FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED CONSTRUCTION OF A WATER PIPELINE FROM THE DORSFONTEIN WEST TO THE DORSFONTEIN EAST MINE AND THE 80 HECTARE EXPANSION OF AN OPEN PIT WITHIN THE DORSFONTEIN EAST MINE, NEAR KRIEL WITHIN THE MPUMALANGA PROVINCE

Prepared for

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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 linear development 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 areas is adequately rehabilitated 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 construction of a water pipeline from the Dorsfontein West to the Dorsfontein East Mine near Kriel within Mpumalanga Province. The proposed project has three alternative water pipeline routes namely Route 1 (10,5km in length) which is the preferred route, Route 2 (8,9km in length) and Route 3 (11,2km in length), hereinafter collectively referred to as "linear development" (Figure 1 & 2). As part of the field assessment and reporting an assessment area of 15m (buffer) on either side of each proposed route was investigated during the site visit.

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 linear development;
- 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 linear development;
- 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 linear development 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

- Three main habitat units were identified during the field assessment, Transformed (mining and agricultural) habitat, Wetland habitat and Grassland habitat. The Grassland habitat is further subdivided into Transformed Grassland, Secondary Grassland, Moist grassland and Rocky Grassland.
- All the habitat units have been impacted upon by varying degrees as a result of mining, grazing and agricultural activities and the edge effects thereof;
- Habitat provision is the highest within the Wetland habitat unit, and the lowest in the Transformed (mining and agriculture) habitat units;
- The Probability of Occurrence (POC) of all South African National Biodiversity Institute (SANBI) listed plants species for the Quarter Degree Square (QDS) 2629AB was calculated:
  - No floral SCC were listed for the QDS on the SANBI PRECIS website;
  - The medicinally important *Hypoxis hemerocallidea* was observed along Route 1 and although this species is not listed as protected in Mpumalanga, it is still considered important as it is declining due to land transformation and habitat loss in areas of its range;
  - The species *Crinum bulbispermum*, although not observed along the linear development, is considered likely to occur within surrounding wetland habitat.
- Provided that all mitigation measures are adhered to, the proposed development is deemed unlikely to pose a conservation threat to floral habitat and species in the region.

FAUNAL RESULTS

- Agricultural and mining activities led to the disturbance and transformation of the natural faunal habitat along the linear development;
- Habitat along the linear development was predominantly inhabited by common faunal species;

- Faunal species were predominantly observed in the valley bottom wetlands, where habitat and resource provision is the highest;
- A number of rodent species were observed within the secondary and moist grassland habitats however it is likely that these rodents will occur within all the habitat units;
- Two faunal SCC were observed during the field assessment, namely, *Sagittarius serpentarius* (Secretarybird) and *Phoenicopterus minor* (Lesser Flamingo). Furthermore, species such as *Pyxicephalus adspersus* (Giant Bullfrog) and *Metisella meninx* (Marsh Sylph) are considered to have increased probability of occurrence; and
- Provided that all mitigation measures are adhered to and the small extent of the construction footprint, the proposed development is deemed unlikely to pose a 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 on floral and faunal SCC are medium-high and medium-low level impacts. If mitigation takes place all impacts will be reduced to low level impacts.

A summary of the results obtained from the floral impact assessment

	Impact 1: Impacts on habitat for floral species	Pre-mitigation	Post-mitigation
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium High	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium High	Low
	Operational	Medium Low	Low
	Impact 2: Impacts on floral diversity	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 3: Impacts on floral SCC	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium High	Medium Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low

A summary of the results obtained from the faunal impact assessment

	Impact 4: Loss of Faunal Habitat and Ecological Structure	Pre-mitigation	Post-mitigation
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 5: Loss of Faunal Diversity and Ecological Integrity	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 6: Impact on Faunal Species of Conservation Concern	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Low	Low

SENSITIVITY

From an ecological perspective, habitat sensitivity varies from low to moderately high levels, mainly as a result of the varying level of disturbances and habitat transformation within and surrounding the linear development. The table below indicates the sensitivity of the habitat units along with an associated conservation objective and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Transformed (Mining and Agricultural) habitat	Low	Optimise development potential.	Although construction activities in this area are unlikely to have a significant impact on the receiving environment, care must be taken to limit edge effects on the surrounding natural areas.
Transformed Grassland	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat unit is of moderately low ecological importance and sensitivity and construction related activities are unlikely to have a significant impact on the receiving environment. However, cognisance must be taken of edge effect management so as to limit disturbances to the surrounding habitat.
Rocky Grassland; Secondary Grassland; Moist Grassland	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential	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.
Wetlands	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	Should a wetland crossing be necessary, directional drilling should be utilised in order to lay the proposed pipeline with minimal surface impact to the wetlands. The surface construction footprint is to be kept to an absolute minimum.

Primary factors leading to the decreased sensitivity levels can be attributed to the increased levels of anthropogenic disturbances from mining and agricultural activities, alien plant proliferation and the overgrazing of the rocky grasslands along the linear development. One floral SCC species, namely *Crinum bulbispermum* is considered to have an increased probability of occurrence within the valley bottom wetlands. The medicinally important species *Hypoxis hemerocallidea* was observed along Route 1. Should any of these individuals be located within the construction footprint, a rescue and relocation plan needs to be implemented in order to relocate this species to suitable similar habitat in the areas. Two avifaunal SCC were observed, *Phoeniconaias minor* (Lesser Flamingo) and *Sagittarius serpentarius* (Secretarybird) whilst another two faunal SCC have an increased probability of occurrence, *Pyxicephalus adspersus* (Giant Bullfrog) and *Metisella meninx* (Marsh Sylph).

It is the opinion of the ecologists that, from a terrestrial ecological point of view, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts are adhered to fully and the project footprint be kept as small as possible. Best practice methods of the linear development construction must be applied and rehabilitation of all disturbed areas must take place once construction activities are completed.

Should *Hypoxis hemerocallidea* be located within the construction footprint, a rescue and relocation plan needs to be implemented in order to relocate this species to suitable similar habitat in the areas

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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
CBA	Critical Biodiversity Area
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
MBSP	Mpumalanga Biodiversity Sector Plan (2014)
MNCA	Mpumalanga Nature Conservation Act
NBA	National Biodiversity Assessment (2011)
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 construction of a water pipeline from the Dorsfontein West to the Dorsfontein East Mine near Kriel within Mpumalanga Province. The proposed project has three alternative water pipeline routes namely Route 1 (10,5km in length) which is the preferred route, Route 2 (8,9km in length) and Route 3 (11,2km in length), hereinafter collectively referred to as “linear development” (Figure 1 & 2). An area of 15m (buffer) on either side of each proposed route was investigated during the site visit. In addition, freshwater resources in the vicinity of the proposed open pit expansion was delineated and assessed.

The linear development is situated approximately 2,1km east of the town Thubelihle and traverses the R544 roadway. A portion of Route 1 is situated approximately 500m south east of the intersection of the R547 and R544, whilst the remaining route traverse northward eastwards from Dorsfontein West mine through agricultural land, crossing the R544 roadway with Route 2 continuing into the mining area of Dorsfontein East Mine and Route 3 circumnavigating around the mining area.

This report, after consideration and the description of the ecological integrity of the linear development, 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.

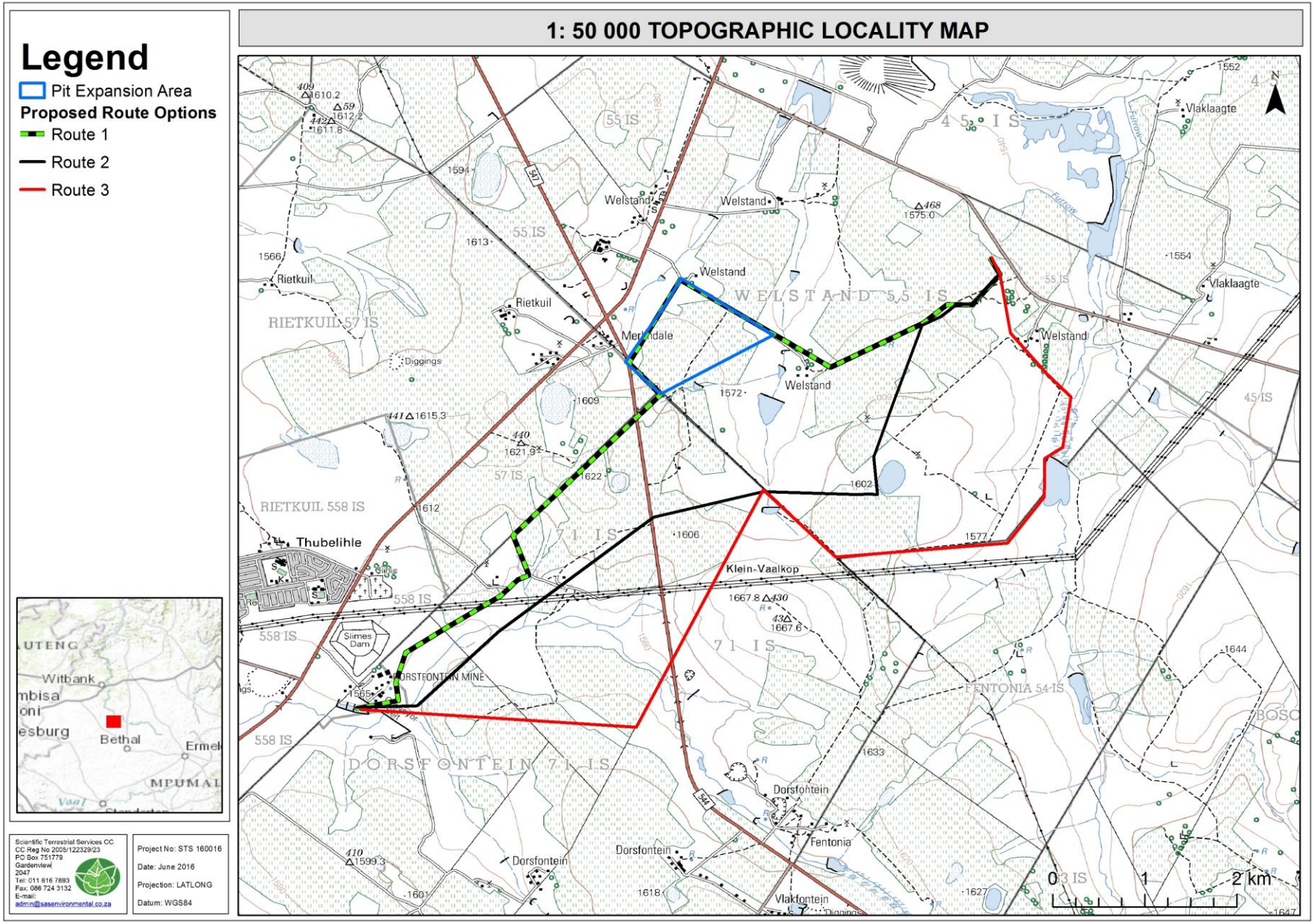


Figure 1: The linear development depicted on a 1:50 000 topographical map in relation to the surrounding area.

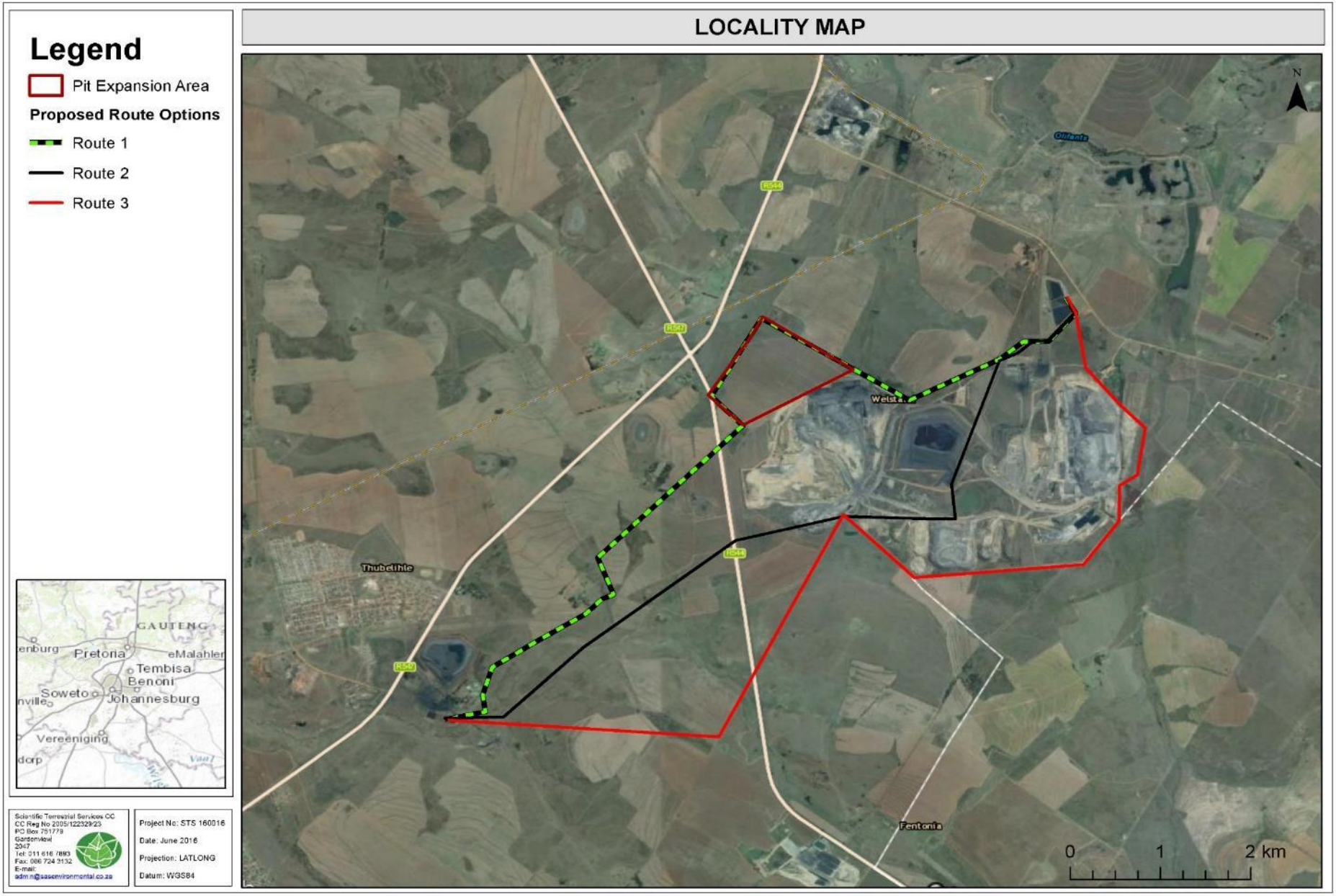


Figure 2: Digital Satellite image depicting the location of the linear development in relation to surrounding areas.

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 in the vicinity of the linear development;
- To determine and describe habitats, communities and ecological state of the linear development;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the 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 pipeline might have on the terrestrial ecology associated with the linear development, 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 linear development (30m survey area) as provided and confirmed by SRK consulting 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 linear development may have been missed during the assessment; and
- The data presented in this report are based on one site visit, undertaken in June 2016. 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 linear development.

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); 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 linear development 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 linear development included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Mpumalanga Biodiversity Sector Plan (MBSP, 2014), 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);
- A visual on-site assessment of the linear development was conducted during June 2016 in order to confirm the assumptions made during consultation of the maps and to

determine the ecological status of the linear development. 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 will be 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 linear development 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 Linear Development

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 linear development's actual biodiversity characteristics.

Table 1: Summary of the conservation characteristics for the linear development.

NBA (2011)	The linear development falls within an area currently not protected	
Threatened Ecosystems (2011)	Vulnerable	
SAPAD (2015)	The linear development is not located within or near any protected areas.	
IBA (2015)	The linear development is not located within or near an important bird area.	
Vegetation Type (M&R, 2006)	Eastern Highveld Grassland (Detailed description provided in Appendix E)	
Biome (M&R, 2006)	Grassland	
Bioregion (M&R, 2006)	Mesic Highveld Grassland	
MBSP (2014)	All three proposed routes fall within areas categorised as:	
	Heavily Modified	All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.
	Moderately Modified -Old lands	Old cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas may still play a role in supporting biodiversity and providing ecosystem services.

	Other Natural Areas	Areas that have not been identified as priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.
	CBA Irreplaceable	Areas required to meet targets and with irreplaceability values of more than 80%; Critical linkages or pinch-points in the landscape that must remain natural; Critically Endangered Ecosystems.
	Route 3 traverses an area categorised as CBA Optimal.	The CBA Optimal Areas (previously called 'important and necessary' in the MBCP) are the areas optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not 'irreplaceable' they are the most efficient land configuration to meet all biodiversity targets and design criteria.

NBA = National Biodiversity Assessment; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; M&R = Mucina and Rutherford; MBSP = Mpumalanga Biodiversity Sector Plan; CBA = Critical Biodiversity Area;

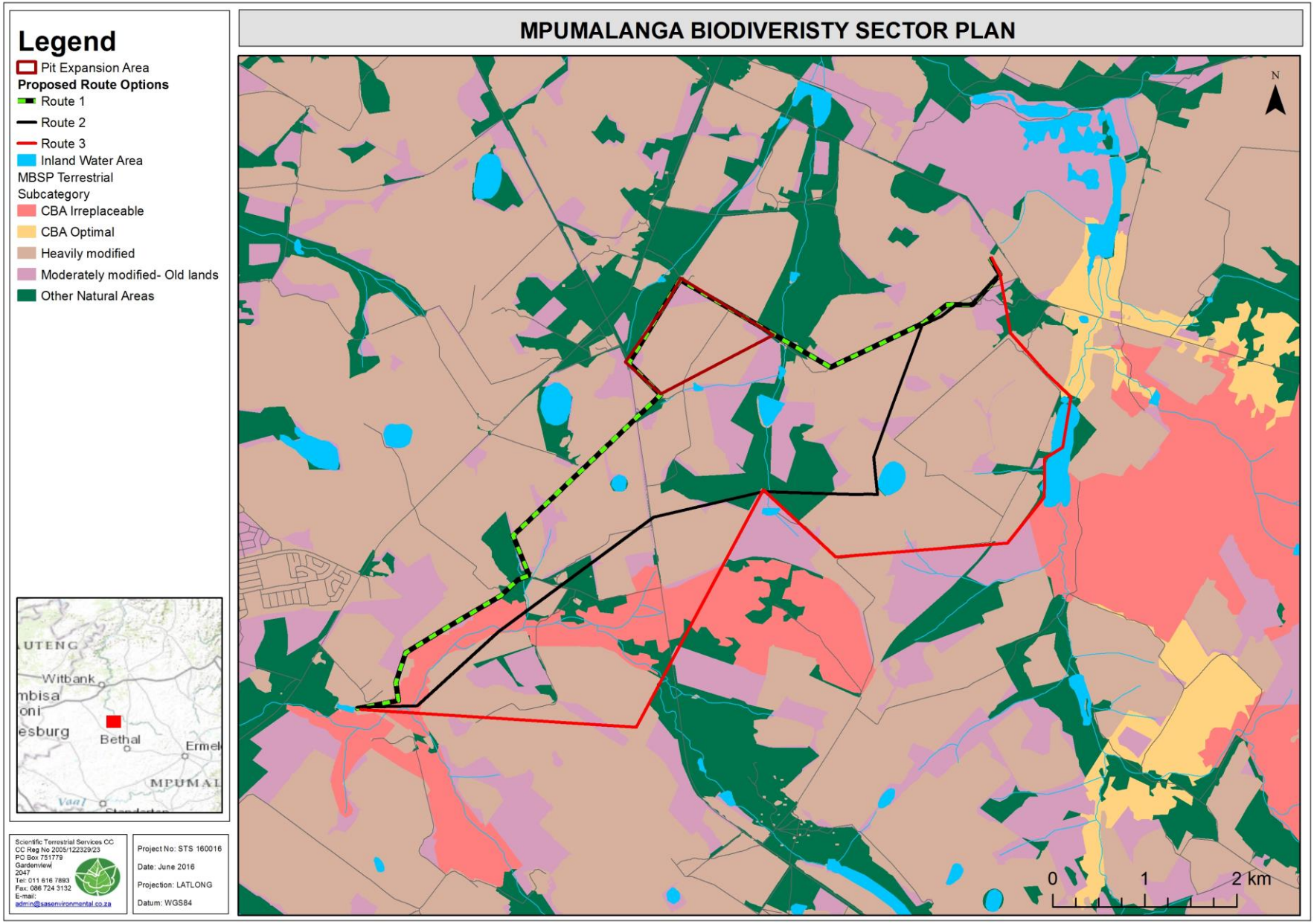


Figure 3: The Terrestrial MBSP associated with the linear development and its surroundings (MBSP, 2014).

4. RESULTS OF THE FLORAL ASSESSMENT

4.1 Habitat Units within the Proposed Routes

Following the assessment of the linear development and the associated habitat, it has been concluded that there are 3 main habitat units that will impacted upon. These habitat units are described below:

Transformed (Agricultural and Mining) Habitat

This habitat unit comprises of land that is currently being utilised for agricultural purposes or has been disturbed as a result of mining activities. This habitat type has been largely transformed either through monoculture (Maize fields) or as a result of mining activities resulting in habitat clearing and dumping of waste material from mining activities. In terms of habitat provision this habitat is considered to have very low habitat provision capabilities, and is under constant land changing impacts from either ploughing or earth moving/ dumping activities.

Wetland Habitat

Wetlands predominated within the lower valley regions of the linear development, as well as the hillslopes between the agricultural fields. The seep wetlands are largely impacted upon by Route 1, whilst Route 2 impacts upon both valley bottom and seep wetlands. Route 3 has a large impact on the Unchannelled valley bottom wetland that is located alongside the Dorsfontein East mining area. Although edge impacts from edge effects were evident, the valley bottom wetland habitats are considered to still be in a fairly good condition, capable of providing suitable habitat to number of floral wetland species as well as floral SCC species such as *Crinum bulbispermum*. The wetland areas are currently utilised for grazing however the grazing impact on this habitat unit was not considered to be high, as a dense herbaceous layer was still evident. From the habitat analysis of the wetlands, Route 1 is expected to have a lower impact risk.

Grassland Habitat Unit

This habitat unit has been further subdivided in order to better assess and discuss the affected areas along the various routes

Transformed Grassland Habitat

Large scale edge effects from farming and mining activities as well as grazing has resulted in an altered grassland habitat. Some areas are likely to be old lands previously under cultivation.

Alien plant proliferation (*Bidens pilosa* and *Tagetes minuta*) was high within this habitat, whilst many

Moist Grassland Habitat

Seepage from the artificial dams and water runoff from roads have created moist conditions for facultative wetland species (species occurring within wetland or terrestrial areas) to occur. Soil samples were taken within these habitat units; however, no hydromorphic characteristics were evident in these soil samples. This habitat unit is located within all the proposed routes alongside the agricultural fields, and as such edge effects from farming activities has impacted upon this habitat unit, with a small number of alien invasive species being observed. Areas of moist grassland were observed within all of the proposed routes.

Secondary Grassland

This grassland is characterised by a very low forb diversity, largely isolated between agricultural land. Grassland species observed were a mixture of pioneer (*Cynodron dactylon*), sub-climax and climax species (*Themeda triandra*), indicating that this habitat unit is not in a climax stage of succession, but rather maintained in a sub-climax or secondary stage as a result of edge effects and possibly altered fire regimes. Grazing activities were evident in this habitat unit however they were not impacting heavily and appeared to be infrequent, resulting in a fairly tall grass structure.

Rocky Grassland

The rocky grassland located within Route 3 comprised of very shallow soils over quartzite rocks. The herbaceous layer within this habitat unit had been grazed very short at the time of assessment. Species composition and overall veld condition indicates that this habitat unit has been systematically overgrazed. Species such as *Seriphium plumosum* were observed, which along with the very short herbaceous layer, is an indicator of an overgrazed veld.

4.2 Habitat Unit within the Proposed Pit Expansion Area

The proposed expansion pit comprised primarily of transformed agricultural land used for the production of crops. The north western corner of the expansion pit contained a small area of both secondary and moist grassland, whilst the south western corner was associated with transformed grassland. Impacts from agricultural activities has had an impact on the overall expansion pit area, and is not expected to provide habitat to any floral or faunal SCC.

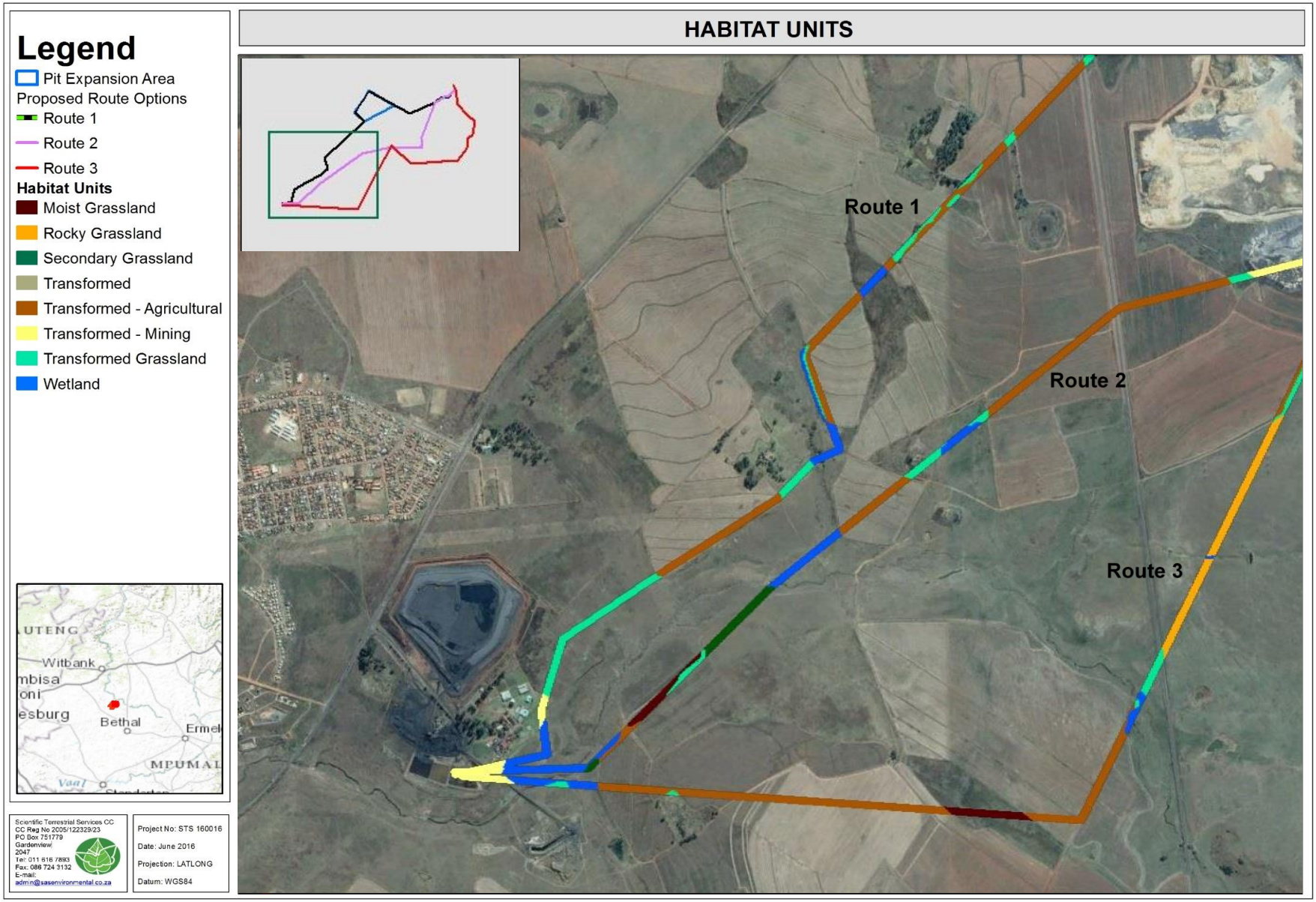


Figure 4: Habitat units encountered within the 30m survey zone of the linear development.

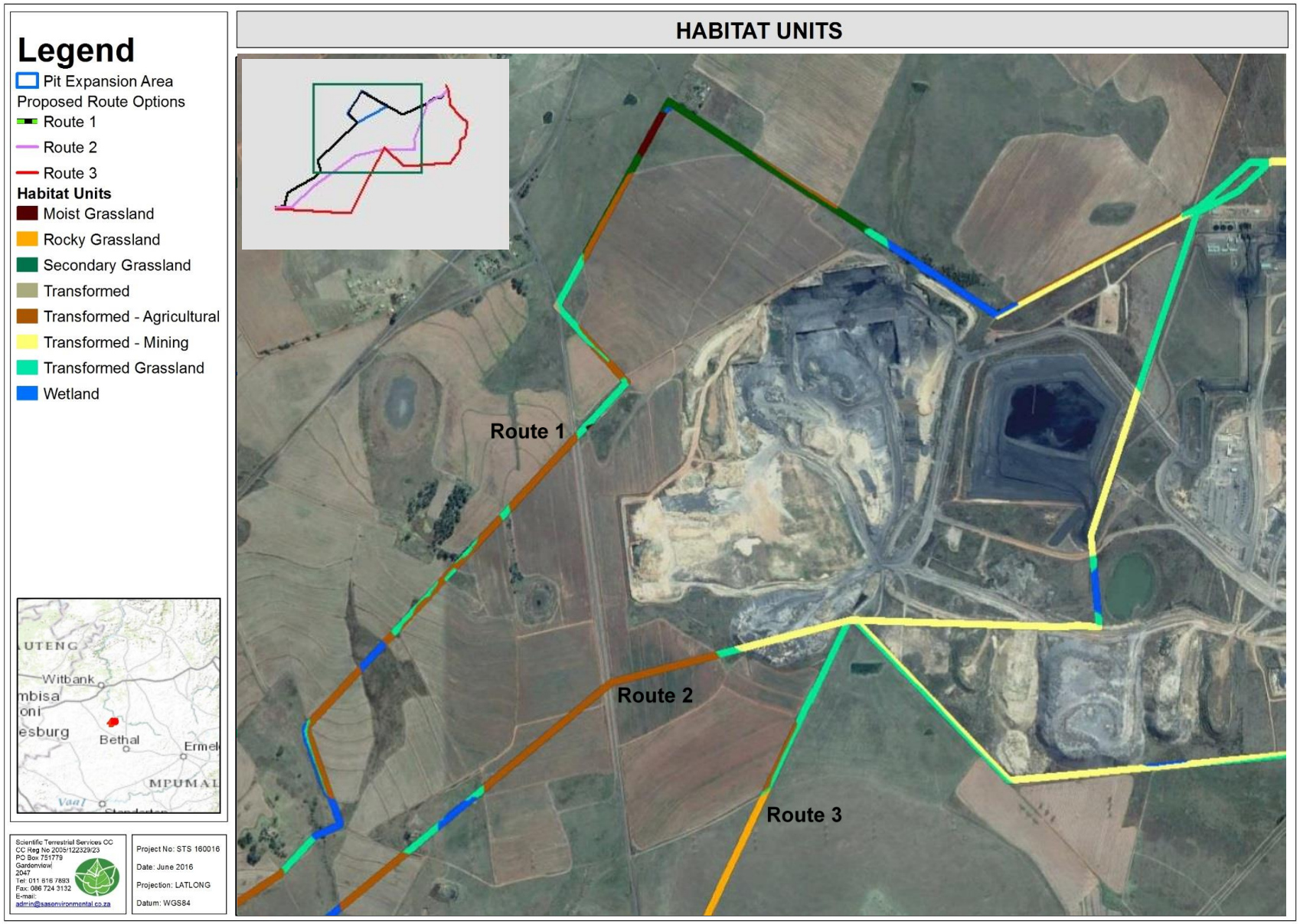


Figure 5: Habitat units encountered within the 30m survey zone of the linear development.

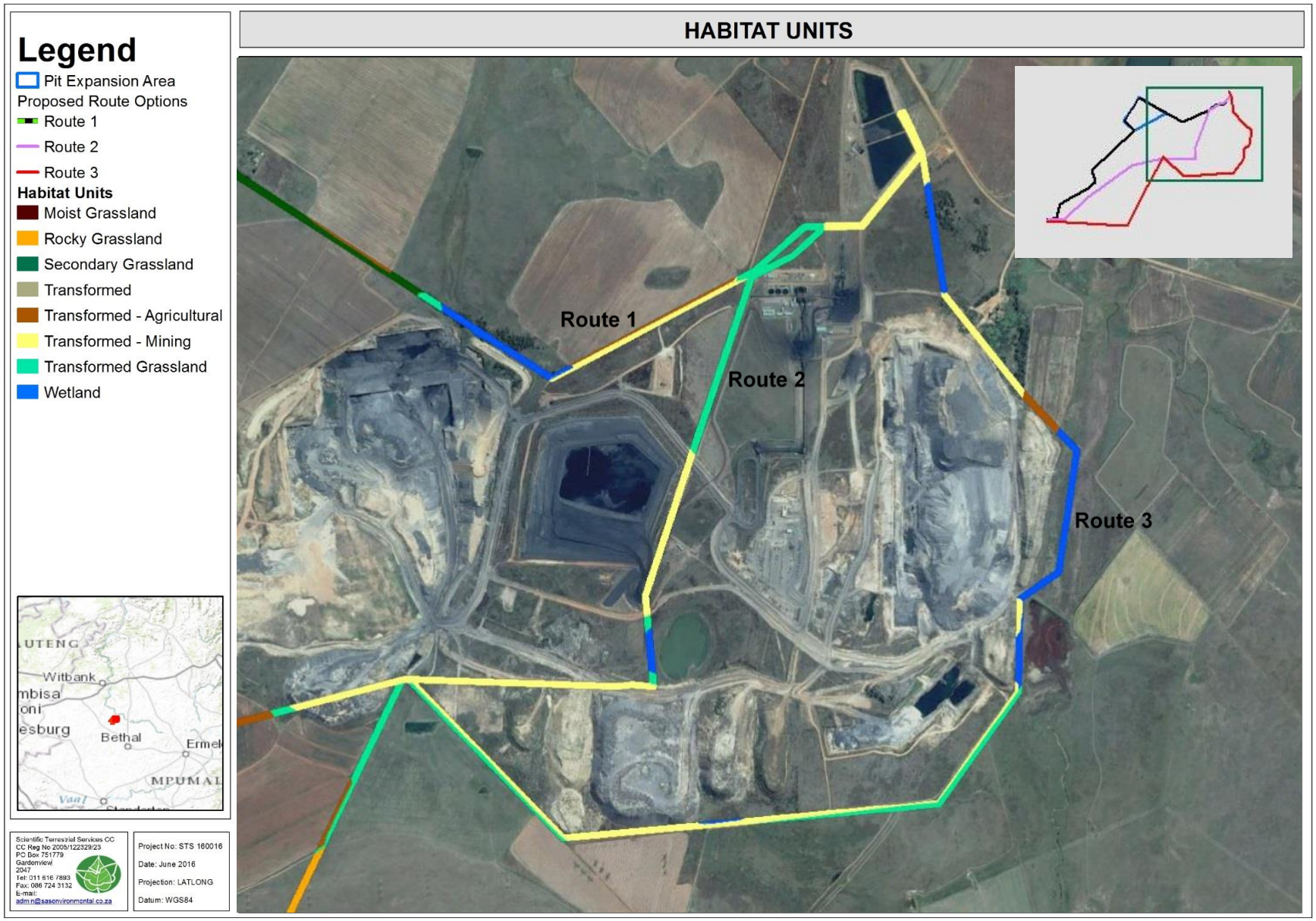
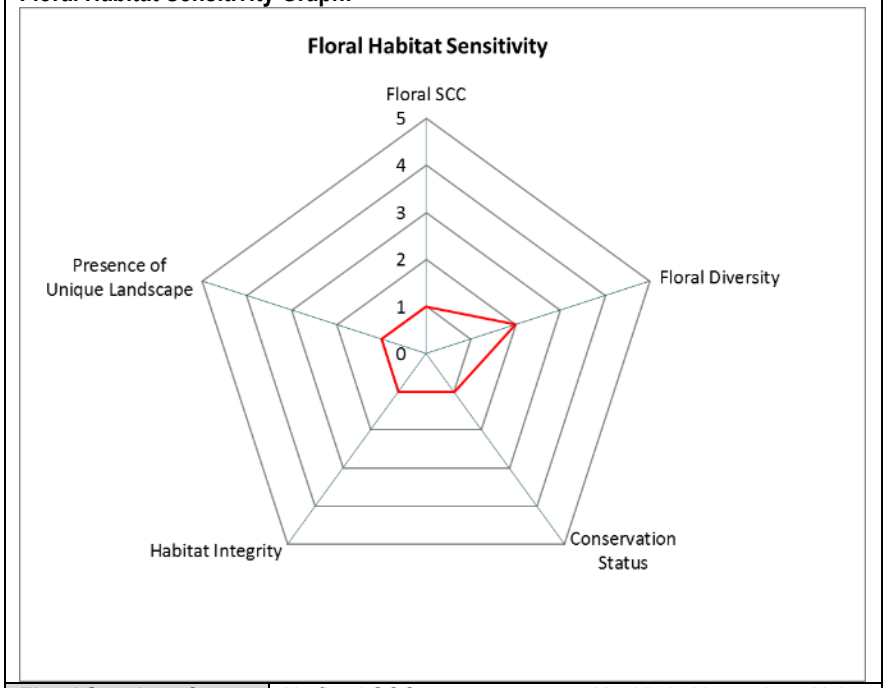


Figure 6: Habitat units encountered within the 30m survey zone of the linear development.

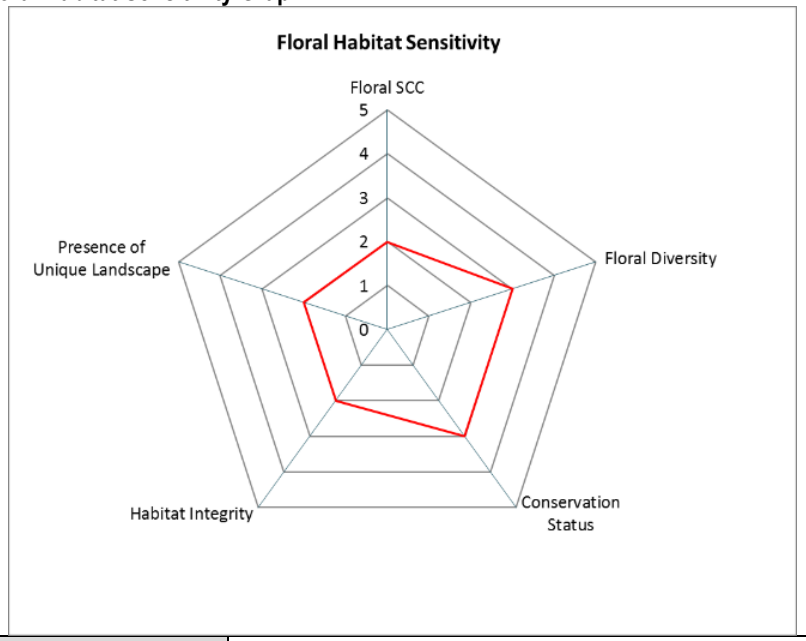
Table 2: Summary of results of the floral assessment

<table>
<tr><td colspan="2">Habitat Unit:
Transformed (Agricultural and Mining) Habitat</td><td>Floral Habitat Sensitivity</td><td>Low</td><td colspan="2" rowspan="2"> 
  </td></tr>
<tr><td colspan="3">Notes on Photograph:
Above: Transformed Agricultural lands;
Below: Transformed Mining Area.</td></tr>
<tr><td colspan="4">Floral Habitat Sensitivity Graph:
 
</td><td colspan="2"></td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="3">No floral SCC were encountered in this habitat unit and it is unlikely that any such species will occur as a result of historic and ongoing anthropogenic activities associated with mining and agricultural activities.</td><td colspan="2"></td></tr>
<tr><td>Floral Diversity</td><td colspan="3">Floral diversity was low and dominated by pioneer grasses, alien invasive plant species and maize. Species observed included Eragrostis curvula, Bidens pilosa, Cynodon dactylon and Tagetes minuta. For a comprehensive species list refer to Appendix F.</td><td>General comments:
As already stated, this habitat unit has been significantly transformed as a result of long term agriculture and mining activities. Little to no representative vegetation of the Eastern Highveld Grassland remains, with the</td><td>Business Case, Conclusion and Mitigation Requirements:
This habitat unit is of low ecological sensitivity. Construction related activities within this habitat unit are unlikely to result in any current or long</td></tr>
</table>

Conservation Status of Vegetation Type/Ecosystem	Falls within the Eastern Highveld Grassland which is considered to be Endangered. However, due to large scale transformation and habitat disturbance, no remnants of this vegetation type exists within the transformed habitat unit.	majority of the species observed being pioneer forbs and grasses associated with heavily disturbed areas. Alien plant growth was noted to be relatively high, with dense stands of *Tagetes minuta* and *Bidens pilosa* growing within this habitat unit. Furthermore, the pit expansion area is predominated by transformed agricultural land, and as such is unlikely to impacts upon floral species in the area. This habitat Unit is associated with all 3 of the proposed routes.	term environmental impacts. However, although this habitat unit has been historically impacted upon, mitigation measures must still be implemented, so as to ensure further alien plant species propagation is managed and controlled, and that any surrounding habitat is not impacted upon further as a result of edge effects from construction activities.
Habitat integrity/Alien and Invasive species	The habitat has been extensively transformed and dominated by maize crops in the agricultural fields and alien vegetation in the transformed mining areas. Yearly ploughing of the agriculture fields and constant earth works in the mining areas maintain the habitat in a transformed state.		
Presence of Unique Landscapes	No unique landscapes important to flora were present.		

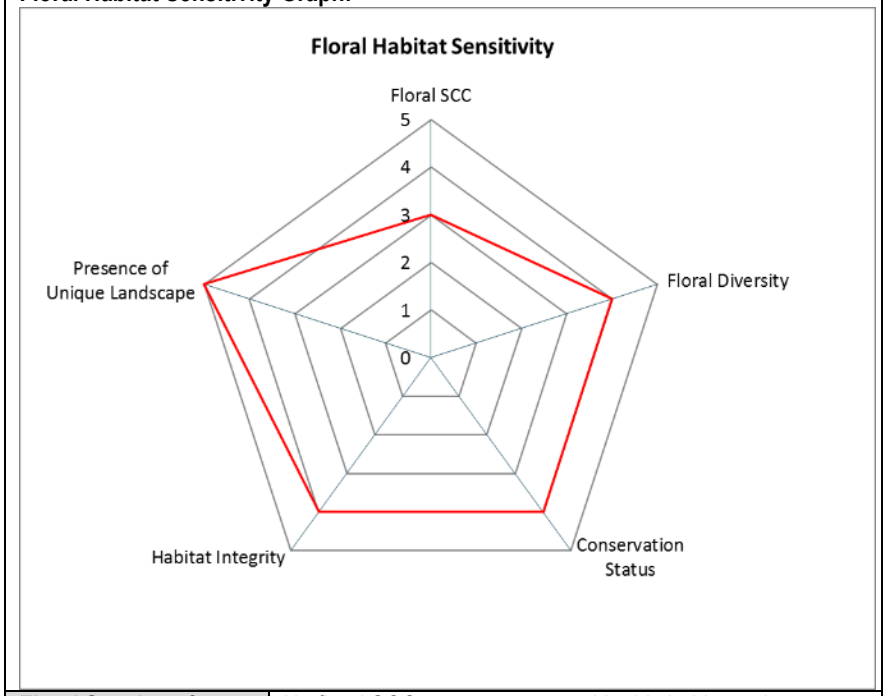
Table 3: Summary of results of the floral assessment

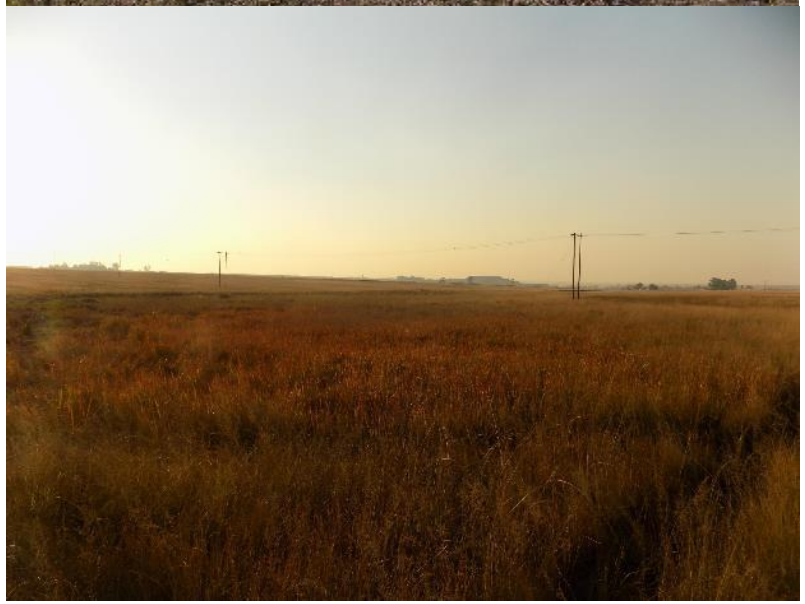
<table>
<tr><td colspan="2">Habitat Unit:
Transformed Grassland Habitat</td><td>Floral Habitat Sensitivity</td><td>Moderately low</td><td rowspan="2"> 


</td></tr>
<tr><td colspan="3">Notes on Photograph: Above: Images depicting the transformed grassland habitat unit;
Below: Hypoxis hemerocallidea observed within Route 1</td></tr>
<tr><td colspan="4">Floral Habitat Sensitivity Graph:
 
</td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="3">No floral SCC were encountered in this habitat unit. Historic and ongoing anthropogenic activities such as mining and agricultural are likely to preclude many floral SCC. Although not listed as an SCC, Hypoxis hemerocallidea, a medicinally important species was observed in the transformed grasslands associated with Route 1.</td></tr>
<tr><td>Floral Diversity</td><td>Floral diversity was moderate, with a number of pioneer and sub-climax grass species being observed. Forb diversity of this habitat was considered to be moderately low however. Much of this habitat unit is associated with the agricultural areas, either located between crop lands or alongside such.</td><td colspan="2">General comments:
Much of this habitat unit is associated with the agricultural lands, both currently cultivated and fallow lands. As such this habitat unit has been subject to edge effects from these areas over a long period of time. The transformed</td><td>Business Case, Conclusion and Mitigation Requirements:
This habitat unit is of moderately low ecological sensitivity. Although this habitat unit has been historically impacted upon, it is imperative that</td></tr>
</table>

	As a result, alien plant proliferation is common and wide spread within this habitat unit. Common species observed within this habitat include *Eragrostis curvula, Seriphium plumosum, Eragrostis chloromelas, Helichrysum nudifolium, Tagetes minuta, Bidens pilosa, Hermannia transvaalensis, Dicoma zeyheri, Eragrostis gummiflua, Hyparrhenia tamba, Hyparrhenia hirta, Populus x canescens* and *Acacia mearnsii*. For a comprehensive species list refer to Appendix F.	grasslands are likely to be mowed on occasion, and are also utilised as areas of grazing for local cattle herds, although not intensively. Alien plant growth was noted to be relatively high, with dense stands of *Tagetes minuta* and *Bidens pilosa* growing within the boundary areas between the transformed grasslands and the agricultural areas. This habitat unit is associated with all of the proposed routes.	moving forwards no further decline in habitat integrity occurs as a result of construction related activities pertaining to the linear development. As such all mitigation measures as stipulated within this report must be implemented, so as to ensure further alien plant species propagation is controlled, and that the transformed and surrounding habitat is not impacted upon further as a result of any edge effects from construction related activities. Should *Hypoxis hemerocallidea* be located within the construction footprint, a rescue and relocation plan needs to be implemented in order to relocate this species to suitable similar habitat in the areas.
Conservation Status of Vegetation Type/Ecosystem	Falls within the Eastern Highveld Grassland which is considered to be Endangered. Although the habitat unit was noted to contain some species associated with the Eastern Highveld Grassland, habitat disturbance and species composition in this habitat unit not being considered representative of the vegetation type of the region.		
Habitat integrity/Alien and Invasive species	Habitat disturbance and edge effects from agricultural and mining activities have resulted in a moderately low habitat integrity for this habitat unit. Habitat disturbance has resulted in the proliferation of alien plant species, which outcompete indigenous plant species in disturbed environments.		
Presence of Unique Landscapes	No unique landscapes important to flora were present.		

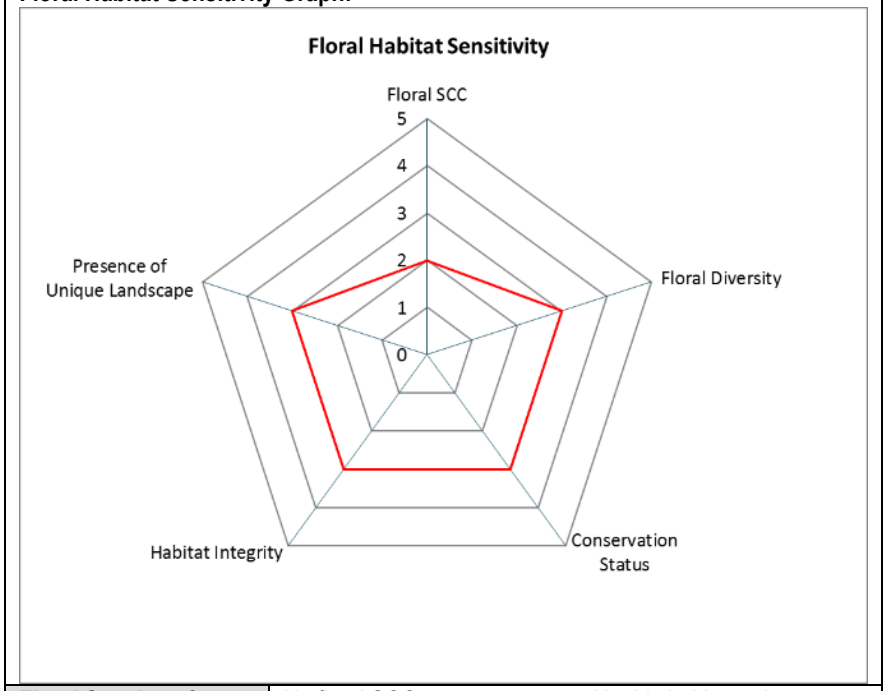
Table 4: Summary of results of the floral assessment

Habitat Unit: Wetland Habitat	**Floral Habitat Sensitivity**	**Moderately high**
	Notes on Photograph: Top: Channelled Valley Bottom wetland, Below: Seep wetland	
Floral Habitat Sensitivity Graph: 		
Floral Species of Conservation Concern (SCC)	No floral SCC were encountered in this habitat unit. However, as the site assessment was conducted late in the season, it is highly likely that any floral SCC present would have already died back. It is highly likely that species such as *Crinum bulbispermum* will occur within the wetlands. Of importance is that all *Crinum spp* are protected under the Mpumalanga Nature Conservation Act (MNCA) of 1998. *Hypoxis hemerocallidea* was observed north of the wetland seep that is located on route along the northern boundary of the current mining area. It is possible that further individuals may exist within the seep wetland, although none were observed.	



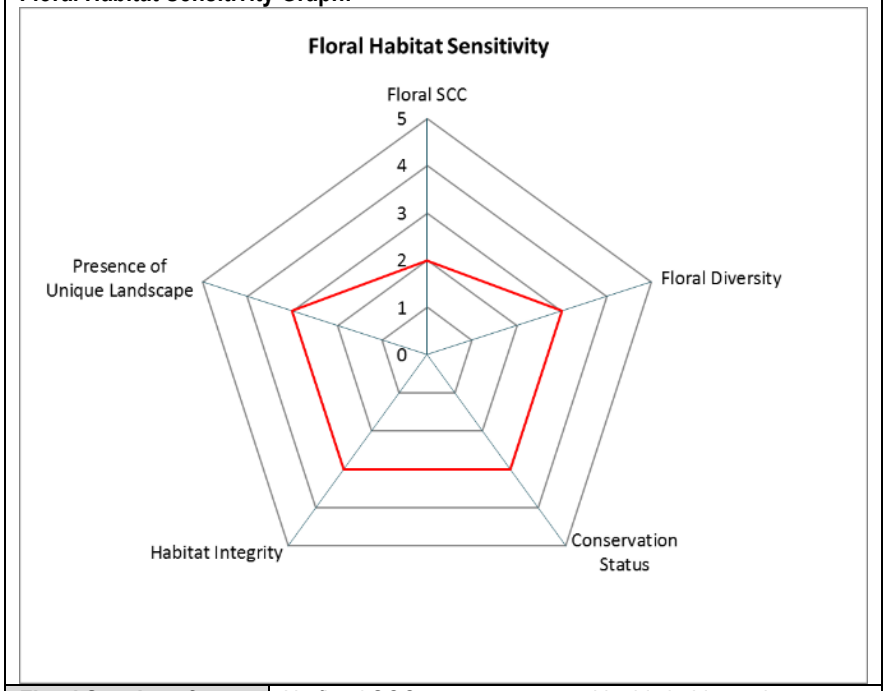
Floral Diversity	Floral diversity was moderately high, with a number of obligate wetland floral species observed as well as grass species adapted to moist soil conditions. Floral species observed include *Typha capensis, Cyperus rustris, Cyperus rupestris, Sporobolus fimbriatus, Imperata cylindrica* and *Eragrostis gummiflua*. For a comprehensive species list refer to Appendix F.	**General comments:** The wetland habitat units are located primarily in the lower valley regions through which the linear development traverses. Smaller seep wetlands are located between a number of the agricultural fields, where they have been exposed to edge effects as a result of ongoing crop cultivation. They valley bottom wetlands are capable of providing suitable habitat to a number of floral SCC such as *Crinum bulbispermum* which is protected under the MNCA (1998). The wetland habitat is associated with all of the proposed routes.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is of moderately high ecological sensitivity. Although this habitat unit has been historically impacted upon, it is imperative that moving forwards no further decline in habitat integrity occurs as a result of construction related activities pertaining to the linear development. As such all mitigation measures as stipulated within this report must be implemented, so as to ensure the maintenance of wetland floral habitat, function and species diversity. Should any floral SCC be observed within the linear development, these species need to form part of a rescue and relocation plan, and are to be moved to suitable habitat in the areas outside of the disturbance footprint.
Conservation Status of Vegetation Type/Ecosystem	Falls within the Eastern Highveld Grassland which is considered to be Endangered. The wetland habitat unit, notably the wetlands in the lower valley bottom are considered to be fairly consistent and representative of wetlands found in this vegetation type.		
Habitat integrity/Alien and Invasive species	Habitat disturbance and edge effects from agricultural and mining activities had a degree of impact on this habitat unit, however habitat integrity is still considered to be moderately high overall. As a result of the habitat disturbances, alien plant species such as *Tagetes minuta, Verbena bonariensis* and *Salix babylonica* were observed within a number of the seep and Unchannelled valley bottom wetlands.		
Presence of Unique Landscapes	Due to the nature of wetlands, they are considered unique in a landscape as they are important for floral and faunal species, as well as the maintenance of the hydrological regimes in an area.		

Table 5: Summary of results of the floral assessment

Habitat Unit: Moist grassland	**Floral Habitat Sensitivity**	**Intermediate**
	Notes on Photograph: Images depicting the moist grassland habitat unit and soil sample taken	
Floral Habitat Sensitivity Graph: 		
Floral Species of Conservation Concern (SCC)	No floral SCC were encountered in this habitat unit nor are any expected to occur within this habitat unit.	

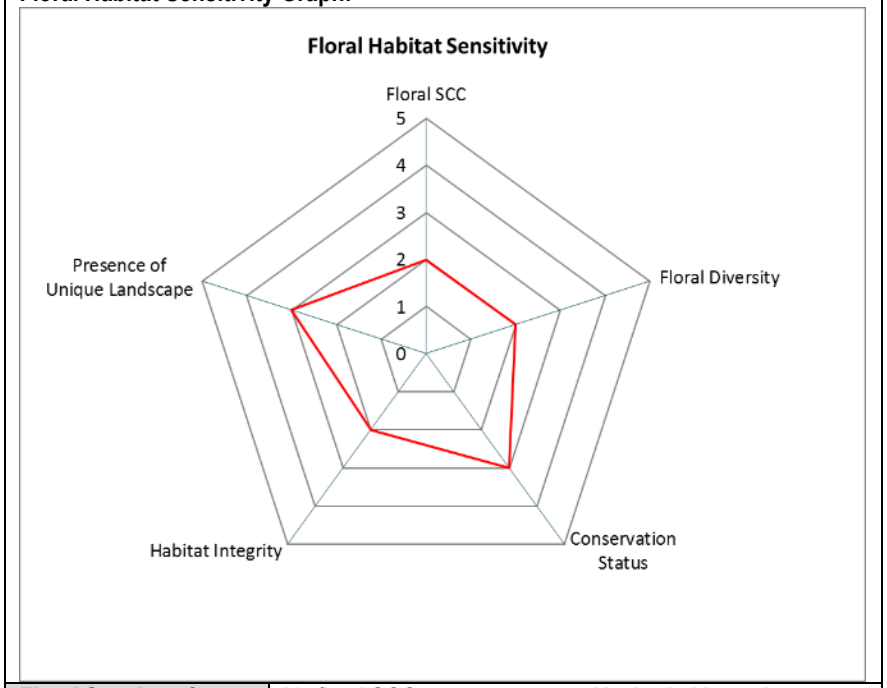
Floral Diversity	Floral diversity was intermediate. Old farm dams and altered water runoff patterns due to dirt roads and agricultural activities have resulted in an increased soil moisture content of the soil which has resulted in facultative wetland species (species occurring within wetland or terrestrial areas) being observed. Floral species observed include *Imperata cylindrica* and *Verbena bonariensis*. For a comprehensive species list refer to Appendix F.	**General comments:** The moist grasslands are associated primarily with the agricultural lands and habitat surrounding old earthen dams that are no longer functional. Although wetland indicative grass species were observed, upon taking soil samples at various points within the habitat unit no mottles were observed. This habitat unit is associated with all of the proposed routes.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is of an intermediate ecological sensitivity. Although this habitat unit has been historically impacted upon, moving forwards it must be ensured that no further decline in habitat integrity occurs as a result of construction related activities pertaining to the linear development. As such all mitigation measures as stipulated within this report must be implemented, so as to ensure further alien plant species propagation is controlled.
Conservation Status of Vegetation Type/Ecosystem	Falls within the Eastern Highveld Grassland which is considered to be Endangered, however species composition of the moist grassland is not considered to be representative of the vegetation type.		
Habitat integrity/Alien and Invasive species	Habitat integrity is considered to be intermediate. Much of the moist grassland habitat unit has been formed as a result of anthropogenic activities and edge effects from the crop fields. As a result of the habitat disturbances, alien plant species such as *Verbena bonariensis* were observed within this habitat unit.		
Presence of Unique Landscapes	Although less disturbed than the agricultural lands, the moist grasslands are still not considered very unique to the landscape, and are not key drivers for the continued conservation of any floral SCC in the region.		

Table 6: Summary of results of the floral assessment

Habitat Unit: Secondary grassland	**Floral Habitat Sensitivity**	**Intermediate**
	Notes on Photograph: Images depicting the secondary grassland habitat unit	
Floral Habitat Sensitivity Graph:  		
Floral Species of Conservation Concern (SCC)	No floral SCC were encountered in this habitat unit nor are any expected to occur within this habitat unit. The secondary grassland has been impacted upon through edge effects from the agricultural areas.	

Floral Diversity	Floral diversity was intermediate. This habitat unit was dominated by grassland species, with a very low forb diversity observed. Floral species observed include *Eragrostis curvula, Hyparrhenia hirta, Themeda triandra, Cynodon dactylon, Tagetes minuta* and *Sporobolus fimbriatus*. For a comprehensive species list refer to Appendix F.	**General comments:** The secondary grassland has been impacted upon by edge effects from the agricultural activities. Furthermore, this habitat unit contained high levels of moribund material, indicating a lack of grazing or burning activities.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is of an intermediate ecological sensitivity. Although this habitat unit has been historically impacted upon, moving forwards it must be ensured that no further decline in habitat integrity occurs as a result of construction related activities pertaining to the linear development. As such all mitigation measures as stipulated within this report must be implemented.
Conservation Status of Vegetation Type/Ecosystem	Falls within the Eastern Highveld Grassland which is considered to be Endangered. A small number of grass species commonly associated with this vegetation type were identified within the secondary grassland habitat, however long terms impacts from agricultural related activities has altered the overall specie composition of the habitat unit, and as such bares very little resemblance to the original vegetation type.		
Habitat integrity/Alien and Invasive species	Habitat integrity is considered to be intermediate. This habitat unit is associated primarily with the boundaries of the agricultural areas, as well as the original Eastern Highveld grasslands prior to disturbances. Alien floral species such as *Tagetes minuta* were observed within this habitat unit.		
Presence of Unique Landscapes	The secondary grasslands are not considered unique to the landscape, and are unlikely to be key drivers for the continued conservation of any floral SCC in the region.		

Table 7: Summary of results of the floral assessment

Habitat Unit: Rocky grassland	**Floral Habitat Sensitivity**	**Intermediate**
	Notes on Photograph: Images depicting the rocky grassland habitat unit	
Floral Habitat Sensitivity Graph: 		
Floral Species of Conservation Concern (SCC)	No floral SCC were encountered in this habitat unit nor are any expected to occur within this habitat unit.	

Floral Diversity	Floral diversity was moderately low. Due to the overgrazed condition of the veld, species identification was limited. However as expected species that are indicative of a shallow rocky habitat, that is largely overgrazed were observed. Species found within this habitat unit include *Eragrostis sp, Hyparrhenia hirta, Aristida diffusa* and in the lower slopes of the rocky grassland stands of *Eucalyptus camaldulensis* were found. For a comprehensive species list refer to Appendix F.	**General comments:** The rocky grassland has been impacted upon as a result of wide spread overgrazing, resulting in a very low herbaceous layer within this habitat unit. This is further compounded by the shallow rocky natures of the soils, which are likely to be low in nutrients and as such impacts are readily perceivable in these vegetation types.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is of an intermediate ecological sensitivity. Although this habitat unit has been historically impacted upon, moving forwards it must be ensured that no further decline in habitat integrity occurs as a result of construction related activities pertaining to the linear development. As such all mitigation measures as stipulated within this report must be implemented.
Conservation Status of Vegetation Type/Ecosystem	Although this habitat unit falls within the Eastern Highveld Grassland which is considered to be Endangered, the rocky grassland has been largely disturbed and as such the species composition is not considered to be representative of the vegetation type.		
Habitat integrity/Alien and Invasive species	Habitat integrity is considered to be moderately low. This habitat unit is located between agricultural lands, mining activities and the R544 main road. Extensive grazing activities were evident within this habitat unit, further impacting upon the habitat integrity. Alien floral species such as *Tagetes minuta* and *Eucalyptus camaldulensis* were observed within this habitat unit.		
Presence of Unique Landscapes	The rocky grassland is not considered unique to the landscape.		

4.3 Floral Species of Conservation Concern Assessment

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken. The complete SANBI PRECIS Red Data Listed plants was acquired for the Quarter Degree Square (QDS) 2629AB.

Threatened 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.

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.

The PRECIS plant list for the grid reference (2629AB) did not contain any floral SCC. Habitat disturbance as a result of crop cultivation and mining activities, roads and the resultant edge effects from these impacts has led to disturbance of the overall natural habitat that is traversed by the linear developments. Although no floral SCC were observed it must be noted that the site assessment was conducted late in the season, and it is likely that any floral SCC present are likely to have died back already. Although not listed on PRECIS, it is considered likely that species such as *Crinum bulbispermum* may occur within the valley bottom wetlands.

Should any floral SCC be observed within the proposed linear development, these species need to form part of a rescue and relocation plan, and are to be moved to suitable habitat in the areas outside of the disturbance footprint. All rescue and relocation activities are to be overseen by a suitably qualified specialist.

4.4 Alien and Invasive Plant Species

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

Table 8: Dominant alien vegetation species identified during the field assessment.

Species	English name	Country of Origin	Category*
	Trees/ shrubs		
Acacia mearnsii	Black wattle	Australia	2
Eucalyptus camaldulensis	Red river gum	Australia	1b
Populus x canescens	Grey Poplar	Europe and Asia	2

Species	English name	Country of Origin	Category*
Salix babylonica	Weeping willow	Europe	NA
Melia azedarach	Syringa	India	1b
Pinus patula	Patula pine	Mexico	1b
	Forbs		
Bidens pilosa	Common blackjack	S America	NA
Campuloclinium macrocephalum	Pompom weed	Argentina	1b
Datura ferox	Large Thorn Apple	Asia	1b
Tagetes minuta	Tall khakiweed	Native to S America	NA
Verbena bonariensis	Purple top	Native to S America	1b
Verbena brasiliensis	Purple top	S America	1b

N/L = Not Listed and not categorised
National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R598 of 2014:
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 an intermediate diversity of alien species was observed in the habitat through which the linear development traverses. Although the diversity is not very high, many of the species observed were growing in dense stands and as such were outcompeting the natural vegetation. Alien species located within the linear development need to be removed according to the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R598 of 2014 during construction activities. Furthermore, it is recommended that the construction footprint, as far as possible be kept free from weeds and alien vegetation. As part of rehabilitation activities, it is recommended that monitoring of the linear development occurs for a period of 2 years during the operation of the pipeline, so as to ensure that no new alien vegetation growth occurs

4.5 Medicinal Plant Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The table below presents a list of dominant plant species with traditional medicinal value, plant parts traditionally used and their main applications, which were identified during the field assessment. These medicinal species are all commonly occurring species and are not confined to the linear development.

Table 9: Dominant traditional medicinal floral species identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2009).

Species	Name	Plant parts used	Medicinal uses
Ledebouria ovatifolia		Bulb	Used for medicinal purposes, including pregnancy, diarrhoea, influenza, backache, skin irritations, wounds and lumbago. The genus is also reputed to be poisonous in Africa, although it is reported that bushmen eat the bulbs of L. apertiflora and L. revoluta.
Hypoxis hemerocallidea	Star flower	Bulb	Infusions of the corm are used as emetics to treat dizziness bladder disorders and insanity. Decoctions have been given to weak children as a tonic and the juice is reported to be applied to burns. The stems and leaves are mixed with other ingredients to treat prostate problems. Traditional uses are also said to include testicular tumours, prostate hypertrophy and urinary infections. In recent years, the plant has become an important commercial source of extracts used in prostate preparations and in various tonics and so-called immune boosting preparations.
Tagetes minuta	Tall khaki bush	Leaves	Highly aromatic leaves have repellent properties of essential oils used by gardeners to keep plants disease free. Oil used in perfumery and as flavouring in foods, beverages and tobacco.
Helichrysum nodifolium	Hottentot's tea	Leaves, roots	It is traditionally used for food, the leaves are cooked and eaten. Leaves are burned as incense and used in ritual ceremonial occasions to summon the good spirits of the ancestors. Medicinally the roots and leaves are used as traditional medicine for chest complaints, colic in children, coughs, colds, internal sores, fever, headaches, and for dressing wounds.
Typha capensis	Bulrush	Rhizomes	A decoction of the rhizomes is used for venereal diseases or during pregnancy to ensure easy delivery: decoctions are taken orally or applied externally to promote expulsion of the placenta. It is also said to strengthen uterine contractions. It is also taken to promote fertility in women, to enhance male potency and libido, to improve circulation and for diarrhoea and dysentery. The fleshy, spongy rhizomes are dug up and may be pounded to a meal and used as a source of starch. The pollen may also be used as a high-protein food. The leaves are used to make hand brooms and are also used to some extent in weaving and thatching.
Seriphium plumosum	Slangbos		The form of *Seriphium plumosum* which was previously known as *Stoebe plumose* was not used medicinally. However, in the Western Cape, the form previously known as *Stoebe cinerea* is still used as a remedy for heart trouble, whereas another unidentified *Stoebe/Seriphium sp*. that smells like valerian, may have a beneficial effect in epilepsy.

A low diversity of medicinal species is present, and most of the species are common and widespread and thus the proposed activities are not likely to pose a significant threat to medicinal species locally and regionally.

5. RESULTS OF THE FAUNAL ASSESSMENT

5.1 Habitat Description

After the field assessment, it is evident that six faunal habitat units exist within the linear development. All of the habitat units discussed below were observed within each of the routes, and as such each habitat unit will be impacted upon regardless of route selection.

Transformed (Agricultural and Mining) Habitat

This habitat has been largely altered and modified as result of crop cultivation and earth works relating to mining activities. The habitat presented within this unit is not desirable to faunal species, and as such contained a low diversity and abundance of faunal species, which were primarily restricted to common avifaunal species.

Transformed Grassland Habitat

The habitat has been disturbed and modified as a result of historic and current agricultural activities, impacts and edge effects. This habitat is considered suitable to common avifaunal and invertebrate species. It is likely that small rodents will also utilise this habitat unit, whilst it may serve as a movement corridor for other faunal species such as *Canis mesomelas* (Black-backed Jackal).

Wetland Habitat

Habitat unit is relatively intact and capable of providing suitable cover and resources to faunal species. The wetland habitat was noted to have the highest abundance and diversity of faunal species, with the dense grass providing cover and shelter for a number of species. The interconnected nature and extent of the wetland habitat allows for the relatively unrestricted movement of faunal species within the greater area. This habitat unit is likely to be utilised by species such as *Leptailurus serval* (serval), *Asio capensis* (African Marsh Owl) and a variety of rodent species for both foraging and possibly breeding.

Moist Grassland Habitat

Much like the wetland, the dense grass cover provides shelter and refuge for smaller faunal species, however due to this habitat unit being located closer to the transformed agricultural

areas it has been impacted by edge effects, and as such only common faunal species are likely to occur here.

Secondary Grassland Habitat

Locate alongside the moist grasslands and the wetlands, this habitat unit is likely to be utilised by common faunal species, notably small mammals and gregarious avifaunal species. The habitat unit provides suitable resources and cover, and allows for unrestricted movement between the wetland, moist grassland and secondary grassland habitats.

Rocky Grassland

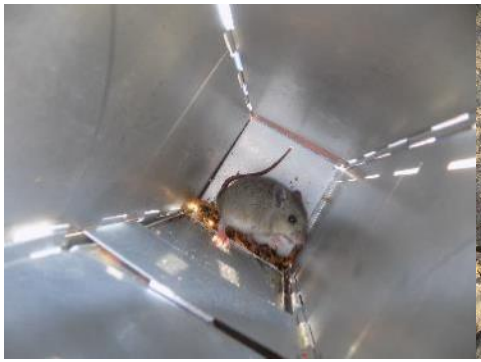
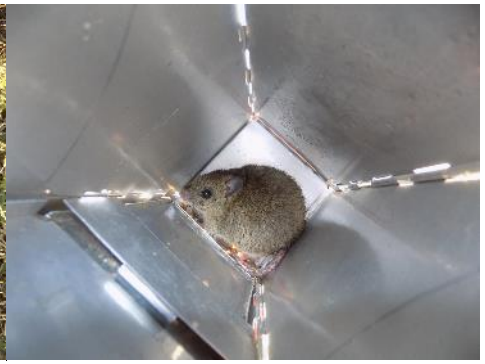
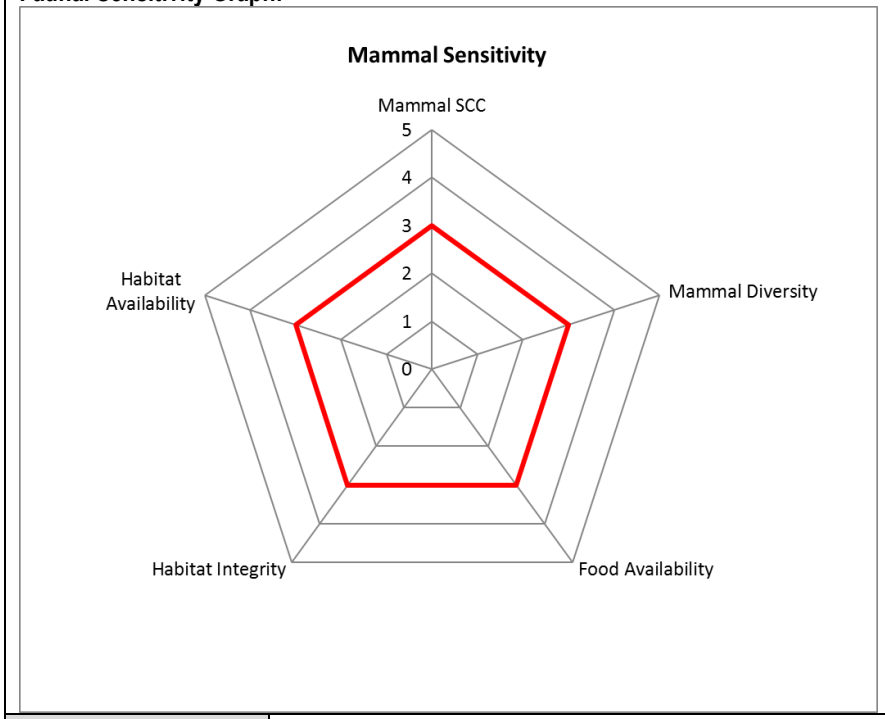
The rocky grassland comprised of very shallow soils over quartzite rocks, with a notably low grass sward as a result of overgrazing. The arid and rocky nature combined with the effects of the overgrazing limit faunal species habitation in this unit. Specie that predominated in this unit were mostly that of invertebrates, with a small number of avifaunal species observed flying through the unit.

Habitat within the Proposed Pit Expansion Area

The proposed expansion pit comprised primarily of transformed agricultural land used for the production of crops. The north western corner of the expansion pit contained a small area of both secondary and moist grassland, whilst the south western corner was associated with transformed grassland. Impacts from agricultural activities has had an impact on the overall expansion pit area, and is not expected to provide habitat to any floral or faunal SCC. The habitats within the proposed expansion pit area had a very low faunal abundance and diversity, and as such the expansion of operations into this area is not expected to have any impact on faunal species.

5.2 Mammals

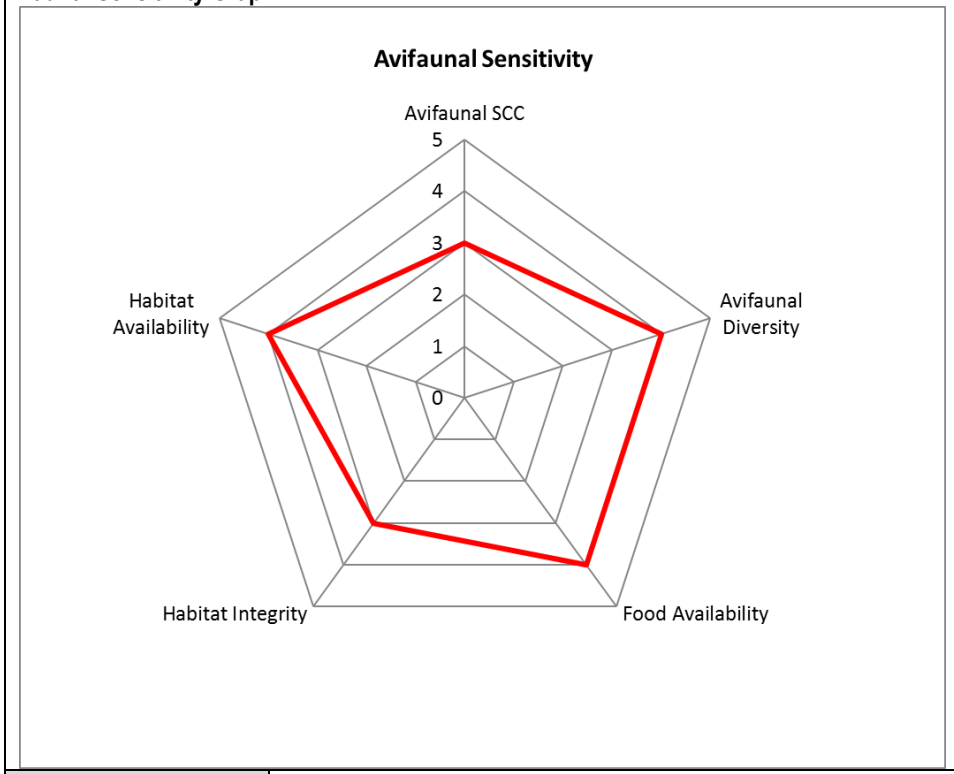
Table 10: Field assessment results pertaining to mammal species within the linear development.

<table>
<tr><td rowspan="2">Faunal Class:
Mammals</td><td>Faunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
 
 
 
  </td></tr>
<tr><td colspan="2">Notes on Photograph: Top left to bottom right: Mastomys coucha (Multimammate mouse); Atilax paludinosus (Water mongoose) spoor; Canis mesomelas (Black-backed jackal) scat; Aethomys chrysophilus (Red vlei rat).</td></tr>
<tr><td colspan="4">Faunal Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/Endemics/TOPS/</td><td colspan="3">No mammal SCC were encountered during the field assessment. There has been a significant amount of habitat disturbance through which the proposed routes traverse, and as such no mammal SCC are expected to occur along the linear development. For the full list of potentially occurring mammal SCC see Section 5.8.</td></tr>
</table>

Faunal Diversity	Mammal diversity has been negatively affected within the linear development as a result of mining and agricultural activities that have transformed faunal habitat. Direct observations and signs (spoor and dung/scat) of species such as *Galerella sanguinea* (Slender Mongoose), *Canis mesomelas* (Black-backed jackal), *Atilax paludinosus* (Water mongoose) *Mus minutoides* (Pygmy mouse), *Mastomys coucha* (Multimammate mouse), *Aethomys chrysophilus* (Red vlei rat) and *Lepus saxatilis* (Scrub hare) were observed along the linear development.	**General comments (dominant faunal species/noteworthy records etc.):** Faunal species observed are considered common throughout the region, are not threatened and have proven to be fairly adaptable to disturbed habitats. For a full list of species observed see Appendix D.	**Business Case, Conclusion and Mitigation Requirements:** The linear development (all the routes) and the associated habitat is considered to be of an intermediate sensitivity in terms of mammal conservation. The wetland habitat is deemed to be the most important faunal habitat, as it provides the highest degree of resources and shelter to mammal species. All mitigation measures as stipulated within this report must be implemented so as to ensure minimal impacts affect mammal species and the habitat thereof within and surrounding the linear development.
Food Availability	The wetlands and moist grasslands are likely to form the basis and bulk of the food resources for resident small herbivores, whilst smaller rodentia species will utilise the seeds and new growth of the herbaceous layer. The small mammals in turn provide food for the small and medium carnivores.		
Habitat Integrity	Faunal habitat has been largely disturbed, with a significant amount of land being transformed by agricultural and mining. The wetlands and remnant areas of grassland are the only sources of feasible habitat remaining in the area, with the wetlands forming the largest contingent of such. Habitat connectivity still exists as a result of the interconnectedness of the wetlands.		
Habitat Availability	Although widespread habitat disturbance has occurred, the faunal habitat is still considered suitable for a relatively diverse range of mammal species, albeit predominantly the smaller mammal species. Habitat availability was highest within the wetland and grassland areas, whilst the transformed areas and rocky grassland had a noticeably decreased availability in terms of mammal species		

5.3 Avifauna

Table 11: Field assessment results pertaining to avifaunal species within the linear development.

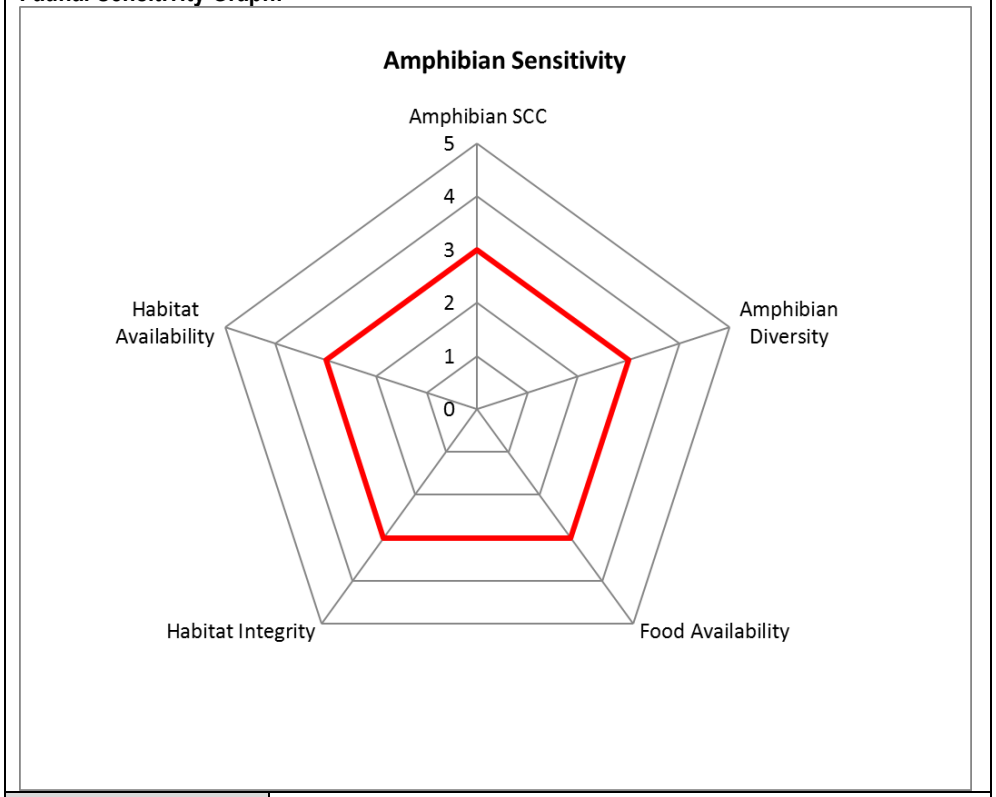
Faunal Class: **Avifauna**	**Faunal Habitat Sensitivity**	**Moderately high**
	Notes on Photograph: Top: Lesser Flamingo (*Phoeniconaias minor*) and *Sagittarius serpentarius* (Secretarybird) Bottom: *Asio capensis* (Marsh Owl).	
Faunal Sensitivity Graph: 		
Faunal SCC/Endemics/TOPS/	Two avifaunal SCC was recorded along the linear development, namely *Sagittarius serpentarius* (Secretarybird, Vulnerable) and *Phoenicopterus minor* (Lesser Flamingo, Near Threatened). No other avifaunal SCC were observed or are expected along the linear development.	

Photograph:

Faunal Diversity	Avifaunal diversity is considered to be moderately high, regardless of the impacts from the surrounding agricultural and mining activities. Species observed were those commonly associated with the grassland habitats. Species diversity was highest in the wetland and grassland areas. A number of water fowl were observed at the dam within the mining property. Species such as *Buteo rufofuscus* (Jackal Buzzard), *Sagittarius serpentarius* (Secretarybird), *Anas undulata* (Yellow-billed Duck), *Ardea cinerea* (Grey Heron), *Plectropterus gambensis* (Spur-winged Goose) and *Myrmecocichla formicivora* (Anteating Chat). For a full list of avifaunal species see Appendix F.	**General comments (dominant faunal species/noteworthy records etc.):** Impacts from mining and agricultural related activities have resulted in decreased habitat connectivity and suitability. However avifaunal species are generally less impacted upon by these disturbances, largely as a result of their increased mobility. However, continued loss of habitat and resources will lead to a decrease on avifaunal numbers and possibly species losses from the area.	**Business Case, Conclusion and Mitigation Requirements:** The linear development and the associated habitat is considered to be of a moderately high sensitivity in terms of avifaunal conservation. The wetland habitat is deemed to be the most important faunal habitat, as it provides the highest degree of resources. All mitigation measures as stipulated within this report must be implemented so as to ensure minimal impacts affect avifaunal species and the habitat thereof within and surrounding the linear development.
Food Availability	The food provision of the area is considered to be moderately high with the wetland, grasslands and agricultural fields forming the bulk of the foraging areas. Small rodent species are the main food source for many of the raptors.		
Habitat Integrity	Habitat integrity is considered to be of a moderate level. Large tracts of avifaunal habitat have been transformed or disturbed, leaving only patches of viable habitat available to avifaunal species.		
Habitat Availability	The wetlands and surrounding grassland habitat are considered to be the primary habitat for many of the avifaunal species in the areas. The remaining habitats are utilised for foraging, with the trees along route 1 being utilised for nesting and roosting.		

5.4 Amphibians

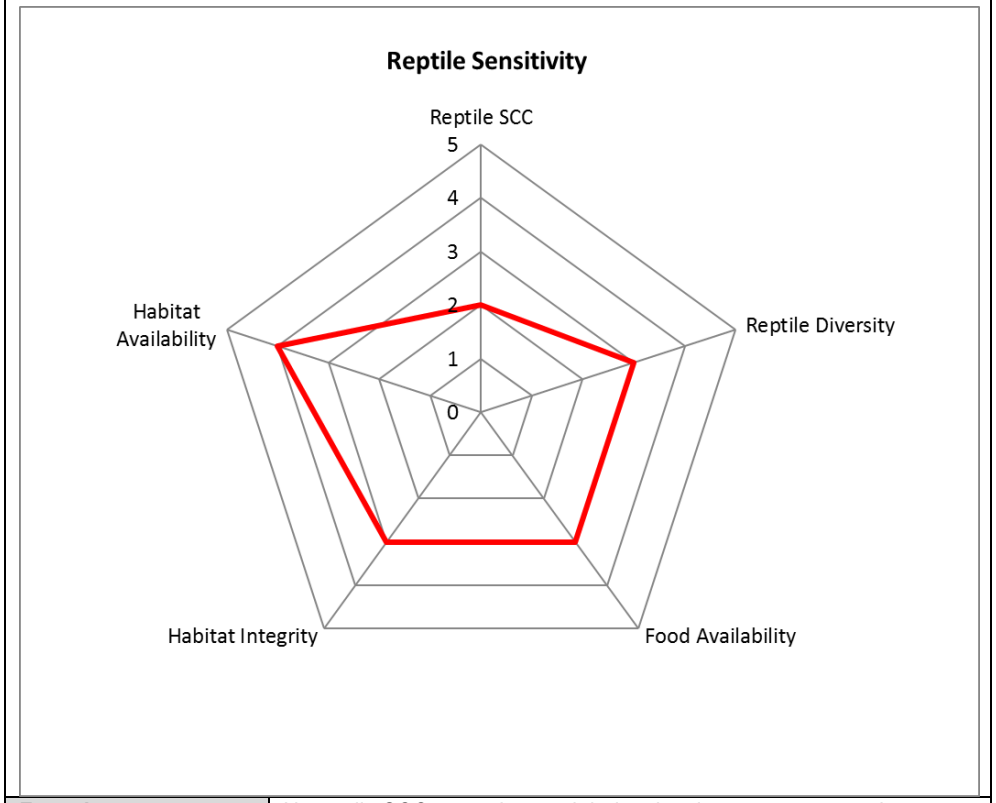
Table 12: Field assessment results pertaining to amphibian species within the linear development.

Faunal Class: Amphibians	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:**  
	Notes on Photograph: Wetland habitat along the linear development that is favourable to amphibian species		
Faunal Sensitivity Graph: 			
Faunal SCC/Endemics/TOPS/	Only one amphibian SCC is likely to occur within the wetland and surrounding grasslands associated with the linear development, namely *Pyxicephalus adspersus* (Giant Bullfrog, Vulnerable). Populations of this species are likely to be found in the outer edges of the wetlands and low lying grasslands that surround the wetlands, within sandy non clay soil.		

Faunal Diversity	No amphibians were observed during the assessment of the linear development, however suitable habitat for amphibians was found. According to the South African Frog Atlas (SAFAP) for the QDS 2629AB, an intermediate diversity of amphibians can be expected in the wetland and moist grassland areas. Species such as *Amietophrynus gutturalis, Cacosternum boettgeri* and *Kassina senegalensis* are likely to occur in the wetland areas.	**General comments (dominant faunal species/noteworthy records etc.):** Amphibian populations appeared to be localised within the wetland and seasonally inundated depressions within the valley bottom wetland. The soil moisture content was observed to be higher within these areas and were food resources were more accessible and abundant. For a full list of species observed see Appendix D.	**Business Case, Conclusion and Mitigation Requirements:** The amphibian sensitivity associated with the linear development is considered to be intermediate. The wetlands are optimal amphibian habitat, and as such, all mitigation measures as stipulated within this report must be implemented so as to ensure that the available habitat is minimally impacted upon, and impacts to amphibian species are minimised as far as possible.
Food Availability	A large abundance of invertebrates was observed, particularly within the valley wetlands. These invertebrates are a primary food resource for amphibian species.		
Habitat Integrity	Habitat integrity for amphibians is considered to be intermediate. There is still a good degree of connectivity between the wetlands and grasslands, of which are favoured by amphibians.		
Habitat Availability	The wetlands provide suitable habitat for amphibian species that are more water dependant, whilst the grassland areas surrounding the wetlands are suitable for amphibian species that have a decreased dependency on permanent water bodies.		

5.5 Reptiles

Table 13: Field assessment results pertaining to reptile species within the linear development.

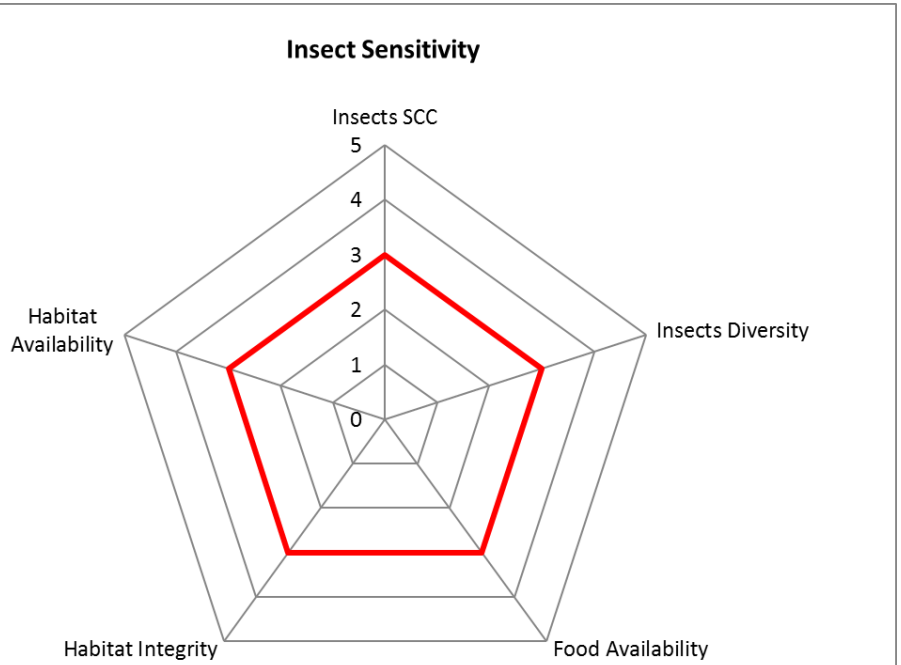
Faunal Class: Reptiles	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:** 
	Notes on Photograph: Wetland and grassland habitat were the majority of reptile species are likely to be observed.		
Faunal Sensitivity Graph: 			
Faunal SCC/Endemics/TOPS/	No reptile SCC were observed during the site assessment and none are expected to be present within the habitats traversed by the linear development.		

Faunal Diversity	Although no reptile species were observed during the field assessment, largely as a result of the winter season and cold temperatures, the habitat of the linear development is considered to have an intermediate reptile diversity. Many of the reptiles that are expected to occur along the linear development are those best adapted and suited to the grassland biome, mainly predatory snakes and lizards. Furthermore, the presence of speciality predatory birds like *Sagittarius serpentarius* (Secretarybird) that only prey on snakes indicates that the habitat of the linear development is suitable to these species.	**General comments (dominant faunal species/noteworthy records etc.):** Only common reptile species such as *Bitis arietans* (Puff Adder), *Hemachatus haemachatus* (Rinkhals), *Crotaphopeltis hotamboeia* (Herald Snake), *Pachydactylus capensis* (Cape Gecko) are to be expected to be present within the linear development, notably in areas of increased food and water resources. No reptile SCC were encountered and none are likely to occur within the habitat through which the linear development traverses.	**Business Case, Conclusion and Mitigation Requirements:** The reptile habitat sensitivity is intermediate. Reptile species are expected to be relatively localised around the wetland areas, as well as any old infrastructures. The wetland habitat unit is expected to be a primary source of viable resources for many reptile species, although it is unlikely that reptile species will limit themselves to this habitat only.
Food Availability	An abundance of small mammals and invertebrates provide a primary food resource for predatory snakes and lizards. Furthermore, small frogs that occur within or nearby the wetlands will also form part of the prey base of predatory snakes.		
Habitat Integrity	Overall the habitat integrity of the linear development was considered to be intermediate. Although habitat disturbance has occurred, the overall ecological connectivity in terms of the movement of reptile has not been severely affected.		
Habitat Availability	Much of the area has been transformed through farming and mining practices. However, many reptiles are adept at adapting to and utilising new environments, notably snakes. The open grasslands and old burrows of rodents provide habitat and areas of refuge for reptile species.		

5.6 Insects

Table 14: Field assessment results pertaining to insect species within the linear development.

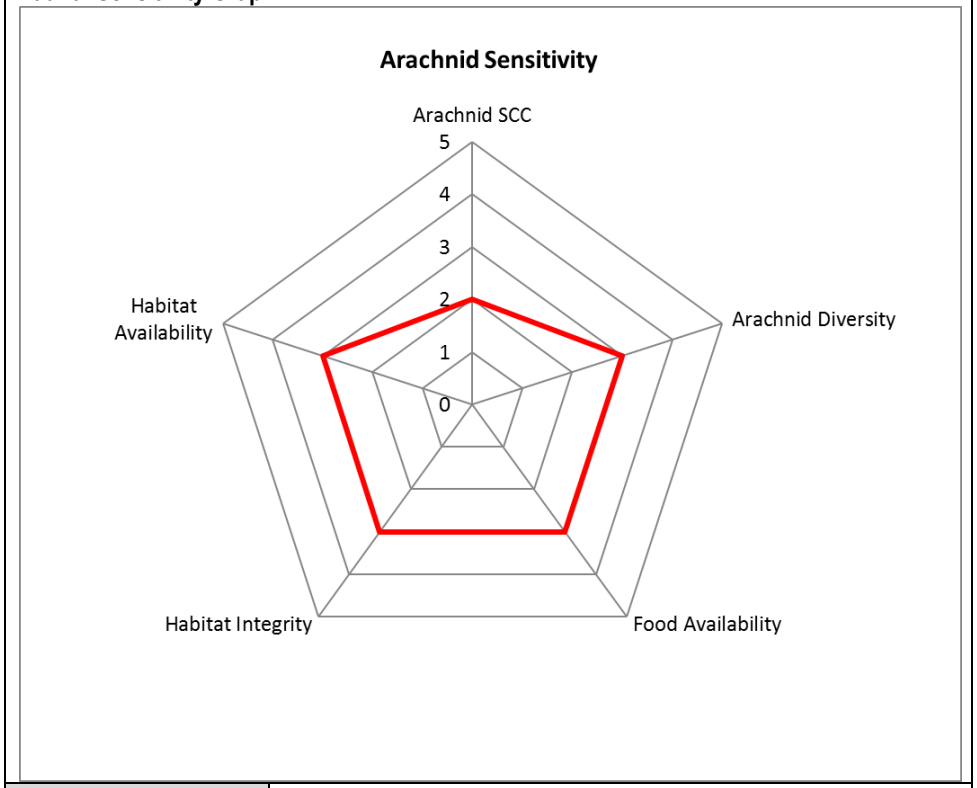
Faunal Class: **Insects**	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:**
	Notes on Photograph: Above: *Gastrimargus sp*; Below: *Junonia orithya madagascariensis* (Eyed Pansy).		
Faunal Sensitivity Graph:			
Faunal SCC/Endemics/TOPS/	No SCC were observed, however there remains the possibility that *Metisella meninx* (Marsh Sylph, Vulnerable) may occur within the linear development, notably in the wetland habitat unit.		



Faunal Diversity	Overall, insect diversity of the linear development is considered to be intermediate, however the overall insect abundance was fairly high. The intermediate diversity is mainly attributed to the season shifts experienced prior to the assessment and the unusually dry summer months that have been experienced this year. Only common species were observed, including *Belenois aurota* (Brown-veined White), *Junonia hierta* (Yellow Pansy), *Acanthacris ruficornis* (Garden Locust), *Danaus chrysippus* (African Monarch) and *Pantala flavescens* (Wandering Glider).	**General comments (dominant faunal species/noteworthy records etc.):** The wetlands and grasslands are considered important in terms of ongoing insect survival of the greater area. A healthy and strong insect population is necessary to ensure a suitable and ongoing food resource for a number of other species, as well as the insects playing a vital role in terms of pollinating plant species.	**Business Case, Conclusion and Mitigation Requirements:** The insect habitat sensitivity is considered to be intermediate. The grasslands and wetlands provide a range of varying habitats for insect species. These species in turn are utilised as a food source by numerous other faunal species. The construction footprint should be kept as small as possible, with all edge effects such as alien plant proliferation and soil erosion suitably managed.
Food Availability	The grassland and wetland habitat units proved suitable habitat in terms of food provision for a number of insect species. The overall food availability for insects within the linear development is considered to be intermediate.		
Habitat Integrity	Overall habitat integrity is considered to be intermediate, the wetland habitat and periphery grasslands still exhibit a degree of connectivity.		
Habitat Availability	Both the wetlands and the grasslands provide suitable habitat to a number of insect species. The areas where the herbaceous layer has been decreased, notably in the mining properties, agricultural fields and rocky grassland had a decreased level of habitat provision for insect species.		

5.7 Arachnids

Table 15: Field assessment results pertaining to arachnid species within the linear development.

Faunal Class: **Arachnids**	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:**
	Notes on Photograph: *Olurunia ocellata* (Funnel-web spider) web observed in the wetland habitat		
Faunal Sensitivity Graph: 			
Faunal SCC/Endemics/TOPS/	No arachnid SCC were observed within the linear development, nor are any expected to occur within the habitats of the linear development.		

Faunal Diversity	A small number of arachnid species were observed that are known to be commonly occurring in grassland and wetland areas. A combination of habitat disturbance, general secretive nature and small size often betrays the true diversity of arachnid species. The habitat and suitable insect population allows for the inference that the linear development is likely to have a healthy arachnid population	**General comments (dominant faunal species/noteworthy records etc.):** Anthropogenic and past farming activities, specifically ploughing and earth moving activities related to mining have impacted upon the arachnid species composition of the linear development. However, there still appears to be a number of arachnid species present within the linear development, which is to be expected due to suitable food and habitat resources. Although no scorpions were observed within the linear development during the time of the assessment, it is likely that commonly occurring species, notably those that are known to occur around human habitation and disturbed habitats, are likely to be found within the linear development. Scorpion species expected to occur within the various habitats include *Pseudolychas pegleri* (Plain Pygmy-thicktail) and *Uroplectes triangulifer* (Highveld Lesser-thicktail).	**Business Case, Conclusion and Mitigation Requirements:** Arachnid habitat sensitivity is considered to be intermediate. The construction footprint should be kept as small as possible in order to minimise impacts to the receiving environment. Provided that mitigation measures are implemented and the development footprint is kept as small as possible, the linear development is unlikely to have any long term detrimental impacts to arachnid species or habitat.
Food Availability	The relatively high number of insects within the linear development provides a suitable food source for many of the arachnid species.		
Habitat Integrity	Habitat integrity is considered to be intermediate as a result of habitat disturbance from farming and mining activities. There was very little variation in species observed along the linear development, with the habitat units appearing to be inhabited by similar species.		
Habitat Availability	The linear development is considered to have an intermediate level of habitat availability for arachnid species. The habitat within the linear development provides habitat for different arachnid species, both web building and ground hunting spiders, as well as terrestrial based scorpions.		

5.8 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 linear development. Species listed in Appendix G whose known distribution ranges and habitat preferences include the linear development were taken into consideration. The species listed below are considered to have an increased probability of occurring within or being affected by the linear development.

Table 16: Faunal SCC that obtained a POC score of 60% or more.

Scientific Name	Common Name	MP SoER 2003	POC %
Pyxicephalus adspersus	Giant Bullfrog	VU	60%
Sagittarius serpentarius	Secretarybird	Vu	100%
Phoenicopterus minor	Lesser Flamingo	NT	100%
Metisella meninx	Marsh Sylph	VU	60%

From the table it is evident that only two SCC have an increased POC and may occur within the wetland habitats. *Pyxicephalus adspersus* (Giant Bullfrog) and *Metisella meninx* (Marsh Sylph) are under threat as a result of habitat loss, namely wetlands and moist grasslands. *Sagittarius serpentarius* (Secretarybird) and *Phoenicopterus minor* (Lesser Flamingo) were both observed along the linear development, with *Sagittarius serpentarius* (Secretarybird) being observed hunting within the borders of the valley bottom wetlands along Route 2, whilst *Phoenicopterus minor* (Lesser Flamingo) was observed within the large dam present within the mining area, in close proximity to Route 2.

The Wetlands and Secondary and Moist grasslands are considered to be the most likely habitats in which these species may be found, and as such increased importance needs to be placed on limiting, and where applicable, mitigating impacts that occur within these habitat units.

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 intactness 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.

Routes 2 and 3 are considered to be more sensitive in terms of faunal species, as both these routes are located in the valley bottoms and traverse a number of suitable wetland habitat areas. The tall dense grass structure observed in the lower topographical regions of the valley bottom wetlands through which Routes 1 and 2 traverse provide habitat to a large number of faunal species. These areas of habitat provide resources and refuge in an area that has already undergone large degrees of transformation. Route 1 is deemed to have a lower level of sensitivity in terms of faunal species in comparison to Routes 2 and 3.

Table 17: A summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Transformed (Mining and Agricultural) habitat	Low	Optimise development potential.	Although construction activities in this area are unlikely to have a significant impact on the receiving environment, care must be taken to limit edge effects on the surrounding natural areas.
Transformed Grassland	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat unit is of moderately low ecological importance and sensitivity and construction related activities are unlikely to have a significant impact on the receiving environment. However, cognisance must be taken of edge effect management so as to limit disturbances to the surrounding habitat.
Rocky Grassland; Secondary Grassland; Moist Grassland	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential	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.
Wetlands	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	Should a wetland crossing be necessary, directional drilling should be utilised in order to lay the proposed pipeline with minimal surface impact to the wetlands. The surface construction footprint is to be kept to an absolute minimum.

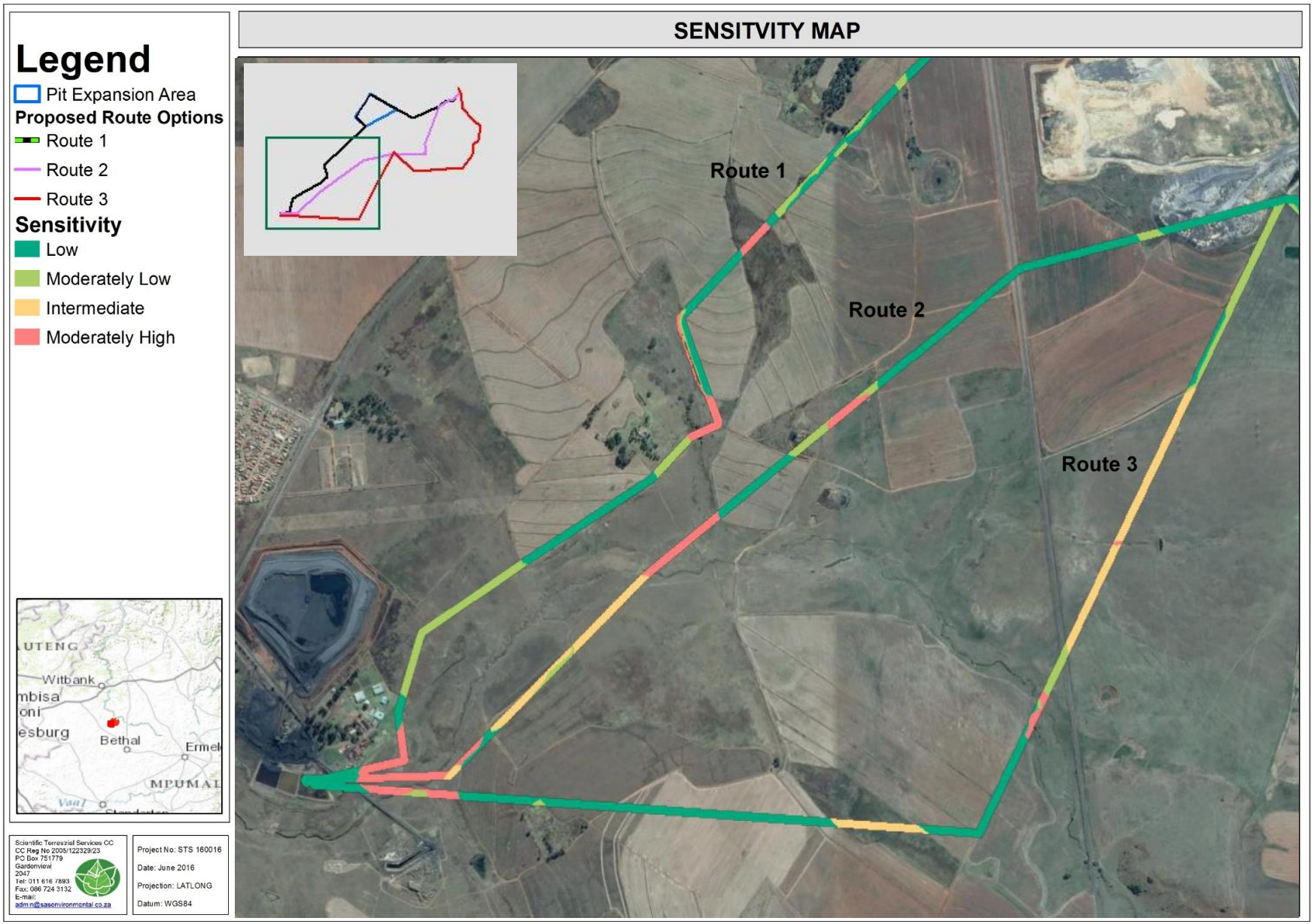


Figure 7: Combined sensitivity map of the linear development for fauna and flora.

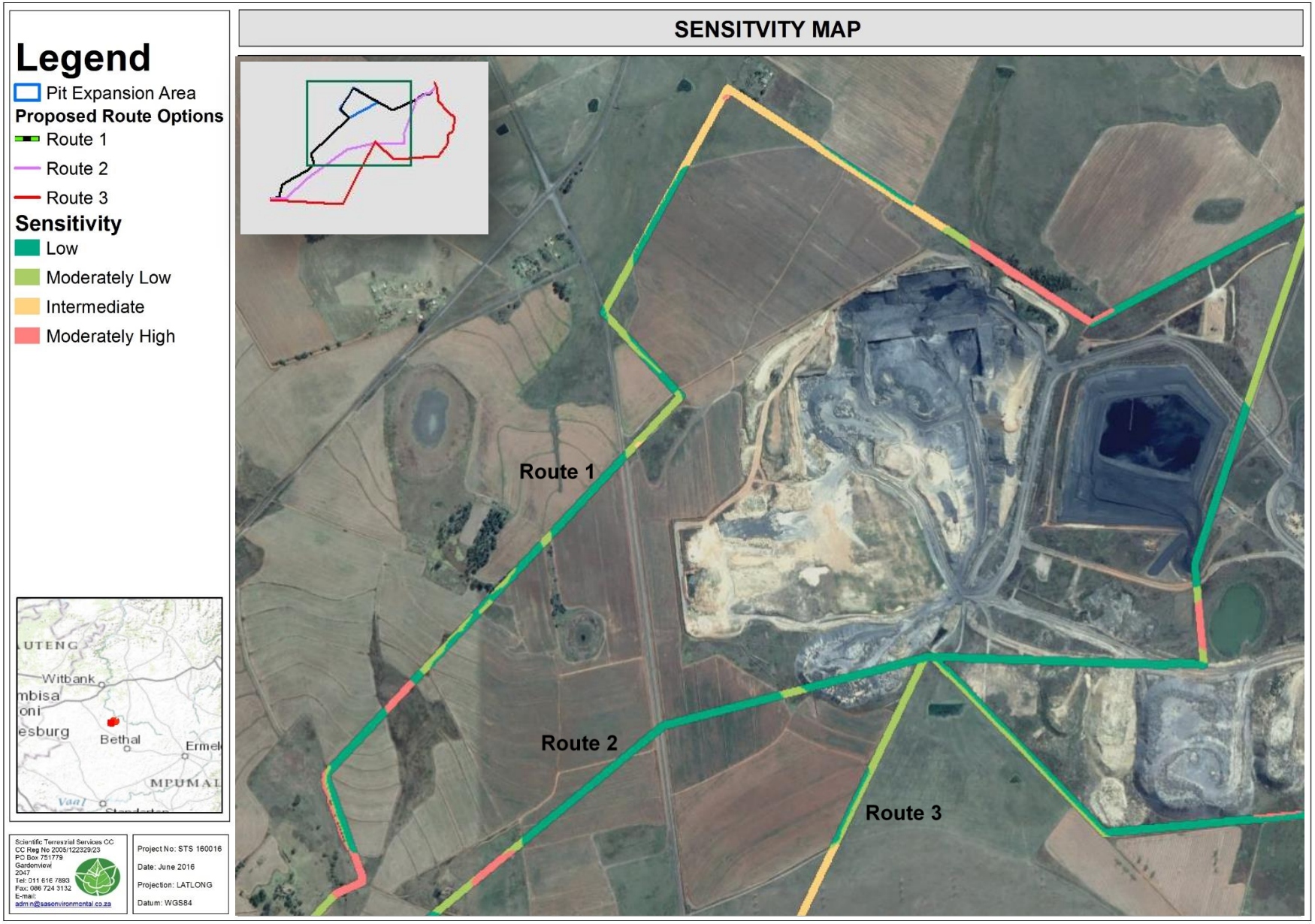


Figure 8: Combined sensitivity map of the linear development for fauna and flora.

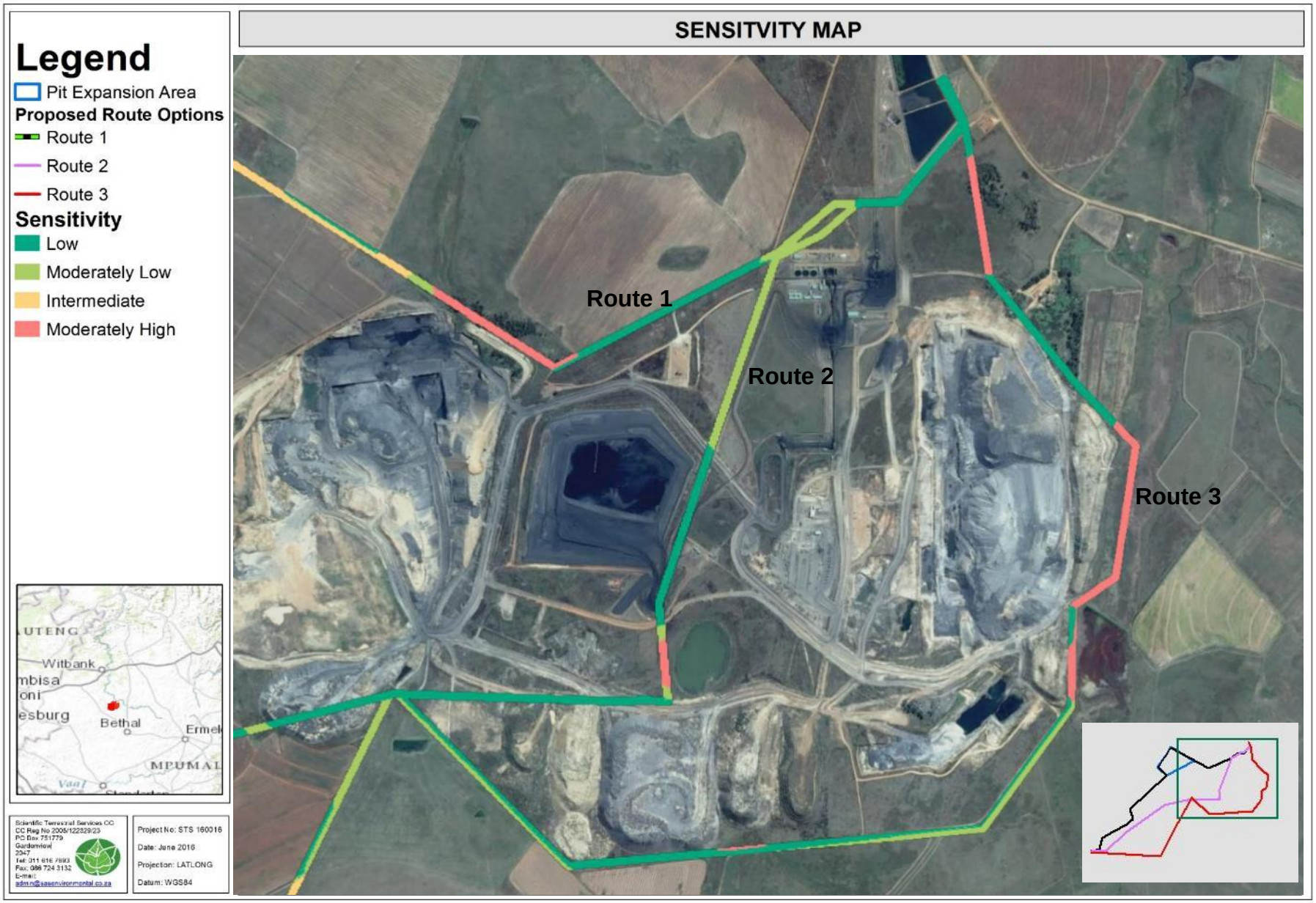


Figure 9: Combined sensitivity map of the linear development for fauna and flora.

7. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology of the linear development, with each individual impact identified presented in Section 7.1 and 7.2 of this report. A summary of all potential pre-construction, construction and operational impacts is provided in Section 7.3.

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 7.4.

7.1 IMPACT 1: Impact on Habitat for Floral Species

The tables below present the impact ratings of the various activities that might take place during the operational phase and those that might have taken place during construction phase, on the floral habitat and species diversity of the area. Essential and recommended mitigation measures are also presented.

Activities and aspects register

Pre-Construction	Construction	Operational
Possible insufficient planning of infrastructure placement and design leading to 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
	Loss of floral biodiversity through invasion of alien species	Increased introduction and proliferation of alien plant species and further transformation of natural habitat
	Movement of construction vehicles and access road construction	On-going disturbance may lead to erosion and sedimentation
	Dumping of material outside designated areas leading to loss of floral habitat	Poor management and monitoring of rehabilitation measures
	Compaction of soils reducing floral re-establishment	

Placement and construction of the linear development will result in the removal of vegetation and loss of floral habitat. Although the vegetation has been disturbed as a result of surrounding agricultural activities, grazing of livestock and mining activities, habitat units such as the

wetlands are still considered to be in a good condition. Loss of vegetation within the habitat units will result in a further and ongoing degradation of the floral habitat units, resulting in an altered species composition and alien plant proliferation. Prior to mitigation measures, impacts are expected to be medium-high to medium low during the construction and operational phase, decreasing to a low level impact with the implementation of mitigation measures.

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
Route 2	Construction phase	4	3	4	4	3	7	11	77 (Medium high)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
Route 3	Construction phase	4	3	4	4	3	7	11	77 (Medium high)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)

Routes	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 2	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 3	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)

7.2 IMPACT 2: Impact on Floral Diversity

The tables below present the impact ratings of the various activities that might take place during the operational phase and those that might have taken place during construction phase, on the floral habitat and species diversity of the area. Essential and recommended mitigation measures are also presented

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
	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
	Increased fire frequency and intensity, as well as uncontrolled fires due to increased human activity may 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	

Floral diversity within the habitat units has been decreased as a result of historic and on-going disturbances from mining and agriculture. Floral species diversity was highest within the wetland habitat, and lowest in the agricultural and mining areas. 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.

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	4	3	4	3	3	7	10	70 (Medium low)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
Route 2	Construction phase	4	3	4	3	3	7	10	70 (Medium low)
	Operational phase	4	3	4	3	3	7	10	70 (Medium low)
Route 3	Construction phase	4	3	4	3	3	7	10	70 (Medium low)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	1	3	5	6	30 (Low)
Route 2	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	3	5	7	35 (Low)
Route 3	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	2	3	5	7	35 (Low)

7.3 IMPACT 3: Impacts on Floral SCC

The tables below present the impact ratings of the various activities that might take place during the operational phase and those that might have taken place during construction phase, on the floral habitat and species diversity of the area. Essential and recommended mitigation measures are also presented

Aspects and activities register

Pre-Construction	Construction	Operational
Potential placement of infrastructure in floral SCC habitat in the Channelled and Unchannelled valley bottom wetlands	Site clearance and removal of indigenous vegetation including floral SCC	An increase in alien plant species leading to loss of medicinal plant species by outcompeting these species
	Construction of infrastructure in natural areas	Ineffective rehabilitation of exposed and impacted areas leading to on-going loss of medicinal plants
	Increased anthropogenic activity within the linear development and an increase in the collection of plant material for medicinal and other	
	Potential uncontrolled fires due to increased human activity may impact on floral communities	

No floral SCC that is listed as protected under the Mpumalanga Nature Conservation Act (MNCA) of 1998 was observed during the site assessment. However, *Crinum bulbispermum* was deemed to have an increased POC, most likely occurring within the valley bottom wetlands. 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 low levels of significance. The medicinally important species *Hypoxis hemerocallidea* was observed along Route 1. Should any of these individuals be located within the construction footprint, a rescue and relocation plan needs to be implemented in order to relocate this species to suitable similar habitat in the areas.

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	5	3	4	3	3	8	80	80 (Medium high
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
Route 2	Construction phase	4	3	4	3	3	7	10	70 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
Route 3	Construction phase	4	3	4	3	3	7	10	70 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	5	3	3	2	2	8	7	56 (Medium low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 2	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 3	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30(Low)

7.4 IMPACT 4: Loss of Faunal Habitat and Ecological Structure

All proposed development activities that may impact on the faunal community of the linear development are discussed below.

Activities and aspects leading to impact

Pre-Construction	Construction	Operational
Placement of infrastructure in sensitive wetland habitat areas	Site clearing and the removal of faunal habitat leading to increased habitat loss	Increased fire frequency during operation leading to a loss of sensitive faunal habitat
	Loss 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
	Erosion as a result of mining development and storm water runoff resulting in a loss of faunal habitat	
	Movement of construction vehicles and access road construction through sensitive faunal habitat	
	Failure to implement a rehabilitation plan and alien floral control plan during the construction phase	
	Possible increased fire frequency during construction leading to a loss of sensitive faunal habitat	

Construction of the water pipeline will result in the loss of faunal habitat, notably within the wetland and grassland (secondary and moist) habitat unit. Although the vegetation associated with the linear development has been disturbed as a result of crop farming activities, grazing of livestock and current mining edge effects these areas still provide habitat to support a number of indigenous faunal species, as well as faunal SCC. Placement of the linear development within the wetland habitat will result in the loss of intact 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 for all habitat units

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
Route 2	Construction phase	5	3	3	3	3	8	9	72 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
Route 3	Construction phase	5	3	3	3	3	8	9	72 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)

	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 2	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 3	Construction phase	3	3	3	3	2	6	8	48 (Low)
	Operational phase	2	3	2	2	3	5	7	35 (Low)

7.5 IMPACT 5: Loss of Faunal Diversity and Ecological Integrity

Activities and aspect register

Pre-Construction	Construction	Operational
Placement of surface infrastructure in sensitive wetland habitats.	Site clearing and the removal of vegetation leading to a loss of faunal habitat and faunal diversity	Increased introduction and proliferation of alien plant species and further transformation of faunal habitat and diversity
	Loss of faunal habitat through invasion of alien species in disturbed areas resulting in altered faunal diversity	Collision of faunal species with operational vehicles
	Erosion as a result of storm water runoff leading to a loss of faunal diversity.	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	Collision of faunal species with operational vehicles
	Increased fire frequency during construction leading to a loss of faunal diversity	
	Poaching and trapping of faunal species	

Faunal diversity within the linear development and surrounding areas has decreased as a result of historic and on-going disturbances from farming, alien plant proliferation and mining related edge effects. Faunal species diversity was noted to be highest in the more intact habitats, notably the wetland and grassland (Secondary and Moist Grassland) habitats. The impact significance associated with the loss of faunal species diversity is considered to be medium low to low prior to the implementation of mitigation measures.

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	3	3	3	3	3	6	9	54 (Medium low)
Route 2	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
Route 3	Construction phase	4	3	3	3	3	7	9	72 (Medium low)
	Operational phase	4	3	3	3	3	7	9	63 (Medium low)
	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 2	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 3	Construction phase	3	3	3	2	3	6	8	48 (Low)
	Operational phase	2	3	2	2	3	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
Placement of infrastructure within areas of potential faunal SCC 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	

Two faunal SCC namely *Sagittarius serpentarius* (Secretarybird) and *Phoenicopterus minor* (Lesser Flamingo) were observed along the linear development, notably along Route 2. Furthermore, 2 other species *Pyxicephalus adspersus* (Giant Bullfrog) and *Metisella meninx* (Marsh Sylph) have an increased possibility of occurring within the habitat through which the linear development traverses. 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.

Routes	Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	3	3	3	3	3	6	9	54 (Medium low)
	Operational phase	3	3	3	3	2	6	8	48 (Low)
Route 2	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	3	3	3	3	2	6	8	48 (Low)
Route 3	Construction phase	4	3	3	3	3	7	9	63 (Medium low)
	Operational phase	3	3	3	3	2	6	8	48 (Low)

	Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Route 1	Construction phase	2	3	2	2	2	5	6	30 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 2	Construction phase	3	3	2	2	2	6	6	36 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (Low)
Route 3	Construction phase	3	3	3	2	2	6	7	42 (Low)
	Operational phase	2	3	2	2	2	5	6	30 (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 medium-high to medium-low level impacts. If effective mitigation takes place, all impacts may be reduced to low levels of significance.

Table 18: A summary of the results obtained from the floral impact assessment

	Impact 1: Impacts on habitat for floral species	Pre-mitigation	Post-mitigation
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium High	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium High	Low
	Operational	Medium Low	Low
	Impact 2: Impacts on floral diversity	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 3: Impacts on floral SCC	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium High	Medium Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low

Table 19: A summary of the results obtained from the faunal impact assessment

	Impact 4: Loss of Faunal Habitat and Ecological Structure	Pre-mitigation	Post-mitigation
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 5: Loss of Faunal Diversity and Ecological Integrity	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Medium Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Medium Low	Low
	Impact 6: Impact on Faunal Species of Conservation Concern	**Pre-mitigation**	**Post-mitigation**
Route 1	Construction	Medium Low	Low
	Operational	Low	Low
Route 2	Construction	Medium Low	Low
	Operational	Low	Low
Route 3	Construction	Medium Low	Low
	Operational	Low	Low

7.8 Integrated Impact Mitigation

Mitigation Measures

- Should any floral or faunal SCC be encountered within the linear development during the construction phase, the following should be ensured:
  - Effective relocation of individuals to suitable similar habitat in the vicinity of the linear development must be ensured;
  - All rescue and relocation plans should be overseen by a suitably qualified specialist;
- It is recommended that site clearing takes place in a phased manner to allow for any faunal species present to move away from the linear development;
- If possible, avoid placement of the linear development within the sensitive wetland habitat unit. If this is unavoidable, wetland crossing are to be made at an acute angle to the wetland, and where possible directional drilling is to be used, running the pipe below the wetland surface whilst avoiding any excavation activities directly within the wetlands themselves;

- 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 so as to minimise further impacts to the receiving environment;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- Should new road development be necessary during construction activities, the roads should be ripped and rehabilitated at the end of construction 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;
- As far as possible, indigenous grassland species, including grasses, should be used to revegetate bare areas. It is suggested that species such as *Cynodon dactylon* and *Eragrostis sp* be used for revegetation purposes;
- Informal fires by construction personnel should be prohibited;
- Edge effect control needs to be implemented within construction areas, with specific consideration to erosion control and alien floral species management;
- Alien vegetation as listed in Appendix F must be removed from the linear development during both the construction and operational phases, with specific mention of Category 1b species in line with the NEMBA Alien and Invasive Species Regulations (2014); and
- Establishment of reintroduced vegetation must be monitored during the operational phase.

Rehabilitation Plan:

- Disturbed and cleared areas need to be revegetated with indigenous grass species in order to help stabilise the soil surface

- All alien plants within the linear development should be cleared, with follow up activities running concurrently for one year;
- Erosion berms and hessian sheets are to be used in areas where soils are susceptible to high levels of erosion;
- Soils that have been compacted as a result of the construction and operational activities must be ripped and profiled in line with the surrounding area; and
- Where wetland areas have been impacted upon, these areas need to be rehabilitated and in stream flow must be reinstated where necessary;

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;
- Altered wetland vegetation structure;
- Disturbed areas are unlikely to be rehabilitated to pre-development conditions of ecological functioning and significant loss of faunal habitat and species diversity will most likely be permanent.
- Altered wetland vegetation structures; and
- Eroded and incised wetlands are unlikely to be rehabilitated;

8. CONCLUSION

Based on the terrestrial impact assessment of potential impacts on floral and faunal habitat, diversity and SCC along the linear development and surrounding habitats, it is evident that impacts are medium low prior to mitigation, decreasing to low significance levels should mitigation measures be implemented. Should any floral SCC be encountered during the construction of the linear development, they should be relocated to suitable habitat in the vicinity of the linear development by a suitably qualified specialist. From the above results of the site assessment and the impact assessment, it is recommended that Route 1 be considered as the favorable route, as it is deemed to have the lowest impact levels on the surrounding environment. Furthermore, following the site assessment, the pit expansion area is not deemed to provide any viable floral or faunal habitat, and is predominated by crop fields. As such, development in this area is not deemed to be detrimental to floral and faunal species within the area.

It is the opinion of the ecologists that, from a terrestrial ecological point of view, 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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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 linear development 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 linear development 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 linear development 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 linear development, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the linear development. 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 in the Mpumalanga DACE, 2003 report in conjunction with 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 linear development. 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 linear development. 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 linear development 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 linear development, all insect species visually observed were identified, and where possible photographs taken. Furthermore, at suitable and open sites within the linear development 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 linear development 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 linear development.

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 linear development 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 linear development 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 linear development 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 linear development 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 linear development 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 C2. 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 C2: 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 / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected <	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected <	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments 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 C3: 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 C4: 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.
- 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 – Vegetation Types

Eastern Highveld Grassland

Distribution

Eastern Highveld Grassland occurs in the Mpumalanga and Gauteng Provinces. It occurs in the plains between Belfast in the east and the eastern side of Johannesburg in the west and extends southwards to Bethal, Ermelo and west of Piet Retief. Altitude ranges from 1 520m to 1 780m, but also declines as low as 1 300m (Mucina & Rutherford, 2006).

Climate

Eastern Highveld Grassland is characterised by strongly seasonal summer rainfall, with very dry winters. The Mean Annual Precipitation (MAP) ranges from 650 to 900 mm (overall average: 726 mm). The MAP is considered relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit, but drops to 21% in the east and southeast. Incidences of frost form (13-42 days) have been recorded, but are higher at higher elevations (Mucina & Rutherford, 2006).

The Mean Annual Soil Moisture Stress (MASMS) value for the region is 73%. These values, when compared to the Mean Annual Temperature (MAT) and Mean Annual Potential for Evaporation (MAPE) averages of 14.7°C and 1,926mm, respectively, show the region to be a relatively water-stressed area. Conservation of surface (and ground) water resources is therefore imperative to biodiversity conservation within the region.

Table E1: General climatic information for the Eastern Highveld Grassland (Mucina & Rutherford, 2006).

Bioregion	Vegetation types	Altitude (m)	MAP* (mm)	MAT* (°C)	MAPE* (mm)	MASMS* (%)
Mesic Highveld Grassland	*Eastern Highveld Grassland*	1520 - 1780	726	14.7	1926	73

**MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply).*

Geology and soils

The area is characterised by red to yellow sandy soils of Ba and Bb land types found on shales and sandstones of Madzaringwe formation (Karoo Supergroup), which are prominent throughout the Eastern Highveld Grassland (Mucina & Rutherford, 2006).

Conservation

Eastern Highveld Grassland is considered endangered. Only a very small fraction is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkranse, Kransbank, Morgenstond). Some 44% is transformed primarily by cultivation, plantations, mines, and urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but Acacia mearnsii can become dominant in disturbed areas. Erosion is very low (Mucina & Rutherford, 2006).

Taxa of the Eastern Highveld Grassland

In terms of recent vegetation classifications, the assessed area occurs within the Eastern Highveld Grassland vegetation type (Mucina & Rutherford, 2006). This vegetation occurs in slightly too moderately undulating plains including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual Highveld grass composition (*Aristida, Digitaria, Eragrostis,*

Themeda, Tristachya etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lyciodes subsp lyciodes, Parinari capensis, Protea caffra, P. welwitschii and Rhus magalismontanum*). Key indicator species of this vegetation type include:

- Succulent herbs: *Aloe ecklonis;*
- Low Shrub: *Anthospermum rigidium* subsp*. pumilum, Stoebe plumosa;*
- Geophytic herbs: *Gladiolus crassifolius, Haemanthus humilis* subsp. *hirsutus, Hypoxis rigidula* var. *pilosissima, Ledebouria ovatifolia;*
- Grass: *Aristida aequiglumis, A. congesta, A. junciformis* subsp. *galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, Sporobolus pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides;*
- Herbs: *Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides* subsp. *latifolia, Selago densiflora, Senecio*

APPENDIX F- Species List

Table F1: Dominant floral species encountered in the three route alternatives. 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, 2014.

=Grasses and sedges	Forbs and groundcovers	Trees and shrubs
Melinis repens subsp. *repens*	**Tagetes minuta*	**Eucalyptus camaldulensis* **1b**
Eragrostis chloromelas	**Bidens pilosa*	**Pinus patula* **1b**
Eragrostis curvula	*Ledebouria ovatifolia*	**Melia azedarach* **3 (Urban areas)**
Eragrostis superba	**Campuloclinium macrocephalum* **1b**	**Acacia mearnsii* **2**
Eragrostis gummiflua	**Verbena bonariensis* **1b**	**Populus x canescens* **2**
Hyparrhenia hirta	**Verbena brasiliensis* **1b**	**Salix babylonica* **2**
Hyparrhenia tamba	*Hypoxis hemerocallidea*	
Cynodon nlemfuensis	*Hypoxis iridifolia*	
**Cynodon dactylon*	*Helichrysum cephaloideum*	
Themeda triandra	*Helichrysum coriacium*	
Pennisetum thunbergii	**Datura stramonium* **1b**	
**Pennisetum clandestinum*	*Senecio venosus*	
Sporobolus africanus	*Dicoma anomala*	
Brachiaria brizantha	*Hermannia transvaalensis*	
Digitaria eriantha	**Conyza bonariensis*	
Heteropogon contortus	*Seriphium plumosum*	
Tricholaena monachne	*Helichrysum nodifolium*	
Typha capensis	**Cirsium vulgare*	
Cyperus rupestris		
Sporobolus fimbriatus		
Imperata cylindrical		
Setaria species		

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
Sylvicapra grimmia	Common Duiker	LC
Canis mesomelas	Black-backed Jackal	LC
Galerella sanguinea	Slender Mongoose	LC
Atilax paludinosus	Water Mongoose	LC
Aethomys chrysophilus	Red Vlei Rat	LC
Mus minutoides	Pygmy Mouse	LC
Hystrix africaeaustralis	African Porcupine	LC
Lepus saxatilis	Scrub Hare	LC
Galerella sanguinea	Slender Mongoose	LC
Mastomys coucha	Southern Multimammate Mouse	LC

LC = Least Concern, NT = Near Threatened

Avifaunal species observed

Scientific name	Common Name	IUCN Red List Status
Streptopelia capicola	Cape turtle-dove	LC
Merops bullockoides	White-fronted Bee-eater	LC
Euplectes orix	Southern Red Bishop	LC
Passer melanurus	Cape Sparrow	LC
Streptopelia senegalensis	Laughing dove	LC
Myrmecocichla formicivora	Ant eating chat	LC
Acridotheres tristis	Common Myna	LC
Streptopelia semitorquata	Red-eyed Dove	LC
Coturnix coturnix	Common Quail	LC
Cisticola tinniens	Zitting Cisticola	LC
Bubulcus ibis	Cattle Egret	LC
Lanius collaris	Southern Fiscal Shrike	LC
Bostrychia hagedash	Hadeda Ibis	LC
Delichon urbicum	Common House-martin	LC
Threskiornis aethiopicus	Sacred Ibis	LC
Bostrychia hagedash	Hadeda Ibis	LC
Ploceus velatus	Southern Masked-weaver	LC
Anthus cinnamomeus	African Pipit	LC
Cisticola fulvicapilla	Neddicky	LC
Passer domesticus	House sparrow	LC
Anthus cinnamomeus	African Pipit	LC
Corvus albus	Pied Crow	LC
Vanellus armatus	Blacksmith Lapwing	LC
Macronyx capensis	Cape Longclaw	LC
Crithagra gularis	Streaky-headed Seedeater	LC
Numida meleagris	Helmeted Guineafowl	LC
Euplectes progne	Long-tailed Widowbird	LC

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

Amphibian species observed or previously recorded by SAFAP for the relevant QDS (2629AB)

Scientific name	IUCN Red List Status
Amietophrynus gutturalis	Least Concern
Cacosternum boettgeri	Least Concern
Kassina senegalensis	Least Concern
Phrynobatrachus natalensis	Least Concern
Amietia angolensis	Least Concern
Schismaderma carens	Least Concern
Strongylopus fasciatus	Least Concern
Semnodactylus wealii	Least Concern
Xenopus laevis	Least Concern

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

Insect species observed

Order	Family	Scientific Name	Common Name	IUCN 2015 Status
Lepidoptera	Pieridae	*Belenois aurota*	Brown-veined White	NYBA
		Eurema brigitta brigitta	Broad-bordered Grass Yellow	NYBA
		Pontia helice helice	Meadow White	NYBA
		Phalanta phalanta	Common Leopard	NYBA
		Byblia ilythia	Spotted Joker	NYBA
	Nymphalidae	*Junonia octavia*	Gaudy Commodore	NYBA
		Junonia hierta	Yellow Pansy	LC
		Junonia orithya madagascariensis	Eyed Pansy	NYBA
		Vanessa cardui	Painted Lady	NYBA
		Danaus chrysippus	African Monarch	NYBA
Orthoptera	Acrididae	*Acanthacris ruficornis*	Garden Locust	NYBA
		Orthoctha dasycnemis	N/A	NYBA
		Truxaloides sp	N/A	NYBA
		Rachitopis sp	N/A	NYBA
		Oedaleus sp	N/A	NYBA
		Gastrimargus sp	N/A	NYBA
		Catantops humeralis	N/A	NYBA
	Pyrgomorphidae	*Zonocerus elegans*	Elegant Grasshopper	NYBA
Odonata	Libellulidae	*Pantala flavescens*	Wandering Glider	LC
Coleoptera	Meloidae	*Decapotoma lunata*	Lunate Blister Beetle	NYBA
		Mylabris oculata	CMR Bean Beetle	NYBA
Diptera	Bombyliidae	*Systoechus*	Woolly bee flies	NYBA
Hemiptera	Tessaratomidae	*Coridius nubilis*	N/A	NYBA
Isoptera	Hodotermitidae	*Hodotermesmossambicus*	Northern Harvester Termite	NYBA
Hymenoptera	Formicidae	*Anoplolepis custodiens*	Pugnacious Ant	NYBA
	Apidae	*Apis mellifera*	Honey Bee	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

APPENDIX G – Faunal SCC

Threatened mammal species that occur in the Mpumalanga Province (MP DACE, 2003).

English Name	Species	MP 2003 Status	IUCN 2015 Status
Cape mole rat	*Georychus capensis*	EN	LC
Sclater's golden mole	*Chlorotalpa sclateri montana*	CR	LC
Highveld golden mole	*Amblysomus septentrionalis*	VU	NT
Rough-haired golden mole	*Chrysospalax villosus rufopallidus*	CR	VU
Rough-haired golden mole	*Chrysospalax villosus rufus*	EN	VU
Juliana's golden mole	*Neamblysomus julianae*	EN	VU
Robust golden mole	*Amblysomus robustus*	VU	VU
Meester's golden mole	*Amblysomus hottentotus meesteri*	VU	NYBA
Laminate vlei rat	*Otomys laminatus*	VU	LC
Peak-saddle horseshoe bat	*Rhinolophus blasii empusa*	EN	LC
Lesser long-fingered bat	*Miniopterus fraterculus*	VU	LC
Welwitsch's hairy bat	*Myotis welwitschii*	EN	LC
Short-eared trident bat	*Cloeotis percivali australis*	EN	LC
Aardvark	*Orycteropus afer*	NT	LC
Oribi	*Ourebia ourebi*	VU	LC
African striped weasel	*Poecilogale albinucha*	NE	LC
Wild dog	*Lycaon pictus*	EN	EN
Pangolin	*Manis temminckii*	VU	LC
Aardwolf	*Proteles cristatus*	NT	LC
African Leopard	*Panthera pardus*	NT	NT
Natal red rock rabbit	*Pronolagus crassicaudatus ruddi*	NT	NYBA

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, NYBA = Not yet been assessed

Threatened avifaunal species that occur in the Mpumalanga Province (MP DACE, 2003).

English Name	Species	Status	IUCN 2015 Status
Whitewinged Flufftail	*Sarothrura ayresi*	CR	CR
Rudd's Lark	*Heteromirafra ruddi*	CR	VU
Yellow-breasted Pipit	*Anthus chloris*	VU	VU
Bald Ibis	*Geronticus calvus*	VU	VU
Botha's Lark	*Spizocorys fringillaris*	EN	EN
Wattled Crane	*Bugeranus carunculatus*	CR	VU
Blue Crane	*Anthropoides paradiseus*	VU	VU

English Name	Species	Status	IUCN 2015 Status
Grey Crowned Crane	*Balearica regulorum,*	VU	EN
Blue Swallow	*Hirundo atrocaerulea*	CR	VU
Pinkthroated Twinspot	*Hypargos margaritatus*	NT	LC
Chestnutbanded Plover	*Charadrius pallidus*	NT	NT
Striped Flufftail	*Sarothrura affinis*	VU	LC
Southern Ground Hornbill	*Bucorvus leadbeateri*	VU	VU
Black-rumped Buttonquail	*Turnix nanus*	EN	LC
Blue Korhaan	*Eupodotis caerulescens*	VU	NT
Stanley's Bustard	*Neotis denhami*	VU	NT
African Marsh Harrier	*Circus ranivorus*	VU	LC
Grass Owl	*Tyto capensis*	VU	LC
Whitebellied Korhaan	*Eupodotis cafra/ E. senegalensis*	VU	LC
Saddlebilled Stork	*Ephippiorhynchus senegalensis*	CR	LC
Lappetfaced Vulture	*Torgos tracheliotos*	EN	VU
Whiteheaded Vulture	*Trigonoceps occipitalis*	EN	VU
Bateleur	*Terathopius ecaudatus*	VU	NT
Cape Vulture	*Gyps coprotheres*	VU	VU
Martial Eagle	*Polemaetus bellicosus*	VU	VU
Peregrine Falcon	*Falco peregrinus*	VU	LC
Taita Falcon	*Falco fasciinucha*	NT	NT

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, NYBA = Not yet been assessed

Reptile species that are priorities in Mpumalanga Province (MP DACE, 2003).

English Name	Species	Status	IUCN 2015 Status
Haacke's flat gecko	*Afroedura haackei*	EN	NYBA
Abel Erasmus Pass flat gecko	*Afroedura sp.*	EN	NYBA
Mariepskop flat gecko	*Afroedura sp.*	EN	NYBA
Rondavels flat gecko	*Afroedura sp.*	EN	NYBA
Natal purple glossed snake	*Amblyodipsas concolor*	VU	LC
Lowveld shieldnosed snake	*Aspidelaps scutatus intermedius*	VU	NYBA
Wolkberg Dwarf chameleon	*Bradypodion transvaalense* complex	VU	LC
Sungazer/ Giant girdled lizard	*Cordylus giganteus*	VU	VU
Barberton girdled lizard	*Cordylus warren barbertonensis*	VU	NYBA
Lebombo girdled lizard	*Cordylus warreni warreni*	VU	NYBA
Swazi rock snake	*Lamprophis swazicus*	VU	NT
Transvaal flat lizard	*Platysaurus orientalis orientalis*	NT	NYBA

English Name	Species	Status	IUCN 2015 Status
Wilhelm's flat lizard	*Platysaurus wilhelmi*	VU	NYBA
Montane burrowing skink	*Scelotes mirus*	LC	NYBA
Breyer's longtailed seps	*Tetradactylus breyeri*	VU	VU

EN= Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, NYBA = Not yet been assessed

Threatened amphibian species that occur in the Mpumalanga Province (MP DACE, 2003).

English Name	Species	Status	IUCN 2015 Status
Karoo Toad	*Vandijkophrynus gariepensis*	VU	LC
Natal Ghost Frog	*Hadromophryne natalensis*	VU	LC
Spotted Shovel-Nosed Frog	*Hemisus guttatus*	VU	VU
Yellow Striped Reed Frog	*Hyperolius semidiscus*	VU	LC
Plain Stream Frog	*Strongylopus wageri*	VU	LC
Giant Bullfrog	*Pyxicephalus adspersus*	VU	LC
Greater Leaf-Folding Frog	*Afrixalus fornasinii*	VU	NYBA
Whistling Rain Frog	*Breviceps sopranus*	VU	LC

VU = Vulnerable, LC = Least Concern, NYBA = Not yet been assessed

Threatened invertebrate species that occur in the Mpumalanga Province (MP DACE, 2003).

English Name	Species	Status	IUCN 2015 Status
Rossouw's Copper	*Aloeides rossouwi*	EN	VU
Barbara's Copper	*Aloeides barbarae*	EN	NYBA
Swanepoel's Blue	*Lepidochrysops swanepoeli*	EN	VU
Jeffery's Blue	*Lepidochrysops jefferyi*	EN	VU
Stoffberg Widow	*Dingana fraterna*	EN	NYBA
Marsh Sylph*	*Metisella meninx*	VU	NYBA
Cloud Copper	*Aloeides nubilus*	VU	EN
Catshead Sprite - Coenagrionidae	*Pseudagrion coeleste*	CR	LC
Balinsky's Sprite - Coenagrionidae	*Pseudagrion inopinatum*	VU	EN
Newton's Sprite - Coenagrionidae	*Pseudagrion newtoni*	VU	VU
Sjostedt's Sprite - Coenagrionidae	*Pseudagrion sjoestedti pseudojoestedti*	CR	NYBA
Elliot's Hawker-Aeshnidae	*Aeshna ellioti usambarica*	VU	NYBA
Unicorn Cruiser - Corduliidae	*Phyllomacromia monoceros*	CR	LC

EN = Endangered, VU = Vulnerable, NT = Near threatened, NYBA = Not yet been assessed

South African Bird Atlas Project 2 list for quadrant 2629AB

Avifaunal Species for the pentads 2610_2915 and 2610_2920 within the QDS 2629AB

http://sabap2.adu.org.za/pentad_info.php?pentad=2610_2915#menu_top
http://sabap2.adu.org.za/pentad_info.php?pentad=2610_2920#menu_top

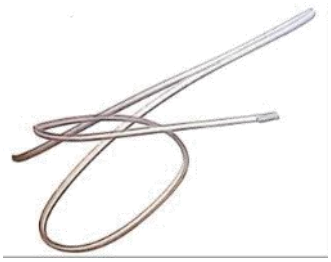
APPENDIX H – Declaration and Specialists CV's

Declaration

Declaration that the specialist is independent in a form as may be specified by the competent authority

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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist

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.

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Ecologist, Botanist specialist
Date of Birth	6 June 1983
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009

COUNTRIES OF WORK EXPERIENCE

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

Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment as part of the environmental assessment and authorisation process for the proposed Mzimvubu water project at Maclear, Eastern Cape.
- Floral assessment as part of the environmental authorisation process for the proposed Assmang Iron Ore Black Rock, Northern Cape Province.
- Floral assessment as part of the environmental authorisation process for the proposed Bloemwater Knellpoort water project pipeline assessment, Free State Province
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed Sappi Pipeline, Gauteng.
- Floral assessment as part of the proposed Setlagole Mall development, North West Province.

Wetland Assessments

- Consideration of potential wetland features on the proposed residential development on Vlakfontein Portion 50, Gauteng.
- Riparian Vegetation Index determination and wetland delineation for the proposed Doornkloof infrastructure, Gauteng.

- Wetland assessment along the proposed Powerline route, Delareyville, North West Province.
- Wetland delineation in the vicinity of a proposed mining development site, New Denmark Mine, Mpumalanga Province.

Basic Assessment (BA) and Environmental Impact Assessment (EIA) Reports

- EIA and Scoping report for the proposed new township development near Lubumbashi, DRC (4000ha)
- Basic Assessment report and process for a mixed use development, New Redruth, Gauteng
- EIA and Scoping report for the proposed Lesotho border road, Free State Province (in progress)

Environmental and Ecological Management Plans

- Biodiversity Action plans for African Exploration, Mining and Finance Corporation in line with the NEMBA requirements.
- Biodiversity Action plans for Twickenham Platinum mining operations in line with the NEMBA requirements, Limpopo Province.
- Biodiversity Action plans for Bokoni Platinum mining operations in line with the NEMBA requirements, Limpopo Province
- Environmental management plan for Erf 1086 New Redruth Extension 6, Gauteng Province.

Permit applications for protected tree and floral species

- Permit application for the removal of protected tree species for the Bushbuckridge Shopping Mall development within the Mpumalanga Province.
- Permit application for the removal and propagation of protected tree species for the Open Cast Operations within Bokoni Platinum Mine in the Limpopo Province.
- Permit application for the removal of protected tree species for Modikwa Mine within the Limpopo Province.
- Permit application for the removal of protected tree species for the Umfolozi Power line within the Kwa-Zulu Natal Province

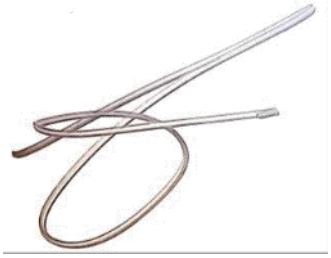
Water Use License Applications (WULA) and Risk Assessments

- General Authorisation for the commercial development of Erf 1086 New Redruth Extension 6, Gauteng Province.
- A Water Use License Application for the mixed development on the Gillimead Agricultural Holdings, Gauteng Province.
- A Water Use License Application for the Riba Cross Shopping Centre development, Limpopo Province
- A Water Use License Application for the proposed upgrade of the Lesotho border road, Free State Province (in progress).
- A Risk Assessment for the proposed residential development in Fourways, Gauteng Province

1.(b) a declaration that the specialist is independent in a form as may be specified by the competent authority

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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist