Appendix D4: Biodiversity Assessment

FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED NEW KATHU CEMETERY, KATHU, NORTHERN CAPE

Prepared for

Synergistics Environmental Services (Pty) Ltd

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EXECUTIVE SUMMARY

Based on the findings of the ecological assessment, it is the opinion of the ecologists that from an ecological perspective, the proposed project be considered favorably. However, all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure the ecology within the proposed construction area is adequately managed in order to minimise the deviations from the Present Ecological State.

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the environmental assessment and authorisation process for the proposed new Kathu Cemetery within the Northern Cape Province. The project comprises approximately 5 ha of land, and will include site clearing for new graves, a parking area as well as an access road and support infrastructure. Two alternatives for the access road are proposed, one from Dingleton Road (Alternative 1) and the second from the N14 highway (Alternative 2). The new cemetery together with the proposed access road alternatives, will henceforth collectively be referred to as the "study area".
As part of the field assessment and reporting an assessment area of 100m (perimeter zone) was included around the study area, so as to better quantify the available habitat and possible impacts that the development may have on the receiving environment.

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) of the terrestrial ecological resources in the vicinity of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur or to have occurred within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, natural grasslands, wetlands and any other ecologically important features; and
- To determine the environmental impacts that the construction of the study area might have on the terrestrial ecology associated with the footprint area, and to develop mitigation and management measures for all phases of the development.

FLORAL RESULTS

- One habitat unit was identified during the field assessment, namely Kuruman Thornveld.
- The habitat unit has been degraded as a result of edge effects from local mining activities, road construction and heavy grazing;
- No plants species are listed for the Quarter Degree Square (QDS) 2723CC by the South African National Biodiversity Institute (SANBI);
- Two tree species, *Vachallia erioloba* and *Vachellia haematoxylon*, which are listed as Protected in Section 15 (1) of the National Forest Act (1998, as amended in September 2011) were observed and marked within the study area. All relevant permits pertaining to these species are to be acquired prior to construction activities;
- One plant species as listed in both the TOPS (NEMBA, 2015) and the NCNCA (Act No 9 of 2009) plants list for threatened and protected floral species was observed, namely *Harpagophytum procumbens*, for which permits are required from the relevant authorities pertaining to the removal/ relocation or destruction of this species;
- Provided that all mitigation measures are adhered to and that the necessary permitting systems are followed, it is deemed that the proposed development be considered favorable.

FAUNAL RESULTS

- Local edge effects from mining activities and road construction as well as high levels of grazing have led to a discernible degradation of the natural faunal habitat within the study area;
- The study area was predominantly inhabited by faunal species common to the region, that are widely distributed throughout the surrounding habitats;
- One faunal SCC was recorded during the field assessment, namely, Genus *Pterinochilus* (Golden-brown baboon spiders), observed 50m outside of the north-eastern border of the study

area, however no individuals were observed within the study area. Should this species be located within the study area it is recommended that individuals be relocated to suitable habitat near the study area; and

- Provided that all mitigation measures are adhered to, the proposed development is deemed unlikely to pose a significant conservation threat to faunal habitat and species in the region.

TERRESTRIAL IMPACT ASSESSMENT

The tables below summarises the findings indicating the significance of the impacts before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation measures it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs. From the table, it is evident that prior to mitigation the impacts are of a medium-low to low significance level. If mitigation takes place all impacts can be further reduced. Where impact significance ratings do not adjust following the implementation of mitigation measures, the impact score (numbers) has been indicated to illustrate that mitigation measures will result in the lowering of impact on the receiving environment, however not to the degree where a lower rating can be assigned.

A summary of the impact significance of the construction phase on floral species.

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium Low (70)	Medium Low (56)
2: Impact on floral diversity	Medium Low	Low
3: Impact on important species	Medium Low (72)	Medium Low (63)

A summary of the impact significance of the operational phase on floral species.

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium Low	Low
2: Impact on floral diversity	Medium Low	Very Low
3: Impact on important species	Medium Low	Low

A summary of the impact significance of the construction phase on faunal species

Impact	Unmanaged	Managed
1: Impact on habitat for faunal species	Medium-Low	Low
2: Impact on faunal diversity	Medium-Low	Low
3: Impact on important species	Medium-Low	Very Low

A summary of the impact significance of the operational phase on faunal species.

Impact	Unmanaged	Managed
1: Impact on habitat for faunal species	Medium Low	Low
2: Impact on faunal diversity	Medium Low	Low
3: Impact on important species	Low	Very Low

SENSITIVITY

The table below indicates the sensitivity of the habitat unit along with an associated conservation objective and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Kuruman Thornveld	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential within the designated study area.	Development activities in this area are unlikely to have a significant impact on the receiving environment, provided that all mitigation measures are adhered to, and that the construction footprint is kept as small as possible. Where feasible, the existing vegetation should be incorporated into the landscape design of the cemetery, so as to retain as much of the onsite habitat as possible, but also to create areas/corridors of movement within the cemetery for faunal species. A site walkdown is to be conducted prior to development in order to identify any possible *Pterinochilus* burrows that may be disturbed.

The overall site sensitivity for both flora and fauna is considered to be intermediate. Long term edge effects from mining activities, infrastructure development and heavy grazing have impacted upon the floral and faunal species composition of the study area. The study area however still provides habitat to floral SCC such as *Vachallia erioloba*, *Vachellia haematoxylon* and *Harpagophytum procumbens*. Where applicable, permits for the removal of these species are to be obtained, however it is recommended that as far as possible individual plants be left in place to form part of the landscape design. Should it be unfeasible to leave these species in situ, every effort is to be made to either re-use individual plants in the landscape plan, or alternatively relocate plants to suitable similar habitat outside of the development footprint. Should any individuals of the Genus *Pterinochilus* (Golden-brown baboon spiders) be observed within the development footprint, this species must be collected and relocated outside of the study area to similar habitat.

DOCUMENT GUIDE

The table below provides the NEMA (2014) Requirements for Biodiversity Assessments and also the relevant sections in the reports where these requirements are addressed.

NEMA Regulations (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Appendix J
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix J
A declaration that the person is independent in a form as may be specified by the competent authority	Appendix J
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.3 Section 2.1
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2 Appendix B Appendix C
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4 Section 5 Section 6
An identification of any areas to be avoided, including buffers	Section 4 Section 5 Section 6
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Sections 7
Any mitigation measures for inclusion in the EMPr	Section 7
Any conditions for inclusion in the environmental authorisation	Section 4 Section 5 Section 7
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 4 Section 5 Section 7
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 8
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 7
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

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GLOSSARY OF TERMS

Alien vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
IBA (Important Bird and Biodiversity Area)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation	Vegetation occurring naturally within a defined area.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.

LIST OF ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment (2011)
NCNCA	Northern Cape Nature Conservation Act (Act No 9 of 2009)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NT	Near Threatened
PES	Present Ecological State
POC	Probability of Occurrence
POSA	Plants of Southern Africa
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
RE	Regionally Extinct
SABAP 2	Southern African Bird Atlas 2
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VU	Vulnerable

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the environmental assessment and authorisation process for the proposed new Kathu Cemetery within the Northern Cape Province. The project comprises approximately 5 ha of land, and will include site clearing for new graves, a parking area as well as an access road and support infrastructure. Two alternatives for the access road are proposed, one from Dingleton Road (Alternative 1) and the second from the N14 highway (Alternative 2). The new cemetery together with the proposed access road alternatives, will henceforth collectively be referred to as the "study area".

The study area is situated approximately 13 km south of central Kathu, and adjacent to the N14 highway, on the remaining extent of the farm Lyleveld 545 within the Gamagara Municipality and John Taolo Gaetsewe District Municipality.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

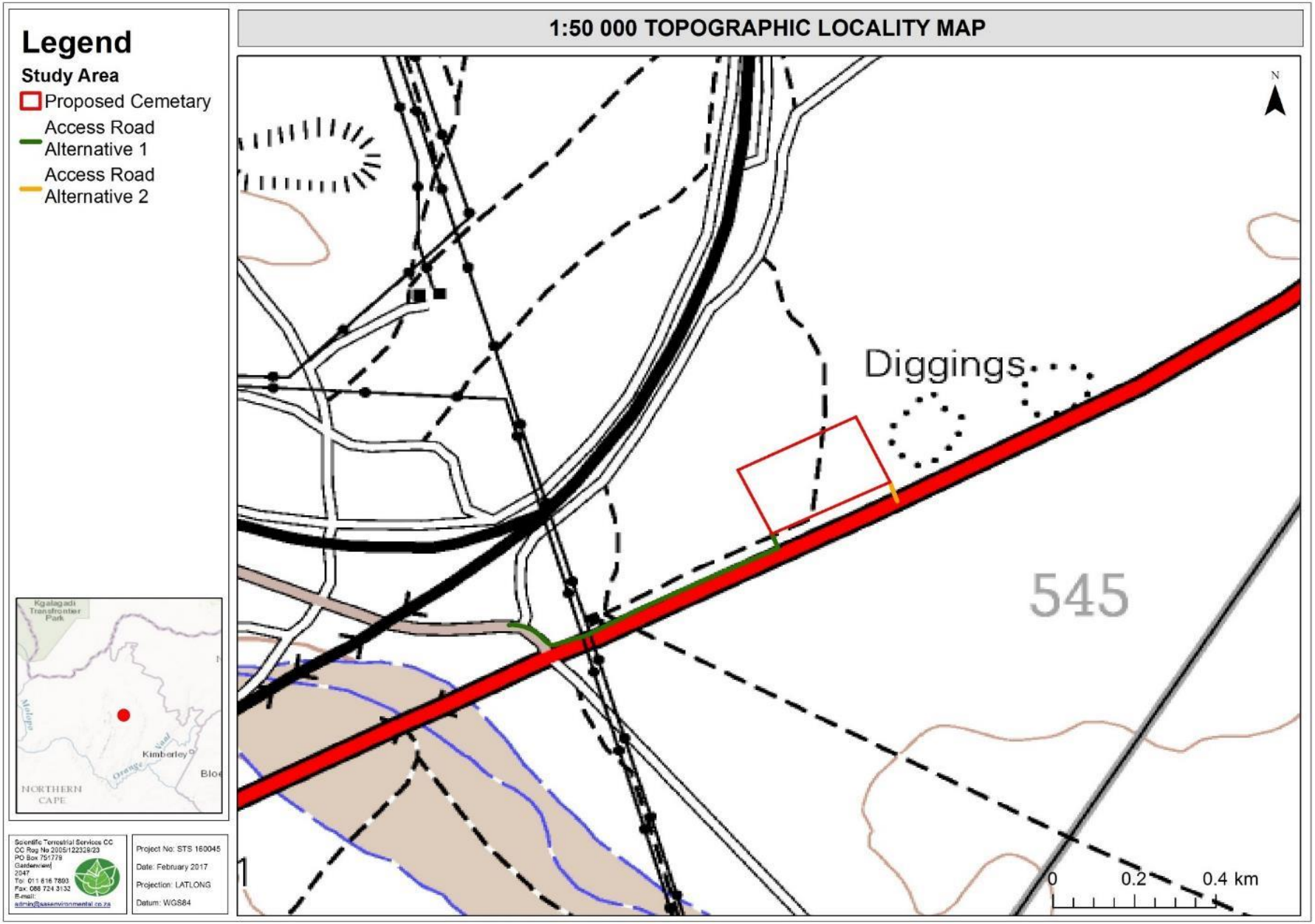


Figure 1: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

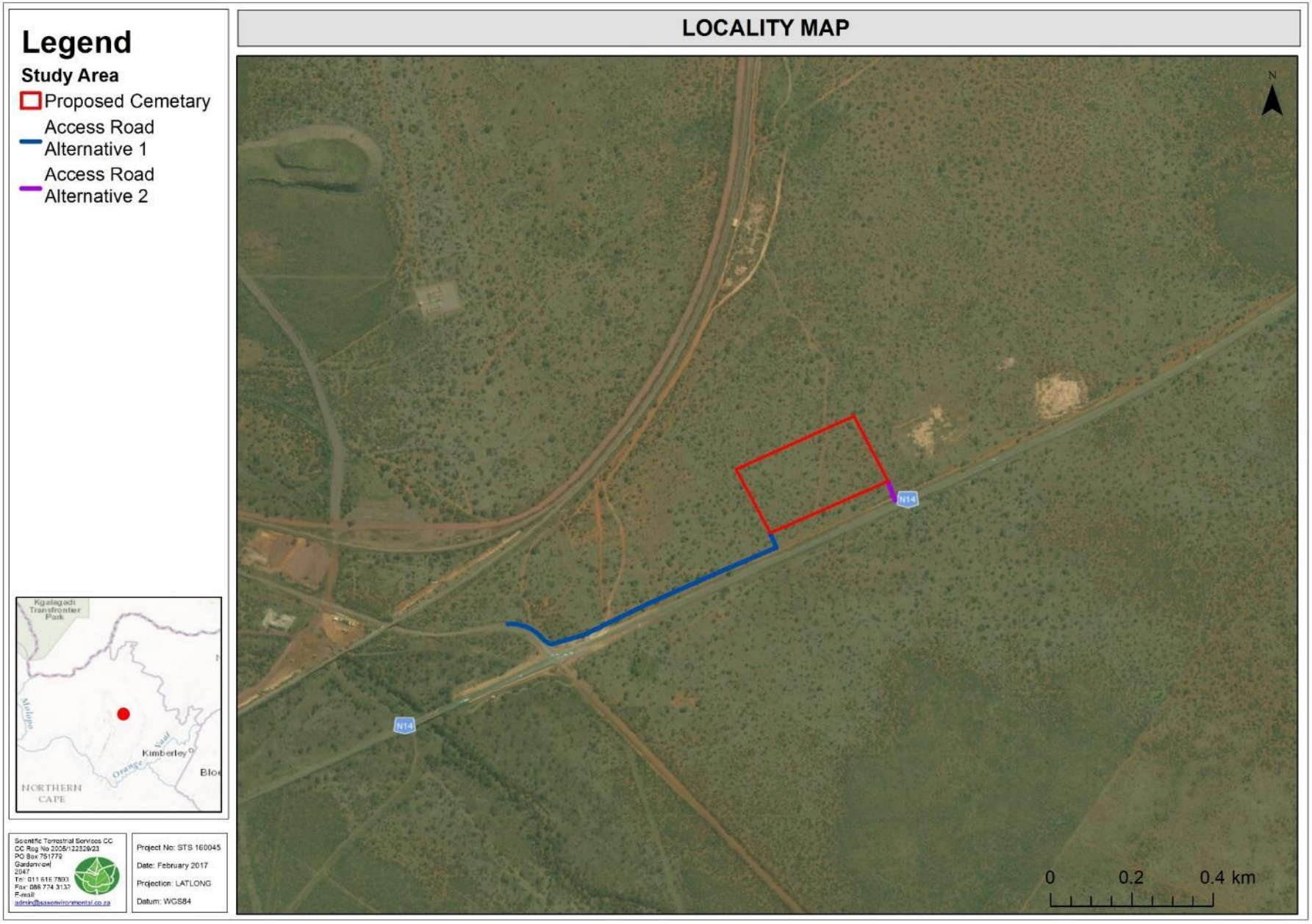


Figure 2: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the study area;
- To determine and describe habitats, communities and ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the construction of the proposed development might have on the terrestrial ecology associated with the study area, as well as potential impacts on the ecology due to activities related to the proposed development and to develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and immediate surrounding area (within 100m) and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities and the time (season) of the assessment, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may have been missed during the assessment; and
- The data presented in this report are based on two site visits, undertaken in November 2016 and again in January 2017. A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, and the findings of this

assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- National Environmental Management Act (NEMA) (Act 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- The Northern Cape Nature Conservation Act (NCNCA, Act No 9 of 2009); and
- Conservation of Agricultural Resources Act (CARA, Act 43 of 1983).

The details of each of the above, as they pertain to this study, are provided in Appendix A of this report.

2. ASSESSMENT APPROACH

2.1 General Approach

In order to accurately determine the PES of the study area and capture comprehensive data with respect to the terrestrial ecology, the following methodology was used:

- 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. The results of this analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- A literature review with respect to habitats, vegetation types and species distribution was conducted;
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Northern Cape Spatial Development Framework (2012), Mucina and Rutherford (2006), National Biodiversity Assessment, Important Bird Areas in conjunction with the South African Bird Atlas Project (SABAP2), International Union for Conservation of Nature (IUCN), and Pretoria Computer Information Systems (PRECIS);
- Two visual on-site assessments of the study area were conducted during November 2016 and in January 2017 in order to confirm the assumptions made during

consultation of the maps and to determine the ecological status of the study area. A thorough 'walk through' on foot was undertaken in order to identify the occurrence of the dominant floral species and faunal and floral habitat diversities;

- Specific methodologies for the assessment, in terms of field work and data analysis of faunal and floral ecological assemblages are presented in Appendices B and C; and
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to Appendix D of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition, identified locations of SCC and SANBI protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high quality data, the various databases do not always provide an entirely accurate indication of the study areas actual biodiversity characteristics.

Table 1: Summary of the conservation characteristics for the study area.

Details of the study area in terms of Mucina & Rutherford (2006)		Description of the vegetation type(s) relevant to the study area (Mucina & Rutherford 2006)		
Biome	The study area is situated within the **Savanna Biome.**	**Vegetation Type**	Kuruman Thornveld	Kuruman Mountain Bushveld
Bioregion	The study area is located within the **Eastern Kalahari Bushveld Bioregion**	**Climate**	Summer and autumn rainfall, very dry winters	Summer and autumn rainfall, very dry winters
Vegetation Type (Figure 3)	The study area is situated within the **Kuruman Thornveld,** although the western section of Access Road Alternative 1 falls within the **Kuruman Mountain Bushveld** Vegetation type.	**Altitude (m)**	1100-1500	1100-1800
		MAP* (mm)	368	371
		MAT* (°C)	17.5	16.8
Conservation details pertaining to the study area (Various databases)		**MFD* (Days)**	36	40
NBA (2011)	The study area falls within an area that is currently not protected	**MAPE* (mm)**	2786	2728
		MASMS* (%)	84	83
National Threatened Ecosystems (2011)	The study area falls within an area that is least threatened.	**Distribution**	North-West & Northern Cape Provinces	Northern Cape and North-West Provinces
		Geology & Soils	Some Campbell Group dolomite and chert and mostly younger, superficial Kalahari Group sediments, with red wind-blown sand.	Blanded iron formation, with jaspilite, chert and riebeckite-asbestos of the Asbestos Hills Supergroup of the Griqualand West Supergroup (Vaalian)
NPAES (2009) & SAPAD (2016)	The study area is not located within or near any protected area within a 5km radius	**Conservation**	Least threatened. Target 16%. None conserved.	Least threatened. Target 16%. None conserved.
IBA (2015)	Not located within or near an IBA			
Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)		**Vegetation & landscape features (Dominant Floral Taxa in Appendix F)**	Flat rocky plains and some sloping hills, with very well developed, closed shrub layer and open tree stratum consisting of *Vachellia erioloba*	Rolling hills with gentle to moderate slopes and hill pediment areas with open shrubveld. *Lebeckia macrantha* prominent in places, and well developed grass layer.
• The proposed study area is situated within the Griqualand West Centre of Endemism) (Figure 4). Please refer to Appendix E for further detail; and • The proposed study area is situated within the Gamagara Corridor. The corridor focuses on the mining of iron and manganese (Figure 5).				

NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply).

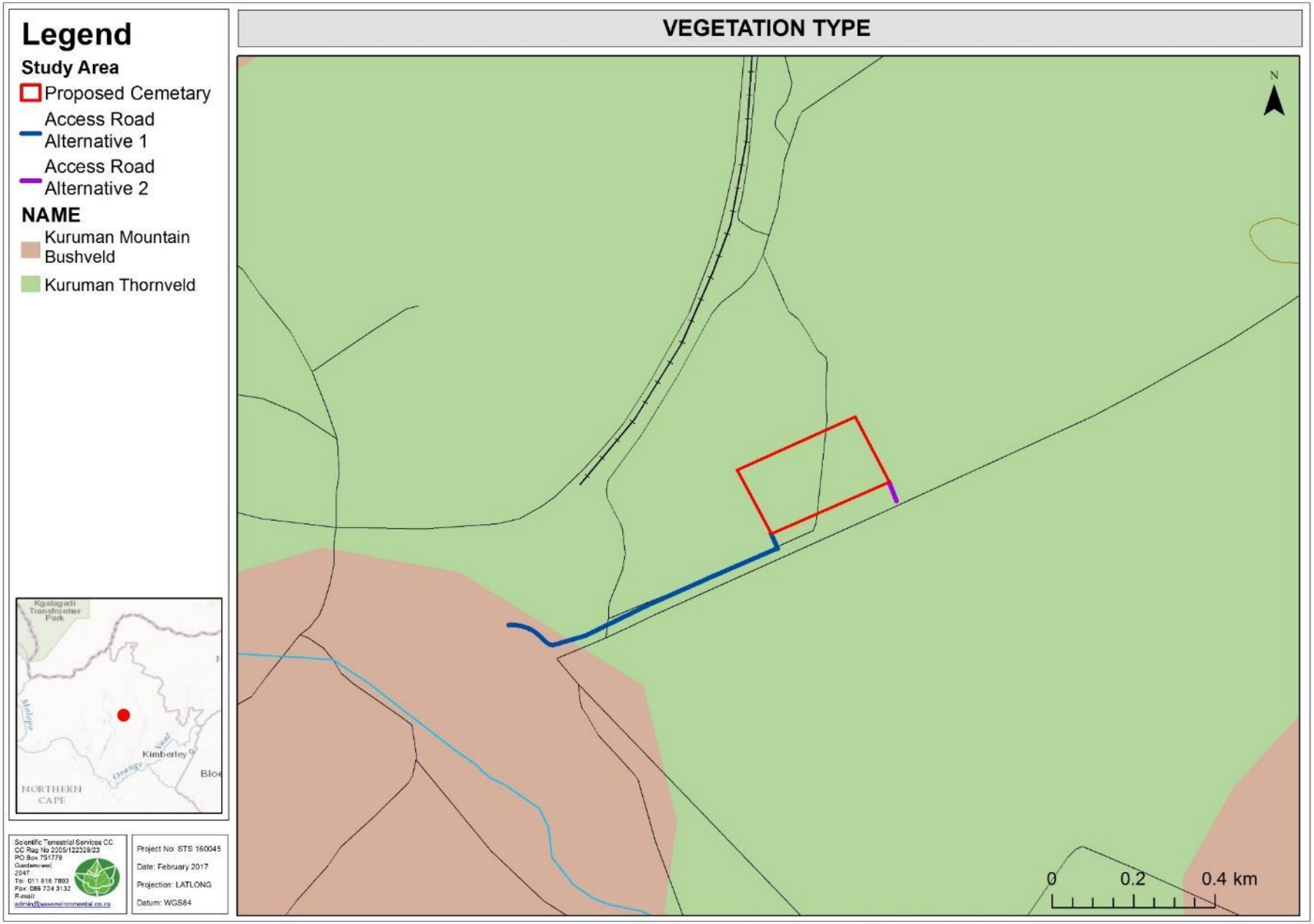


Figure 3: Vegetation types associated with the study area (Mucina & Rutherford, 2006)

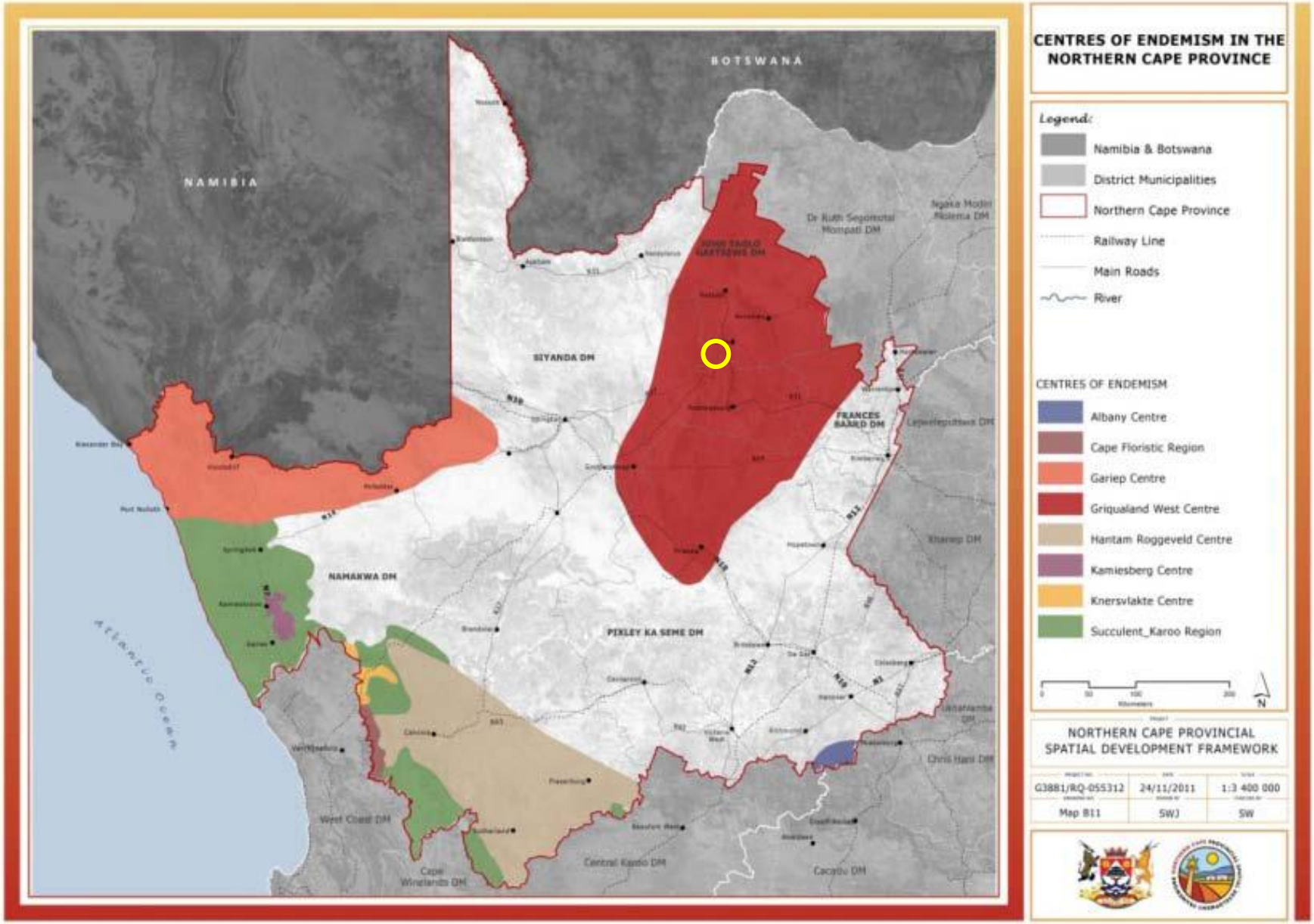


Figure 4: Centers of endemism of the Northern Cape Province: the MRA indicated by a yellow circle (Northern Cape Provincial Spatial Development Framework, 2012).

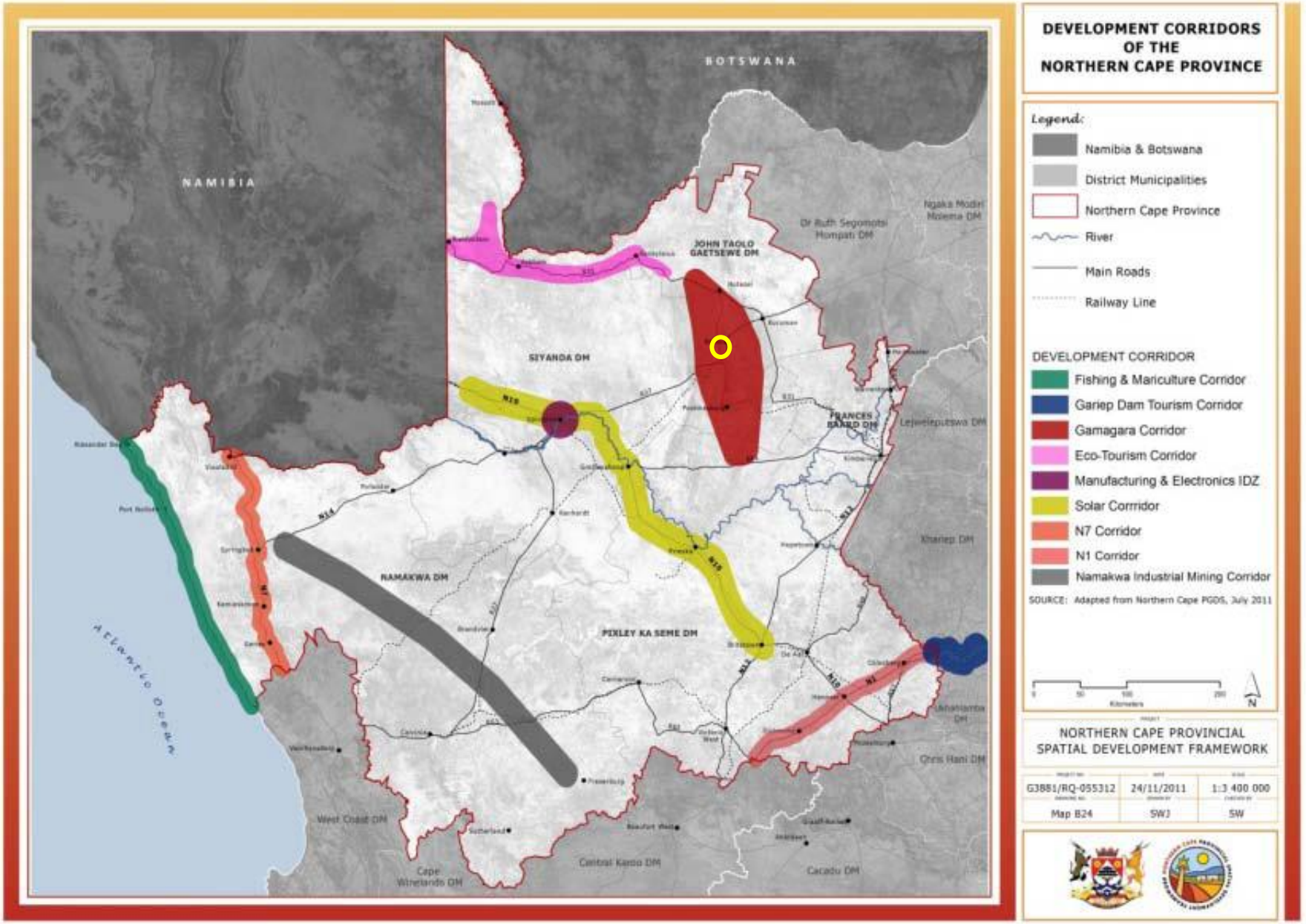


Figure 5: Development regions and corridors of the Northern Cape: the MRA indicated by the yellow circle (NPSDF, 2012).

4. RESULTS OF THE FLORAL ASSESSMENT

4.1 Habitat Units within the Study Area

A 100m perimeter zone was placed around the study area as well as alternative road options in order to suitably describe the area, and to ensure that edge effects on the surrounding habitat could be adequately quantified. Following the assessment of the study area and the associated habitat, it has been concluded that a single habitat type best described the ecology associated with the study area. The habitat unit is described below:

Kuruman Thornveld

This habitat unit is characteristic of the Kuruman Thornveld vegetation type as described by Mucina & Rutherford (2006). The study area is predominantly flat with characteristic deep red soils throughout. The woody component of the study area is dominated by species such as *Vachallia erioloba*, *Vachellia haematoxylon*, *Grewia flava* and *Senegalia mellifera subsp. detinens*, with the herbaceous layer dominated by species such as *Fingerhuthia africana*, *Stipagrostis amabilis* and *Eragrostis lehmanniana* amongst others. During the first site visit, it was evident that the prolonged dry period had affected the vegetation, notably the herbaceous layer, however following the rains received in the early parts of the year (2017), the herbaceous layer was observed to be recovering to a degree. Much of the study area is heavily utilised for grazing by resident wildlife species, evident when looking at the grass species present, with many of the grass species being known to predominate in areas that are heavily grazed/ disturbed.

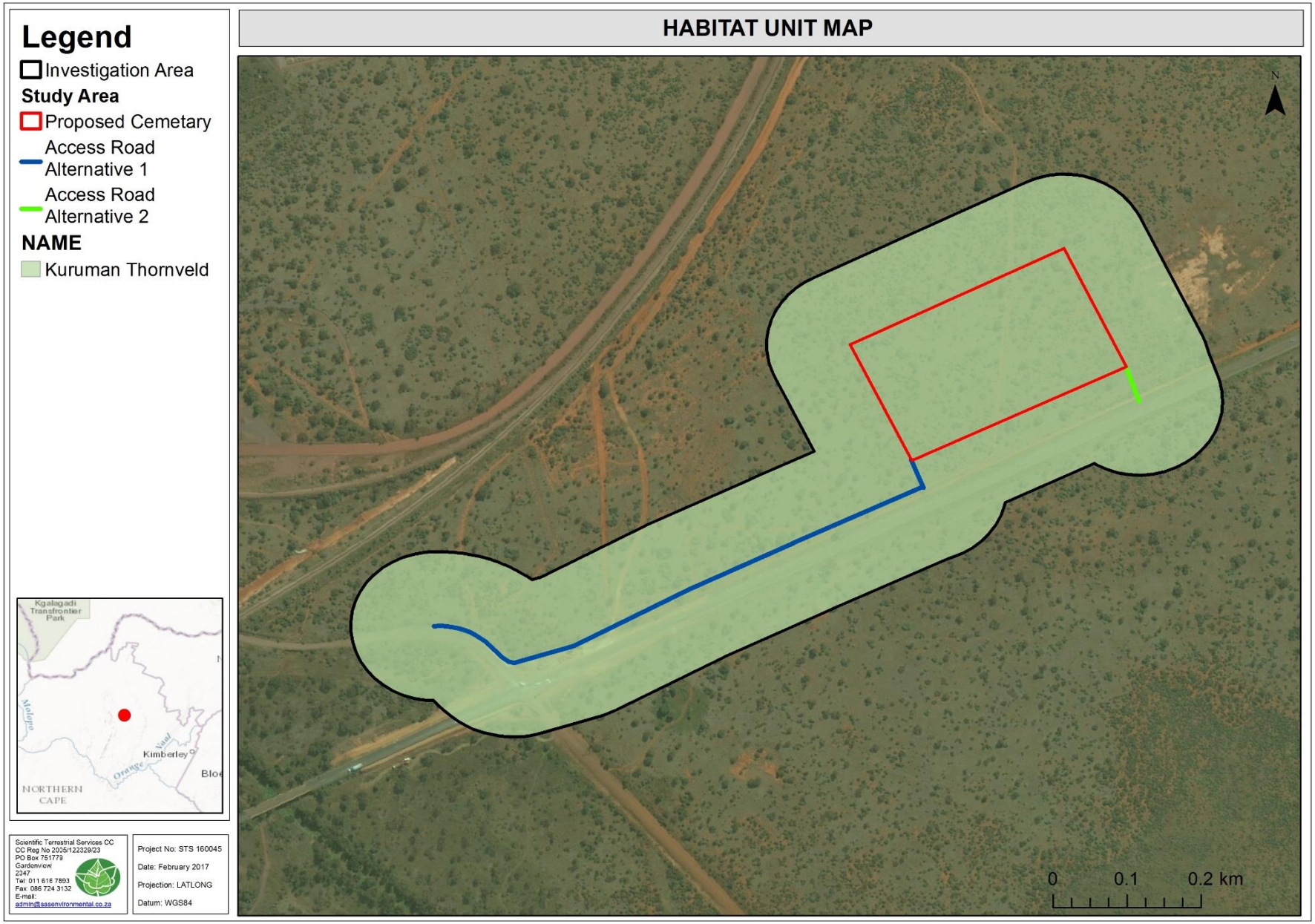
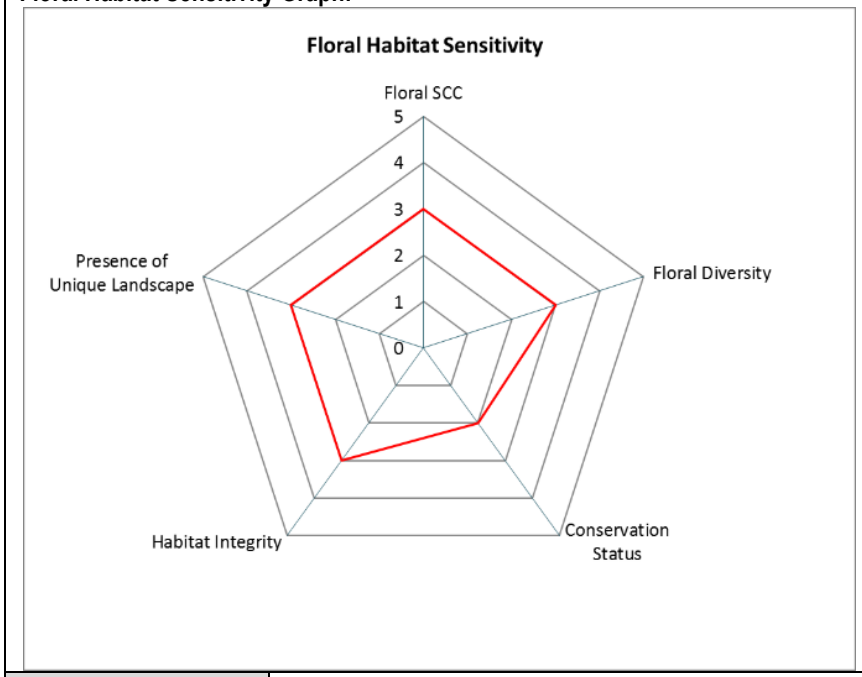


Figure 6: Habitat units encountered within the study area.

Table 2: Summary of results of the floral assessment.

Habitat Unit: Kuruman Thornveld	**Floral Habitat Sensitivity**	**Intermediate**
	Notes on Photograph: Top: Images depicting the Kuruman Thornveld; **Middle**: *Vachallia erioloba* and *Harpagophytum procumbens*; **Below**: *Ammocharis coranica*, along the proposed Alternative 1 access road.	
Floral Habitat Sensitivity Graph: 		
Floral Species of Conservation Concern (SCC)	Three floral SCC were observed within the study area, namely *Harpagophytum procumbens* (Specially Protected, (NCNCA, Act No 9 of 2009, TOPS, Notice 389 of 2013), *Vachellia erioloba* and *Vachellia haematoxylon* of which both are listed as protected in the National Forest Act (1998, as amended in September 2011). Where applicable the relevant permits will be required for the removal or destruction of individual plants, however, it is recommended that as far as possible these species are to be incorporated in the landscaping plan, or alternatively relocated to similar suitable habitat close to the study area but outside of the development footprint.	

Photograph:

Floral Diversity	Floral diversity was intermediate and dominated by herbaceous species that are commonly associated with areas that have been disturbed or overgrazed. Grass species observed included *Aristida congesta*, *Aristida meridionalis*, *Cenchrus ciliaris, Enneapogon cenchroides*, *Eragrostis lehmanniana* and *Hyparrhenia hirta*. Woody species observed within the study area include *Vachallia erioloba*, *Vachellia haematoxylon*, *Grewia flava* and *Senegalia mellifera subsp. detinens*. For a comprehensive species list refer to Appendix G.	**General comments:** The study area has been degraded as a result of edge effects from years of mining activities that are in the immediate surrounds, land uses and service infrastructures (roads, power lines, railway lines). The study area forms part of a larger area that is utilised by fenced in game species, specifically grazers. As such, the herbaceous layer shows signs of overgrazing and related disturbances. Although the area has been degraded, a number of important tree species were observed and marked on site which will require permits for the removal/ destruction should the development progress.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is of an intermediate ecological sensitivity. Development activities within the study area are unlikely to have a significant impact on regional ecological functionality, provided that all mitigation measures as stipulated in this report are implemented. Furthermore, protected plant species, where possible, are to be incorporated into the landscape design or relocated to suitable habitat in the area. Permits for the removal/destruction of protected plants are to be obtained from the relevant authorities prior to the commencement of construction activities. In terms of the proposed access roads, Alternative 2 is likely to have the least impact on the receiving environment due to the direct access to the N14. Alternative 1 is of a longer length, however there is an existing road along this option, with only a small portion being non-existent. As such, it is deemed that neither will have significantly greater or lesser impacts than the other, therefore access options should be determined in terms of best access practices concerning vehicle and occupant safety concerns when accessing any main roads.
Conservation Status of Vegetation Type/Ecosystem	Falls within the Kuruman Thornveld which is considered to be of Least Concern. Impacts largely from increased grazing activities and ancillary mining activities have degraded the vegetation, however there are still species representative of the vegetation type remaining.		
Habitat integrity/Alien and Invasive species	The habitat within the study area is deemed to be of an intermediate integrity. Habitat connectivity has been compromised as a result of roads (tar and dirt) and rail infrastructure, as well as fence systems. Windblown dust from surrounding mining activities has further degraded the state of habitat and natural functioning of vegetation within the study area. Only one alien invasive species was identified at the time of assessment, namely *Chenopodium album*, with indigenous plant species still dominant in the study area.		
Presence of Unique Landscapes	No unique landscapes were observed within the study area, or within the immediate surrounds.		

4.2 Floral Species of Conservation Concern Assessment

Threatened/protected species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species. Furthermore, SCC are 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 (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken. The SANBI PRECIS RDL plants database was consulted for the Quarter Degree Square (QDS) 2723CC in order to obtain historical floral SCC observations. Furthermore, the TOPS (NEMBA, 2015) floral species list was also considered, as was the Protected tree species listed within Section 15 (1) of the National Forest Act (1998, as amended in September 2011).

The following protected species were observed within the study are at the time of assessment:

- *Harpagophytum procumbens*;
- *Vachallia erioloba;* and
- *Vachellia haematoxylon.*

The study area was observed to have a large and healthy population of *Vachallia erioloba*, *Vachellia haematoxylon* trees, with individuals ranging from 1m to larger than 4m located throughout. The removal, relocation or destruction of these species will require permits as stipulated within the National Forest Act (1998, as amended in September 2011), and as such construction activities cannot commence until such permits are in place. It is recommended that as far as possible these trees remain in their original locations and incorporated into landscape plans. Where this is not feasible, trees should be relocated to suitable habitat in the surrounding area. Destruction of tree species should only be entertained as a last option resort should none of the abovementioned alternatives be feasible. *Harpagophytum procumbens*, listed as specially protected in the NCNCA (Act 9 of 2009) and in TOPS (Notice 389 of 2013) will require permits should the removal or destruction of this species in the study area be necessary. A small number of individuals were located under existing stands of large *Vachallia erioloba* trees, and as such should these trees remain undisturbed, and the 5m buffer around the trees be enforced, *Harpagophytum procumbens* species located within this buffer are likely to remain intact and not impacted upon. Should other *Harpagophytum procumbens* be located within areas designated for clearing activities, these individuals are to be relocated to suitable habitat in the surrounding area by a specialist.

4.3 Alien and Invasive Plant Species

During the floral assessment, alien and invasive floral species were identified and are listed in the table below.

Table 3: Dominant alien vegetation species identified during the field assessment.

Forbs			
Chenopodium album	White goosefoot	Europe	N/L

N/L = Not Listed and not categorised
*** National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016**
Category 1a – Invasive species that require compulsory control.
Category 1b – Invasive species that require control by means of an invasive species management programme.
Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
Category 3 – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

From the table above it is clear that the study area has remained largely unaffected by alien plant species. The very low alien plant diversity is most likely attributed to the aridity of the region, with very limited habitat for the proliferation of alien plant species. Alien plant species located within the study area need to be removed/controlled according to the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016 during construction activities. Furthermore, it must be ensured that the construction footprint, as far as possible be kept free from weeds and alien vegetation. Ongoing maintenance activities conducted within the proposed cemetery and associated roads must include the ongoing control of alien plant species, notably as there will be an increased risk of alien plant proliferation due to seeds being deposited from cut flowers that are placed by gravesites regularly.

5. RESULTS OF THE FAUNAL ASSESSMENT

5.1 Habitat Description

Kuruman Thornveld

This habitat unit comprised of open grassland areas interspersed with patches of woody vegetation. The soft dep sand provided habitat to many small mammal, reptile and invertebrate species that burrow underground, notably within the dense stands of vegetation. The woody component provided areas for refuge, nesting and roosting, notably for avifauna. The habitat provided suitable food resources to grazers, browsers as well as smaller granivores. For further detail pertaining to the Kuruman Thornveld habitat unit observed within the study area, please refer to Section 4.1 above.

Discussed in the dashboard below is the relevant faunal components pertaining specifically to the available habitat and preference thereof by various faunal species. Furthermore, the study area is discussed in terms of specific habitat utilisation by faunal species, with particular focus on important species (SCC) within the region. Mention is also made pertaining to the function of the study area as part of a larger natural area, and not as an ecologically isolated island.

5.2 Faunal Ecology

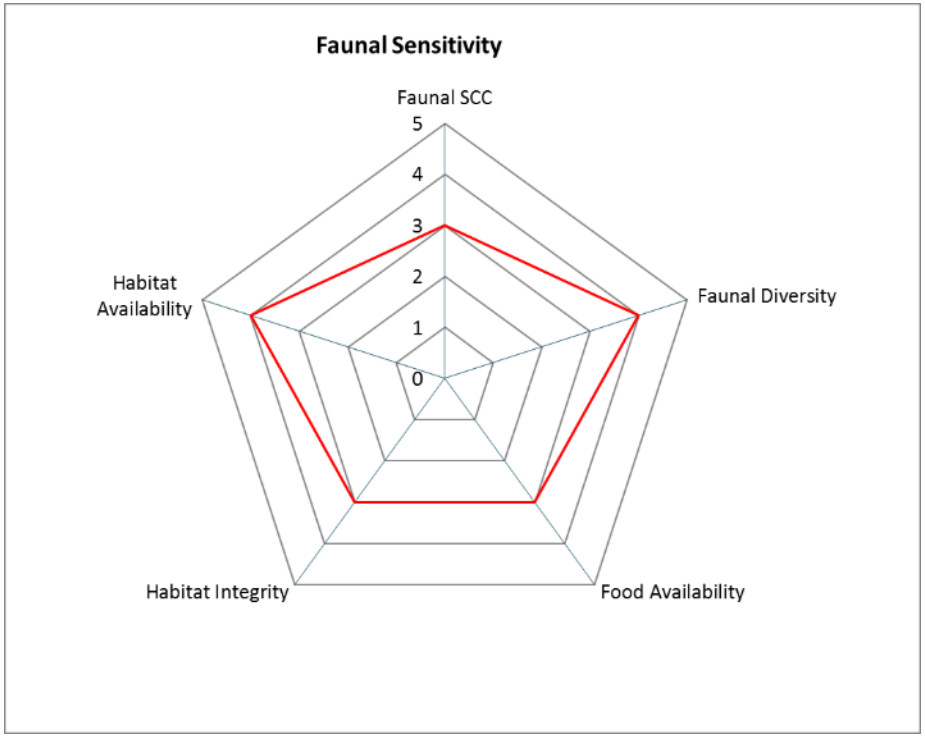
Table 4: Field assessment results pertaining to faunal species within the study area.

Summary of the study area	Faunal Sensitivity	Intermediate

Notes on Photograph:

Top left: *Uroplectes carinatus*;
Top right: *Agama atra* (Southern Rock Agama)
Centre left: Genus *Pterinochilus* (Golden-brown baboon spiders);
Centre right: Order Solifugae (Sunspider)
Bottom left: *Systophlochius palochius* (Orange wing);
Bottom right: *Parisoma subcaeruleum* (Titbabbler).

Faunal Sensitivity Graph:








Faunal SCC/Endemics/TOPS/	During the assessment of the study area, a burrow that is likely to be that of the Genus *Pterinochilus* (Golden-brown baboon spiders) was observed 50m outside of the north-eastern border of the study area. Species in this Genus are listed as Specially Protected under the NCNCA (2009). Species of this Genus are known to occur in the region, and particularly prevail themselves to the soft sandy substrate as found in the study area for the construction of their vertical burrows. It is recommended that a walkdown of any development areas be conducted prior to construction activities in order to determine if any baboon spiders are present and will be impacted upon. No other evidence of faunal SCC was observed within the study area, and taking into further consideration the habitat on site, nearby mining activities and location of the study area to surrounding infrastructure, it is unlikely that faunal SCC will be located within the study area. Faunal SCC are likely to utilise/select the habitat to the south and the north-east of the study area which is subject to significantly less anthropogenic activities, is more open and offers a greater mosaic of useable habitat. However, should natural areas be retained as part of the landscape plan, it is likely that species, notably the baboon spiders, are likely to continue utilising the study area.
Habitat Integrity	Long term mining activities to the north-west of the study area have resulted in mining related edge effects, including increased movement of personnel through the study area and large quantities of airborne dust that covers vegetation, impacting on the browsing and grazing quality of the vegetation. The study area is located in the south-western section of a larger portion of land set aside as a "natural" area, however it is located between a railway to the north and the N14 to the south, with evidence of old excavation pits scattered around in the localised area. Indications of heavy grazing were evident within the study area, with the net result being that of a marked increase in bush encroachment through species such as *Senegalia mellifera subsp. detinens*, which have created dense impenetrable stands resulting in a marked decrease in available grazing land. Grazing impacts have also resulted in the proliferation of less palatable herbaceous species, lowering the overall use-ability and integrity of the study area for faunal species.
Habitat Availability	The Kuruman Thornveld vegetation provides habitat for a diversity of species, however as stated above, heavy grazing activities in the past have resulted in a decreased level of habitat availability, notably for larger grazers that are known to occur on site. Although the habitat is less suitable for large grazing mammals, it is still considered highly suitable for smaller faunal species, providing various degrees of useable habitat in both the vertical and horizontal axis. The sandy soil within the study area is an ideal substrate in which small burrowing mammals, insects and arachnids can construct nests and burrows, notably under the dense stands of shrubs/trees where the soil is more stable. The dense stands of thorny shrubs as well as larger trees provide favoured roosting and nesting sites for avifaunal species, whilst also providing vantage points whilst foraging. The open herbaceous areas between bush clumps are extensively utilised by grasshopper species such as *Rhachitopis* sp, *Truxalis* sp and *Acrotylus* sp, who favour the open areas, most often observed resting within the open patches of sand between grass clumps. Leaf litter under the trees and large fallen branches provide suitable areas of refuge to scorpions and spiders during the day, whereas during the night these nocturnal predators will move out into the more open areas in order to hunt for prey.
Faunal Diversity	Faunal diversity of the study area is considered to be moderately high, with a large number of invertebrates, reptiles and small mammals being either directly observed, or evidence of their presence being located (dung, spoor, active burrows). The study area is dominated by insects and avifaunal species, and to a lesser degree by those of the reptiles and arachnid species. Mammal diversity of the study area was lowest; however, mammal species tend to utilise much larger areas or habitats, and as such the small size of the study area would only form a part of the normal range utilisation of mammal species. As such, mammal diversity is considered to be low when focusing on the study area in isolation, however, taking the surrounding areas into consideration, the potential mammal diversity will likely increase, although these mammals may only periodically utilise the study area. Smaller less wide ranging species such as the various insects, arachnids and small reptiles (lizards etc.) that are known to occur in the region were well represented within the study area, as were avifaunal species, contributing to the species diversity being considered as moderately high.
Food Availability	Fruit bearing woody species such as *Grewia flava* and *Ziziphus micronata* are widely utilised by faunal species as a seasonal food resource. The herbaceous layer within the study area further provides a food resource, albeit limited due to the low palatability of the grass species to a number of herbivorous species. The seeds produced by the grasses are utilised by small mammals and birds when available. The fruit bearing plants, seed bearing grasses and diversity of insect, small reptiles and small mammals further provide food resources for a diversity of avifaunal and mammal species, notably predators. Although food resources are available within the study area, it must be noted that due to the aridity of the region, these resources are not capable of sustaining large populations of faunal species, and as such certain species that are more selective feeders will have to utilise areas outside of the study area in order to obtain sufficient food resource quantities. As such, provision of food resources within the study area is only part of a larger system that faunal species will utilise when foraging for palatable plant material and searching for prey items. Taken in context of the larger interconnected natural environment, the study area is not considered to be a vital food production resource. Similar suitable habitat with equal if not better food production capabilities can be observed surrounding the current study area, notably to the north-east where there is also seasonal pans and water resources. These water resources will further increase plant production, resulting in better and more palatable food resources outside of the study area, minimising cumulative impacts in the region.

General comments (dominant faunal species/noteworthy records etc.)	Business Case, Conclusion and Mitigation Requirements
Overall the study area is considered to be of intermediate sensitivity, largely as a result of impacts associated with long term mining activities in the region. The study area has in the past been overutilized by grazing species, as is evident from the herbaceous species present. There are no major water resources within the study area, or within the immediate surrounds which will limit utilisation of the study area by water dependant species. With the exception of the baboon spider that was located outside of the development footprint, no other important taxa were observed at the time of the assessment, neither inside the proposed nor in the surrounding habitat. It is more likely that important taxa will utilise the natural areas to the north-east of the study area, as the vegetation and overall integrity of the habitat in these areas appeared to be of a higher integrity.	When taking into consideration the study area in isolation, excluding the surrounding areas, development activities are likely to only impact upon a small number of species that occur within the study area, but are common throughout the region. However, when considering that the study area forms part of a larger natural area, which is inhabited by a number of indigenous species, it is evident that development is likely to affect faunal species whose home range incorporates both the study area and the surrounding natural areas. As such, consideration needs to be given to cumulative impacts, that will affect not just faunal species located within the study area, but also those that are far ranging and utilise the study area periodically. Where possible, vegetation should only be cleared as is necessary, in order to try ensure that some patches of natural vegetation remain. The application of a 5m buffer around protected tree species will ensure that to a degree, faunal species will continue to utilise the study area during the operation of the cemetery. It is recommended that the construction of the parking lot and the access roads be contained to areas close to the N14, where edge effects from the N14 and boundary road have already had an impact on the receiving environment. During the construction phase, edge effects are to be monitored and mitigated, so as to ensure that the surrounding habitat is not unduly degraded. Wherever construction is to take place, it must be ensured that the development footprint is kept as small as possible, and that as far as possible, vehicles only utilise the existing road network. In terms of the proposed access roads, Alternative 2 is likely to have the least significant impact on the receiving environment, due to the direct access to the N14. Alternative 1 is of a longer length, however there is an existing road along the majority of this option. As such, it is deemed that neither will have significantly greater or lesser impacts than the other, therefore access options should be determined in terms of best access practices concerning vehicle and occupant safety concerns when accessing any main roads.

5.3 Faunal Species of Conservation Concern Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of may faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed in Appendix I whose known distribution ranges and habitat preferences include the study area were taken into consideration. The species listed below are considered to have an increased probability of occurring within or being affected by the study area.

Table 5: Faunal SCC that obtained a POC score of 60% or more.

Scientific Name	Common Name	POC %
Genus *Pterinochilus*	Golden-brown baboon spiders	90%

As can be seen from the table above, and has been discussed in Section 5.2, a single individual baboon spider belonging to the genus *Pterinochilus* was observed 50m outside of the study area, however, as the habitat both within the study area and the surrounding areas is uniform, it is considered highly probable that further *Pterinochilus* individuals may be located within the study area. As such, throughout the duration of the faunal survey due diligence was exercised and extra vigilance taken in order to locate other possible individuals of *Pterinochilus* that may be in the study area. Following the conclusion of the faunal assessment, no further burrows or signs were observed, however, taking into consideration the delicate and well camouflaged nature of the burrows, observations are not always likely. As such it is possible that individual burrows may have been overlooked, notably if they were located within the dense stands of vegetation. It is recommended that once the layout plans of the development have been finalised, a walkdown of the areas to be disturbed is conducted, in order to make sure that no burrows are present. Should any burrows of *Pterinochilus* be located during construction activities, it is recommended that where feasible they be left undisturbed, however should a burrow be located in an area earmarked for development, the burrow should be carefully excavated in order to extract the spider, which must then be relocated to similar habitat in the surrounding area, outside of any planned construction footprints.

6. SENSITIVITY MAPPING

The figure below conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral and faunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 6: A summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Kuruman Thornveld	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential within the designated study area.	Development activities in this area are unlikely to have a significant impact on the receiving environment, provided that all mitigation measures are adhered to, and that the construction footprint is kept as small as possible. Where feasible, the existing vegetation should be incorporated into the landscape design of the cemetery, so as to retain as much of the onsite habitat as possible, but also to create areas/corridors of movement within the cemetery for faunal species. A site walkdown is to be conducted prior to development in order to identify any possible *Pterinochilus* burrows that may be disturbed.

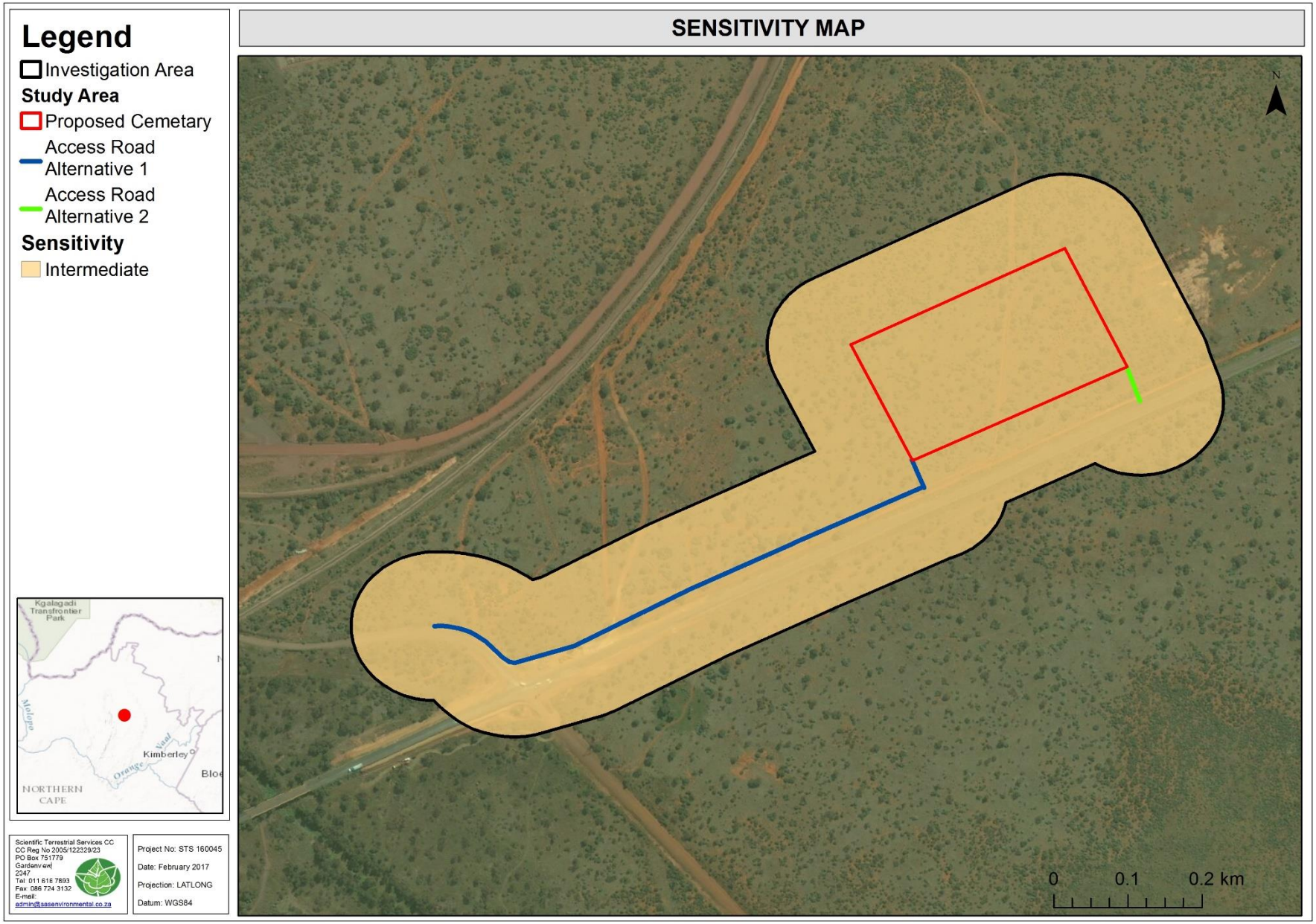


Figure 7: Combined sensitivity map of the study area for fauna and flora.

7. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology of the study area, with each individual impact identified presented in Section 7.1 to 7.6 of this report. A summary of all potential pre-construction, construction and operational impacts is provided in Section 7.7. The tables below present the impact assessment according to the method described in Appendix D. All impacts are considered without mitigation taking place as well as with mitigation fully implemented. All the required mitigatory measures needed to minimise the impact is presented in Section 7.8.

7.1 IMPACT 1: Impact on Habitat for Floral Species

Activities and aspects register

Pre-Construction	Construction	Operational
Possible insufficient planning of infrastructure placement and design leading to excessive floral habitat loss	Site clearing and the removal of vegetation	On-going disturbance of soils due to general operational activities leading to altered floral habitat
Failure to apply for permits pertaining to the removal/destruction of protected plant species.	Loss of floral biodiversity through invasion of alien species	Increased introduction and proliferation of alien plant species and further transformation of natural
	Movement of construction vehicles and access road construction	On-going disturbance may lead to increased wind erosion on exposed surfaces
	Dumping of material outside designated areas leading to loss of floral habitat	Poor management and monitoring of rehabilitation measures

Development activities within the study area will entail the loss of floral species as a result of vegetation clearing within the construction footprint. The habitat unit has been impacted upon historically as a result of edge effects from mining activities, as well as other infrastructure related impacts (railway lines, roads), resulting in the current intermediate sensitivity, however the study area is still capable of providing habitat to SCC species in the region. Cognisance must be given to the fact that the development is for that of a cemetery and as such does not require total habitat destruction if planned properly. As such the impact associated with the loss of floral habitat is considered to be medium-low (70) during the construction phase, and medium-low for the operational phase prior to mitigation being implemented. Should effective mitigation take place, the impact can be lowered to medium-low (56) and low significance levels during the construction and operational phases respectively.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	4	3	3	7	10	70 (Medium-Low)
Operational phase	4	3	3	2	4	7	9	63 (Medium-Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	3	2	3	7	8	56 (Medium Low)
Operational phase	2	3	1	1	4	5	6	30 (Low)

7.2 IMPACT 2: Impact on Floral Diversity

Activities and aspects register

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement and design	Site clearance and removal of vegetation	An increase in alien plant species leading to altered plant community structure and composition
Failure to apply for permits pertaining to the removal/destruction of protected plant species	Construction of infrastructure and access roads through natural areas leading to a loss of plant species diversity	On-going edge effects from maintenance operations impacting on plant species diversity
	Risk of increased fire frequency, as well as uncontrolled fires due to increased human activity will impact on plant communities	Failure to monitor rehabilitation efforts and implement an alien floral control plan
	Increased anthropogenic activity and an increase in the collection of medicinal floral species	Increased anthropogenic activity and an increase in the collection of medicinal floral species

Floral diversity within the habitat units has decreased as a result of historic and on-going disturbances from mining and heavy grazing. Although floral diversity has been impacted upon, key species characteristic of the region were still observed, indicating that complete degradation has not occurred. The impact significance associated with the loss of species diversity is considered to be medium low prior to the implementation of mitigation measures, and low with the implementation of mitigation measures.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	3	3	3	7	9	63 (Medium-Low)
Operational phase	3	3	3	2	4	6	9	54 (Medium-Low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	2	2	6	6	36 (Low)
Operational phase	1	3	2	1	4	3	7	21 (Very Low)

7.3 IMPACT 3: Impacts on Floral SCC

Aspects and activities register

Pre-Construction	Construction	Operational
Poor planning of infrastructure placement and design	Site clearance and removal of indigenous vegetation including floral SCC	Risk of alien plant proliferation, with the alien plants competing directly for resources with indigenous floral SCC
Failure to apply for permits pertaining to the removal/destruction of protected plant species	Increased anthropogenic activity within the study area and an increase in the collection of plant material for medicinal and other purposes	Ineffective rehabilitation of exposed and impacted areas leading to on-going loss of floral SCC
	Potential uncontrolled fires due to increased human activity may impact on floral communities	Increased risk of medicinal plant harvesting within the study area due to increased number of personnel in the area

Three floral SCC were observed during the site assessment, namely *Vachallia erioloba*, *Vachellia haematoxylon* listed as Protected trees in within Section 15 (1) of the National Forest Act (1998, as amended in September 2011), and *Harpagophytum procumbens* within both the TOPS (NEMBA, 2015) and NCNCA (Act 9 of 2009) species list. The impact associated with the loss of habitat for floral SCC is considered to be of medium-low significance during the construction and operational phase prior to the implementation of mitigation measures. With the implementation of mitigation measures the impact significance of the loss of important species may be reduced to medium low and low levels of significance.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	4	2	3	8	9	72 (Medium-Low)
Operational phase	4	3	3	2	4	7	9	63 (Medium-Low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	3	3	2	3	8	8	64 (Medium Low)
Operational phase	4	3	2	1	4	7	7	49 (Low)

7.4 IMPACT 4: Loss of Faunal Habitat and Ecological Structure

Activities and aspects leading to impact

Pre-Construction	Construction	Operational
Poor layout planning and failure to develop a suitable landscaping plan incorporating indigenous habitat	Site clearing and the removal of faunal habitat	Increased fire frequency during operation leading to a loss or altering of faunal habitat
	Degradation of faunal habitat through invasion of alien species in disturbed areas	Increased introduction and proliferation of alien plant species leading to further transformation of remaining natural habitat
	Movement of construction vehicles and access road construction through faunal habitat	Increased risk of hunting/trapping of faunal species
	Possible increased fire frequency during construction leading to a loss or altering of faunal habitat	
	Increased risk of hunting/trapping of faunal species	

Construction of the cemetery will result in the clearing of vegetation within areas of the study area, notably along the road and parking lot area. Although the vegetation associated with the study area has been disturbed as a result of mining edge effects and high levels of grazing, the habitat is still capable of supporting a number of indigenous faunal species, as well as arachnid SCC. Improper planning and development will lead to the further loss of faunal habitat and will result in a medium low impact significance prior to mitigation. With the implementation of mitigation measures, the impact significance may be reduced to low significance.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	3	3	3	7	9	63 (Medium low)
Operational phase	4	3	3	3	4	7	10	70 (Medium low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	2	2	6	6	36 (Low)
Operational phase	2	3	2	1	4	5	7	35 (Low)

7.5 IMPACT 5: Loss of Faunal Diversity and Ecological Integrity

Activities and aspect register

Pre-Construction	Construction	Operational
Poor layout planning and failure to develop a suitable landscaping plan incorporating indigenous habitat	Site clearing and the removal of vegetation leading to a loss of faunal diversity	Increased introduction and proliferation of alien plant species and further transformation of faunal habitat
	Loss of faunal habitat through invasion of alien species in disturbed areas resulting in altered faunal diversity	Collision of faunal species with operational vehicles
	Poaching and trapping of faunal species	Increased fire frequency during operation leading to a loss of faunal diversity
	Movement of construction vehicles and access road construction through sensitive habitat.	Poaching and trapping of faunal species
	Collision of faunal species with construction vehicles	
	Increased fire frequency during construction leading to a loss of faunal diversity	

Faunal diversity within the study area comprised mainly of smaller species, notably insects, avifauna, reptiles and small mammals. The presence of larger mammals was sporadic, with the study area only being utilised for small periods of time during foraging forays. Faunal diversity has been impacted upon as a result of historic and on-going disturbances from mining related edge effects and the construction of fences and roads creating movement barriers. The impact significance considered to be medium low prior to the implementation of mitigation measures, and low following mitigation measures.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	3	3	3	7	9	63 (Medium low)
Operational phase	3	3	3	2	4	6	9	54 (Medium low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	2	2	6	6	36 (Low)
Operational phase	2	3	2	1	4	5	7	35 (Low)

7.6 IMPACT 6: Impact on Faunal Species of Conservation Concern

Activities and aspects leading to impact

Pre-Construction	Construction	Operational
Poor layout planning and failure to develop a suitable landscaping plan incorporating indigenous habitat	Loss of potential faunal SCC due to habitat loss and a decrease in food supply	Loss of potential biodiversity of SCC due to continued habitat loss within the operational footprint and surrounding areas
	Fire hazard from informal fires due to increased human activity on site	Increased introduction and proliferation of alien plant species and further transformation of faunal SCC habitat
	Movement of construction vehicles and access road construction through sensitive faunal habitat	
	Collision of construction vehicles with potential faunal SCC	

One faunal SCC of the Genus *Pterinochilus* (Golden-brown baboon spiders) was observed 50m to north-east of the study area, however, due to the homogeneity of the habitat, it is likely that further individuals have an increased possibility of occurring within the study area. The impact associated with the loss of habitat for these species is considered to be of medium-low significance during the construction phase and low significance during the operational phase prior to the implementation of mitigation measures. With the implementation of mitigation measures the impact significance of the loss of important species may be further reduced, as habitat for these species will be better protected.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	3	2	3	7	8	56 (Medium low)
Operational phase	2	3	3	1	2	5	6	30 (Low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	3	2	1	2	5	5	25 (Very Low)
Operational phase	1	3	1	1	1	4	3	12 (Very Low)

7.7 Assessment Summary

The tables below summarises the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs. From the tables, it is evident that prior to mitigation the impacts on floral and faunal SCC are of medium-low and low level impacts. If effective mitigation takes place, all impacts may be further reduced.

Table 7: A summary of the impact significance of the construction phase on floral species.

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium Low	Medium Low
2: Impact on floral diversity	Medium Low	Low
3: Impact on important species	Medium Low	Medium Low

Table 8: A summary of the impact significance of the operational phase on floral species.

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	Medium Low	Low
2: Impact on floral diversity	Medium Low	Very Low
3: Impact on important species	Medium Low	Low

Table 9: A summary of the impact significance of the construction phase on faunal species

Impact	Unmanaged	Managed
1: Impact on habitat for faunal species	Medium-Low	Low
2: Impact on faunal diversity	Medium-Low	Low
3: Impact on important species	Medium-Low	Very Low

Table 10: A summary of the impact significance of the operational phase on faunal species.

Impact	Unmanaged	Managed
1: Impact on habitat for faunal species	Medium Low	Low
2: Impact on faunal diversity	Medium Low	Low
3: Impact on important species	Low	Very Low

7.8 Integrated Impact Mitigation

Mitigation Measures

- The necessary permits need to be acquired pertaining to the removal of floral SCC that are located within the study area prior to the construction phase, and the following should be ensured:
  - Effective relocation of individuals to suitable similar habitat in the vicinity of the study area;
  - All rescue and relocation plans should be overseen by a suitably qualified specialist;
- A walkdown of the construction footprint is to be undertaken prior to vegetation clearing activities in order to assess the site for any possible burrows of *Pterinochilus* (Golden-brown baboon spider);
- Faunal SCC encountered within the study area are to be relocated by a suitably qualified specialist to suitable habitat in the vicinity of the study area;
- It is recommended that site clearing takes place in a phased manner, in a uniform direction from one side to the other of the study area, so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of clearing activities;
- Where possible, utilise the current indigenous vegetation as part of the landscape plans, with special emphasis on the larger *Vachallia erioloba* and *Vachellia haematoxylon* species;
- Landscape planning should take cognisance of habitat connectivity, ensuring that areas of natural vegetation remain within the development to create areas of refuge and corridors of movement;
- The construction and operational footprint must be kept as small as possible in order to minimise impact on the surrounding environment;
- Edge effects of construction and operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species management;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- No uncontrolled fires whatsoever should be allowed;
- Appropriate sanitary facilities must be provided during the construction phase and all waste must be removed to an appropriate waste facility;
- All soils compacted as a result of construction activities should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas;

- No dumping of waste should take place. If any spills occur, they should be immediately cleaned up;
- 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;
- No trapping or hunting of any faunal species is to take place;
- Upon completion of construction activities, it must be ensured that no bare areas remain and that indigenous grassland species are reintroduced;
- Alien vegetation must be removed from the study area during both the construction and operational phases, in line with the NEMBA Alien and Invasive Species Regulations (2016); and
- Establishment of any revegetated areas must be monitored during the operational phase on a bi-monthly basis for a period of one year.

Rehabilitation Plan:

- Disturbed and cleared areas need to be revegetated with indigenous grass species to help stabilise the soil surface
- All alien plants within the study area should be cleared, with follow up activities running concurrently for one year; and
- Soils that have been compacted because of the construction activities must be ripped and profiled in line with the surrounding area.

Possible latent impacts:

- Loss of floral and faunal habitat;
- Permanent loss of and altered floral and faunal species diversity;
- Loss of floral and faunal SCC;
- Alien floral invasion;
- Disturbed areas are unlikely to be rehabilitated to pre-development conditions of ecological functioning and as such loss of faunal habitat and species diversity will most likely be permanent.

8. CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the environmental assessment and authorisation process for the new Kathu Cemetery within the Northern Cape Province. The proposed project comprises approximately 5 ha of land, and will include site clearing for new graves, a parking area, access road and support infrastructure. Two alternatives for the access road are proposed, one from Dingleton Road (Alternative 1) and the second from the N14 highway (Alternative 2).

The objective of this study was to provide sufficient information on the faunal and floral ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to compared and considered along with the need to ensure economic development of the country.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long term use of the ecological resources in the study area will be made in support of the principle of sustainable development. It is recommended that, from a terrestrial ecological perspective, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts (as outlined in Section 7.8) are adhered to.

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APPENDIX A: Legislative Requirements and Indemnity

National Environmental Management Act, 1998

- The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, 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.

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 the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative 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 the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the 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) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

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

Removal of the alien and weed species encountered in 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 operation, phases.

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 STS 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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reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: Floral Method of assessment

Floral Species of Conservational Concern Assessment

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the study area is situated, as well as relevant regional, provincial and national lists. Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					**Inside known distribution range**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					**Habitat available**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

Vegetation Surveys

Vegetation surveys were undertaken by first identifying different habitat units and then analysing the floral species composition that was recorded during detailed floral assessments using the step point vegetation assessment methodology. Different transect lines were chosen throughout the entire study area within areas that were perceived to best represent the various plant communities. Floral species were recorded and a species list was compiled for each habitat unit. These species lists were also compared with the vegetation expected to be found within the relevant vegetation types as described in Section 4, which serves to provide an accurate indication of the ecological integrity and conservation value of each habitat unit (Evans & Love, 1957; Owensby, 1973).

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and

- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the study area, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the study area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals

Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door. Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.

Medium to large mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising a pair of Bushnell 10x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Furthermore, at suitable and open sites within the study area

sweep netting was conducted, and all the insects captured identified. Due to the terrain, and shallow/ rocky soil structure pitfall traps were not utilised during the site assessment.
It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC scorpions within the study area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.

Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Food availability				
No food available	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Habitat disturbance				
Very High	**High**	**Moderate**	**Low**	**Very Low**
1	2	3	4	5
Distribution/Range				
Not Recorded		**Historically Recorded**		**Recently Recorded**
1		3		5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

Faunal Habitat Sensitivity

The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;

- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Intactness:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table C1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX D: Impact Assessment Methodology

Ecological Impact Assessment Method

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, 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.
- **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 Table D1. 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 are used to determine whether mitigation is necessary[2].

The assessment of significance is undertaken twice. Initial, significance is based on 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.

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

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

Table D1: Criteria for assessing significance of impacts

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 / Study areas affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Study areas affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Study areas affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Study areas affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Study areas 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 D2: Significance Rating Matrix.

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	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 D3: 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 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:
  - Pre-construction;
  - Construction; and
  - Operation.
- 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 after rehabilitation.

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 minimisation, mitigation or compensation; and
- 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.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

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

APPENDIX E: Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)

The study area 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 Kalahari Mountain Bushveld covers the mountainous western parts of the GWC, and, both endemic to the centre, covers the eastern plateau area. *Tarchonanthus camphorates* is a particularly common woody species in these two bushveld types. Typical mountain species include *Searsia tridactyla* (formally known as *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 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 *Senegalia mellifera* (formally known as *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.

APPENDIX F: Vegetation Types

Kuruman Thornveld

Table F1: Dominant & typical floristic species of Kuruman Thornveld (Mucina & Rutherford, 2006).

Grass species	Forb species	Tree/Shrub Species
Aristida meriidionalis (d)	*Dicoma schinzii*	*Acacia erioloba* (d)
Aristida stipitata subsp. *stipitata* (d)	*Gisekia Africana*	*Acacia mellifera* subsp. d*etinens* (d)
Eragrostis lehmanniana (d)	*Harpagophytum* procumbens	*Boscia albitrunca* (d)
Eragrostis echinochloidea	subsp. *procumbens*	*Grewia flava* (d)
Melinis repens	*Indigofera daleoides*	*Lycium hirsutum* (d)
Digitaria polyphylla[GW]	*Limeum fenestratum*	*Tarchonanthus camphoratus* (d)
	Nolletia ciliaris	*Gymnosporia buxifolia*
	Seddera capensis	*Acacia hebeclada* subsp. *hebeclada* (d)
	Tripteris aghillana	*Monechma divaricatum* (d)
	VAhlia capensis subsp. *vulgaris*	*Gnidia polycephala*
	Corchorus pinnatipartitus[GW]	*Helichrysum zeyheri*
	Gnaphalium englerianum[E]	*Hermannia comosa*
		Pentzia calcarea
		Plinthus sericeus
		Elephantorrhiza elephantine
		Acacia leuderitzii var. *leuderitzii*[K]
		Terminalia sericea[S]
		Acacia haematoxylon[K]
		Blepharis marginata[GW]

***(d) – Dominant species for the vegetation type; [GW] Griqualand West endemic; [K] Kalahari endemic; [S] Southernmost distribution in interior of southern Africa; [E] Endemic Taxon**

Kuruman Mountain Bushveld

Table F2: Dominant & typical floristic species of Kuruman Mountain Bushveld (Mucina & Rutherford, 2006).

Grass species	Forb species	Tree/Shrub Species
Melinis repens	*Dicoma schinzii*	*Rhus lancea*
Andropogon chinensis (d)	*Rhynchosia totta*	*Diospyros austro-africana*
Andropogon schirensis (d)	*Dicoma anomala*	*Euclea crispa* subsp. *crispa*
Anthephora pubescens (d)	*Geigeria ornativa*	*Eucklea undulata*
Aristida congesta (d)	*Helichrysum cerastioides*	*Olea europaea* subsp. *Africana*
Digitaria eriantha subsp. *eriantha* (d)	*Heliotropium strigosum*	*Rhus pyroides* var. *pyroides*
Themeda triandra (d)	*Hibiscus marlothianus*	*Rhus tridactyla*
Triraphis andropogonoides (d)	*Kohautia cynanchica*	*Tarchonanthus camphoratus*
Aristida diffusa	*Kyphocarpa angustifolia*	*Tephrosia longiipes*
Brachiaria nigropedata	*Boophane disticha*	*Rhus ciliate* (d)
Bulbostylis burchellii	*Pellaea calomelanos*	*Amphiglossa triflora*
Cymbopogon caesius	*Sutera griquensis*[GW]	*Anthospermum rigidum* subsp. *pumilum*
Diheteropogon amplectens		*Gomphocarpus fruticosus* subsp. *fruticosus*
Elionurus muticus		*Helichrysum zeyheri*
Eragrostis chloromelas		*Lantana rugose*
Eragrostis nindensis		*Wahlenbergia nodosa*
Eustachys paspaloides		*Ebracteola wilmaniae*

Grass species	Forb species	Tree/Shrub Species
Heteropogon contortus *Schzachyrium sanguineum* *Trichoneura grandiglumis* *Digitaria polyphylla*[GW]		*Hertia pallens* *Lebeckia macrantha* (d)[GW] *Justicia puberula*[GW] *Tarchonanthus obovatus*[GW] *Euphorbia wilmaniae*[GW] *Euphorbia planiceps*[E]

***(d) – Dominant species for the vegetation type; [GW] Griqualand West endemic; [E] Endemic Taxon**

APPENDIX G: Species List

Table G1: Dominant floral species encountered in the Study Area. Alien species are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2016.

Grass species	Forb species	Tree/Shrub Species
Aristida congesta	*Ammocharis coranica*	*Asparagus laricinus*
Aristida meridionalis	*Aptosimum elongatum*	*Eriocephalus aspalanthoides*
Cenchrus ciliaris	**Chenopodium album*	*Eriocephalus cf. merxmuelleri*
Enneapogon cenchroides	*Chrycosoma ciliata*	*Grewia flava*
Eragrostis lehmanniana	*Dimorphotheca sp.*	*Lycium hirsutum*
Fingerhuthia africana	*Felicia muricata*	*Senegalia mellifera subsp. detinens*
Hyparrhenia hirta	***Harpagophytum procumbens***	*Tarchonanthus camphoratus*
Lophiocarpus polystachyus	*Ammocharis coranica*	*Terminalia sericea*
Stipagrostis amabilis	*Gnidia polycephala*	***Vachallia erioloba***
	Helichrysum cerastioides	***Vachellia haematoxylon***
	Indigofera sp.	*Ziziphus micronata*
	Melolobium candicans	
	Nolletia arenosa	
	Pentzia globosa	
	Pollicha campestris	
	Pteronia glauca	
	Senna italica subsp. *arachoides*	
	Tribulus zeyheri	

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Mammal species observed

Scientific name	Common Name	IUCN Red List Status
Galerella sanguinea	Slender Mongoose	LC
Lepus saxatilis	Scrub Hare	LC
Hystrix africaeaustralis	Porcupine	LC
Raphicerus campestris	Steenbok	LC
Tragelaphus strepsiceros	Kudu	LC
Cryptomys hottentotus	Common Mole-rat	LC
Antidorcas marsupialis	Springbok	LC
Pedetes capensis	Spring Hare	LC

LC = Least Concern, NT = Near Threatened

Avifaunal species observed

Scientific name	Common Name	IUCN Red List Status
Streptopelia capicola	Cape turtle-dove	LC
Pycnonotus nigricans	Red-eyed Bulbul	LC

Scientific name	Common Name	IUCN Red List Status
Serinus flaviventris	Yellow Canary	LC
Passer melanurus	Cape Sparrow	LC
Streptopelia capicola	Cape Turtle-Dove	LC
Sporopipes squamifrons	Scaly-feathered Finch	LC
Spreo bicolor	Pied Starling	LC
Saxicola torquata	African Stonechat	LC
Myrmecocichla formicivora	Ant-eating Chat	LC
Anthus cinnamomeus	African Pipit	LC
Cisticola fulvicapillus	Neddicky	LC
Cisticola aridulus	Desert Cisticola	LC
Elanus caeruleus	Black-shouldered Kite	LC
Vanellus coronatus	Crowned Lapwing	LC
Tockus nasutus	African Grey Hornbill	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Hirundo fuligula	Rock Martin	LC
Parus cinerascens	Ashy Tit	LC
Calandrella cinerea	Red-capped Lark	LC
Mirafra africana	Rufous-naped Lark	LC
Mirafra africanoides	Fawn-coloured Lark	LC
Batis pririt	Pririt Batis	LC
Sigelus silens	Fiscal Flycatcher	LC
Parisoma subcaeruleum	Chestnut-vented Titbabbler	LC
Emberiza flaviventris	Golden-breasted Bunting	LC
Parisoma subcaeruleum	Titbabbler	LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Insect species observed

Scientific Name	Common Name	IUCN 2015 Status
Junonia hierta	Yellow Pansy	LC
Catopsilia florella	African Migrant	NYBA
Belenois aurota	Brown-veined White	NYBA
Junonia orithya	Eyed Pansy	NYBA
Danaus chrysippus	African Monarch	NYBA
Colotis euippe	Smokey Orange Tip	NYBA
Eurema brigitta	Broad-bordered Grass Yellow	NYBA
Spalia sp	Sandman	NYBA
Loxostege frustalis	Karoo Moth	NYBA
Conistica saucia	Rock Grasshopper	NYBA
Sphingonotus scabriculus	Blue-wing	NYBA
Acanthacris ruficornis	Garden Locust	NYBA
Gastrimargus sp.	N/A	NYBA
Rhachitopis sp	N/A	NYBA
Systophlochius palochius	Orange wing	NYBA
Anterhynchium fallax	N/A	NYBA
Camponotus fulvopilosus	Bal-byter	NYBA
Crematogaster peringueyi	Cocktail Ant	NYBA
Pantala flavescens	Wandering Glider	LC

Scientific Name	Common Name	IUCN 2015 Status
Mylabris oculata	CMR Bean Beetle	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

Arachnids species observed

Scientific Name	Common Name	IUCN 2015 Status
Uroplectes carinatus	N/A	NYBA
Genus Pterinochilus	Golden-brown baboon spiders	NYBA
Order Solifuga	Sunspider	NYBA

Reptile species observed

Scientific Name	Common Name	IUCN 2015 Status
Ichnotropis squamulosa	Common Rough-scaled Lizard	NYBA
Agama atra	Southern Rock Agama	NYBA
Pedioplanis lineoocellata	Spotted Sand Lizard	NYBA

APPENDIX H: Floral SCC

Table H1: TOPS plant list for the floral species expected to occur within the Northern Cape.

Family	Scientific Name	Habitat	Growth Form	Threat Status
Aizoaceae	*Cheiridopsis peculiaris*	Gravels and shale derived from metamorphic rocks of the Namaqualand Complex	Succulent	CR
Aizoaceae	*Conophytum herreanthus subsp. Herreanthus*	Quartz patches	Succulent	CR
Asphodelaceae	*Aloidendron pillansii*	Succulent Karoo shrubland on dry, rocky dolomite and gneiss hillsides.	Succulent, Tree	EN
Amaryllidaceae	*Haemanthus granitcus*	Namaqualand Klipkoppe Shrubland or Namaqualand Granite Renosterveld.	Geophyte	EN
Aizoaceae	*Lithops dorotheae*	Fine-grained, sheared, feldspathic quartzite	Succulent	EN
Asphodelaceae	*Aloidendron dichotomum*	On north-facing rocky slopes (particularly dolomite) in the south of its range. Any slopes and sandy flats in the central and northern parts of range.	Succulent, Tree	VU
Amaryllidaceae	*Brunsvigia herrei*	Succulent Karoo Shrubland, granitic soils on flats and sometimes in deposits of fairly large stones.	Geophyte	VU
Aizoaceae	*Conophytum bachelorum*	Rocky outcrops	Succulent	VU
Aizoaceae	*Conophytum ratum*	Spongy quartz soil.	Succulent	VU
Amaryllidaceae	*Gethyllis grandiflora*	Sandy and or stony soils in arid karroid shrubland.	Geophyte	VU
Amaryllidaceae	*Gethyllis namaquensis*	Coastal dunes and gravelly mountain slopes in succulent karoo shrubland.	Geophyte	VU
Amaryllidaceae	*Brunsvigia josephinae*	Heavy clay soils.	Geophyte	VU
Asphodelaceae	*Aloe krapohliana*	Occurs in the extremely arid northern regions of the Succulent Karoo, on clay, stony (mostly quarzitic) and sandy soils on flats and slopes.	Herb, Succulent	P
Amaryllidaceae	*Cyrtanthus herrei*	Deeply shaded rock ledges on south-facing rocky slopes.	Bulb	P
Aizoaceae	*Sceletium tortuosum*	Quartz patches and is usually found growing under shrubs in partial shade.	Succulent	P
Pedaliaceae	*Harpagophytum procumbens*	Well drained sandy habitats in open savanna and woodlands.	Herb	P

CR= Critically Endangered, EN= Endangered, VU= Vulnerable, P= Protected

APPENDIX I: Faunal SCC

Table I1: TOPS list of faunal species expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
Chrysoritis thysbe schloszae	Schlosz's Opal Butterfly	CR
Trimenia malagrida	Scarce Mountain Copper Butterfly	CR
Trimenia wallengrenii	Wallengren's Silver-spotted Copper Butterfly	CR
Bitis schneideri	Namaqua Dwarf Adder	P
Bitis xeropaga	Desert Mountain Adder	P
Bitis caudalis	Horned Adder	P
Lamprophis fiski	Fisk's House Snake	P
Neophron percnopterus	Egyptian Vulture	CR
Neotis ludwigii	Ludwig's Bustard	EN
Ardeotis kori	Kori Bustard	P
Bunolagus monticularis	Riverine Rabbit	CR
Pelea capreolus	Grey Rhebok	P

CR= Critically Endangered, EN=Endangered, P=Protected

South African Bird Atlas Project 2 list for quadrant 2723CC

Avifaunal Species for the pentads 2745_2300 within the QD2723CC

http://sabap2.adu.org.za/pentad_info.php?pentad=2745_2300#menu_top

APPENDIX J: Declaration and Specialists CV's

Declaration

the denc
Department:
Environment & Nature Conservation
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

Private Bag X6102, Kimberley, 8300, Metlife Towers, T-Floor, Tel: 053 807 7300, Fax: 053 807 7328

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Application for authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

1. Project title:

New Kathu Cemetery

2. Details of the specialist:

Project Specialist:	Chris Hooton		
Trading name (if any):	Scientific Terrestrial Services		
Business reg. no./ID. no.:	2005/122329/23		
Contact person:	Emile van der Westhuizen		
Physical address:	29 Arterial Road West, Oriel, Bedfordview, 2007		
Postal address:	PO Box 751779, Gardenview, 2047		
Postal code:	2047	**Cell:**	082 850 7753
Telephone:	011 616 7893	**Fax:**	011 615 6240/ 086 724 3132
E-mail:	emile@sasenvironmental.co.za		
Qualifications:	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Professional affiliation (s) (if any)	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

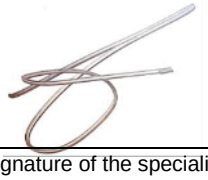
3. Details of the consultant

Project consultant/firm:	**Synergistics Environmental Services (Pty) Ltd**		
Business reg. no./ID. no.:	**2003/030216/07**		
Contact person:	**Chiara D'Egidio Kotze**		
Postal address:	**PO Box 1596 Cramerview**		
Postal code:	**2060**	**Cell:**	**0732 777 228**
Telephone:	**011 467 0945**	**Fax:**	**011 467 0978**
E-mail:	**ckotze@slrconsulting.com**		

4. Declaration by the specialist appointed in terms of the Environmental Impact Assessment Regulations, ~~2010~~ 2014

I, Emile van der Westhuizen, declare that --

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

Scientific Terrestrial Services

Name of company (if applicable):

Date:

I, Nelanie Cloete, declare that --

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Scientific Terrestrial Services

Name of company (if applicable):

Date:

Signature of the Commissioner of Oaths:

Date:

Designation:

Official stamp (below):

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF EMILE BASSON VAN DER WESTHUIZEN

PERSONAL DETAILS

Position in Company	Ecologist, Botanist
Date of Birth	30 May 1984
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2008

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Candidate Member of the South African Council for Natural Scientific Professions (SACNASP) (Reg. Number 100008/15).

EDUCATION

Qualifications

BSc (Hons) Plant Science (University of Pretoria)	2012
B.Sc. Botany and Environmental Management (University of South Africa)	2010

Short Courses

Grass Identification – Africa Land Use Training	2009
Wild Flower Identification – Africa Land Use Training	2009

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State, Eastern Cape.

Mozambique (Tete, Sofala and Manica Provinces)

Democratic Republic of the Congo (Katanga and Kivu Provinces)

Ghana (Western and Greater Accra Provinces)

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment for the proposed Modikwa Platinum Mine South 2 Shaft Project, Burgersfort, Limpopo Province.
- Floral assessment for the proposed New Clydesdale Colliery Stoping Project, Vandyksdrift, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Harriet's Wish PGM Project, Limpopo Province.
- Floral assessment as part of the environmental authorisation process for the proposed Shanduka Coal Argent Colliery in the vicinity of Argent, Mpumalanga.
- Floral assessment for the Auroch Resources Manica Gold Mining Project, Manica, Mozambique.
- Floral assessment for the Namoya Gold Mine project in Namoya, Democratic Republic of Congo.
- High level floral risk assessment and alternatives analysis for the proposed new Tete Airport, Tete, Mozambique.
- Floral assessment for the proposed Richardsbay Harbour Compactor Slab development, Richardsbay, Kwa-Zulu-Natal Province.
- Site walkdown and floral ecological input prior to the construction of the proposed 180km Mfolozi-Mbewu powerline, Richardsbay, Kwa-Zulu-Natal Province.
- Floral assessment as part of the EIA process for the proposed Peerboom Colliery, Lephalale, Limpopo Province.
- Floral assessment as part of the EIA process for the proposed Overvaal Underground Coal Mine Project, Ermelo, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed King's City Takoradi 3000 hectare development, Takoradi, Ghana
- Floral assessment as part of the EIA process for the proposed Aquarius Platinum Fairway Platinum Mine, Steelpoort, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Geniland Lubumbashi City 4000 hectare development, Likasi, Katanga Province, Democratic Republic of Congo.

- Floral, faunal, aquatic and wetland assessment as part of the EIA process for the proposed Appollonia City Accra 3000 hectare development, Accra, Ghana.
- Floral assessment as part of the EIA process for the proposed Leeuw Colliery, Utrecht, Kwa-Zulu Natal Province.
- Floral assessment as part of the EIA process for the proposed Lubembe Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Kinsenda Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Lonshi Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Jozini Shopping Mall, Jozini, Kwa-Zulu Natal Province.
- Floral assessment as part of the Biodiversity Action Plan for the Assmang Chrome Dwarsrivier Mine, Steelpoort, Mpumalanga Province.

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Ecologist
Date of Birth	24 June 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Freestate

Zimbabwe

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Mzimvubu Water Project, Eastern Cape.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Setlagole Mall Development, North West.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Expansion and Upgrade of the Springlake Railway Siding, Hattingspruit, Kwa-Zulu Natal.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Styldrift tailings storage facility, return water dams, topsoil stockpile and other associated infrastructure, North West.
- Faunal assessment as part of the environmental assessment and authorisation process for the development of a proposed abalone farm, Brand se Baai, Western Cape.
- Faunal assessment as part of the environmental assessment and authorisation process for the development of a proposed abalone farm, Doringbaai, Western Cape.
- Vegetation composition and subsequent loss of carrying capacity for the Rand Water B19 and VG Residue Pipeline Project, Freestate.
- Faunal assessment as part of the environmental assessment and authorisation process for the Evander Shaft 6 Plant Upgrade, New Tailings Dam Area and Associated Tailings Delivery and Return Water Pipeline, Evander, Mpumalanga.

Previous Work Experience

- Spotted Hyaena Research Project, Phinda Private Game Reserve, KwaZulu Natal.
- Camera Trap Survey as part of the Munyawana Leopard Project, Mkuze Game Reserve, KwaZulu Natal.
- Lowveld Wild Dog Project, Savé Valley Conservancy, Zimbabwe.
- Lion collaring and Tracking as part lion management program, Savé Valley Conservancy, Zimbabwe.
- Junior Nature Conservator, Gauteng Department of Rural Development and Land Reform.