made to the Northern Cape Department of Environment and Nature Conservation.

FAUNAL ASSESSMENT

The following general conclusions were drawn on completion of the faunal assessment:

- The subject property can broadly be divided into three faunal habitat units namely wetland, open veld (including *Acacia erioloba* woodland and Kathu bushveld habitat units as referred to in the floral assessment) and transformed;
- Six mammal species, *Cynictis penicillata* (Yellow Mongoose), *Galerella sanguinea* (Slender Mongoose), *Crocidura cyanea* (Reddish-grey musk shrew), *Raphicerus campestris* (Steenbok), *Lepus saxatilis* (Scrub Hare) and *Acomys subspinosus* (Cape Spiny Mouse) were identified within the subject property. All mammal species are common species for the area and are listed as non-threatened species by the IUCN. However, all of the species are listed as protected within the NCNCA (2009). Should these species be removed or killed a permit will be required from the Northern Cape Department of Environment and Nature Conservation;
- The subject property provides a diversity of avifaunal habitat namely wetland, open veld and woodland in the vicinity of *Acacia erioloba* trees. All avifaunal species identified within the subject property are listed as species of least concern (IUCN, 2013) and are common species for the region. However, the majority of the species identified are listed as protected species by the NCNCA (2009) and none of the species are listed as protected by the National Environmental Management Biodiversity Act (NEMBA, Act 4 of 2004);
- Only three reptile species were identified during the site survey. The subject property does provide habitat for a more diverse reptile community, however their secretive nature makes detection difficult during a field survey of limited duration. Species expected to be found within the subject property would most likely be terrestrial species adapted to grassland and that prey on avifauna and small mammal species;
- Only one amphibian species was identified namely *Amietophrynus garmani* (Eastern olive toad). The amphibian population is not expected to be diverse due to the general lack of natural wetlands within the region. A conclusion supported by the Animal Demography Unit which only lists two additional species for the quarter degree square (QDS) namely *Amietia angolensis* and *Tomopterna cryptotis*. All three amphibian species are considered least concern (IUCN, 2013);
- The sandy soils as well as degree of transformation within the subject property, it was concluded that less transformed areas within the open veld habitat unit may provide habitat for trapdoor spiders;
- The lack of rocky outcrops that would provide rock crevices for *Hadogenes* spp. or rocks that would allow burrowing for *Opistophthalmus* spp., decreases the possibility of finding these scorpion species significantly. The open veld habitat unit may however provide habitat for *Opistacanthus* spp. as well as other more common scorpions found within the Northern Cape. It should be noted that all *Hadogenes* spp. all *Opistophthalmus* spp. and all *Opistacanthus* spp. are listed as protected by the NCNCA (2009); and
- No Red Data List (RDL) species were identified within the subject property and due to surrounding anthropogenic activity it is deemed unlikely that a great diversity of RDL species would be found.

SENSITIVITY MAPPING

All the vegetation and faunal results as discussed above was used to map habitat units according to sensitivity. In terms of overall terrestrial ecological sensitivity the study area can be divided into moderately high sensitivity habitat, moderately low sensitivity habitat, and low sensitivity habitat:

- Moderately high sensitivity habitat includes the *Acacia erioloba* woodland habitat unit;
- Moderately low sensitivity habitat includes the Kathu bushveld habitat unit; and
- Low sensitivity vegetation includes the transformed habitat unit.

The Environmental Importance and Sensitivity of the wetland habitat unit was determined during the wetland assessment, for results refer to the SAS wetland assessment dated 2014.

IMPACT ASSESSMENT

At the time the impacts were assessed the development layout had not been finalised, it was therefore considered important to determine impact significance for each habitat unit separately. Impact due to loss of the wetland habitat unit was assessed as part of the wetland impact assessment therefore only the *Acacia erioloba* woodland, the Kathu bushveld and the transformed habitat units were assessed below. For the faunal impact assessment the *Acacia erioloba* woodland, the Kathu bushveld were combined as one habitat unit namely open veld.

The table below serve to summarise the significance of perceived impacts on the floral and faunal biodiversity of the subject property before mitigation measures are implemented. Also indicated is the impact significance of each perceived impact after the implementation of mitigation measures.

Table A: Summary of vegetation impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on floral habitat	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 2: Impact on floral diversity	*Acacia erioloba* woodland	Medium High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 3: Impact on floral SCC and protected species	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium Low (-ve)	Very Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)

Table B: A summary of faunal impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on faunal habitat	Open veld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 2: Impact on faunal diversity	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)
IMPACT 3: Impact on faunal species of conservational concern	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Very Low	Very Low

Impact	Habitat unit	Unmanaged	Managed
		(-ve)	(-ve)

From the results of the impact assessment it is evident that impact due to loss of vegetation habitat and diversity is expected to be more significant compared to loss of faunal habitat and diversity. This is mainly due to the degree of historical and present anthropogenic activity within the subject property as well as immediate surroundings that would have resulted in a decrease of the faunal species that would utilise the subject property for foraging or breeding.

Several protected and RDL floral species were identified within the subject property during the time of the assessment and loss of individuals or habitat for these species is considered high within the *Acacia erioloba* woodland. No RDL faunal species were encountered within the subject property. Several identified faunal species are listed as protected within the province however all the species are relatively common and potential impact significance due to the presence of these species are therefore not considered very high.

After conclusion of the terrestrial assessment, it is the opinion of the ecologist that, from an ecological point of view, the proposed development will not lead to an unacceptable loss of biodiversity or important ecological aspects and can be considered favourably, provided that the mitigation measures as presented in the impact assessment of this report are strictly adhered to.

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GLOSSARY OF TERMS

Alien Invasive vegetation	Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
Protected species	Any species which is of such high conservation value or national importance that it requires national protection". Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
Red Data listed species	Organisms that fall into the Extinct in the Wild, Critically Endangered, Endangered, Vulnerable categories of ecological status as listed by the IUCN.
Species of Conservation Concern	Floral species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild, Regionally Extinct, Near Threatened, Critically Rare, Rare, Declining and Data Deficient - Insufficient Information.
Threatened species	Species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species.

ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CITES	Convention on International Trade in Endangered Species
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
CARA	Conservation of Agricultural Resources Act
GIS	Geographic Information System
IUCN	International Union for Conservation of Nature and Natural Resources
NBA	National Biodiversity Assessment
NCNCA	Northern Cape Nature Conservation Act
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFA	National Forests Act
NT	Near Threatened
NYBA	Not Yet Been Assessed
PES	Present Ecological State
PRÉCIS	Pretoria Computer Information Systems
PSDF	Provincial Spatial Development Framework

QDS	Quarter degree square (1:50,000 topographical mapping references)
RDL	Red Data listed
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SCC	Species of Conservation Concern
Sp.	*Species*

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed Kathu suppliers park, on the farm Sekgame 461 in the Northern Cape Province, hereafter referred to as the subject property (Figure 1 and 2). The subject property is located directly to the south of the R380 roadway, adjacent to an area presently being developed as part of the town of Kathu.

The final document, after consideration and description of the ecological sensitivity of the subject property, will aim to guide the property owner, Environmental Assessment Practitioner (EAP) and authorities by means of recommendations as to viability of the development from an environmental perspective, with a specific focus on terrestrial ecology.

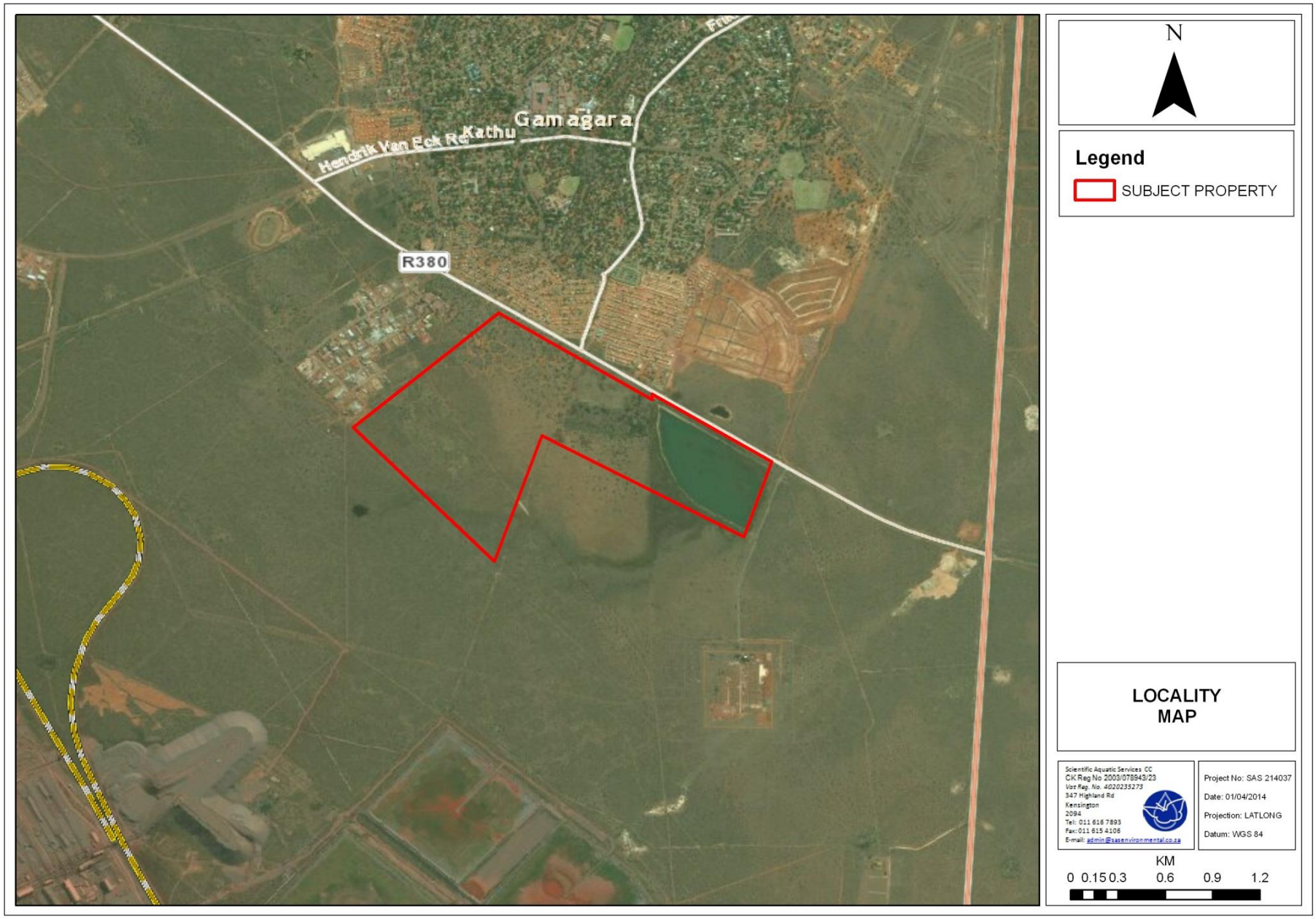

Figure 1: Digital satellite image depicting the location of the subject property in relation to surrounding areas.

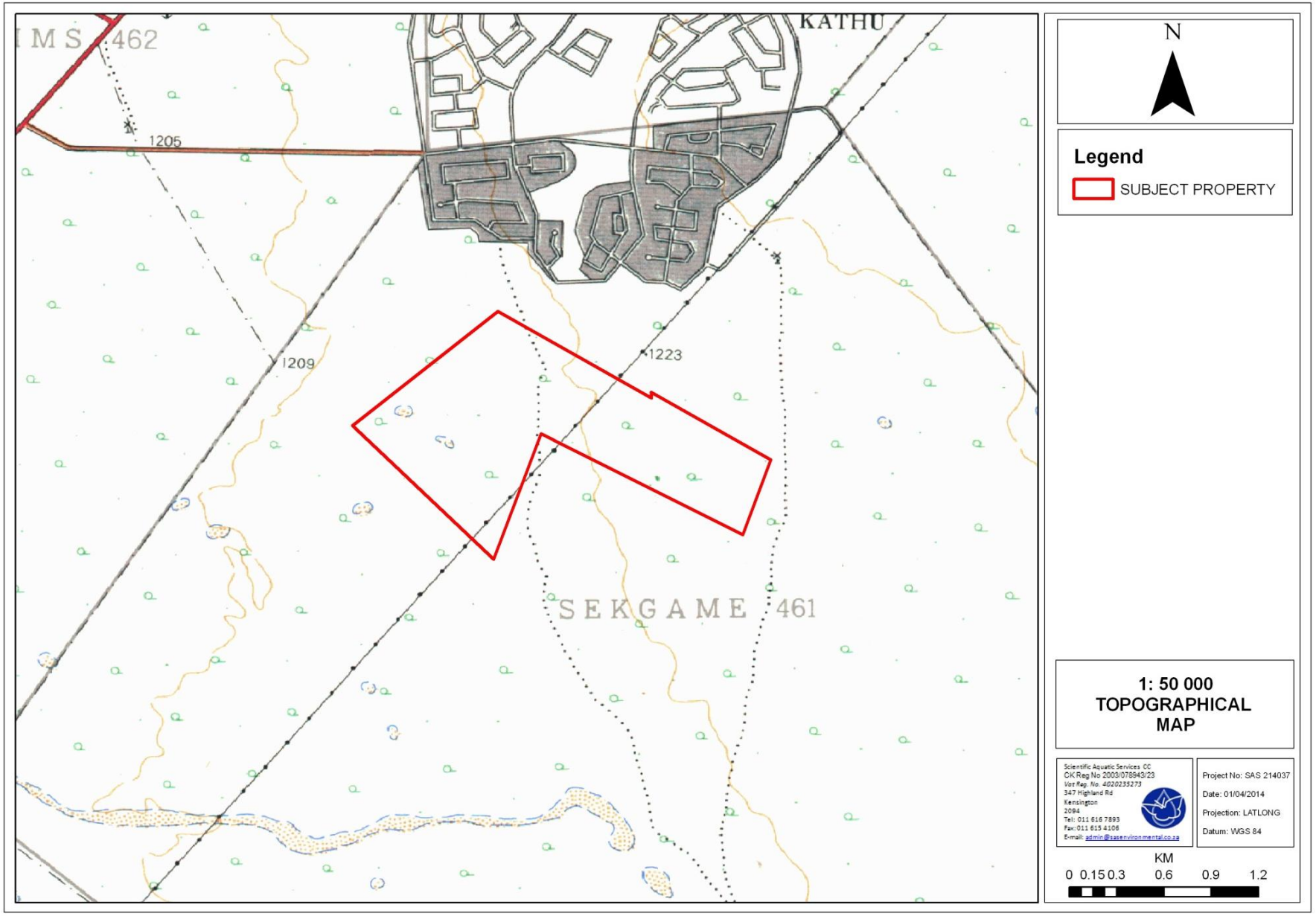

Figure 2: Location of the subject property depicted on a 1:50 000 topographical map in relation to surrounding areas

1.2 Scope

Specific outcomes in terms of this report are as follows:

- Describe and map existing vegetation in the area potentially affected by the proposed project and the likely fauna species found in the area;
- Undertake a field assessment of the entire area to be affected by construction activities;
- Evaluate the conservation value of the site relative to the surrounding natural areas and current and potential conservation areas and targets for the vegetation type occurring on site;
- List any potentially threatened, endangered and endemic flora and fauna species in the area and indicate the importance of the identified species in a local, regional and national context;
- Map areas of higher and lower sensitivity on the site;
- Define applicable legislative requirements regarding any permit applications required;
- Identify potential impacts of the proposed project on terrestrial ecology;
- Identify and assess potential cumulative ecological impacts resulting from the proposed development in relation to proposed and existing developments in the surrounding area;
- Recommend practicable mitigation measures to avoid and/or minimise/reduce impacts and enhance benefits; and
- Compile a monitoring plan to monitor impacts, if required.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The terrestrial assessment was confined to the subject property as well as the immediate adjacent areas of relevance and does not include the neighbouring and adjacent properties. These were however considered as part of the desktop assessment;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the subject property may therefore have been missed during the assessment;
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked; and
- The level of detail undertaken in the study is considered sufficient to ensure that the results of this assessment accurately define the Ecological Importance and Sensitivity (EIS) and the Present Ecological State (PES) of the of the subject property and to provide the relevant planners and decision makers with sufficient information to formulate an opinion in the viability of the proposed development form an ecological conservation viewpoint.

1.4 Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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1.5 Legislative requirements

National Environmental Management Act, (NEMA, Act 107 of 1998)

The guiding principles of NEMA (Act 107 of 1998) refer specifically to biodiversity management in the following Clause:

- (4) (a) *Sustainable* development requires the consideration of all relevant factors including the following:
- (i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- NEMA (Act 107 of 1998) as amended and the associated Regulations (Listing No R. 544, No R. 545 and R. 546), states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact;
- Listed Activities in R386 including:
  - Activity 1 (m) any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including - canals; channels; bridges; dams; and weirs.

National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004)

The objectives of this act are (within the framework of NEMA) to provide for:

- the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- the use of indigenous biological resources in a sustainable manner;
- the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources;
- to give effect to‘ ratified international agreements relating to biodiversity which are binding to the Republic;
- to provide for co-operative governance in biodiversity management and conservation; and
- to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources.

Furthermore a person may not carry out a restricted activity involving either:

a) a specimen of a listed threatened or protected species
b) specimen of an alien species; or
c) a specimen of a listed invasive species without a permit.

National Forests Act (NFA, Act 84 of 1998, as amended in 2011)

In terms of section 15(1) of the NFA (Act No. 84 of 1998, as amended in 2011):

- No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

The Northern Cape Nature Conservation Act (NCNCA, Act No 9 of 2009)

Restricted activities involving specially protected plants:

49(1) No person may, without a permit –

(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Possess;
(f) Cultivate; or
(g) Trade in,

A specimen of a specially protected plant

Restricted activities involving protected plants

50 (1) Subject to the provision of section 52, no person may, without a permit –

(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Cultivate; or
(f) Trade in,

A specimen of a protected plant.

Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

Removal of the alien and weed species encountered on the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operational, phases.

2 METHOD OF ASSESSMENT

A site visit was undertaken during March 2014 in order to determine the EIS of the subject property and the surrounding areas. A thorough 'walk through' of the area was undertaken to determine the general habitat types found throughout the subject property. Special emphasis was placed on areas that may potentially support floral Species of Conservation Concern (SCC) as listed by the South African National Biodiversity Institute (SANBI) PRECIS (National Herbarium Pretoria (PRE) Computerised Information System) database. Furthermore, the subject property was investigated on foot in order to identify the occurrence of the dominant faunal communities, species and habitat diversities. The presence of any faunal inhabitants of the subject property was also assessed through direct visual observation or identifying such species through calls, tracks, scats and burrows.

A detailed explanation of the terrestrial method of assessment is provided in Appendix A.

3 DESKTOP RESULTS

3.1 Importance According to the Northern Cape Provincial Spatial Development Framework (PSDF, 2012)

According to the PSDF (2012) the subject property is located within the Succulent Karoo Region of Endemism in the Northern Cape Province and is located within an area of high vulnerability with regards to biodiversity sensitivity.

3.2 National Land Cover (2009)

Land cover and land use changes often indicate major impacts on biodiversity, especially if those changes show the loss of natural habitat due to urban sprawl, cultivation, etc. The majority of the subject property is indicated to be natural land with urban development located adjacent to the north western border.

3.3 National List of Threatened Terrestrial Ecosystems for South Africa (2011)

The NEMBA (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered, Endangered, Vulnerable or Protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, Biodiversity Geographic information Systems (BGIS)).

The subject property does not fall within the remaining extent of a threatened terrestrial ecosystem.

3.4 National Biodiversity Assessment (NBA), 2011

The recently completed NBA (2011) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators such as ecosystem threat status and ecosystem protection level, and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA (2011) includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels.

According to the NBA (2011) the subject property is not located within either a formal or informal protected area and is listed as a least threatened ecosystem and not protected.

3.5 Griqualand West Centre of Endemism

The subject property falls within the Griqualand West Centre of Endemism (GWC). According to van Wyk and Smith (2001) the GWC coincides with the surface outcrops of the Ghaap Group (previously Griqualand West Sequence) and Olifantshoek Supergroup (previously Sequence). However, in floristic terms the outer boundaries of the centre are rather diffuse, as several of the GWC floristic elements spill over onto related substrates, especially alkaline substrates rich in calcium.

The mountainous western parts of the GWC are covered by Kalahari Mountain Bushveld, and the eastern plateau area is covered by Kalahari Plateau Bushveld, both endemic to the centre. *Tarchonanthus camphorates* is a particularly common woody species in these two bushveld types. Typical mountain

species include *Searsia tridactyla* (*Rhus tridactyla*), *Croton gratissimus* and *Buddleja saligna*. Pockets of Karoo-type vegetation increase towards the south and west, especially in heavily overgrazed areas.

The vegetation of the GWC is still fairly intact, although extremely poorly conserved. Apparently the Kalahari Plateau Bushveld is the only Savanna Biome vegetation type which is not represented in any sizable nature reserve. Bush encroachment by e.g. the indigenous *Acacia mellifera*, which is due to inappropriate veld management practices (mainly overgrazing by domestic livestock), is a major problem in many parts of the region.

All vegetation within the subject property has been disturbed to some degree and would therefore not add to the conservation of intact GWC vegetation.

3.6 Kathu Forest

The subject property is located adjacent to the town Kathu it is therefore important to note that many farms to the north of Kathu were declared part of the Kathu Forest (Declaration of Kathu forest as a protected woodland under section 12 (1) (c) of the NFA, 1998). The Kathu forest is considered unique due to the amount as well as size of *Acacia erioloba* (Camel thorn) trees in this area. It is therefore important to ensure that activities that may lead to impact beyond the subject property are adequately mitigated to avoid or at least decrease possible loss of *Acacia erioloba* trees within Kathu as well as surroundings.

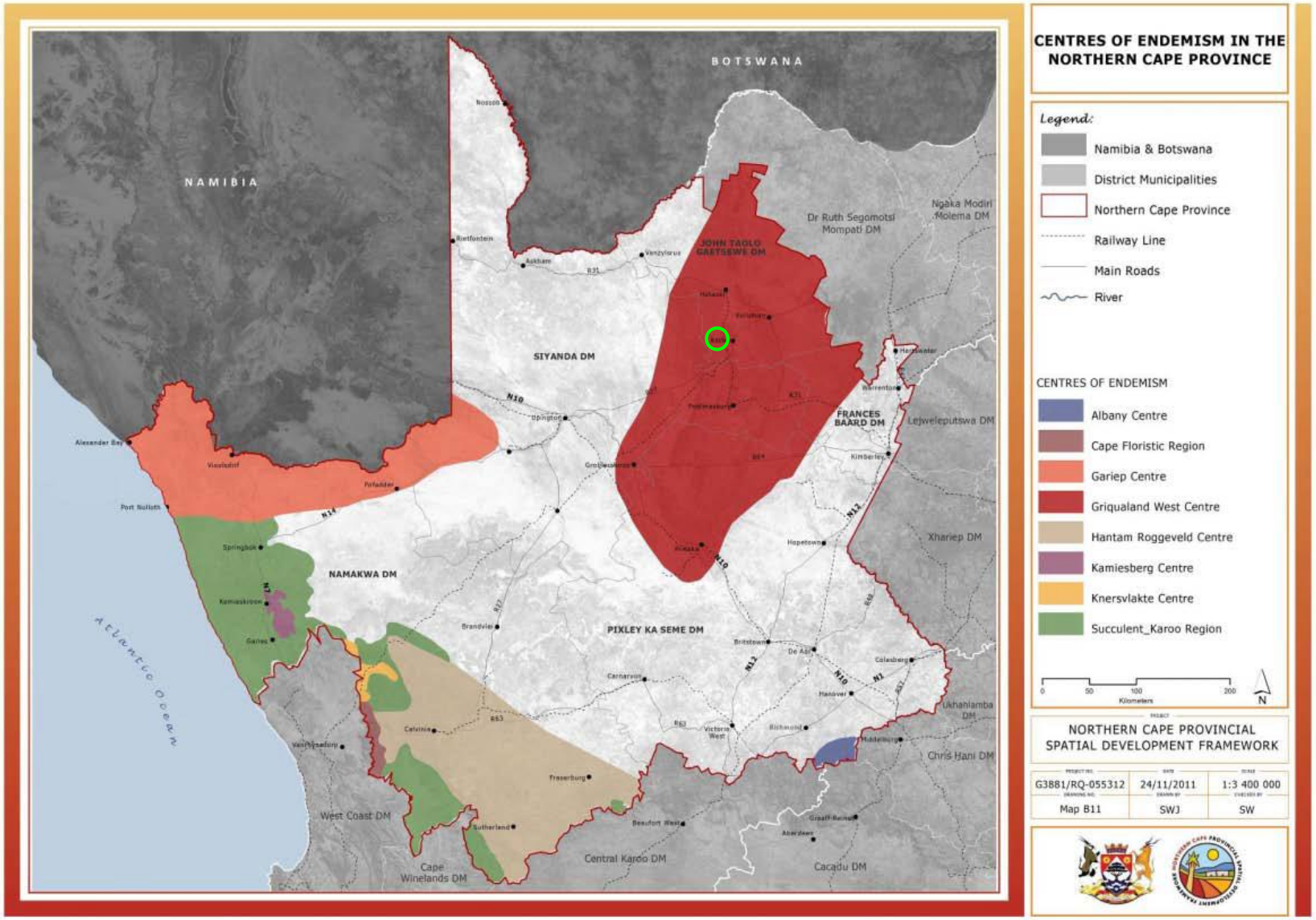


Figure 3: Centers of endemism of the Northern Cape Province; study area indicated by a green circle (Northern Cape Provincial Spatial Development Framework, 2012).

4 RESULTS OF FLORAL INVESTIGATION

4.1 Regional Context

The subject property is located within the Gamagara Municipality which is located within the Northern Cape Province. The subject property covers the Savanna biome and is situated within the Eastern Kalahari Bushveld bioregion. The vegetation type indicated by Mucina and Rutherford (2006) is Kathu Bushveld which is not considered to be of conservation concern (National list of threatened ecosystems for South Africa, 2011). However, the vegetation type is under conserved and is under increased threat as a result of habitat loss to mining activities in the region.

The subject property is located south of the R380, adjacent to an area presently being developed as part of the town Kathu. The area adjacent to the north western boundary is already developed and is presently being used as an industrial area. The remainder of the surrounding properties are currently open space, however these areas would most likely also be developed as part of the expansion of the town in future.

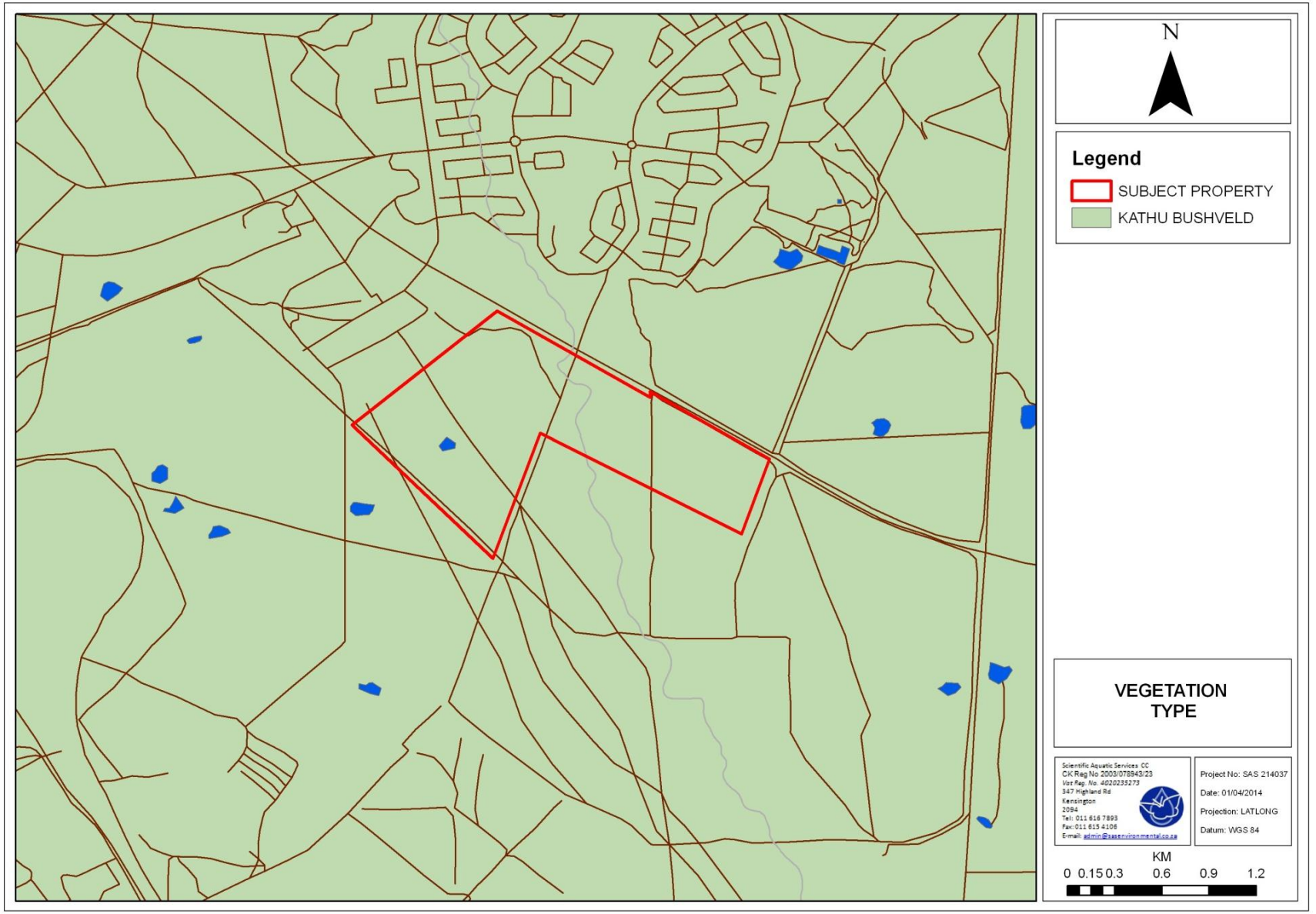


Figure 4: Vegetation types associated with the subject property (Mucina & Rutherford, 2006).

4.2 Floral Habitat Descriptions

Upon completion of the assessment, four floral habitat units were determined to occur within the subject property. These habitat units include:

- The *Acacia erioloba* woodland habitat unit;
- The Kathu bushveld habitat unit;
- The transformed habitat unit; and
- The Wetland habitat unit (The wetland habitat unit is discussed in detail in the wetland report (SAS, 2014)).

The floral habitat units applicable to the subject property are indicated in Figure 5 and will be discussed in further detail in the paragraphs to follow.

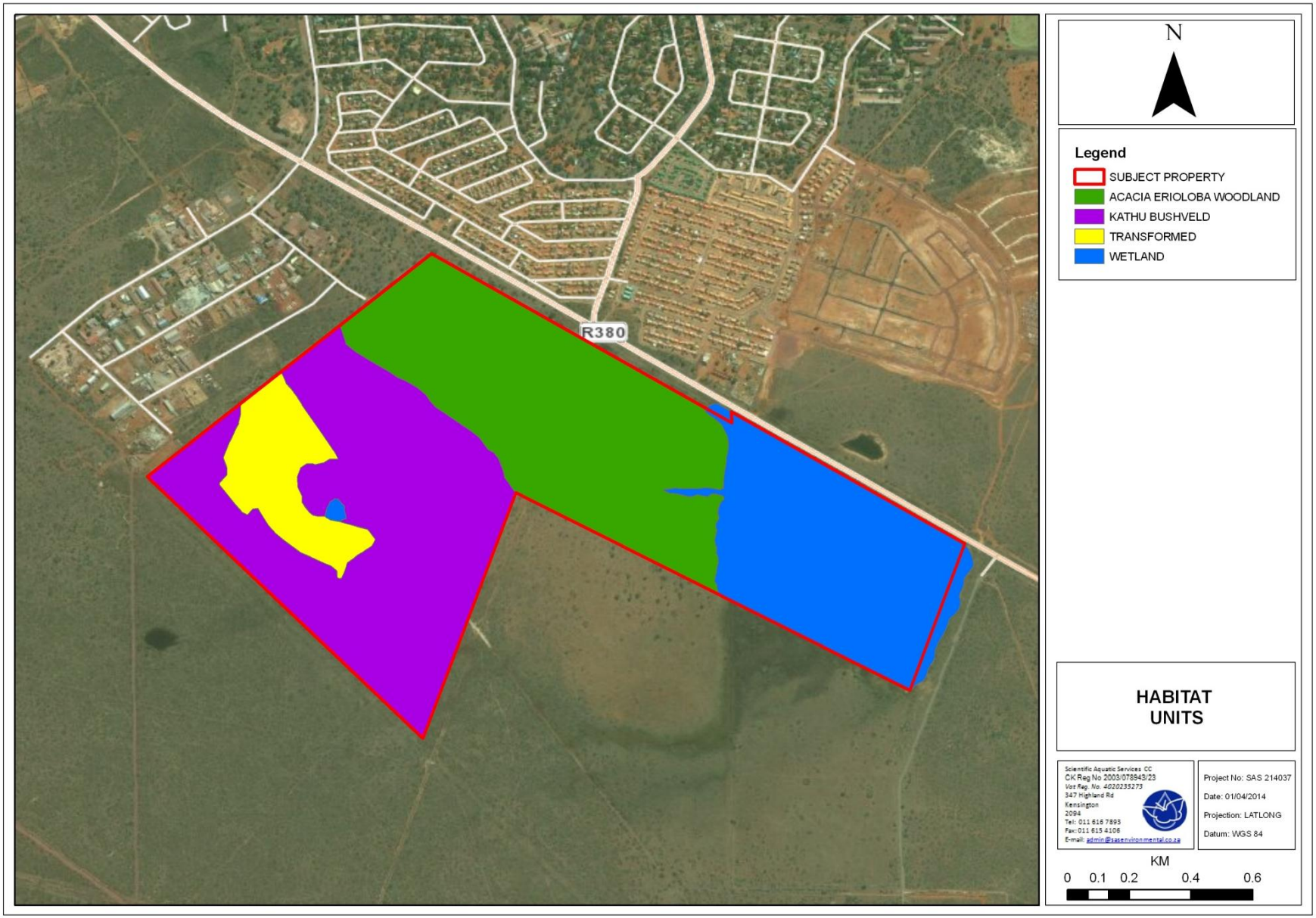


Figure 5: Floral habitat units associated with the subject property

4.2.1 *Acacia erioloba* Woodland Habitat Unit

The *Acacia erioloba* woodland habitat unit is located within the northern and eastern portions of the subject property. This habitat unit is characterised by the dominance of the protected tree species *Acacia erioloba* which is listed as declining in the region. Additional dominant floral species encountered include *Grewia flava*, *Tarconanthus camphoratus*, *Elephantorrhiza elephantina, Acacia mellifera, Ziziphus mucronata, Prosopis glandulosa, Senna italica, Tribulus terrestris, Schmidtia pappophoroides, Aristida meridionalis, Aristida congesta* subsp*. congesta* and *Eragrostis lehmanniana*. A complete list of dominant floral species encountered within the *Acacia erioloba* woodland habitat unit is presented in Appendix B.

The vegetation associated with the habitat unit has been disturbed as a result of the development of multiple 4x4 tracks through the area and as a result of anthropogenic activities and dumping. Areas located within the western portion of the habitat unit, in close proximity to the artificial dam feature, have been significantly disturbed as a result of the dumping of rubble and litter and have been significantly encroached by alien and invasive species such as *Prosopis glandulosa*.

Two SCC, *Acacia erioloba* (declining) and *Boophone disticha* (declining), which are also listed as protected species, were encountered within the habitat unit at the time of the assessment as well as the protected species *Aloe grandidentata*. These species will be discussed in greater detail in Section 4.5 below.

Figure 6: *Acacia erioloba* woodland (top) and dumping encountered within the habitat unit (bottom).

4.2.2 Kathu Bushveld Habitat Unit

The Kathu bushveld habitat unit is located within the central and southern portions of the subject property. The habitat unit is characterised by a scattered shrub layer subtended by a continuous grassy layer. Species dominating the habitat unit include *Grewia flava*, *Tarconanthus camphoratus*, *Elephantorrhiza elephantina, Acacia mellifera, Ziziphus mucronata, Searsia ciliata, Chrysochoma*

ciliata, Schmidtia pappophoroides, Digitaria eriantha, Tragus berteronianus, Aristida meridionalis, Aristida congesta subsp*. congesta, Heteropogon contortus* and *Eragrostis lehmanniana*. A complete list of dominant floral species encountered within the Kathu bushveld habitat unit is presented in Appendix B.

Vegetation within the habitat unit is perceived to be relatively intact with the exception of areas used for dumping and areas disturbed as a result of the development of gravel roads and power lines.

The protected species, *Nerine laticoma*, was encountered within the habitat unit as well as a few individuals of the protected SCC *Acacia erioloba*. SCC and protected species will be discussed in further detail in Section 4.5 below.

Figure 7: Kathu bushveld habitat unit (left) and dumping encountered within the habitat unit (right).

4.2.3 Transformed Habitat Unit

The transformed habitat unit is located within the south western portion of the subject property. The vegetation associated with this habitat unit has been significantly disturbed as a result of earthmoving activities and the dumping of construction rubble and as a result of anthropogenic activities such as the dumping of refuse within the area. Floral species diversity is low and the vegetation is dominated by increaser grass species such as *Schmidtia pappophoroides* and *Eragrostis plana* which are characteristic of disturbance. However, a few isolated individuals of the protected SCC *Acacia erioloba* were encountered.

Figure 8: Transformed habitat unit with dumped rubble evident.

4.3 Vegetation Index Score

The information gathered during the assessment of the subject property was used to determine the VIS – see Appendix C, for vegetation associated with each of the habitat units. The final VIS scores were then categorised as follows:

Table 1: VIS classes.

VIS	Assessment Class	Description
25	**A**	Unmodified, natural
20 to 24	**B**	Largely natural with few modifications.
15 to 20	**C**	Moderately modified
10 to 15	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely

A moderate score was calculated for the *Acacia erioloba* woodland habitat unit which falls within Class C – Moderately modified. The development of multiple 4x4 tracks through the habitat unit as well as anthropogenic activities and dumping have resulted in the disturbance of the vegetation. However, indigenous floral species still remain with special mention of large numbers of the protected tree species *Acacia erioloba*.

A moderate score was calculated for the Kathu bushveld habitat unit which falls within Class C – Moderately modified. This habitat unit has been disturbed as a result of the development of gravel roads and power lines through the vegetation. Vegetation has also been disturbed as a result of anthropogenic activities and dumping in some areas. However, species characteristic of the vegetation type as well as the protected species *Nerine laticoma* were encountered and indigenous species recruitment is considered high which increased the overall score.

A low score was calculated for the transformed habitat unit which falls within Class E – The loss of natural habitat is extensive. Natural vegetation has been lost as a result of the dumping of rubble and floral species diversity is considered to be low

The vegetation PES of the natural pan associated with the subject property has been assessed within the wetland report (SAS, 2014).

4.4 Graminoid Community Assessment

Floral communities can provide information regarding the ecological status of specific areas within a subject property. If the species composition is quantitatively determined and characteristics of all components of the floral community taken into consideration, it is possible to determine the PES of the portion of land represented by the assessment point. The locations of the various transects are depicted in the figure below.

Any given grass species is specifically adapted to specific growth conditions. This sensitivity to specific conditions make grasses good indicators of veld conditions. The sections below summarise the dominant floral species identified within each transect with their associated habitats and optimal growth conditions with reference to the table and figure below.

Table 2: Grouping of grasses (Van Oudtshoorn, 2006).

Pioneer	Hardened, annual plants that can grow in very unfavourable conditions. In time improves growth conditions for perennial grasses.
Subclimax	Weak perennials denser than pioneer grasses. Protects soils leading to more moisture, which leads to a denser stand, which deposits more organic material on the surface. As growth conditions improve climax grasses are replaced by subclimax grasses.
Climax	Strong perennial plants adapted to optimal growth conditions.
Decreaser	Grasses abundant in good veld.
Increaser I	Grasses abundant in underutilized veld.
Increaser II	Grasses abundant in overgrazed veld.
Increaser III	Grasses commonly found in overgrazed veld.

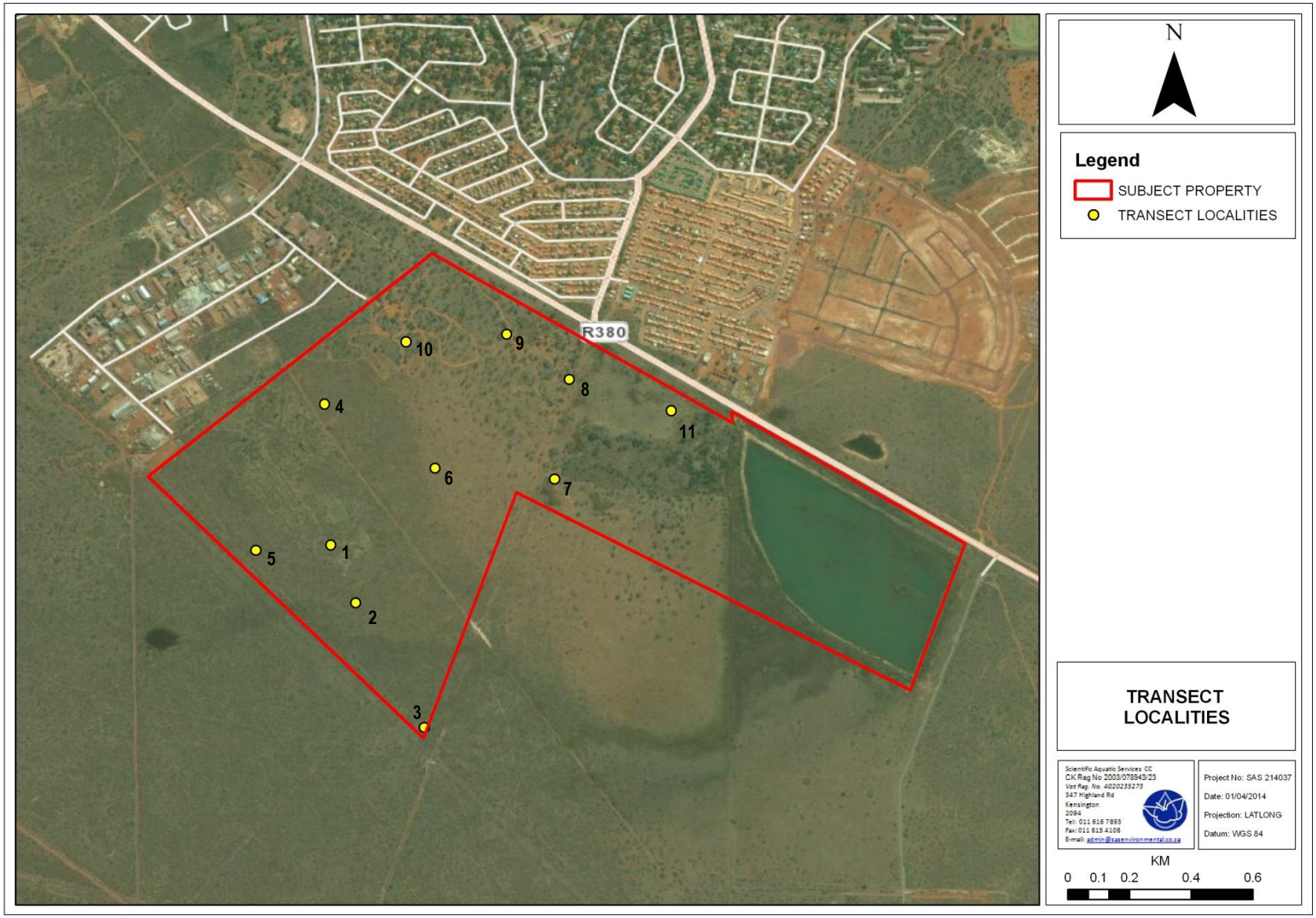
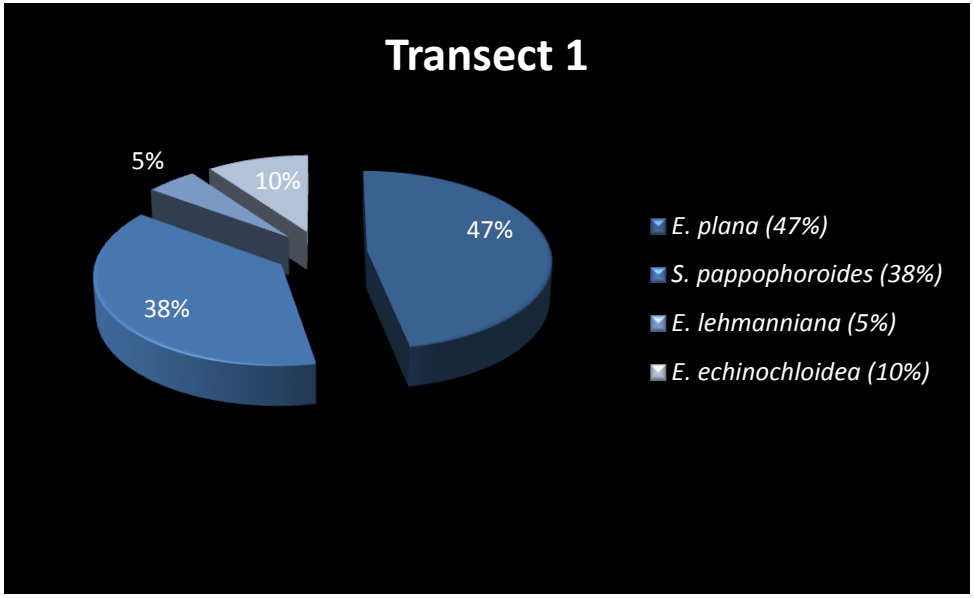


Figure 9: Arial map depicting locations of transects 1-11.



Transect 1 (transformed habitat unit)

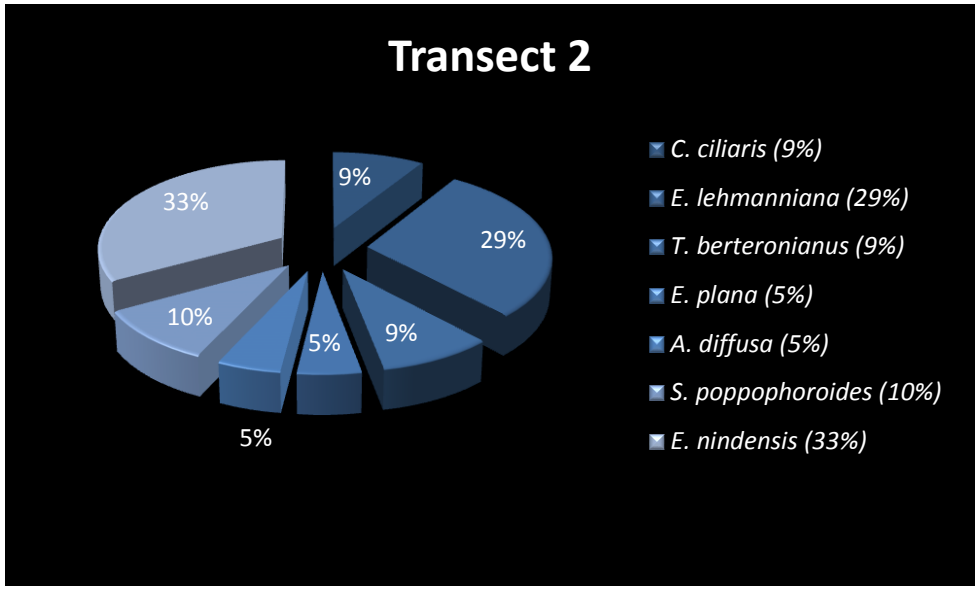
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Eragrostis echinochloidea* (Tick grass) [Increaser II; Subclimax grass]. Tick grass usually grows in disturbed places such as old cultivated lands and road reserves; mostly in shallow lime soil, as well as sandy soil. It is often found in the vicinity of pans.
- *Eragrostis plana* (Tough Love-Grass) [Subclimax grass; Increaser II]. Tough love-grass grows in disturbed places such as old cultivated lands, road reserves and also trampled places such as feedlots and water points. It grows in all types of soils, mostly in damp patches, especially in the more arid western parts of its distribution.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides

Conclusion: All of the species listed above are increaser grasses which are indicative of disturbance. Furthermore species diversity is low and the vegetation is dominated by two species.

Figure 10: Transect 1.



Transect 2 (Kathu bushveld habitat unit)

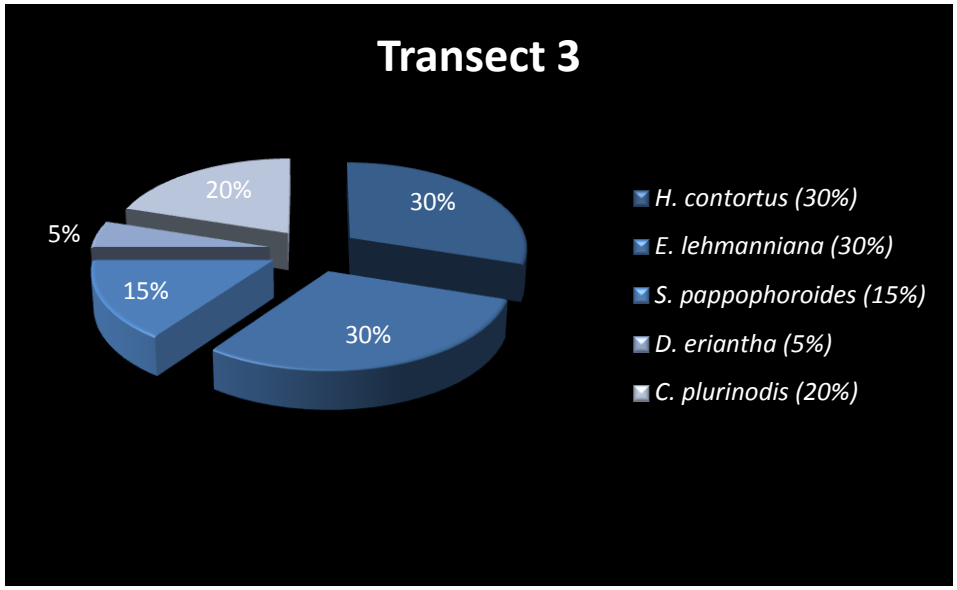
- *Cenchrus ciliaris* (Foxtail Buffalo Grass) [Decreaser; Climax grass]. Foxtail buffalo grass (also called blue buffalo grass) grows in dry warm parts. It grows in all types of soil, but mostly in sandy soil and other well drained soil types. It is often found along roadsides where it utilises the additional runoff rainwater.
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida diffusa* (Iron Grass) [Increaser III; Climax grass]. Iron grass grows in a variety of soil types, but mostly on slopes in gravelly soil. It is particularly associated with shallow soil in overgrazed veld.
- *Tragus berteronianus* (Carrotseed Grass) [Pioneer grass; Increaser II]. Carrotseed grass grows in disturbed places such as bare patches in veld as well as in and besides roads. It is often the first grass to colonise hard, compacted soils, mostly in sandy and loam soil.
- *Eragrostis plana* (Tough Love-Grass) [Subclimax grass; Increaser II]. Tough love-grass grows in disturbed places such as old cultivated lands, road reserves and also trampled places such as feedlots and water points. It grows in all types of soils, mostly in damp patches, especially in the more arid western parts of its distribution.
- *Eragrostis nindensis* (Wether Love Grass) [Subclimax grass; Increaser II]. Wether love grass usually grows in disturbed places in shallow gravelly soils. It often grows in granite outcrops however it is also found in other places in poor soil, seldom in clay soil.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides; Tragus berteronianus

Conclusion: Species diversity increases slightly, however, the majority of species are indicative of disturbance and the vegetation is dominated by *E. lehmanniana* and *E. diffusa*, both species indicative of disturbance.

Figure 11: Transect 2.



Transect 3 (Kathu bushveld habitat unit)

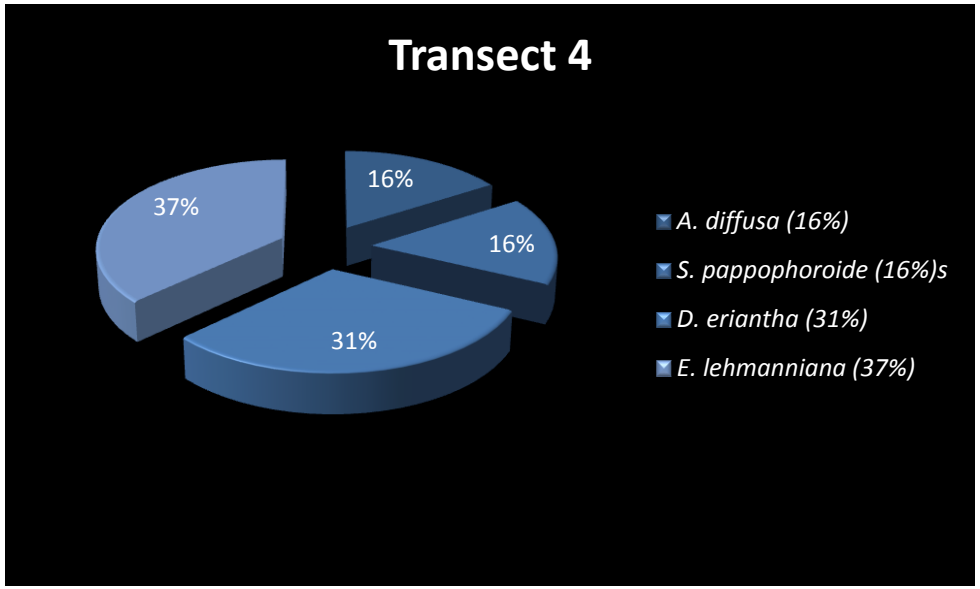
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Cymbopogon plurinodis* (Narrow-leaved Turpentine grass) [Climax; Increaser I and Increaser III]. Narrow-leaved turpentine grass grows in open grassland or open patches in bushveld regions. It grows in all soil types, but prefers heavier soils where it can form dominant stands. In some regions this grass is very common (Cymbopogon/themeda veld) and often occurs in association with red grass.
- *Heteropogon contortus* (Spear Grass) [Subclimax grass, Increaser II]. Spear grass grows especially in gravelly and other well drained soil. It often grows on slopes and in disturbed places such as road reserves where it can form dense stands.
- *Digitaria eriantha* (common finger grass) [Decreaser, Climax grass] Common finger grass grows in sandy and gravelly soil in the more arid parts and in damp soil such as beside vleis in areas with a high rainfall. It utilises a wide range of other habitat types. However it mainly grows in undisturbed veld.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides

Conclusion: The veld is dominated by three species, *H. contortus*, *E. lehmanniana* and *C. plurinodis* of which only *E. lehmanniana* is characteristic of the vegetation type. All three of these species are indicative of disturbance.

Figure 12: Transect 3.



Transect 4 (Kathu bushveld habitat unit)

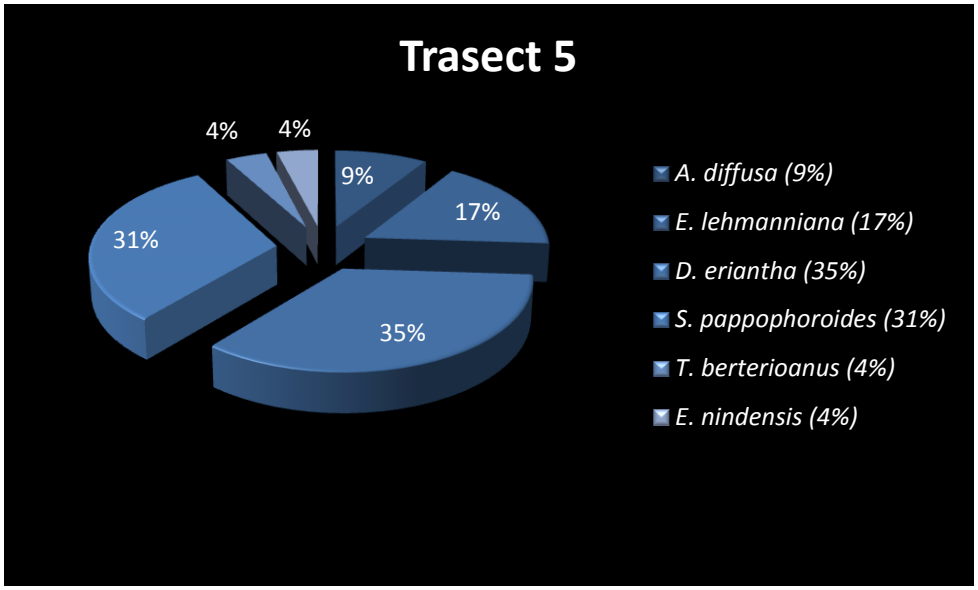
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida diffusa* (Iron Grass) [Increaser III; Climax grass]. Iron grass grows in a variety of soil types, but mostly on slopes in gravelly soil. It is particularly associated with shallow soil in overgrazed veld.
- *Digitaria eriantha* (common finger grass) [Decreaser, Climax grass] Common finger grass grows in sandy and gravelly soil in the more arid parts and in damp soil such as beside vleis in areas with a high rainfall. It utilises a wide range of other habitat types. However it mainly grows in undisturbed veld.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides

Conclusion: The veld was dominated by two species, *D. eriantha* and *E. lehmanniana*. *D. eriantha* is indicative of veld in good condition, however the species is not characteristic of the vegetation type and *E. lehmanniana* is a species which is characteristic of disturbance.

Figure 13: Transect 4.



Transect 5 (Kathu bushveld habitat unit)

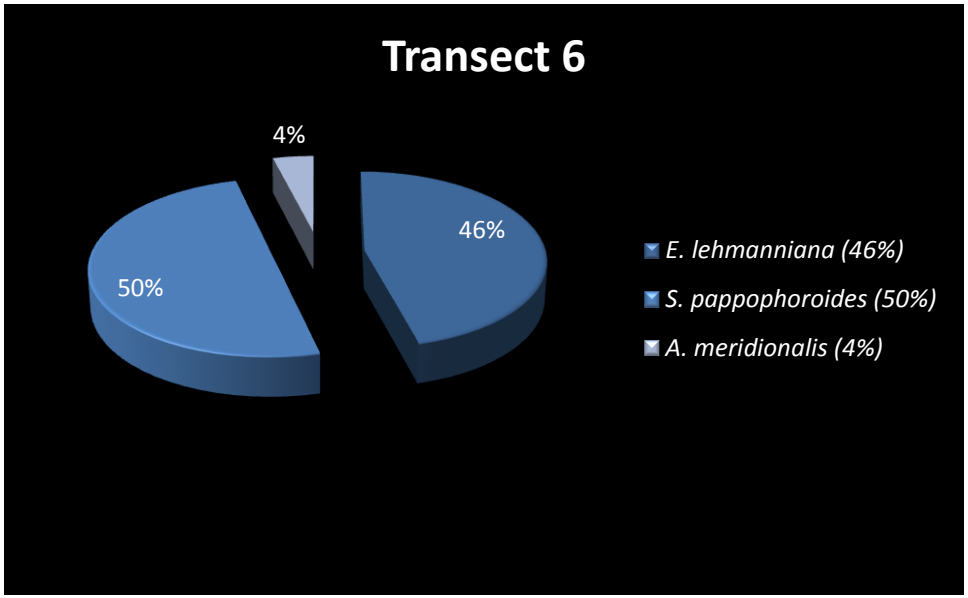
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida diffusa* (Iron Grass) [Increaser III; Climax grass]. Iron grass grows in a variety of soil types, but mostly on slopes in gravelly soil. It is particularly associated with shallow soil in overgrazed veld.
- *Digitaria eriantha* (common finger grass) Decreaser, Climax grass Common finger grass grows in sandy and gravelly soil in the more arid parts and in damp soil such as beside vleis in areas with a high rainfall. It utilises a wide range of other habitat types. However it mainly grows in undisturbed veld.
- *Tragus berteronianus* (Carrotseed Grass) [Pioneer grass; Increaser II]. Carrotseed grass grows in disturbed places such as bare patches in veld as well as in and besides roads. It is often the first grass to colonise hard, compacted soils, mostly in sandy and loam soil.
- *Eragrostis nindensis* (Wether Love Grass) [Subclimax grass; Increaser II]. Wether love grass usually grows in disturbed places in shallow gravelly soils. It often grows in granite outcrops however it is also found in other places in poor soil, seldom in clay soil.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides; Tragus berteronianus

Conclusion: Species diversity increases slightly in this portion of the veld, however, the majority of the species present are indicative of disturbance and the vegetation is dominated by two species, *S. pappophoroides* and *D. eriantha*. *D. eriantha* is indicative of veld in good condition, however the species is not characteristic of the vegetation type. *S. pappophoroides* can be an indicator of veld in both good and bad condition, however, its presence together with species such as *A. diffusa, E. lehmanniana* and *E. nindense* which are all species indicative of disturbance indicates that the veld in this area has been disturbed to some degree.

Figure 14: Transect 5.



Transect 6 (Kathu bushveld habitat unit)

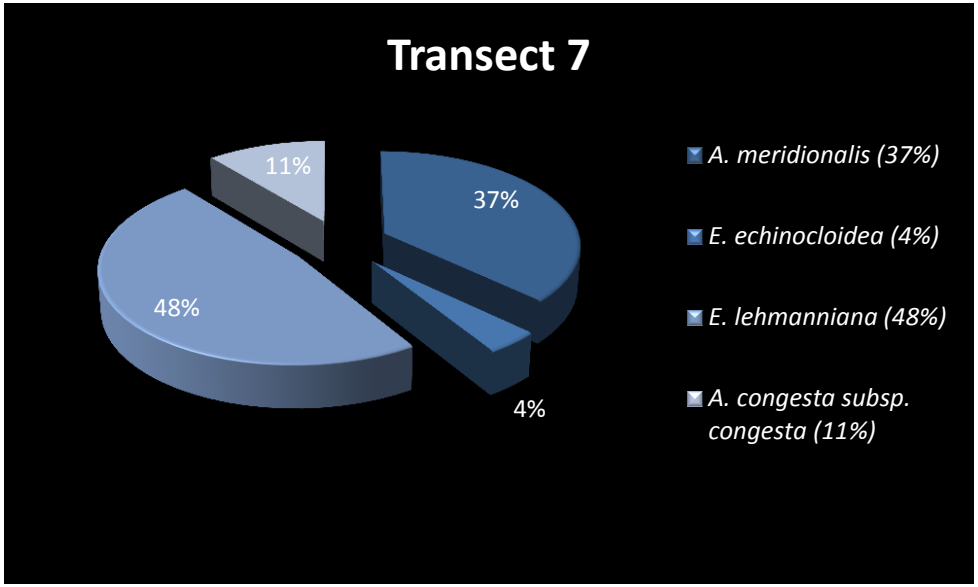
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Increaser III; Climax grass]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.

Kathu Bushveld Indicators:

Aristida meridionalis; Eragrostis lehmanniana; Schmidtia pappophoroides

Conclusion: The veld in this area is dominated by three species which, although indicative of the vegetation type, are all characteristic of disturbed areas.

Figure 15: Transect 6.



Transect 7 (*Acacia erioloba* woodland habitat unit)

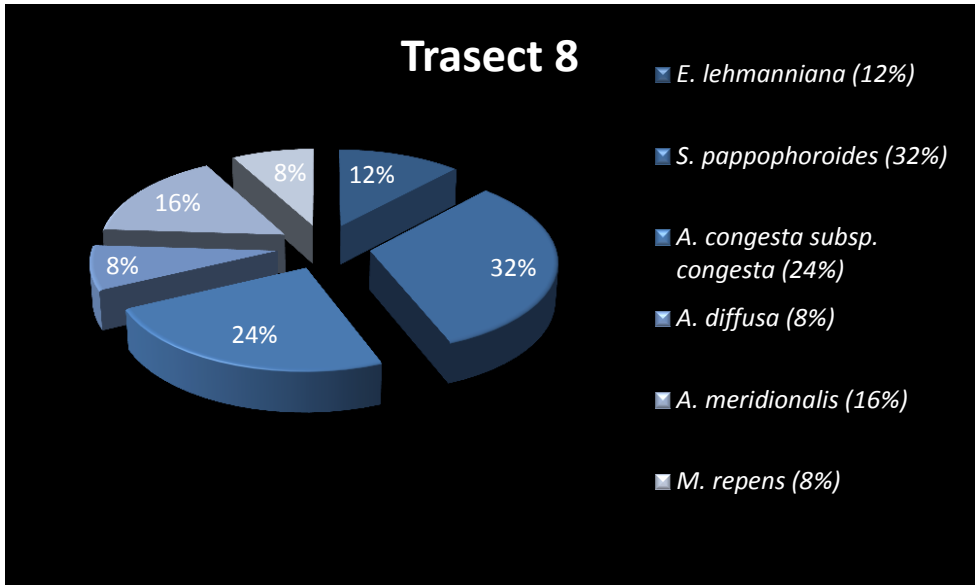
- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Increaser III; Climax grass]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.
- *Eragrostis echinochloidea* (Tick grass) [Increaser II; Subclimax grass]. Tick grass usually grows in disturbed places such as old cultivated lands and road reserves; mostly in shallow lime soil, as well as sandy soil. It is often found in the vicinity of pans.

Kathu Bushveld Indicators:

Aristida meridionalis; Eragrostis lehmanniana; Aristida congesta subsp. *congesta*

Conclusion: All species present, with exception of *E. echinocloidea* are indicative of the vegetation type. However, the dominance of *A. meridionalis* and *E. lehmanniana*, both species which are indicative of disturbance, is an indication that the veld is in poor condition. However, it should be noted that the abundance of *Acacia erioloba* individuals increases within this area which increases the sensitivity of the area.

Figure 16: Transect 7.



Transect 8 (*Acacia erioloba* woodland habitat unit)

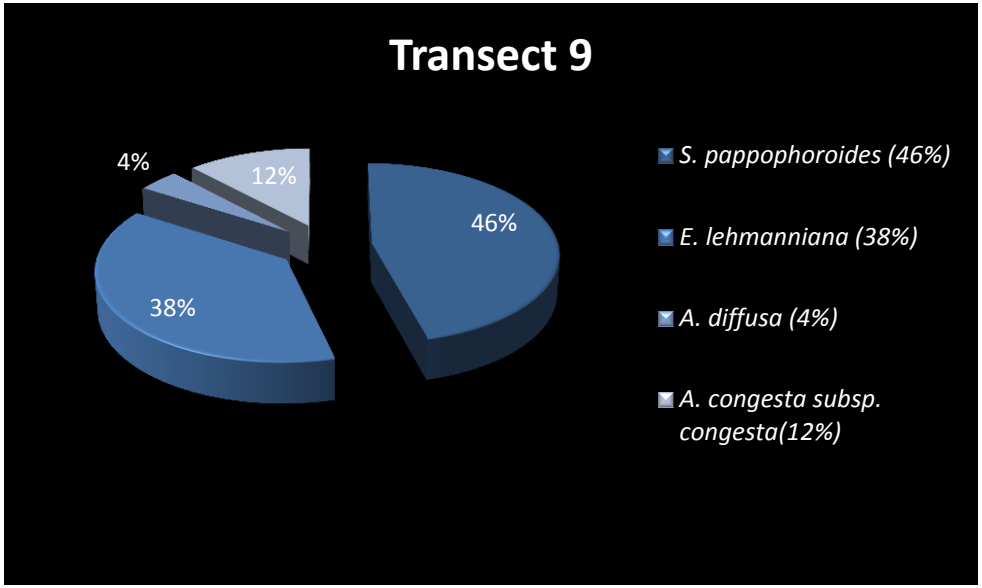
- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Increaser III; Climax grass]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.
- *Melinis repens* (Natal Red Top) [Pioneer and subclimax grass Increase II]. Natal Red Top grows in disturbed places such as roadsides and old cultivated lands. Or in sunny dry places. In all soil types but especially well drained soils.
- *Aristida diffusa* (Iron Grass) [Increaser III; Climax grass]. Iron grass grows in a variety of soil types, but mostly on slopes in gravelly soil. It is particularly associated with shallow soil in overgrazed veld.

Kathu Bushveld Indicators:

Aristida meridionalis; Eragrostis lehmanniana; Schmidtia pappophoroides; Aristida congesta subsp. *congesta, Melinis repens*

Conclusion: All species present within this portion of veld are indicative of disturbance. Furthermore, the veld is dominated by two species, *S. pappophoroides* and *A. congesta* subsp. *congesta*. Both species are indicative of the vegetation type but their dominance here suggests that the area has been disturbed to some degree. Although the area has been disturbed it should be noted that the density of individuals of the protected tree species *A. erioloba* increases within this portion of the veld which increases its sensitivity.

Figure 17: Transect 8.



Transect 9 (*Acacia erioloba* woodland habitat unit)

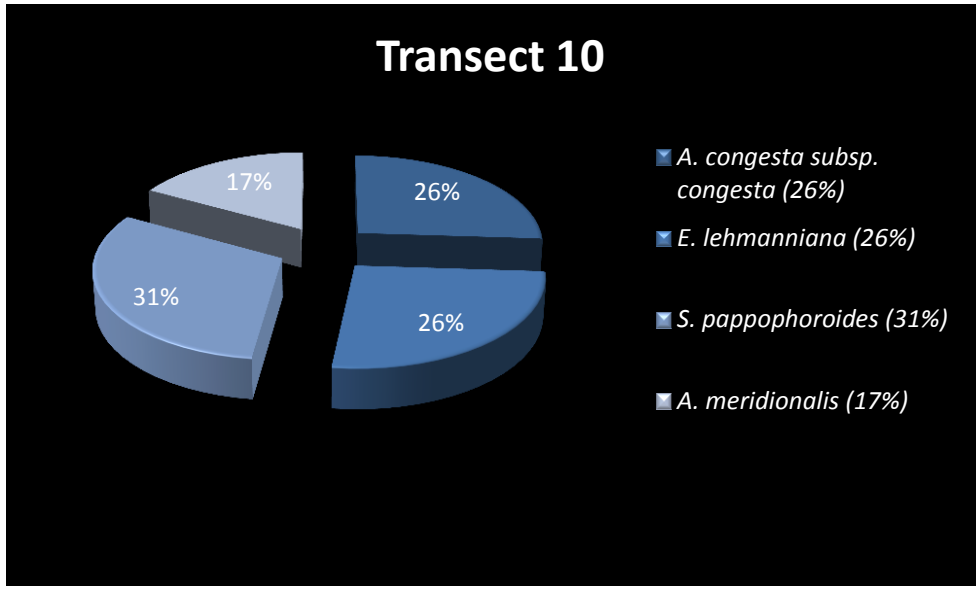
- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida diffusa* (Iron Grass) [Increaser III; Climax grass]. Iron grass grows in a variety of soil types, but mostly on slopes in gravelly soil. It is particularly associated with shallow soil in overgrazed veld.

Kathu Bushveld Indicators:

Eragrostis lehmanniana; Schmidtia pappophoroides; Aristida congesta subsp. *congesta*

Conclusion: This portion of veld is dominated by *S. pappophoroides* and *E. lehmanniana*. These species are characteristic of the vegetation type, however their dominance of the vegetation suggests that the veld has been disturbed. Although the area has been disturbed it should be noted that the density of individuals of the protected tree species *A. erioloba* increases within this portion of the veld which increases its sensitivity.

Figure 18: Transect 9.



Transect 10 (*Acacia erioloba* woodland habitat unit)

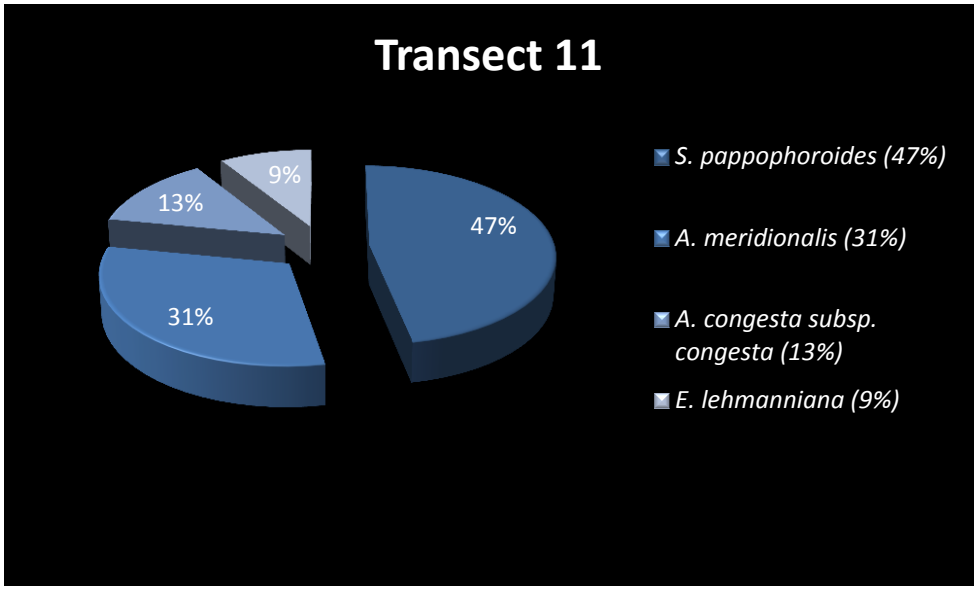
- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Increaser III; Climax grass]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.

Kathu Bushveld Indicators:

Aristida meridionalis; Eragrostis lehmanniana; Schmidtia pappophoroides; Aristida congesta subsp. *congesta*

Conclusion: This portion of the veld has been significantly disturbed as a result of the development of 4x4 tracks through the area and is dominated by species indicative of this disturbance. Although the area has been disturbed it should be noted that the density of individuals of the protected tree species *A. erioloba* increases within this portion of the veld which increases its sensitivity.

Figure 19: Transect 10.



Transect (*Acacia erioloba* woodland habitat unit).

- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Schmidtia pappophoroides* (Sand Quick) [Climax & Sub climax grass; Increaser & Decreaser grass]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy, loam and gravelly soil. It often grows in limeveld, and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Increaser III; Climax grass]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.

Kathu Bushveld Indicators:

Aristida meridionalis; Eragrostis lehmanniana; Schmidtia pappophoroides; Aristida congesta subsp. *congesta*

Conclusion: This portion of veld is dominated by *S pappophoroides*. Although this species is characteristic of the vegetation type its dominance of the vegetation (almost 50%) is indicative that the veld has been disturbed.

Figure 20: Transect 11.

The majority of the grass species encountered are indicative of past disturbance and only six species found are listed as indicators of the Kathu bushveld vegetation type (Musina and Rutherford, 2006). Therefore, it can be concluded that disturbance of the vegetation was evident throughout the subject property. Although the floral community results should guide layout plans, the density of the *Acacia erioloba* trees should take preference to ensure that the number of these to be cut or destroyed is limited.

4.5 SCC and Protected Species Status Assessments

No SCC are indicated for the quarter degree square (QDS) 2723CA by the PRECIS SANBI database. However, two SCC, *Acacia erioloba* (declining) and *Boophone disticha* (declining) were encountered within the *Acacia erioloba* woodland habitat unit at the time of the assessment.

Four protected species were also encountered within the subject property. These include the SCC *Acacia erioloba* (NFA, 1998) and *Boophone disticha* (NCNCA, 2009) as well as *Nerine laticoma* (NCNCA, 2009) and *Aloe grandidentata* (NCNCA, 2009). *Nerine laticoma* was encountered within the Kathu bushveld habitat unit and *Aloe grandidentata* was encountered within the *Acacia erioloba* woodland habitat unit.

Figure 21: *Acacia erioloba* (a), *Boophone disticha* (b), *Nerine laticoma* (c) and *Aloe grandidentata* (d)

4.6 Exotic and Invader Species

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are

overtaken by sub-climax and climax species through natural veld succession. This process however takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures and
- Increased agricultural input costs.

Alien vegetation was encountered scattered throughout the subject property. However, the density of alien species was found to increase in areas in the vicinity of the artificial dam. Alien and weed species encountered within the subject property are to be removed in order to comply with existing legislation (amendments to the regulations under CARA, 1983 and Section 28 of the NEMA, 1998).

Alien and invasive species encountered within the subject property are listed below. One species, *Acacia mellifera*, is indigenous; however, it has the potential to result in bush encroachment after disturbance. It is deemed important that abundances of this species be monitored in order to identify the possibility of encroachment and if necessary the implementation of appropriate management measures to avoid loss of natural species diversity.

Table 3: Dominant exotic vegetation species identified during the general area assessment.

Scientific name	Common name	Category
TREES		
Acacia mellifera	Black thorn	Indicator of bush encroachment
Prosopis glandulosa	Honey Mesquite	Category 2
SHRUB AND FORBS		
Conyza bonariensis	Flax leaf fleabane	N/A
Sesamum triphyllum	Wild sesame	N/A
Opuntia sp.	Prickly pear	Category 1
Datura stramonium	Common thorn apple	Category 1
Verbesina encelioides	Golden crownbeard	N/A
GRASS		
Tragus berteronianus	Carrotseed Grass	N/A

Category 1 – Declared weed, prohibited and must be controlled; Category 2 - Declared invader (commercial and utility plants), allowed in demarcated areas by permit holders

4.7 Medicinal Plants

The medicinal species *Senna italica*, *Acacia erioloba*, *Elephantoriza elephantina* and *Ziziphus mucronata* were encountered within all habitat units. However, *Boophone disticha* was only encountered within the *Acacia erioloba* woodland habitat unit. Two medicinal species, *Acacia erioloba* and *Boophone disticha* are SCC and are listed as protected species within the region.

Table 4: Traditional medicinal plants identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2012).

Scientific name	Common name	Plant part used	Uses
Senna italica	Wild senna	Roots	Used to treat influenza, indigestion, liver and gall bladder complaints, gastrointestinal disorders, dysmenorrhoea and uterine pain.
Acacia erioloba	Camel thorn	Pods, roots	Ground pods are used to treat ear infections. Roots are used to treat headache, Tuberculosis and also tooth ache.
Elephantoriza elephantina	Elandsbean	Underground rhizomes.	This is a traditional remedy for a wide range of ailments, including diarrhoea and dysentery, stomach disorders, haemorrhoids and perforated peptic ulcers, and as emetics. It is popular for the treatment of skin diseases and acne.
Ziziphus mucronata	Buffalo-thorn	Roots, bark and leaves	Warm bark infusions are used as expectorants in cough and chest problems, while root infusions are popular as a remedy for diarrhoea and dysentery. Decoctions of roots and leaves are applied externally to boils, sores and glandular swellings, not only to promote healing bur also for pain relief.
Boophone disticha	Bushman poison bulb	Bulb scales	The outer scales of the bulb are used as an outer dressing after circumcision and are also applied to boils or septic wounds to alleviate pain and to draw out the pus. Weak decoction of the bulb scales are administered by mouth or as an enema for various complaints such as headaches, abdominal pain, weakness and eye conditions. In the Karoo near Touws River there is an old belief that sleeping on a mattress filled with bulb scales will relieve hysteria and insomnia. Very weak decoction is used as an effective sedative. Higher doses induce visual hallucinations which are sometime used for divination and even higher doses can be fatal.
Datura stramonium	Common thorn apple	Leaves and fresh green fruit	Used for the relief of asthma and to reduce pain. Weak infusions are used as hypnotics by the elderly and as aphrodisiacs by adults. The fresh warm leaves may be used as a poultice to relive the pain of rheumatism, gout, boils, abscesses and wounds. The fresh green fruit is sometimes applied locally for toothache, a sore throat and tonsillitis. The leaf is rolled up and smoked to relieve asthma and bronchitis.
Tarconanthus camphoratus	Wild camphor bush	Leaves and twigs	Infusions and tinctures of the leaves and twigs are used for stomach trouble, abdominal pain, headache, toothache, asthma, bronchitis and inflammation. A hot poultice on the chest is said to give relief from headache, asthma, bronchitis, and inflammation. Smoke or fumes from the fresh and dried plant are inhaled for asthma, headache and rheumatism.

4.8 Floral Sensitivity

After considering all the above results a sensitivity map was compiled for the subject property. Sensitivities were determined based on the irreplaceability of the vegetation type, on observations

of the abundance and diversity of floral species present at the time of the assessment and on the degree of disturbance encountered.

Vegetation associated with the *Acacia erioloba* woodland habitat unit has been disturbed as a result of the development of 4x4 tracks through the vegetation and as a result of anthropogenic activity and dumping. This has led to the proliferation of increaser grass species and has resulted in the encroachment of alien and invasive species such as *Prosopis glandulosa* into the habitat unit. However, densities of *Acacia erioloba* (SCC and protected species) increased significantly within this habitat unit. Furthermore, individuals of the SCC *Boophone disticha* and the protected species *Aloe grandidentata* were encountered within this habitat unit. The *Acacia erioloba* woodland habitat unit is therefore considered to be of a moderately high sensitivity.

Vegetation associated with the Kathu bushveld habitat unit has been disturbed as a result of the development of gravel roads and power lines and as a result of anthropogenic activities and dumping. However, although the vegetation has been disturbed, floral species occurring within the habitat unit are considered representative of species which would naturally occur within the vegetation type and the protected species *Nerine laticoma* was also encountered scattered throughout the habitat. The Kathu bushveld habitat unit is therefore considered to be of a moderately low sensitivity.

The transformed habitat unit has been significantly disturbed as a result of the dumping of rubble and litter and as a result of anthropogenic activities. Species diversity within the habitat unit was considered low and the vegetation was dominated by increaser grass species which are indicative of disturbance. The transformed habitat unit is therefore considered to be of a low sensitivity.

The wetland sensitivities indicated in the figure below have been extracted from the wetland EIS assessment undertaken in the wetland report (SAS, 2014).

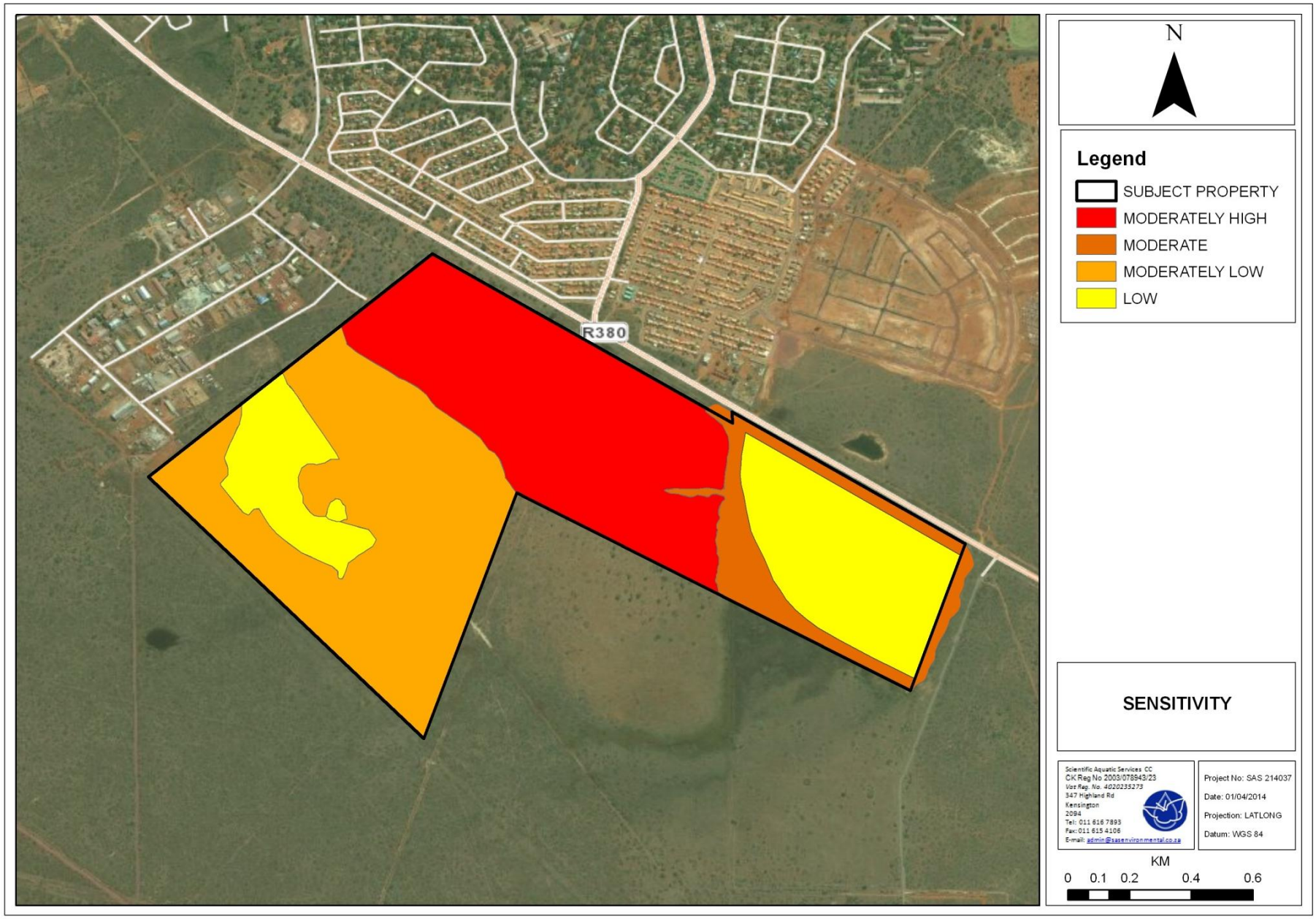


Figure 22: Sensitivity of the floral habitats associated with the subject property (wetland sensitivities have been extracted from the SAS wetland report).

5 RESULTS OF FAUNAL INVESTIGATION

5.1 Faunal Habitat Units

The subject property can broadly be divided into three faunal habitat units namely wetland, open veld (including *Acacia erioloba* woodland and Kathu bushveld habitat units as referred to in the floral assessment section 4.2) and transformed. The wetland habitat unit include the artificial impoundment with associated seeps and the pan located within the western portion of the subject property. The south western portion of the subject property has been significantly disturbed due to past earth moving activity, dumping and subsequent alien vegetation encroachment and was therefore dealt with separately as the transformed habitat unit. The remainder of the subject property was considered relatively uniform with some increase in *Acacia erioloba* numbers noted within the eastern portion and was therefore considered one habitat unit. Isolated rocky outcrops were also encountered within the open veld habitat unit (south west of the impoundment), however from a faunal perspective these rocky areas do not provide niche habitat for any rock dwelling species. This is due the lack of rock crevices that would provide shelter for species such as lizards and geckos. Furthermore the relatively big rocks are also imbedded into the ground and would therefore limit burrowing species such as scorpions.

Although the impoundment as well as seeps are artificial, these features has remained inundated long enough for the establishment of hydrophilic floral species that in turn provide foraging as well as breeding habitat for wetland faunal species as well as drinking water for terrestrial species. However, in its present state the pan feature will not provide habitat for a significant wetland faunal assemblage due to dumping within the feature that resulted in contamination and transformation of wetland vegetation. However, with rehabilitation it is considered possible that natural wetland conditions can be re-instated that would provide habitat for several wetland faunal species.

Figure 23: Wetland habitat unit.

The disturbance within the south western portion are considered significant and presently would only provide habitat for faunal species adapted to transformed areas. As a result this habitat unit cannot be considered of significant importance in terms of faunal conservation. Additional dumping areas were also encountered within other portions of the subject property that pose a threat to individuals and their associated habitat. It is therefore considered important that the refuse be removed and that entry to the site be strictly prohibited to ensure no further dumping takes place.

Figure 24: Earth moving activity within the transformed habitat unit.

Figure 25: Various areas encountered where dumping has taken place.

Isolated areas within the remainder of the subject property can also be considered transformed to some degree, however still provides habitat for more common terrestrial faunal species. The increase in *Acacia erioloba* numbers within the eastern portion also increases the number of avifaunal species that could potentially use the subject property for breeding.

Figure 26: Open veld habitat unit.

The faunal taxa assessed in relation to the three habitat units are discussed in detail below.

5.2 Mammals

The Southern African bio climate zones, or biotic zones, for mammals are identified in Mammals of Southern Africa, A Field Guide (Smithers, 2000). The subject property falls within the Arid zone for mammal species. The Arid zone is characterised by an open cover of thornbush or low scrub, with scattered patches of *Acacia erioloba* (camelthorn trees) and a good grass cover on soils of Kalahari

sand. The open veld habitat unit is considered the most representative of the Arid zone of all the habitat units identified within the subject property.
Six mammal species were identified within the subject property through direct visual observation or with the use of tracks, scats and burrows, listed in Table 5 below. The mammal species identified during the site assessment were all common species for the area and are listed as non-threatened species by the International Union for the Conservation of Nature (IUCN). However, all of the species are listed as protected within the NCNCA (2009). Should these species be removed or killed a permit will be required from the Northern Cape Department of Environment and Nature Conservation.

Table 5: Mammal species identified through sighting or other evidence within the subject property with 2013 IUCN status. Species protected under the NCNCA (2009) and NEMBA (2004) are indicated with an X.

Scientific name	Common name	2013 IUCN Status	NCNCA (2009)	NEMBA (2004)
Cynictis penicillata	Yellow mongoose	LC	X	
Galerella sanguinea	Slender mongoose	LC	X	
Crocidura cyanea	Reddish-grey musk shrew	LC	X	
Raphicerus campestris	Steenbok	LC	X	
Lepus saxatilis	Scrub hare	LC	X	
Acomys subspinosus	Cape Spiny Mouse	LC	X	

LC = Least Concern. NYBA = Not yet been assessed for the IUCN Red List

All the species above was identified within the terrestrial habitat unit, with the exception of *Crocidura cyanea* that was caught within wetland habitat with the use of Sherman trapping. It is considered likely that the Muridae family may be more diverse due to the high diversity of foraging habitat available in combination with tall grass and trees that would provide cover and protection against predators. The rodent population will in turn also attract medium sized carnivores such as *Canis mesomelas* (Black Backed Jackal). However, the subject property is considered too close to anthropogenic activities to host larger mammal species such as antelope. If larger mammal species do utilise the subject property for foraging they would most likely be restricted to the western portion located further from roads and development.

Small mammal trapping was done over two nights within wetland areas that were considered the most likely to provide habitat for smaller mammal species. Only one individual was caught namely *Crocidura cyanea*. It is considered highly likely that the poor trapping success rate was due to the abundance of vegetation and insects at the time of the assessment due to the high rainfall within the preceding months. Therefore the trapping success rate is not considered an indication of the abundance or diversity of smaller mammal species within the subject property and as mentioned above the Muridae family is expected to be high.

Figure 27: *Crocidura cyanea* caught within the wetland habitat unit.

In summary no large or medium sized faunal species are expected to utilise the subject property and if present, most likely would only move through the subject property occasionally when foraging or hunting. If the subject property does provide habitat for threatened small mammals, individuals would most likely be restricted to wetland habitat that would offer foraging habitat for longer periods of the year. The common faunal species presently within the subject property will move away from construction activity into the surrounding open area and if not illegally trapped would not be significantly impacted by the proposed activities.

5.3 Avifauna

The subject property provides a diversity of avifaunal habitat namely wetland, open veld and woodland in the vicinity of *Acacia erioloba* trees. Each of these areas would host its own unique avifaunal community. The avifaunal species identified within the subject property are listed in the table below and are listed as species of least concern (IUCN, 2013) and are common species for the region. However, the majority of the species identified are listed as protected species by the NCNCA (Act 9 of 2009) and none of the species are listed as protected by NEMBA (Act 4 of 2004).

Table 6: Avifauna species identified through sighting or call identification within the subject property with 2013 IUCN status. Species protected under the NCNCA (2009) and NEMBA (2004) are indicated with an X.

Scientific name	Common name	2013 IUCN Status	NCNCA (2009)	NEMBA (2004)
Falco biarmicus	Lanner Falcon	LC	X	
Passer domesticus	House sparrow	LC		
Chersomanes albofasciata	Spike-heeled lark	LC	X	
Corvus albus	Pied crow	LC		
Lanius collaris	Common fiscal	LC	X	
Urocolius indicus	Red faced mousebird	LC		
Stigmatopelia senegalensis	Laughing dove	LC	X	
Ploceus velatus	Southern masked weaver	LC		
Cinnyris fuscu	Dusky sunbird	NYBA	X	
Erythropygia paena	Kalahari scrub robin	LC	X	
Streptopelia capicola	Cape turtle dove	LC	X	
Anthus cinnamomeus	African pipit	NYBA	X	
Dicrurus adsimilis	Forked tailed drongo	LC	X	
Euplectes orix	Red Bishop	LC	X	
Ploceus velatus	Southern Masked Weaver	LC	X	
Cercotrichas coryphaeus	Karoo Scrub Robin	LC	X	
Numida meleagris	Helmeted Guineafowl	LC	X	

LC = Least Concern. NYBA = Not yet been assessed for the IUCN Red List.

The probability of avifaunal species being killed during the construction or operational phase is considered to be low as any avifaunal species inhabiting the construction footprint area are likely to migrate out of the area prior to the commencement of construction. The potential of collision with construction and maintenance vehicles is also low and is likely to be restricted to ground dwelling species. Therefore if a speed limit is enforced within the property boundaries the likelihood of avifauna being killed due to collisions can be decreased significantly. Another threat identified for individuals migrating to and from the impoundment is the power lines located on the south eastern boundary of the subject property. Collisions of avifauna with power lines are common especially for larger bird species

such as herons that would utilise the impoundment. It is therefore suggested that cognisance be afforded to the location of any new power lines needed near the impoundment, if possible the lines

should follow the same route as the existing lines and not create any additional hazards on other sides of the impoundment.

Figure 28: Power lines near the impoundment.

5.4 Reptiles

The reptile ecoregion for the subject property is indicated to be the savanna ecoregion. The savannah ecoregion is the most extensive ecoregion in the subregion. Reptile species richness and endemism is extremely high, but this is partially a result of the large extent of the ecoregion. Few savannah reptiles are classified as threatened, and many have extensive ranges (Alexander and Marais, 2008).

11 Reptile species are listed for the QDS, of which all are considered least concern (Animal Demography Unit). Only three reptile species were identified during the site survey, listed in the table below. The subject property does provide habitat for a more diverse reptile community, however their secretive nature makes detection difficult during a field survey of limited duration. Species expected to be found within the subject property would most likely be terrestrial species adapted to grassland and that prey on avifauna and small mammal species. Two common species expected are *Naja nivea* (Cape Cobra) and the *Bitis arietans* (Puff Adder).

Table 7: Reptile species list within the subject property with 2013 IUCN status. Species protected under the NCNCA (2009) and NEMBA (2004) are indicated with an X.

Scientific name	Common name	2013 IUCN Status	NCNCA (2009)	NEMBA (2004)
Pseudaspis cana	Mole snake	NYBA	X	
Chondrodactylus sp.	Tubercled Geckos	N/A	X	
Pedioplanis lineoocellata	Spotted sand lizard	NYBA	X	

VU = Vulnerable, EN = Endangered, NT = Near threatened. NYBA = not yet been assessed according to the IUCN Red List, 2013.

The construction related activities are not considered a direct threat to reptiles within the subject property, due to similar habitat within surrounding areas. However, it would be important that individuals that are encountered during all phases of the development be rescued and relocated by a trained person.

5.5 Amphibians

There are nine principal macro habitats in Southern Africa for amphibians. The subject property falls within the arid savanna unit. This habitat unit is dominated by acacia species and trees spaced sufficiently apart so that there is an understory of grass and no closed canopy (du Preez and

Carruthers, 2009). The open veld habitat unit is the most representative, however the area where the *Acacia erioloba* abundance increase have been transformed due to dumping and 4x4 trails that would limit the diversity as well as abundance of amphibians that could potentially inhabit the unit.

Only one amphibian species was identified namely *Amietophrynus garmani* (Eastern olive toad). The amphibian population is not expected to be diverse due to the general lack of natural wetlands within the region. A conclusion supported by the Animal Demography Unit which only lists two additional species for the QDS namely *Amietia angolensis* and *Tomopterna cryptotis*. All three amphibian species are considered least concern (IUCN, 2013). The fact that the impoundment and seeps are artificial should also be taken into consideration, because a lack of an amphibian community prior to construction of the impoundment would mean that individuals would have to travel over a significant distances to reach these wetlands, which decreases the likelihood of establishment of a more diverse population.

The proposed development activities are not considered a threat to the *A. garmani* population provided that wetland features be left undisturbed. However, should the mine decide to stop augmentation of the impoundment, habitat for this population would be lost.

Figure 29: *A. garmani* encountered near the impoundment.

5.6 Invertebrates, Arachnids and Scorpions

Invertebrate vegetation habitat types in Southern Africa are divided into five major types. The subject property falls within the bushveld vegetation distribution area. The invertebrate assemblage associated with the bushveld have a very wide distribution and are generally subtropical species whose presence in South Africa reflects a southern extension of a range that is primarily Afrotropical. The invertebrates of this region is diverse and contains many unique species (Picker *et al,* 2004).

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the subject property. As such, the invertebrate assessment will not be an indication of the complete invertebrate diversity potential of the subject property. A representation of commonly encountered families in the Insecta class that were observed during the assessment is listed in Table 8 within Appendix D. It should be noted that invertebrate species have been identified to family level, and where possible, invertebrates have been identified to genus and species level.

No threatened invertebrate species are listed for the QDS (Animal Demography Unit) and after completion of the general invertebrate field survey conducted within the subject property the likelihood of finding any Red Data List (RDL) invertebrate species is considered low due to the lack of niche habitat. Thus, the proposed development is deemed unlikely to pose a significant conservational threat to threatened or RDL individuals or their associated habitat.

Table 8: Invertebrate species identified through sighting or other evidence within the subject property.

Scientific name	Common name
Apis mellifera capensis	Cape Honeybee
Psammodes bertolonii	Toktokkie
Microhodotermes viator	Southern harvester termites
Belenois aurota	Brown-veined white
Glymmatophora	Metallic assassin bugs
Family Coreidae	Twig wilters, squash bugs and leaf footed bugs
Family Chrysopidae	Green lacewings
Culex	House mosquitoes
Haematopota	Clegs
Glyphodes bicolor	Bi-coloured Pearl
Leucochitonea levubu	White-cloaked skipper
Colotis subfasciatus subfasciatus	Lemon Treveller
Danaus chrysippus aegyptius	African monarch
Pontia helice helice	Meadow white
Colotis lais	Kalahari Orange tip
Junonia hierta	Yellow Pansy
Archispirostreptus gigas	African millipede

5.7 *Arachnids and Scorpions*

Arachnids can be notoriously hard to observe in the field due to their behavioural habits and hiding when danger is approaching. Additionally, due to the size and nocturnal or crepuscular nature of many arachnid species; it is not practical to identify all possibly occurring species during a limited site visit. Therefore an inference of possible occurring species has to be made by evaluating habitat suitability, prey sources and the study areas location. Taking the aforementioned into consideration as well as the sandy soils as well as degree of transformation within the subject property, it was concluded that less transformed areas within the open veld habitat unit may provide habitat for trapdoor spiders.

Table below lists the spider species identified during the site visit.

Table 9: Araneae species recorded during the survey.

Common Name	Scientific Name	2013 IUCN Status	NCNCA (2009)	NEMBA (2004)
Stegodyphus sp	Community nest spiders	NYBA		
Argiope australis	Garden Orb-web	NYBA		
Angelena sp	Funnel web spiders	NYBA		

LC = Least Concern. NYBA = Not yet been assessed for the IUCN Red List.

The lack of rocky outcrops that would provide rock crevices for *Hadogenes* spp. or rocks that would allow burrowing for *Opistophthalmus* spp., decreases the possibility of finding these scorpion species significantly. The open veld habitat unit may however provide habitat for *Opistacanthus* spp. as well as other more common scorpions found within the Northern Cape. It should be noted that all *Hadogenes* spp. all *Opistophthalmus* spp. and all *Opistacanthus* spp. are listed as protected by the NCNCA (2009).

5.8 *Red Data Listed Species*

A regional list of protected faunal species for the Northern Cape Province is included in the Northern Cape Nature Conservation Act No. 9 of 2009 (NCNCA, 2009). No Red Data List (RDL) status has been included in this report and thus the National publication of RDL faunal species list, which was published in 2004 and amended in 2007 (National Environmental Management: Biodiversity Act No. 10 of 2004, NEMBA 2007), was used to identify RDL or threatened species with distribution ranges that overlap with the subject property. Optimal habitat for these species as documented by the IUCN 2013 and BirdLife International were then compared to the habitat available within the subject property.

No RDL species were identified within the subject property and due to surrounding anthropogenic activity it is deemed unlikely that a great diversity of RDL species would be found. Listed below are faunal species that were considered the most likely species to utilise the subject property from time to time. The status as provided by NEMBA is also indicated.

- *Necrosyrtes rnonachus (*Hooded Vulture) - EN
- *Torgos tracheliotus (*Lappet-faced Vulture) – EN
- *Aquila rapax (*Tawny Eagle) - VU
- *Ardeotis kori (*Kori Bustard) - VU
- *Falco naumanni (*Lesser Kestrel) - VU
- *Falco peregrinus (*Peregrine Falcon) - VU
- *Neotis ludwigii (*Ludwig's Bustard) - VU

From the species listed above it is evident that only avifaunal species are considered likely to be found within the subject property. Terrestrial birds are not necessarily restricted to specific habitat and foraging ranges tend to be larger compared to species that would be restricted to wetland habitat. Furthermore, it is not considered likely that any of the habitat units will be used for breeding purposes. Therefore, the likelihood of the proposed development resulting in loss of breeding habitat for these species is considered low and similar foraging habitat with less anthropogenic activity within surrounding areas would offer alternative foraging habitat for individuals that may be found within the subject property from time to time.

6 IMPACT ASSESSMENT

The tables below serve to summarise the significance of potential impacts on the terrestrial ecology of the subject property. Impacts associated with the floral and faunal ecology of the subject property have been assessed separately. A summary of all potential pre-construction, construction and operational phase impacts is provided before the impact discussion. The sections below indicate the required mitigatory and management measures needed to minimise potential ecological impacts and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures, assuming that they are fully implemented.

At the time the impacts were assessed the development layout had not been finalised, it was therefore considered important to determine impact significance for each habitat unit separately. Impact due to loss of the wetland habitat unit was assessed as part of the wetland impact assessment therefore only the *Acacia erioloba* woodland, the Kathu bushveld and the transformed habitat units were assessed below. For the faunal impact assessment the *Acacia erioloba* woodland, the Kathu bushveld were combined as one habitat unit namely open veld.

The table below illustrates the mitigation hierarchy, a fundamental tool for impact mitigation (Department of Environmental Affairs (DEA) *et. al*., 2013), as well as the forms of mitigation which may be applicable to this project.

Table 10: The Mitigation Hierarchy and the forms of mitigation which are applicable to the mining project

Forms of mitigation	Applicability
Avoiding or preventing impacts	Impacts will be avoided or prevented if possible.
Minimise impacts	Impacts will be minimised where possible.
Rehabilitate impacts	Rehabilitation of areas disturbed as a result of construction activities will take place.
Offset impacts	An offset area is not deemed necessary as all impacts will either be avoided, prevented, minimised or rehabilitated.

6.1 Floral Impact Assessment

IMPACT 1: Impact on floral habitat

Activities and aspects registry

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement	Site clearing and removal of vegetation within the *Acacia erioloba* woodland and the Kathu bushveld habitat units	On-going disturbance of vegetation within surrounding areas due to increased anthropogenic activity
Inadequate design of infrastructure	Encroachment of alien floral species within surrounding open veld	Increased encroachment of alien floral species within surrounding open veld
	Erosion as a result of infrastructure development and storm water runoff	Erosion as a result of storm water runoff
	Indiscriminate driving through surrounding open veld	Indiscriminate driving through surrounding open veld
	Risk of spillages and deliberate dumping of pollutants into the surrounding environment	Dumping of refuse within surrounding open veld
	Compaction of soils	
	Risk of discharge and contamination from construction vehicles	

Development within the *Acacia erioloba* woodland habitat unit will result in the permanent removal of vegetation. Although the vegetation has been disturbed as a result of the development of multiple 4x4 tracks and as a result of anthropogenic activity, this area still provides the habitat to support a large number of the protected SCC *Acacia erioloba* which increases the sensitivity and the severity of the impact. Development within the habitat unit will therefore result in high impact significance prior to the implementation of mitigation measures.

Vegetation associated with the Kathu bushveld habitat unit has been disturbed as a result of the development of gravel roads and power lines through the vegetation and as a result of anthropogenic activities and dumping. However, the area still provides the habitat to support indigenous species including the protected species *Nerine laticoma* as well as a few individuals of the protected SCC *Acacia erioloba*. Development within the Kathu bushveld habitat unit will therefore result in the permanent removal of this indigenous vegetation and will result in a medium high impact significance prior to the implementation of mitigation measures.

The transformed habitat unit has been significantly disturbed as a result of earthmoving activities and the dumping of construction rubble and as a result of anthropogenic activities such as the dumping of refuse within the area. Floral habitat within this area is therefore largely transformed and the development of infrastructure within the habitat unit will therefore result in a medium low impact significance prior to the implementation of mitigation measures.

With the implementation of mitigation measures the impact significance may be reduced for all habitat units. However, the severity of the impact associated with the removal of the *Acacia erioloba* woodland habitat unit remains at a moderate level and will still result in an overall medium high significance impact after mitigation.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Acacia erioloba woodland	5	4	4	3	5	9	12	108 (High)
Kathu bushveld	5	3	3	3	5	8	11	88 (Medium-high)
Transformed	5	1	2	3	5	6	10	60 (Medium-low)

Essential construction phase mitigation measures:

- Keep the proposed development within designated low sensitivity areas as far as possible;
- If possible, avoid development within the *Acacia erioloba* woodland habitat unit;
- Demarcate the construction footprint, clearly, prior to commencement of vegetation clearing;
- Do not clear areas falling outside of the construction footprint;
- Ensure that the proposed development footprint areas remain as small as possible;
- Remove alien species encountered within the subject property in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Species specific and area specific eradication recommendations:
  - Take care with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used, with special mention of areas in close proximity to SCC.;
  - Keep footprint areas as small as possible when removing alien plant species;
  - Monitor the abundance of *Acacia mellifera* in order to identify the possibility of encroachment and if necessary the implementation of appropriate management measures to avoid loss of natural species diversity.
- Rip and profile all soils compacted as a result of construction activities falling outside of development footprint areas. Special attention should be paid to alien and invasive control within these areas;
- Manage edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect floral habitat within surrounding areas;
- Rip and profile all soils compacted as a result of construction activities falling outside development footprint areas;
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil;
- Remove all waste, with special mention of waste rock and spoils and remaining building material, from the site on completion of the project;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- Prohibit informal fires in the vicinity of construction areas; and
- Rehabilitate any natural areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

Recommended construction phase mitigation measures:

- Fence construction footprint areas to contain all activities within designated areas.

Essential operation phase mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint;
- Alien and invasive vegetation control should take place throughout the operational phase of the development;
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- Prohibit informal fires; and
- Do not allow dumping of refuse within the surrounding environment.

Recommended operation phase mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Acacia erioloba woodland	5	4	3	2	5	9	10	90 (Medium-High)
Kathu bushveld	5	3	2	2	5	8	9	72 (Medium-low)
Transformed	5	1	1	2	5	6	8	48 (Low)

Probable latent impacts:

- Permanent loss of floral habitat within areas where construction has taken place.

IMPACT 2: Impact on floral diversity

Activities and aspects registry

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement	Site clearing and removal of vegetation within the *Acacia erioloba* woodland and the Kathu bushveld habitat units	On-going disturbance of vegetation within surrounding areas due to increased anthropogenic activity
	Encroachment of alien floral species within surrounding open veld	Increased encroachment of alien floral species within surrounding open veld
	Increased anthropogenic activity and an increase in the collection of medicinal floral species as well as trees for fire wood.	Increased anthropogenic activity and an increase in the collection of medicinal floral species as well as trees for fire wood.

Floral diversity within all habitat units has been decreased as a result of past and present disturbance. However, species diversity within the *Acacia erioloba* woodland and Kathu bushveld habitat units is higher than that associated with the transformed habitat unit. The impact significance associated with the loss of species diversity associated with the *Acacia erioloba* woodland and Kathu bushveld habitat units is therefore considered to be of a medium high significance prior to the implementation of mitigation measures and the impact associated with the loss of floral species diversity from the transformed habitat unit is considered to be of a medium low significance prior to the implementation of mitigation measures.

With the implementation of mitigation measures the impact can be decreased to a medium low significance for the Kathu bushveld habitat unit and to a low significance for the transformed habitat unit. However, although the severity and spatial scale of the impact is reduced, the impact significance remains medium high for the *Acacia erioloba* woodland habitat unit.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Acacia erioloba woodland	5	4	3	3	5	9	11	99 (Medium-high)
Kathu bushveld	5	3	3	3	5	8	11	88 (Medium-high)
Transformed	5	1	1	3	5	6	9	54 (Medium-low)

Essential construction mitigation measures:

- Keep the construction footprint as small as possible and within designated low sensitivity areas as far as possible;
- If possible, avoid development within the *Acacia erioloba* woodland habitat unit;
- Rescue and relocate SCC and protected bulb and *Aloe* species with the assistance of a suitably qualified specialist;

- Obtain special authorisation for protected and indigenous species to be cut, disturbed, damaged or destroyed. Applications for such activities must be made to the Northern Cape Department of Environment and Nature Conservation;
- As many individuals of *Acacia erioloba* should be included in the landscaping plan as possible;
- Remove alien species encountered within the subject property in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998);
- Prohibit the collection of plant material for firewood or for medicinal purposes;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities.

Recommended construction mitigation measures:

- N/A.

Essential operation mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint;
- Alien and invasive vegetation control should take place throughout the operational phase of the development;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- Prohibit the collection of plant material for firewood or for medicinal purposes;
- Prohibit informal fires; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities.

Recommended operation mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
***Acacia erioloba* woodland**	**5**	**4**	**2**	**2**	**5**	**9**	**9**	**81 (Medium-high)**
Kathu bushveld	**5**	**3**	**2**	**2**	**5**	**8**	**9**	**72 (Medium-low)**
Transformed	**5**	**1**	**1**	**2**	**5**	**6**	**8**	**48 (Low)**

Probable latent impacts:

- Permanent loss of floral diversity within areas where construction has taken place.
- Alien and invasive species proliferation and bush encroachment into disturbed areas.

IMPACT 3: Impact on floral SCC and protected species

Activities and aspects registry

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement	Site clearing and removal of SCC and protected species associated with the *Acacia erioloba* woodland and the Kathu bushveld habitat units.	On-going disturbance of vegetation within surrounding areas due to increased anthropogenic activity
	Indiscriminate movement of construction vehicles through open veld areas	Indiscriminate movement of vehicles through open veld areas
	Increased anthropogenic activity and an increase in the collection of plant material for firewood or for medicinal purposes	Increased anthropogenic activity and an increase in the collection of plant material for firewood or for medicinal purposes

The *Acacia erioloba* woodland habitat unit is characterised by the dominance of the protected SCC *Acacia erioloba* (declining) and the development of this habitat unit will therefore result in the permanent removal of a large number of this species. The protected SCC *Boophane disticha* (declining) and the protected species *Aloe grandidentata* were also identified within this habitat unit and will be lost as a result of construction activities. The impact associated with the loss of these species from the

subject property is considered to be of a high significance prior to the implementation of mitigation measures.

The protected species, *Nerine laticoma*, was identified scattered throughout the Kathu bushveld habitat unit and a few individuals of *Acacia erioloba* were encountered. The development of the habitat unit will result in the permanent removal of these species from the subject property and the impact associated with this loss is considered to be of a medium low significance prior to the implementation of mitigation measures.
A single individual of the protected species, *Nerine laticoma*, was identified within the transformed habitat unit at the time of the assessment and additional individuals may therefore be present. Furthermore, a few individuals of *Acacia erioloba* were encountered. The development of the habitat unit will result in the permanent removal of these species from the subject property and the impact associated with this loss is considered to be of a medium low significance prior to the implementation of mitigation measures.

With the implementation of mitigation measures the impact significance associated with the loss of SCC and protected species may be reduced for all habitat units as SCC and protected species will be rescued and relocated. However, the rescue and relocation of *Acacia erioloba* from the *Acacia erioloba* woodland habitat unit will not be feasible due to the large size and deep root systems of the species. The development of this habitat unit will therefore result in the permanent removal of a large number of individuals of this species and the impact significance will therefore remain medium high after the implementation of mitigation measures.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
***Acacia erioloba* woodland**	**5**	**4**	**4**	**3**	**5**	**9**	**12**	**108 (High)**
Kathu bushveld	**4**	**2**	**2**	**3**	**5**	**6**	**10**	**60 (Medium-low)**
Transformed	**4**	**1**	**1**	**3**	**5**	**5**	**9**	**45 (Low)**

Essential construction mitigation measures:

- Keep the construction footprint as small as possible and within designated low sensitivity areas as far as possible;
- If possible, avoid development within the *Acacia erioloba* woodland habitat unit;
- Rescue and relocate SCC and protected bulb and *Aloe* species with the assistance of a suitably qualified specialist;
- Obtain special authorisation for protected and indigenous species to be cut, disturbed, damaged or destroyed. Applications for such activities must be made to the Northern Cape Department of Environment and Nature Conservation;
- As many individuals of *Acacia erioloba* should be included in the landscaping plan as possible;
- Prohibit the collection of plant material for firewood or for medicinal purposes;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities.

Recommended construction mitigation measures:

- N/A.

Essential operation mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- Prohibit the collection of plant material for firewood or for medicinal purposes; and
- Prohibit informal fires.

Recommended operation mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Acacia erioloba woodland	5	4	4	2	5	9	11	99 (Medium-high)
Kathu bushveld	2	2	1	2	2	4	5	20 (Very low)
Transformed	2	1	1	2	2	3	5	15 (Very Low)
Probable latent impacts: • Permanent loss of the protected SCC *Acacia erioloba*.								

6.2 Faunal Impact Assessment

IMPACT 1: Impact on faunal habitat

Activities and aspects registry

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement	Site clearing and removal of vegetation within the open veld habitat unit	On-going disturbance of faunal habitat within surrounding areas due to increased anthropogenic activity
	Discontinuing water supply to the impoundment and development within associated seeps	Increased encroachment of alien floral species within surrounding open veld
	Encroachment of alien floral species within surrounding open veld	Erosion as a result of storm water runoff
	Erosion as a result of infrastructure development and storm water runoff	Indiscriminate driving through surrounding open veld
	Indiscriminate driving through surrounding open veld	Dumping of refuse within surrounding open veld
	Risk of spillages and deliberate dumping of pollutants into the surrounding environment	

The disturbance within the south western portion are considered significant and presently would only provide habitat for faunal species adapted to transformed areas. As a result this habitat unit cannot be considered of significant importance in terms of faunal conservation. The impact significance was therefore only determined to be medium low prior to mitigation and with the implementation of mitigation measures can be reduced to low.

Isolated areas within the remainder of the subject property can also be considered transformed to some degree, however still provides habitat for more common terrestrial faunal species. The increase in *Acacia erioloba* numbers within the eastern portion also increases the number of avifaunal species that could potentially use the subject property as breeding habitat. Therefore impact significance associated with the open veld habitat unit is higher compared to the transformed habitat unit prior to mitigation. However can be decreased to medium low with the implementation of mitigation measures as provided.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	5	1	2	3	5	6	10	60 (Medium-low)
Open veld	5	3	3	3	5	8	11	88 (Medium-high)

Essential construction phase mitigation measures:

- Keep wetland habitat strictly off limits to construction personnel and vehicles;
- Keep the proposed development within designated low sensitivity areas as far as possible;
- Demarcate the construction footprint, clearly, prior to commencement of vegetation clearing;
- Do not clear areas falling outside of the construction footprint;
- Ensure that the proposed development footprint areas remain as small as possible;
- Manage edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas;
- Rip and profile all soils compacted as a result of construction activities falling outside development footprint areas;
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- Rehabilitate and natural areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

Recommended construction phase mitigation measures:

- Fence construction footprint areas to contain all activities within designated areas.

Essential operation phase mitigation measures:

- Ensure that operational related activities are kept strictly within the development footprint;
- Alien and invasive vegetation control should take place throughout the operational phase of the development;
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- Do not allow dumping of refuse within the surrounding environment.

Recommended operation phase mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	5	1	1	2	5	6	8	48 (Low)
Open veld	5	3	2	2	5	8	9	72 (Medium-Low)

Probable latent impacts:

- Permanent loss of faunal habitat within areas where construction has taken place.

IMPACT 2: Impact on faunal diversity

Activities and aspects registry

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement	Collision of construction vehicles with faunal species	Collision of operational vehicles with faunal species
	Fire hazard from informal fires	Fire hazard from informal fires
	Poaching of faunal species due to increased human activity on site	Poaching of faunal species due to increased human activity on site
	Decline in faunal species within surrounding areas due to increased human activity and noise	Decline in faunal species within surrounding areas due to increased human activity

The subject property is bordered by residential and industrial development as well as roads. Furthermore, the presence of 4x4 routes, various footpaths, dumping within the property and general anthropogenic activity near the impoundment would have further decreased the abundance as well as diversity of the faunal assemblage within the subject property as well as surrounding areas. The open veld would provide foraging habitat for small to medium sized mammal species as well as reptiles, all mobile species that could move away from construction areas. The impact associated with loss of faunal individuals are therefore not considered significant and was determined to be low for the transformed habitat unit and medium low for the open veld habitat unit prior to mitigation. After mitigation the impact can be further reduced to very low for the transformed habitat unit and low for the open veld habitat unit.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	**2**	**1**	**2**	**2**	**5**	**3**	**9**	**27 (Low)**
Open veld	**3**	**3**	**3**	**2**	**5**	**6**	**10**	**60 (Medium-Low**

Essential construction mitigation measures:

- Keep the construction footprint as small as possible and where possible within already disturbed areas;
- Rescue and relocate faunal species found within the development footprint area with the assistance of a suitably qualified specialist;
- Prohibit trapping or hunting of fauna;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions.

Recommended construction mitigation measures:

- Construct speed humps to help slow vehicles and help mitigate collision with faunal species.

Essential operation mitigation measures:

- Keep the construction footprint as small as possible and where possible within already disturbed areas;
- Rescue and relocate faunal species found within the development footprint area with the assistance of a suitably qualified specialist;
- Prohibit trapping or hunting of fauna;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions.

Recommended operation mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	1	1	1	2	4	2	7	14 (Very low)
Open veld	2	3	2	2	4	5	8	40 (Low)

Probable latent impacts:

- A decrease in faunal species diversity may lead to loss of species richness over time.

IMPACT 3: Impact on faunal species of conservational concern

Activities and aspects registry

Pre-Construction	Construction	Operational
	Increased poaching risk of potential species of conservational concern and due to increased human activity on site	Increased poaching risk of potential species of conservational concern and due to increased human activity on site
	Increased risk of informal fires due to increased human activity on site	Increased risk of informal fires due to increased human activity on site
	Collision of construction vehicles with potential species of conservational concern	Collision of operation vehicles with potential species of conservational concern

No RDL species were identified within the subject property and due to surrounding anthropogenic activity it is deemed unlikely that a great diversity of RDL species would be found. If any RDL species would be found within the subject property they would most likely be avifaunal species. However, terrestrial birds are not necessarily restricted to specific habitat and foraging ranges tend to be larger compared to species that would be restricted to wetland habitat. Furthermore, it is not considered likely that any of the habitat units will be used for breeding purposes. Therefore, the likelihood of the proposed development resulting in loss of breeding habitat for these species is considered low and similar foraging habitat with less anthropogenic activity within surrounding areas would offer alternative foraging habitat for individuals that may be found within the subject property from time to time. As a result impact due to loss of individuals or habitat for faunal species of conservational concern is only expected to be very low within the transformed habitat unit and low within the open veld habitat unit prior to mitigation.

It should however be noted that a large number of faunal species identified within the subject property are listed as protected within the NCNCA (Act 9 of 2009). Should these species be removed or killed a permit will be required from the Northern Cape Department of Environment and Nature Conservation.

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	1	1	1	2	5	2	8	16 (Very low)
Open veld	3	3	2	2	5	6	9	54 (Medium Low)

Essential construction mitigation measures:

- Keep the construction footprint as small as possible and where possible within already disturbed areas;
- Rescue and relocate faunal species found within the development footprint area with the assistance of a suitably qualified specialist;
- Prohibit trapping or hunting of fauna;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the

possibility of collisions.

Recommended construction mitigation measures:

- Construct traffic calming devices to help slow vehicles and help mitigate collision with faunal species.

Essential operation mitigation measures:

- Keep the construction footprint as small as possible and where possible within already disturbed areas;
- Rescue and relocate faunal species found within the development footprint area with the assistance of a suitably qualified specialist;
- Prohibit trapping or hunting of fauna;
- Prohibit informal fires in the vicinity of construction areas; and
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions.

Recommended operation mitigation measures:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Transformed	**1**	**1**	**1**	**2**	**4**	**2**	**7**	**14 (Very low)**
Open veld	**1**	**3**	**1**	**2**	**4**	**4**	**7**	**28 (Low)**

Probable latent impacts:

- A decrease in potential diversity of species of conservational concern may lead to a loss of species richness over time.

6.3 Impact Assessment Conclusion

The table below serves as a summary of the key findings made during the impact assessment process.

Table 11: A summary of vegetation impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on floral habitat	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 2: Impact on floral diversity	*Acacia erioloba* woodland	Medium High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 3: Impact on floral SCC and protected species	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium Low (-ve)	Very Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)

Table 12: A summary of faunal impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on faunal habitat	Open veld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low	Low (-ve)

Impact	Habitat unit	Unmanaged	Managed
		(-ve)	
IMPACT 2: Impact on faunal diversity	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)
IMPACT 3: Impact on faunal species of conservational concern	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Very Low (-ve)	Very Low (-ve)

From the results of the impact assessment it is evident that impact due to loss of vegetation habitat and diversity is expected to be more significant compared to loss of faunal habitat and diversity. This is mainly due to the degree of historical and present anthropogenic activity within the subject property as well as immediate surroundings that would have resulted in a decrease of the faunal species that would utilise the subject property for foraging or breeding.

Several protected and RDL floral species were identified within the subject property during the time of the assessment and loss of individuals or habitat for these species is considered high within the *Acacia erioloba* woodland. No RDL faunal species were encountered within the subject property. Several identified faunal species are listed as protected within the province however all the species are relatively common and potential impact significance due to the presence of these species are therefore not considered very high.

6.4 Cumulative Impacts

The region in which the project footprint is located has been significantly impacted as a result of the development of the town of Kathu and as a result of extensive open pit mining activities. This has resulted in the removal of large areas of vegetation and faunal habitat. However, the vegetation associated with the subject property is considered least threatened within the region and the development of the subject property is not likely add to impact on the conservation targets for the vegetation in the region. Furthermore, the faunal assemblage was not found to be very diverse or abundant and species presently utilising the property for either foraging or breeding habitat can move to similar habitat within the surrounding properties therefore development of the property is not considered to significantly contribute to the cumulative impact on fauna within the region.

7 CONCLUSION

SAS was appointed to conduct a terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed Kathu suppliers park, on the farm Sekgame 461 in the Northern Cape Province, hereafter referred to as the 'subject property'. The subject property is located directly to the south of the R380 roadway, adjacent to a residential area presently being developed as part of the town of Kathu.

DESKTOP ASSESSMENT

The following general conclusions were drawn on completion of the desktop assessment:

- According to the Northern Cape PSDF (2012) the subject property is located within the Succulent Karoo Region of Endemism in the Northern Cape Province and is located within an area of high vulnerability with regards to biodiversity sensitivity;
- According to the National land cover database (2009), the majority of the subject property is indicated to be natural land with urban development located adjacent to the north western border;

- According to the National List of Threatened Terrestrial Ecosystems the subject property does not fall within a threatened terrestrial ecosystem; and
- According to the NBA (2011) the subject property is not located within either a formal or informal protected area.

VEGETATION ASSESSMENT

The following general conclusions were drawn on completion of the floral assessment:

- Four vegetation habitat units were identified within the subject property. These habitat units include:
    - The *Acacia erioloba* woodland habitat unit;
    - The Kathu bushveld habitat unit;
    - The transformed habitat unit; and
    - The wetland habitat unit (The wetland habitat unit is discussed in detail in the wetland report (SAS, 2014)).
- The VIS for each of the habitat units was calculated and is listed below:
    - The *Acacia erioloba* woodland and Kathu Bushveld habitat units calculated a moderate score which falls within Class C – Moderately modified with few modifications;
    - The transformed habitat unit calculated a low score which falls within Class E- Loss of natural habitat is extensive;
    - The vegetation PES of the natural pan has been assessed as part of the wetland report (SAS, 2014).
- The majority of the grass species encountered within the subject property are indicative of past disturbance and only six species found are listed as indicators of the Kathu bushveld vegetation type (Musina and Rutherford, 2006);
- An assessment considering the presence of any floral SCC and protected plant species was undertaken:
    - Floral SCC identified within the study area at the time of the assessment include *Acacia erioloba* (declining) and *Boophone disticha* (declining);
    - Four protected species were also encountered within the subject property. These include the SCC *Acacia erioloba* (NFA, 1998) and *Boophone disticha* (NCNCA, 2009) as well as *Nerine laticoma* (NCNCA, 2009) and *Aloe grandidentata* (NCNCA, 2009);
    - *Acacia erioloba* densities increased significantly within the *Acacia erioloba* woodland habitat unit. Additional scattered individuals of *Acacia erioloba* were also encountered within the Kathu bushveld and transformed habitat unit;
    - *Boophone disticha* was encountered within the *Acacia erioloba* woodland habitat unit;
    - *Nerine laticoma* was encountered scattered throughout the Kathu bushveld habitat unit. A single individual was also encountered within the transformed habitat unit at the time of the assessment and additional individuals may therefore be present; and
    - *Aloe grandidentata* was encountered within the *Acacia erioloba* woodland habitat unit.
- It is therefore recommended that, where possible, development within the *Acacia erioloba* woodland is avoided in order to avoid impacts associated with the loss of large numbers of floral SCC and protected floral species;
- SCC and protected bulb and *Aloe* species which will be disturbed as a result of development activities must be rescued and relocated with the assistance of a suitably qualified specialist;
- Should protected and indigenous species to be cut, disturbed, damaged or destroyed, applications for such activities must be made to the Northern Cape Department of Environment and Nature Conservation.

FAUNAL ASSESSMENT

The following general conclusions were drawn on completion of the faunal assessment:

- The subject property can broadly be divided into three faunal habitat units namely wetland, open veld (including *Acacia erioloba* woodland and Kathu bushveld habitat units as referred to in the floral assessment) and transformed;
- Six mammal species, *Cynictis penicillata* (Yellow Mongoose), *Galerella sanguinea* (Slender Mongoose), *Crocidura cyanea* (Reddish-grey musk shrew), *Raphicerus campestris* (Steenbok), *Lepus saxatilis* (Scrub Hare) and *Acomys subspinosus* (Cape Spiny Mouse) were identified within the subject property. All mammal species are common species for the area and are listed

as non-threatened species by the IUCN. However, all of the species are listed as protected within the NCNCA (2009). Should these species be removed or killed a permit will be required from the Northern Cape Department of Environment and Nature Conservation;
- The subject property provides a diversity of avifaunal habitat namely wetland, open veld and woodland in the vicinity of *Acacia erioloba* trees. All avifaunal species identified within the subject property are listed as species of least concern (IUCN, 2013) and are common species for the region. However, the majority of the species identified are listed as protected species by the NCNCA (2009) and none of the species are listed as protected by the NEMBA (Act 4 of 2004);
- Only three reptile species were identified during the site survey. The subject property does provide habitat for a more diverse reptile community, however their secretive nature makes detection difficult during a field survey of limited duration. Species expected to be found within the subject property would most likely be terrestrial species adapted to grassland and that prey on avifauna and small mammal species;
- Only one amphibian species was identified namely *Amietophrynus garmani* (Eastern olive toad). The amphibian population is not expected to be diverse due to the general lack of natural wetlands within the region. A conclusion supported by the Animal Demography Unit which only lists two additional species for the QDS namely *Amietia angolensis* and *Tomopterna cryptotis*. All three amphibian species are considered least concern (IUCN, 2013);
- The sandy soils as well as degree of transformation within the subject property, it was concluded that less transformed areas within the open veld habitat unit may provide habitat for trapdoor spiders;
- The lack of rocky outcrops that would provide rock crevices for *Hadogenes* spp. or rocks that would allow burrowing for *Opistophthalmus* spp., decreases the possibility of finding these scorpion species significantly. The open veld habitat unit may however provide habitat for *Opistacanthus* spp. as well as other more common scorpions found within the Northern Cape. It should be noted that all *Hadogenes* spp. all *Opistophthalmus* spp. and all *Opistacanthus* spp. are listed as protected by the NCNCA (2009); and
- No RDL species were identified within the subject property and due to surrounding anthropogenic activity it is deemed unlikely that a great diversity of RDL species would be found.

SENSITIVITY MAPPING

All the vegetation and faunal results as discussed above was used to map habitat units according to sensitivity. In terms of overall terrestrial ecological sensitivity the study area can be divided into moderately high sensitivity habitat, moderately low sensitivity habitat, and low sensitivity habitat:
- Moderately high sensitivity habitat includes the *Acacia erioloba* woodland habitat unit;
- Moderately low sensitivity habitat includes the Kathu bushveld habitat unit; and
- Low sensitivity vegetation includes the transformed habitat unit.

The Environmental Importance and Sensitivity of the wetland habitat unit was determined during the wetland assessment, for results refer to the SAS wetland assessment dated 2014.

IMPACT ASSESSMENT

At the time the impacts were assessed the development layout had not been finalised, it was therefore considered important to determine impact significance for each habitat unit separately. Impact due to loss of the wetland habitat unit was assessed as part of the wetland impact assessment therefore only the *Acacia erioloba* woodland, the Kathu bushveld and the transformed habitat units were assessed below. For the faunal impact assessment the *Acacia erioloba* woodland, the Kathu bushveld were combined as one habitat unit namely open veld.

The table below serve to summarise the significance of perceived impacts on the floral and faunal biodiversity of the subject property before mitigation measures are implemented. Also indicated is the impact significance of each perceived impact after the implementation of mitigation measures.

Table C: Summary of vegetation impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on floral habitat	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 2: Impact on floral diversity	*Acacia erioloba* woodland	Medium High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 3: Impact on floral SCC and protected species	*Acacia erioloba* woodland	High (-ve)	Medium High (-ve)
	Kathu bushveld	Medium Low (-ve)	Very Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)

Table D: A summary of faunal impact significance before and after mitigation.

Impact	Habitat unit	Unmanaged	Managed
IMPACT 1: Impact on faunal habitat	Open veld	Medium High (-ve)	Medium Low (-ve)
	Transformed	Medium Low (-ve)	Low (-ve)
IMPACT 2: Impact on faunal diversity	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Low (-ve)	Very Low (-ve)
IMPACT 3: Impact on faunal species of conservational concern	Open veld	Medium Low (-ve)	Low (-ve)
	Transformed	Very Low (-ve)	Very Low (-ve)

From the results of the impact assessment it is evident that impact due to loss of vegetation habitat and diversity is expected to be more significant compared to loss of faunal habitat and diversity. This is mainly due to the degree of historical and present anthropogenic activity within the subject property as well as immediate surroundings that would have resulted in a decrease of the faunal species that would utilise the subject property for foraging or breeding.

Several protected and RDL floral species were identified within the subject property during the time of the assessment and loss of individuals or habitat for these species is considered high within the *Acacia erioloba* woodland. No RDL faunal species were encountered within the subject property. Several identified faunal species are listed as protected within the province however all the species are relatively common and potential impact significance due to the presence of these species are therefore not considered very high.

After conclusion of the terrestrial assessment, it is the opinion of the ecologist that, from an ecological point of view, the proposed development will not lead to an unacceptable loss of biodiversity or important ecological aspects and can be considered favourably, provided that the mitigation measures as presented in the impact assessment of this report are strictly adhered to.

8 REFERENCES

Alexander, G and Marais, J 2008 Second Edition. *A Guide to the Reptiles of Southern Africa.* Struik Publishers, Cape Town.

Branch, B. 1998. Third Edition. *Field Guide to Snakes and other Reptiles in Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Bromilow, C. 2001. Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

De Jager, S. 2010. *Veld Medicine from the Klein Karoo*. Drukkor Printing, George.

Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report*. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

EWT, Endangered Wildlife Trust (Conservation Breeding Specialist Group). 2004. *Red Data Book of the Mammals of South Africa: A conservation Assessment*

Germishuizen, G & Clarke, B. 2003. First Edition, First Impression. *Illustrated Guide to the Wildflowers of Northern South Africa.* Briza Publications, Pretoria, RSA.

IUCN 2012. *The IUCN Red List of Threatened Species. Version 2012.2*. <http://www.iucnredlist.org>. Downloaded on 18 February 2013.

Leroy, A. and Leroy, J. Second Edition. 2003. *Spiders of Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Manning, J. 2009. *Field Guide to Wild Flowers of South Africa*. Struik Publishers, Cape Town, RSA.

Marais, J. 2004. *A Complete Guide To The Snakes Of Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Moffett, R. (1997) *Grasses of the Eastern Free State*. UNIQWA, Phuthaditjhaba.

Mucina, L. & Rutherford, M.C. (Eds). 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA

Office of the Premier of the Northern Cape 2012. *Northern Cape Provincial Spatial Development Framework*. Department of Cooperative Governance, Human Settlements and Traditional Affairs, South Africa.

Picker, M., Griffiths, C. & Weaving, A. 2004. New Edition. *Field Guide to Insects of South Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Raimondo, D., von Staden, L., Foden., W., Victor, JE., Helme, NA., Turner, RC., Kamundi, DA., Manyama, PA. (eds) 2009. *Red List of South African Plants* Strelitzia 25. South African National Biodiversity Institute, Pretoria.

SAS, 2014. *Wetland Ecological Assessment as Part Of The Environmental Assessment and Authorisation Process for the Proposed Kathu Suppliers Park in the Northern Cape Province*.

Sinclair, I., Hockey, P. and Tarboton, W. 2002. Third Edition. *Sasol Birds of Southern Africa.* Struik Publishers, Cape Town, RSA

Smithers, R. H. N. 2000. Third Edition. Edited by Peter Apps. *The Mammals of the Southern African. A Field Guide.* Struik Publishers, Cape Town, RSA.

Steyn, M. 2007. *Acacia field guide for Southern Africa*. D&V Premier Print Group, Bendor Place, Polokwane, RSA.

The South African National Biodiversity Institute is thanked for the use of data from the National Herbarium, Pretoria (PRE) Computerised Information System (PRECIS) as well as from the Biodiversity GIS website.

Threatened Species Programme 2005. *Red Data List of South African Plant Species*. Available online: http://www.redlist.org.

Van Oudtshoorn, F. 2004. Second Edition, Third Print. *Guide to Grasses of South Africa.* Briza Publications, Pretoria, RSA.

Van Rooyen, Noel. 2001. *Flowering Plants of the Kalahari Dunes*. Ekotrust CC, Lynnwood, RSA

Van Wyk, B & Van Wyk, P. 1997. *Field Guide to Trees of Southern Africa.* Struik Publishers, Cape Town, RSA.

Van Wyk AE. & Smith, GF. 2001. *Regions of Floristic Endemism in Southern Africa*. UMDAUS Press, Hatfield, RSA.

APPENDIX A

Method of Assessment

Terrestrial

A-1 Desktop Study

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the project footprint was made in order to confirm the assumptions made during consultation of the maps;
- Literature review with respect to habitats, vegetation types and species distribution was conducted;
- Relevant data bases and reports considered during the assessment of the project footprint included:
    - The National Land Cover Dataset (2009);
    - The National Biodiversity Assessment (NBA, 2011);
    - The National List of Threatened Terrestrial Ecosystems (2011);
    - The Northern Cape Provincial Spatial Development Framework (PSDF, 2012);
    - The South African National Biodiversity Institute (SANBI) Threatened species programme (TSP);
    - Pretoria Computer Information Systems (PRECIS).

A-2 Vegetation Index Score

The Vegetation Index Score (VIS) was designed to determine the ecological state of each habitat unit defined within an assessment site. This enables an accurate and consistent description of the Present Ecological State (PES) concerning the project footprint in question. The information gathered during these assessments also significantly contributes to sensitivity mapping, leading to a more truthful representation of ecological value and sensitive habitats.

Each defined habitat unit is assessed using separate data sheets and all the information gathered then contributes to the final VIS score. The VIS is derived using the following formulas:

VIS = [(EVC) + (SI x PVC)+(RIS)]
Where:

1. **EVC** is extent of vegetation cover;
2. **SI** is structural intactness;
3. **PVC** is percentage cover of indigenous species; and
4. **RIS** is recruitment of indigenous species.

Each of these contributing factors is individually calculated as discussed below. All scores and tables indicated in blue are used in the final score calculation for each contributing factor.

1. ***EVC=[(EVC1+EVC2)/2]***

EVC 1 - Percentage natural vegetation cover:

Vegetation cover % Site score	0%	1-5%	6-25%	26-50%	51-75%	76-100%
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score Site score	0	Very Low	Low	Moderately	High	Very High
EVC 2 score	5	4	3	2	1	0

2. ***SI=(SI1+SI2+SI3+SI4)/4)***

Score:	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous								
Clumped								
Scattered								
Sparse								

Present State (P/S) = currently applicable for each habitat unit
Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

Perceived Reference state (PRS)	Present state (P/S)			
	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

3. PVC=[(EVC)-(exotic x 0.7) + (bare ground x 0.3)

Percentage vegetation cover (exotic):

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
PVC Score	0	1	2	3	4	5

4. RIS

Extent of indigenous species recruitment	0	Very Low	Low	Moderate	High	Very High
RIS	0	1	2	3	4	5

The final VIS scores for each habitat unit is then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	A	Unmodified, natural
20 to 24	B	Largely natural with few modifications.
15 to 20	C	Moderately modified
10 to 15	D	Largely modified
5 to 10	E	The loss of natural habitat extensive
<5	F	Modified completely

A-3 Species of Conservation Concern (SCC) Assessment

Prior to the field visit, a record of floral SCC as well as protected species and their habitat requirements were acquired from SANBI for the quarter degree square (QDS) *3418AB*. Throughout the floral assessment special attention was paid with the identification of any of these SCC as well as identification of suitable habitat that could potentially sustain these species.

A-4 Ecological Impact Assessment

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, environmental impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.

[1] The definition has been aligned with that used in the ISO 14001 Standard.

- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and is used to determine whether mitigation is necessary[2].

The assessment of significance is undertaken twice. Initial significance is based only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear features affected < 100m	2
Local area / within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4

[2] Some risks/impacts that have low significance will however still require mitigation

Entire habitat unit / Entire system / > 2000ha impacted / Linear features affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table 8: Significance Rating Matrix.

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 9: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and

- Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.

- Risks/Impacts were assessed for all stages of the project cycle including:
  - Construction;
  - Operation; and
  - Rehabilitation.
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur post-closure.

Mitigation Measure Development

The following points present the key concepts considered in the development of mitigation measures for the proposed development:

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[3] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation.

Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

[3] Mitigation measures should address both positive and negative impacts

APPENDIX B

Floral Species lists

Table 13: Floral species identified within the various habitat units of the study area.

	Acacia erioloba woodland	Kathu bushveld	Transformed
Trees and shrubs			
Acacia erioloba	X	X	X
Acacia mellifera	X	X	X
Aloe grandidentata	X		
Aptosimum procumbens		X	
Aptosimum spinescens	X	X	
Asparagus retrofractus	X		
Barleria rigida		X	
Chrysocoma ciliata	X	X	X
Elephantorrhiza elephantina	X	X	
Grewia flava	X	X	X
Helichrysum sp.	X	X	
Indigofera sp.	X	X	
Lycium cinereum	X	X	
Pentzia incana	X	X	
Pollichia campestris	X		
Prosopis glandulosa	X	X	
Searsia ciliata		X	
Tarconanthus camphoratus	X	X	X
Ziziphus mucronata	X	X	
Zygophyllum pubescens		X	
Herbs			
Acanthosicyos naudinianus	X	X	
Adenogramma aethiopicum		X	
Cleome angustifolia	X	X	X
Geigeria ornativa		X	
Gisekia pharnacoides	X	X	
Hermbstaedtia fleckii	X	X	X
Hermannia sp.	X		
Limeum aethipoicum	X	X	
Senna italica	X	X	X
Sesamum triphyllum	X	X	X
Tribulus terrestris	X	X	X
Bulbs			
Boophane disticha	X		
Ledebouria sp.		X	
Nerine laticoma		X	
Ornithogalum sp.		X	
Schizocarphus nervosus	X	X	
Grasses			
Aristida congesta var congesta	X	X	X
Aristida diffusa	X	X	

Aristida meridionalis	X	X	X
Cenchrus ciliaris	X	X	
Cymbopogon plurinodis		X	
Cyndon dactylon	X	X	
Digitaria eriantha		X	
Eragrostis echinochoidea	X	X	X
Eragrostis lehmanniana	X	X	X
Eragrostis nindens		X	
Eragrostis plana		X	X
Eragrostis trichophora	X	X	
Fingeruthia africana		X	
Heterepogon contortus	X	X	X
Melinis repens	X		
Paspalum dilitatum	X	X	
Schmitia papporophoroides	X	X	X
Setaria verticilata	X	X	
Tragus berteronianus	X	X	X
Restios			
Juncus sp.	X		

APPENDIX C
VIS

Vegetation Index Score –*Acacia erioloba* woodland

EVC=[[(EVC1+EVC2)/2] = 3.5

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score						X
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score				X		
EVC 2 score	5	4	3	2	1	0

SI=(SI1+SI2+SI3+SI4)/4) = 2.75

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	X
Clumped								
Scattered	X	X	X	X		X		
Sparse					X			

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3)) = 2.5

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

RIS

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
					X	
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 14.4

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
22 to 25	**A**	Unmodified, natural
18 to 22	**B**	Largely natural with few modifications.
14 to 18	**C**	Moderately modified
10 to 14	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely

Vegetation Index Score –Kathu bushveld

EVC=[[(EVC1+EVC2)/2] = 3.5

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score						X
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score				X		
EVC 2 score	5	4	3	2	1	0

SI=(SI1+SI2+SI3+SI4)/4) = 2.75

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	X
Clumped								
Scattered	X	X	X	X		X		
Sparse					X			

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3)) = 2.5

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

RIS

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
					X	
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 14.4

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
22 to 25	**A**	Unmodified, natural
18 to 22	**B**	Largely natural with few modifications.
14 to 18	**C**	Moderately modified
10 to 14	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely

Vegetation Index Score –Transformed

EVC=[[(EVC1+EVC2)/2] = 2.5

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score					X	
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score					X	
EVC 2 score	5	4	3	2	1	0

SI=(SI1+SI2+SI3+SI4)/4) = 2.25

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	X
Clumped								
Scattered		X		X		X		
Sparse	X		X		X			

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3)) = 0.9

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %				X		
PVC Score	0	1	2	3	4	5

RIS

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
				X		
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 7.5

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
22 to 25	**A**	Unmodified, natural
18 to 22	**B**	Largely natural with few modifications.
14 to 18	**C**	Moderately modified
10 to 14	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely