Masa Ngwedi 750kV and 400kV lines (Limpopo and North West Provinces)
Section E
Vegetation Input for EMP

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This 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. 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 at the time of study. Therefore, the author reserves 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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The Environmental Impact Assessment Regulations (Regulation 17 of Government Notice No. R345 of 2010), requires that certain information is included in specialist reports. The terms of reference, purpose of the report, methodologies, assumptions and limitations, impact assessment and mitigation (where relevant to the scope of work) and summaries of consultations (where applicable) are included within the main report. Other relevant information is set out below:

Expertise of author:

- Working in the field of ecology, and in specific vegetation related assessments, since 2007;
- Is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology (Reg. No. 400019/11); and
- Has been working with plants indigenous to South Africa since 1997.

Declaration of independence:

Dimela Eco Consulting in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by Dimela Eco Consulting is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

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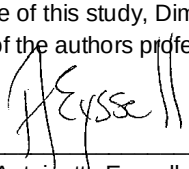
Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during the course of this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.



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SACNASP Reg. No. 400019/11

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1. INTRODUCTION

Eskom proposes to construct powerlines (a 750kV and 400kV line) from Masa substation (Limpopo Province) to Ngwedi substation (North West Province). Dimela Eco Consulting was appointed by Mandara Consulting to undertake a walk down of approximately 80km of the proposed powerline routes and provide input with regards to protected plant species and vegetation sensitivities that should be avoided or impacts mitigated during the construction and operation of the powerline route. The servitude width for the two powerlines is 135m i.e. 80m for the 765kV powerline and 55m for the 400kV powerline.

1.1 Terms of reference

The terms of reference were as follows:

- Walk down with specific reference to plants of conservation concern that could occur along the proposed powerline route;
- General background to the vegetation observed along the proposed routes;
- A report detailing the pylons in proximity to intact and likely sensitive vegetation as well as measures to aid conservation / rehabilitation of this vegetation along the powerline routes as input into the EMP;
- Localities of plants of conservation concern were access allowed; and
- Estimates of numbers of protected species where access were problematic

1.2 Assumptions and Limitations

The length of the line, number of landowners, game farms; access problems and project timeframes presented challenges in accessing and walking the entire line. Much of Section E of the proposed powerline was not in proximity to existing powerline and servitudes. The powerline corridor traverse the Mankwe Wildlife Reserve. After much discussions, the specialists were not granted access and therefore the area is under sampled. However, what could be viewed from the fence was used an attempt to describe the broad vegetation groupings.

In addition, it was assumed that all specialist will walk the line together. As this was not possible, the specialist accessed what she safely could. Therefore exact localities of protected species are limited to areas that was accessible. However, the specialist gained a good overall impression of what is likely to occur where and the data was extrapolated to the entire length of the line. The corridor for both the 750Kv and 400Kv lines was assumed to be about 100m.

Two field surveys was undertaken, both during November 2013. Ideally vegetation assessments should be carried out in different seasons and over a number of years to adequately assess the diversity and vegetation composition. Limited timeframes did not allow for detailed or long-term investigation and therefore plants not in flower, might have been overlooked.

Additional information may come to light during a later stage of the process for which no allowance could have been made at the time of this report. This report relied on the vegetation report done as part of the Environmental Impact Assessment (EIA) phase for additional information regarding plants that was observed to occur (Bathusi Environmental Consulting, 2009).

1.3 Methodology

The assessment entailed a literature review of the existing reports (Bathusi Environmental Consulting, 2009), vegetation information (Mucina & Rutherford, 2006), the short listing plants of conservation concern that could potentially occur along the route alignment, field survey at accessible areas along the powerline routes, analysis of data collected and reporting.

Literature Review:
The description of the regional vegetation relied on literature from Mucina & Rutherford (2006). Plant names follow Onderstall, (1996), Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002), van der Walt (2009) and Bromilow (2010).

Field survey: Walk down
Two site visit was undertaken on 6th to the 9th of November 2013 and 14th to the 15th of November 2013. During the walk down, accessible areas along the powerline routes were surveyed for protected plant species. Where observed, the localities and numbers of these plants were recorded using a handheld GPS (Garmin Montana 600). In addition, sensitive ecological features such as wetlands and ridges that are essential for the maintenance of ecosystems and ecological processes were noted.

Data extrapolation
Due to access difficulties, the entire route was not walked. The presence, frequency and number of protected trees and other species were extrapolated from data recorded between accessible pylons. For example, the number of the protected species between walked pylons were recorded and the population density of the species averaged over the distance between the pylons. At the time of the site visits, the corridor for both the 750Kv and 400Kv lines was not known and it was estimated at 100m.

Protected plant species identification:
The report includes a photographic identification table for protected species confirmed and expected to occur within the 100m corridor that the 750Kv and 400Kv lines will be constructed in. this table should form part of the Construction and Operational Environmental Management Plan (EMP) and be available on site during construction. All workers clearing vegetation should be made aware of these species.

2. BACKGROUND TO THE STUDY AREA

2.1 Locality

The proposed powerlines portion that was assessed comprised Section D and Section E of the Masa-Ngwedi line and is approximately 80km in length. The powerlines extent from the south-west of the town of Thabazimbi in the north and pass west of the town of Northam and the Spitskop substation. The lines cross from west to east the R510 in the Manamakgoteng-area from where is circumvent a portion of Mogwase before it crosses the R510 again in a south-westerly direction to about 6km west of the town of Chaneng and about 7km south of Sun City.

The tower numbers for this assessed portion of the line are as per Table 1. The first 40km is reported on as Section D (concurrent report), while the last 40km is assessed in this report known as Section E. Section E is situated within the North West Province. The line assessed stretch from about 4km north of the Sandfontein area and through the Mankwe Wildlife Reserve, where after the powerlines cross the R510 road in a south westerly direction towards Sun City.

Table 1: Tower numbers for each line and in which Section the towers are situated in

Section	765Kv line (tower number 259-436)	400Kv line (tower numbers 253-417)
Section D	259-340	341-436
Section E(this report)	*253-326*	*327-417*

2.2 Vegetation Type

The study area is situated within the Savanna Biome of South Africa. The savanna includes wooded, shrubby hill slopes and grassy plains with scattered trees or bush-clumps. Diversity in savanna is provided by the variation in soil-type and topography; koppies, river lines and anthills (termitaria) provide localised changes in soil moisture and nutrients which create different habitats for plants and animals. The Savanna Biome comprises different regional vegetation types of which the Central Sandy Bushveld and Zeerust Thornveld are present along the powerlines (Table 2; Figure 1).

Table 2: Vegetation types along the proposed route alignment

Tower positions		Description and Conservation Status (Mucina and Rutherford 2006).
750Kv	**400Kv**	
340 to 399	**327-380**	**1. Central Sandy Bushveld** The Central Sandy Bushveld occurs in low areas, on sandy plains and between mountains and comprises deciduous *Terminalia sericea* (Silver Cluster Leaf*)* and *Burkea africana* (Wild Seringa) woodland on sandy soils. Where soils are more shallow and rocky, *Combretum* woodland occurs and on less sandy soils *Acaica, Ziziphus* and *Euclea* species can be found The herbaceous layer is grass dominated with a low basal cover. The herbaceous layer is

Tower positions		Description and Conservation Status (Mucina and Rutherford 2006).
750Kv	400Kv	
		dominated by grasses. The vegetation can support protected trees such as *Sclerocarya birrea* subsp *caffra* and *Combretum imberbe,* while *Boscia albitrunca* may also occur sporadically. The endemic grass species *Mosdenia leptostachys* and herb *Oxygonum dregeanum* subsp. *canescens* var. *dissectum* are present within this unit. *Central Sandy Bushveld is classified as Vulnerable.* Although about 70% of this vegetation types is still remaining in a fairly natural state, this type of vegetation is poorly protected in formal reserves. Within the studies area, the Mankwe Wildlife Reserve is situated within this vegetation type.
T399 to T436	**T380 to T417**	**2. Zeerust Thornveld** This vegetation occurs on plains and flats between rocky ridges. The vegetation comprise open to dense short thorny woodland dominated by *Acacia*-species. The herbaceous layer is dominated by grasses. The protected tree *Acacia erioloba* and *Combretum imberbe* could occur in ecotones with Dwaalboom Thornveld or Central Sandy Bushveld. The shrub *Searsia maricoana* is endemic to this vegetation type and is nationally classified as Vulnerable to becoming extinct. However, the plant is not thought to occur along the powerline routes as the plants known distribution is within the Zeerust-area (Raimondo *et al,* 2009). The soil comprise deep, high base status soils and clay soils. Zeerust Thornveld is not listed as Least Threatened. Some degradation and transformation from mining, cultivation and urban sprawl has taken place, while about .2% is statutorily conserved.

2.3 Land Use

In Section E, the powerline routes will mainly traverse natural bushveld vegetation used for cattle grazing or game farms. Localised disturbances are present as well as some cultivation, especially in proximity to the Elands River. About 9 tower positions of each line is situated in the Mankwe Wildlife Reserve. Mining is prominent in the mot southern extent of the line as well as high grazing pressure.

2.4 Hydrology

The proposed routes cross two perennial rivers namely the Elands River and the Seshabele (Figure 2). Non-perennial rivers such as the Leragane River and numerous tributaries to the perennial rivers are also crossed by the powerlines.

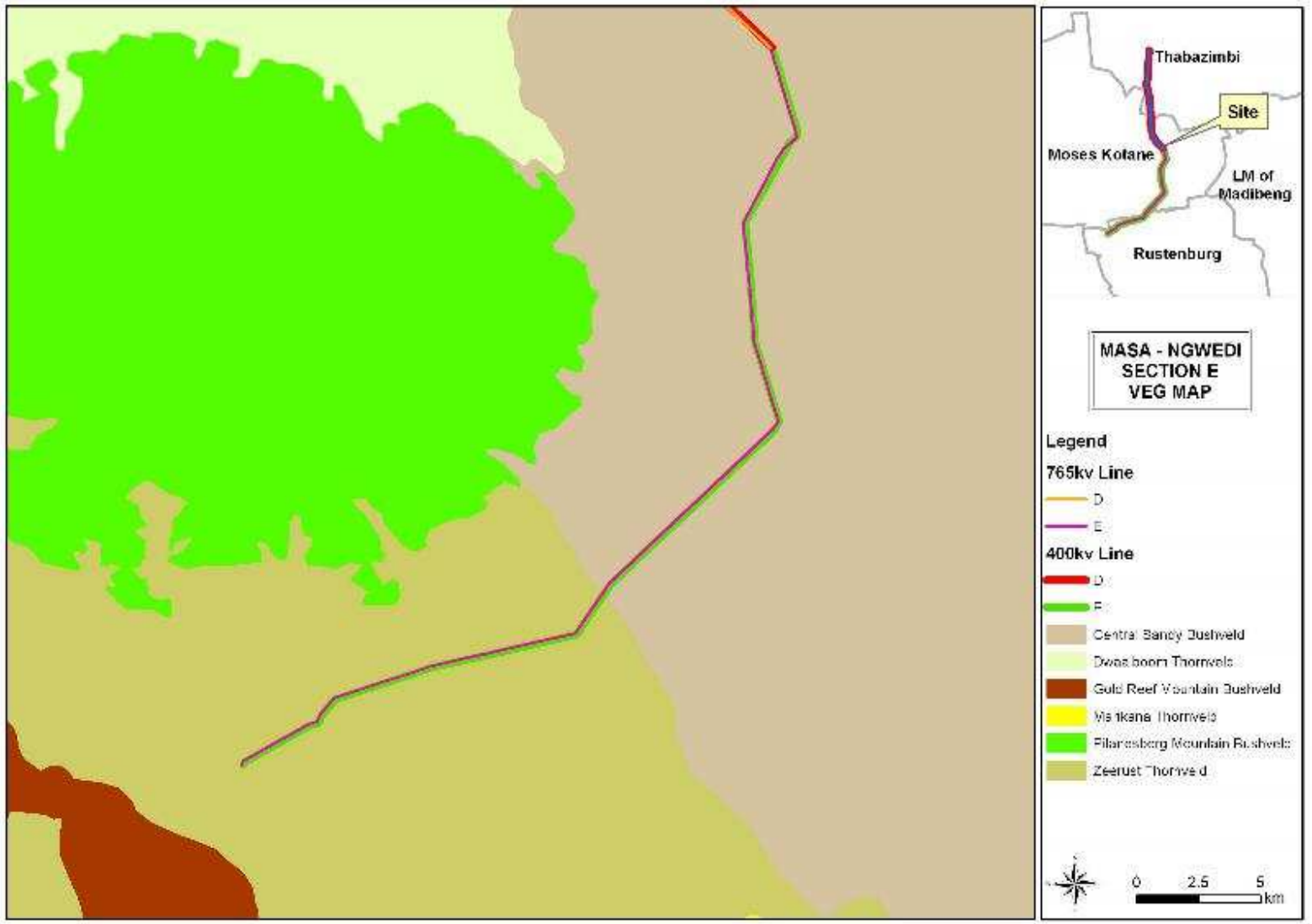


Figure 1: National vegetation description of the vegetation types along the powerlines

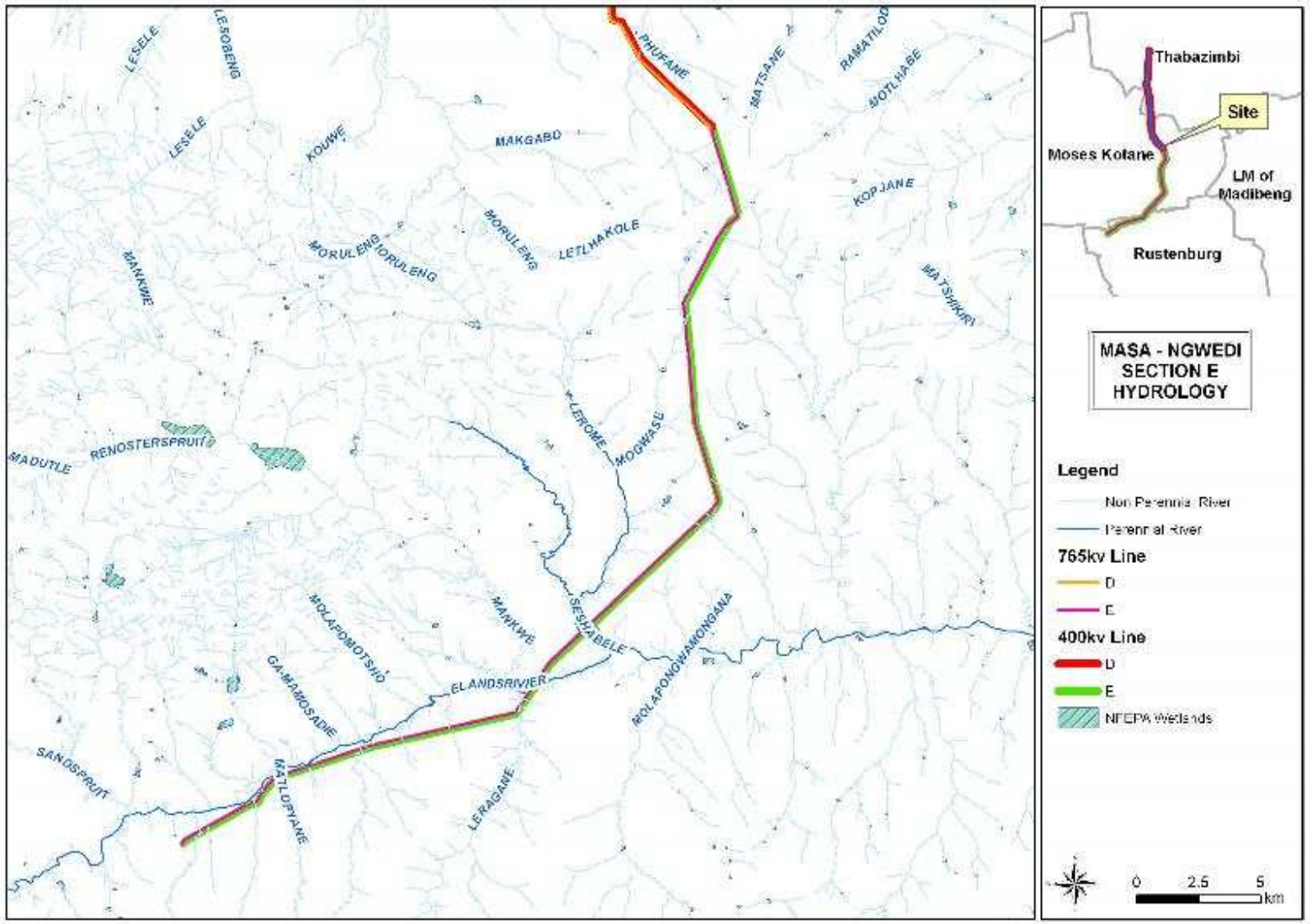


Figure 2: Hydrology of the area that the powerlines are situated in

3. RESULTS OF THE WALK DOWN

3.1 Broad vegetation groups

The vegetation along the powerline routes comprised mainly open to closed mixed woodland with *Acacia* species being prominent in the northern extent of Section E. As the route traverses in a south-westerly direction, the vegetation becomes more open with clumps of trees becoming sparser and dominated by *Acacia*-species. The woodland was thus subdivided open to closed mixed woodland and open *Acacia*-dominated woodland. In addition, riparian vegetation occurred within the powerline corridors.

3.1.1 Open to closed woodland:

The density of the vegetation depended on the land use, land management as well as soil variation along the lines corridor.

Open to closed Mixed Woodland:
The woodland at the start of Section E comprised mixed woodland that include *Acacia* and other microphyllous species (e.g. *Dichrostachys cinerea* – Sickle Bush), as well as broad-leaved species such as *Sclerocarya birrea* subsp *caffra, Combretum imberbe, Pappea capensis, Searsia lancea* and *Ozoroa* species as well as the succulents *Euphorbia ingens* (Naboom) and *Aloe marlothii* (Mountain Aloe). The shrubs *Tarchonanthus camphoratus,* the small *Aloe greatheadii* and the tree *Acacia melifera* occurred copiously and could be an indicator of overgrazing and bush encroachment in the Sandfontein area. At the time of the site visit, a goup of people were found chopping large amounts of wood for commercial purposes. It is thought that the wood was that of *Combretum imberbe* which is known to be an excellent braai-wood. The protected tree *Boscia albitrunca* was observed within 80m east of T343 (400kV). The tree therefore is likely to occur in corridors that was not assessed due to access problems. Other than the *B albitrunca*, two other nationally protected trees were observed within the mixed woodland: *Combretum imberbe* (Leadwood / Hardekool) and *Sclerocarya birrea* subsp *caffra*.

Southward, towards the Mankwe Nature Reserve the woodland vegetation becomes more open and the grass layer more dominant as the lines pass through the reserve. It is likely that due to vegetation management within the reserve, the area is more pristine and therefore more likely to support plants species of conservation concern. South of the Mankwe Wildlife Reserve and just before the powerline routes cross over the R510 in a westerly direction, the tree layer is sparse and a wetland area occurs within the corridor alignment at T374 (765kV). The vegetation included the grasses *Imperata cylindrica* and *Paspalum urvillei,* as well as the reed *Juncus rigidus.* The area included a number of geophytes and two declining bulb species were confirmed to occur here: *Boophone distichia* (Poison Bulb) and *Hypoxis hemerocallidea* (African Potato) (Photograph 2). The open nature of the woodland is more favourable for the bulbs as they typically grow in open, grassy areas. The wetland area was thought be suitable habitat for the Near-Threatened *Stenostelma umbelluliferum* (see 3.2.1)

Photograph 1: Closed mixed woodland at the beginning of Section E. Grazing and bush encroachment was evident.

Photograph 2: Open woodland adjacent to the wetland area with *Hypoxis hemerocallidea* and *Boophone distichia*

As the line cross over the R510 road the tree layer becomes sparser and the protected tree numbers decline. As the line approaches the Mogwase / Sehsabele Rivers, *C imberbe* was the only protected tree species noted and occurred sporadically (Photograph 3). From the Mogwase River, the soil comprise black clay soils and Acacia trees such as *A tortilis* became prominent.

Photograph 3: Open woodland in proximity to the Mogwase River. The area is likely to support a number of bulbous species

Open Acacia-woodland

From T406 (765kV) and T 383 (400kV), the clay content increased and *Acacia* trees such as *A tortilis, A. melifera* and *A tortillis* became the dominant trees. The species diversity in areas were low due to past cultivation. The powerline routes pass over the R556 towards Sun City and through secondary bushveld (the area was cultivated in the past) (Photograph 4). The protected tree *Scleoracya birrea* subsp *caffra* occurred sporadically.

Photograph 4: Secondary bushland (left) and open *Acacia* woodland (right)

Towards the end of the line the area is heavily grazed and no protected species expected to occur. However, one provincially protected succulent species *Orbea lutea* was observed within the *Acacia* woodland (Photograph 5).

Photograph 5: the small succulent, *Orbea lutea* that occurs in the southern extent of Section E.

3.1.2 Riparian vegetation:

The National Water Act (Act No 36 of 1998) describe a watercourse as *(a)* a river or spring; *(b)* a natural channel in which water flows regularly or intermittently; *(c)* a wetland, lake or dam into which, or from which, water flows; and *(d)* any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The powerlines cross Seshabele and Elands perennial rivers and come into close proximity to the Elands River as it traverse through riparian vegetation as well as numerous drainage lines that drain into the river. The vegetation at the riparian areas comprised of *Searsia* species, *Celtis africana* and *Salix mucronata, Ziziphus mucronata* and *Acacia karoo* (Photograph 4). It was thought that the riparian vegetation could provide habitat for the Declining tree species *Ilex mitis.* However, the tree was not observed on areas sampled. The provincially protected bulb *Scadoxus puniceus* (Photograph 7) was recorded under trees in the riparian vegeration. Elands River's vegetation included a number of invasive species such as *Sesbania puniceus* and *Melia azedarach.*

Photograph 6: Vegetation along the Seshebele river (left) and dry drainage lines that drain into the Elands River (right)

Photograph 7: *Scadoxous puniceus* in the riparian area of the Elands River

Figure 3 below shows the broad vegetation groupings along the powerline. Areas that was cultivated or disturbed in the past were assumed to not contain any significance in terms of biodiversity.

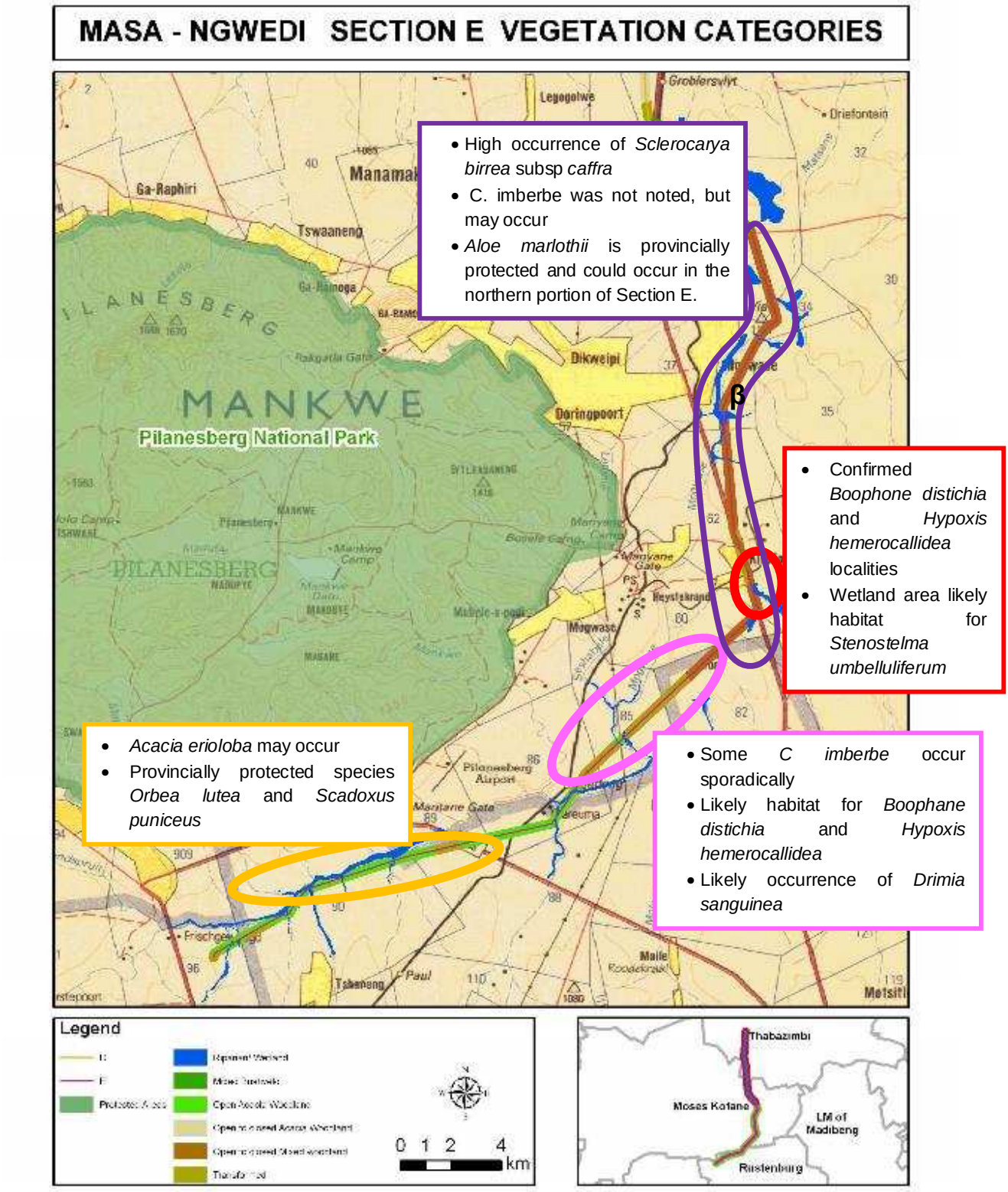
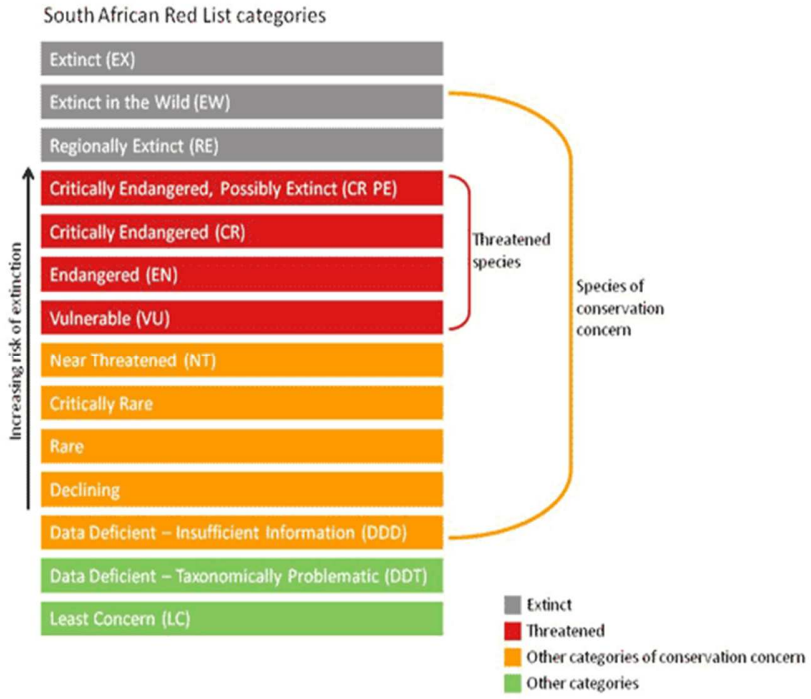


Figure 3: Broad vegetation groupings along the route

3.2 Plants of Conservation Importance

3.2.1 Nationally Protected Plant (Plants of Conservation Concern)

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining (Figure 4). Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.



(Source: http://redlist.sanbi.org/redcat.php)

Figure 4: Threatened species and species of conservation concern

A list of plants of conservation concern was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo *et al*, (2009), as well as information from the existing report (Bathusi Environmental Consulting, 2009). A list of eight (8) plants of conservation concern that have a likelihood of occurring along the routes are specified in Table 3. Two of these species were confirmed to occur. The species *Acacia erioloba*, and *Boophone distichia* are classified as declining. Although these plants are not yet threatened, their numbers are declining. It is advised that these species be conserved *in situ* where possible (Raimondo *et al,* 2009). However, where the bulbous plants (*Boophone* and *Hypoxis*) will be damaged by construction activities, the plants should be removed during

construction and replanted as part of the rehabilitation process. Additional species that might occur includes *Drimia sanguinea.*

Table 3: Plants of conservation concern

<table>
<tr><th>Species</th><th>Conservation status</th><th>Habitat notes</th><th>Possibility of occurring</th></tr>
<tr><td>Drimia elata</td><td>Data deficient (Taxonomic problems)</td><td>Varied habitat - rocky grassland</td><td>Unlikely habitat. The plant is not thought to occur along the lines</td></tr>
<tr><td>Acacia erioloba</td><td>Declining</td><td>Widespread in the drier areas of the northern provinces of South Africa deep sandy soils and drainage lines</td><td>Likely to sporadically occur in the southern extent of the site.</td></tr>
<tr><td>Boophone disticha</td><td>Declining</td><td>Confirmed to occur in the rocky grasslands on the site but particularly in proximity or on rocky outcrops.</td><td>Confirmed to occur in open woodland between
T 374and T375 (765Kv); and
T357-358 (400Kv).

Confirmed localities:
<table><tr><th>Lat</th><th>Lon</th></tr><tr><td>-25.27</td><td>27.28</td></tr><tr><td>-25.27</td><td>27.28</td></tr><tr><td>-25.03</td><td>27.23</td></tr></table>Likely to occur in all the open woodland area within and around Mankwe Wildlife Reserve, especially in rocky areas.</td></tr>
<tr><td>Hypoxis hemerocallidea</td><td>Declining</td><td>Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant and can tolerate some disturbance.</td><td>This plant was recorded in Section E in open woodland close to a wetland area between
T 374and T375 (765Kv); and
T357-358 (400Kv).

Confirmed localities:
<table><tr><th>Lat</th><th>Lon</th></tr><tr><td>-25.27</td><td>27.28</td></tr></table>This plant can survive disturbances and is thought to occur in groups in the open woodland area within and around Mankwe Wildlife Reserve.</td></tr>
<tr><td>Ilex mitis var. mitis</td><td>Declining</td><td>Along rivers and streams in forest and thickets sometimes in the open.</td><td>Not all river areas could be sampled. This tree is more likely to occur where permanent moisture is available and is</td></tr>
</table>

Species	Conservation status	Habitat notes	Possibility of occurring
		Found from sea level to inland mountain slopes.	likely to occur within the riparian vegetation along the Elands River
Drimia sanguinea	Near threatened	Open veld and scrubby woodland in a variety of soil types.	Likely to occur in open woodland through much of the route alignment. See Appendix A
Stenostelma umbelluliferum	Near Threatened	The inconspicuous nature of this species makes it easy to be overlooked. This plant's habitat is limited to deep black turf mainly near drainage lines on vertic soils with high clay content in grassland or savanna	There is a likelihood that this plant occur within the wetland area at T336 (400kV) and T374 (375kV). However, all moist areas in the black turf soils should be considered potential habtiat –see Appendix A
Ledebouria atrobrunnea	Vulnerable	Beestekraal, Kroondal and Northam. Foothills of the Magaliesberg on quartzite. Known only from three locations and is potentially threatened in the future by crop cultivation	This plant is likely to occur within the Northam extent of the powerline. However, its known distribution is on the Swartwitpensbokfonteinberg. The powerline does not traverse quartzite foothills and is therefore unlikely to impact on this plant

3.2.2 Provincially Protected Plants

A number of provincially protected plants are listed in the Transvaal Nature Conservation Ordinance Act No. 12 of 1983 as well as the Limpopo Environmental Management Act 2003 (Act 7 of 2003). These plants are not to be removed, damaged, or destroyed without permit the North West Department of Agriculture, Conservation, Environment and Rural Development (NWDARD) or the Limpopo Economic Development Environment and Tourism. Table 4 indicates protected plant species that were confirmed to occur along the proposed powerline route alignment. Additional protected species that could occur include *Gladiolus serceovillosus*.

Table 4: List of protected plants that was confirmed to occur or could potentially occur

Species	Protection per province	Occurrence
Gladiolus species	Both provinces	**Possible** occurrence
Scadoxis puniceus	Both in Limpopo and North-West	Confirmed to occur along the riparian vegetation of the Elands River
Orbeopsis / Orbea species	North West	Occurs in open Acacia-woodland in proximity to the Elands River
Aloe marlothii	North West	Occurs in the first approximate 5km of the line

3.2.3 Nationally Protected Trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. Table 5 lists the tree species confirmed to occur. As large portions of the line could not be accessed, and an estimate of species along the routes are given as well as an average per tower number in areas where the trees occurred abundantly (Table 6). The extrapolation method assumes the data are smooth.

Table 5: Nationally protected trees occurring along the routes

Species: *Acacia erioloba*
Common Name: Camel Thorn
Occurrence and methodology– if whole servitude is cleared
This tree was not noted within sample areas or immediate surroundings. However, the tree is likely to occur within the woodland vegetation. If the tree does occur within the route alignments, it will occur sporadically.
Species: *Boscia albitrunca*
Common Name: Shepard's Tree / Witgat
Occurrence and methodology
One *Boscia albitrunca* tree was recorded within 80m of T 343 (400kV). It is likely that Boscia *albitrunca* occurrs sporadically within the area that the powerlines are situated in, especially in sandy, loamy and calcrete soils (Alias & Milton, 2003). This is a deep rooted species therefore favors deep sand.
Species: *Combretum imberbe*
Common Name: Leadwood
Occurrence and methodology – if whole servitude is cleared
Combretum imberbe could occur sporadically along about half the route alignment. A number of individuals were noted in sampled areas between T373- 391 (765kV) and T357- 373(400kV). No area of high occurrence was noted and due to the sporadic occurrence no pattern could be established to estimate the number of trees occurring within the route alignment.
Species: *Sclerocarya birrea* subsp *caffra*
Common Name: Marula
Occurrence and methodology
The frequency of Marula trees along the route is the highest of the protected tree species. The Morula trees occurred throughout the northern extent of the powerline: T 341 to 377 (765kV); and T 327 to 360 (400kV) Due to the high frequency of occurrence, an area comprising two tower positions within the corridor was walked at two different points along the line: T 342-343 as well as T374-375(765kV); and T328-329 as well as 357-358(400kV)

The combined area walked measured on Garmin Basecamp = 69987m²=7ha

- In total 20 trees were counted in this area
- Thus the average number of trees per ha = 2,8 trees

The average area where *S birrea* subsp *caffra* is prominent along the corridor of the line was calculated with Garmin Basecamp= 2.35km²=1600000m²=160ha

- Therefore it is estimated that about 2.8 x 160ha = 448* *S birrea* subsp *caffra* trees could be impacted on by the corridor.

Note that this is an average and are likely overestimated as the average number was calculated in the area where a high frequency was noted. However, this compensate for areas where *S birrea* subsp *caffra* might occur sporadically and were not observed.

Prior to construction, permit authorisation for the removal / destruction / pruning / translocation of the species confirmed to occur needs to be applied for. Some of the plants occur within the construction footprint, while others may be affected by stringing or construction related activities. A photo identification of these species are given in Appendix A and should be incorporated into the EMP. Contractors removing bush ahead of construction

4. INPUT INTO ENVIRONMENTAL MANAGEMENT PLAN

The proposed powerline routes will have an impact on woodland and riparian areas, as well as portion of wetland. The woodland vegetation is not considered threatened and therefore not considered to be sensitive to the proposed powerline routes. However, riparian vegetation should be considered sensitive as the removal of these species could have a damaging impact on the watercourses. Riparian vegetation ensure the health and function of riparian areas and therefore it is recommended that vegetation clearing be kept to a minimum in riparian areas. In addition, three protected tree species occur within the powerline route alignment and should not be removed without prior consent and a permit from the National Department of Forestry and Fisheries, while a permit from the North West Department of Economic Development, Environment, Conservation and Tourism will be required to remove any plant of conservation concern.

General and specific mitigation measures per tower positions where impacts are likely are listed in Table 6.

Table 6: Tower numbers and proposed management input for construction

Tower numbers	Impact and Mitigation
General mitigation measures	
All towers	*Pre-construction and construction* • Appoint Environmental Control/ Site Officer. Appointment prior to start of construction, responsibilities should include, but not limited to ensuring adherence to EMP guidelines, guidance of activities, planning, reporting. • The Contractor shall supply a method statement regarding vegetation clearing at the tender stage. • The Contractor must adhere to the bush clearing, erosion control and herbicide use guidelines of Eskom as a minimum. • Demarcate the construction footprint as well as the construction camps. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • No open fires are permitted within naturally vegetated areas. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Remove and destroy all alien invasive plant species from the route corridors and immediate surroundings. • Provincially protected and 'Declining' bulbous plants must be removed - where possible and feasible - and either used during rehabilitation or be relocated to conserved areas. These plants can only be removed and relocated with permission (permit) from the local conservation authority (LEDET, and NW DEDECT). • Wherever possible, the construction footprint should not infringe on riparian vegetation. • Construction workers may not remove flora and neither may anyone collect seed from the plants without permission from the local authority. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005). • Remove only the vegetation where essential for construction and stringing and do not allow any disturbance to the adjoining natural vegetation cover. • Clearance of vegetation should be done in accordance to standards as available in Eskom documentation. • Pruning of indigenous trees is preferred to complete removal. Pruning must be according to set standards as available in Eskom documentation. • All litter should be contained in suitable storage areas and immediately removed to a suitable disposal facility. • The use of fires for cooking purposes or any other purpose may result in accidental spread to adjacent areas. All areas, as a result of high biomass and flammability are regarded prone to the development and spread of

Tower numbers	Impact and Mitigation
	accidental fires. Although fire is a natural occurrence, any accidental occurrence should be prevented. Other causes include smoking, discarded cigarettes and matches, overheating vehicles or equipment or faulty electrical equipment or wiring, welding and cutting operations. No firewood may be collected. *Operational:* • Pruning during maintenance must be according to set standards as available in Eskom documentation. • Maintenance workers should not unnecessary trample vegetation and clear the work area of any surplus materials.
Erosion Control:	
All Towers	*Pre-construction and construction* • Due to the clayey nature of much of the powerline routes as well as the relative flat topography and dry climate conditions, erosion is likely to be low. However, vegetation clearing, especially in proximity to drainage lines and watercourses could result erosion in the rainy season. • Stockpiled topsoil should not be compacted and should be replaced as the final soil layer once construction is complete. • No vehicles may be allowed access onto the stockpiles after they have been placed. • Stockpiled soil must be protected by erosion-control berms if exposed for a period of greater than 14 days during the wet season. • Topsoil obtained from sites with different soil types must not be mixed. • Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and micro-organisms in the soil. • Soil must not be stockpiled on drainage lines or near watercourses. • Soil must be exposed for the minimum time possible once cleared of invasive vegetation. The timing of clearing and grubbing should be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. • If topsoil will be stockpiled for a longer period, it must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds. • To limit the introduction of alien species into the area, no soil may be imported onto site without notifying the environmental officer. • Seasonally wet areas and/or turf soils to be avoided during wet and rainy periods or while the soil is drenched.

Tower numbers	Impact and Mitigation
	Operational: • Monitor re-vegetation after construction ceased and ensure that all disturbed soils are colonised by species typical of the area.
Alien Invasive Vegetation:	
All Towers	*Pre-construction and construction* • Alien vegetation is mostly associated with the rivers and old agricultural fields and overgrazed areas. All alien vegetation should be removed from the servitude area and immediate surrounds. • Alien invasive plant species included *Opuntia* species (Prickly Pear) in woodland vegetation and *Sesbania punica* and *Melia azedarach* within riparian vegetation. Appendix B list the species that may become invasive along the route corridors. • By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. • All alien seedlings and saplings must be removed as they become evident for the duration of construction. • Manual / mechanical removal is preferred to chemical control. • All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO • Appointment of alien plant working group / assign this duty to specific staff. • Ensure that contractors / alien working group can identify the relevant plants and are aware of the removal procedures. • Ensure that only registered and certified person(s) apply herbicides according to manufacturer's instruction. Please note that all person(s) / contractors appointed to apply herbicides should be registered in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947), as amended. Herbicides application shall be done by suitably trained personnel in possession of an appropriate course certificate, or under the direction of a qualified pest control operator, registered under the Fertilizers, Farm Feeds, Agricultural Remedies Act. Registration with the Pest Control Service Industry Board (PCSIB) is also preferred. • Sequence of areas to be cleared of invasive plants as construction progresses. • Accepted removal and treatment methods should be implemented with extreme caution not to contaminate aquatic systems.

Tower numbers	Impact and Mitigation
	• Herbicide application to be conducted according to manufacturer's label. • Clearance of vegetation should be done in accordance to standards as available in Eskom documentation. *Operational:* • The servitude should be monitored at least twice a year for the emergence of alien invasive plant species • Should these species become apparent, the timeous eradication will prevent the plants spreading into natural vegetation. • Mechanical removal is preferred to the use of herbicides, especially in proximity to watercourses.
Rehabilitation:	
All Towers	*Pre-construction and construction* • The Contractor shall supply a method statement regarding vegetation clearing and rehabilitation at the tender stage. • A search and rescue operation must take place at the discretion of the ECO prior to site clearance activities. A nursery could be established on site to store the bulbous plants that could be sued in rehabilitation once construction is complete. • The pruning of the woody layer is recommended instead of complete removal of all woody plants. Leaving a significant portion of the woody structure intact will prevent the establishment of an atypical habitat, limiting adverse impacts to a large extent. • The contractor must rehabilitate the construction camp and any other disturbed areas once construction activities have terminated. Compacted areas will be ripped and mulched in order to ensure recovery of the natural vegetation cover. • A method statement must be provided and maintained by the contractor. *Operational:* • The disturbed area should be left to rehabilitate from re-growth from trees pruned trees and from seeds in the soil bank and proximate indigenous vegetation. However, the area should be monitored and corrective action taken if alien invasive plant spices or declared bush encroacher species are noted within the servitude. • Re-plant bulbous plants of conservation concern (e.g. *Boophone distichia & Hypoxis hemerocallidea*) that was removed prior to the construction. • Prevent cattle grazing on the rehabilitated footprint as to ensure rehabilitation success. The rehabilitated areas

Tower numbers	Impact and Mitigation
	could be cordoned off for at least two years. As soon as rehabilitation was found to be successful, the cordons could be removed. • Implement an alien invasive plant monitoring and management plan whereby the spread of alien and invasive plant species into the rehabilitated areas are regularly removed and re-infestation monitored for at least two years. • Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. • Monitoring of the rehabilitation success should take place for at least three years and include corrective follow-up action.
Bush encroachment:	
All towers	*Operational:* Bush encroachment is a term used for "stands" of indigenous woody plants that tend to become abnormally abundant when the area is degraded by e.g. overgrazing or inappropriate fire regimes or the complete lack thereof (Agricultural Research Council, 2013). The plants themselves are thus not the problem, but their increased abundance or encroachment into grassland serves as an indicator of poor land management practices or degradation. The natural vegetation could degrade over time if suitable rehabilitation of the disturbed soils does not take place. The invasion by this tree species could lead to the demise of the grassland and loss of grazing potential to the local farmers. • Construction related disturbances can lead to densification of open woodland, resulting in loss of species diversity. • The servitudes should be monitored for densification by species such as *Acacia eurubescens, A nilotica, A tortilis, A. melifera* and *A. karoo*, as well as Asparagus species and *Tarchonanthus camphoratus*. • Delay the re-introduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of re-vegetation has been reached.
Nationally Protected Trees-	
All Towers	*Pre-construction and construction* • The contractors that will be undertaking bush clearing must be able to identify the protected species that occur and are likely to occur. • Once the position of the tower numbers are marked and access established, it is advised that the construction footprints be assessed by the ECO / contractor to determine if all species observed and that must be removed, have permits in place for their removal.

Tower numbers	Impact and Mitigation
Likely occurrence in the northern extent of the line	Nationally Protected *A erioloba* tree species, also classified as Declining: • Although none of these trees were observed in sample areas, these trees can occur along the route, especially in areas with deep sand. • The contractor must be able to identify these trees – see Appendix A. • Prior to site clearing, the area must be surveyed for the occurrence of these trees. If the tree is found within the construction footprint, it can only be removed or pruned with a permit from the Department of Forestry and Fishery (DAFF). • Pruning the trees are preferred to clear felling. • If the tree is pruned, the tree is able to coppice even from cut stumps and fallen over, partly dead trees (Seymour & Milton, 2003). It can also multiplies by root suckers. However, the coppices out of cut stumps are highly sensitive to browsing by goats /cattle and presumably other browsers, which substantially reduced biomass and hampers regeneration from old tree stumps (Seymour & Milton, 2003). • Prune the trees beyond the goat / cattle browsing line. • If the pruned trees can be protected from browsing or pruned high enough, re-growth can be very successful.
Likely occurrence: T344 to 367 (765kV) T 330 to 351 (400kV).	*Boscia albitrunca* may occurred sporadically within the area that the powerlines are situated in. This is a deep rooted species favors deep sand and although not recorded in accessible areas of the powerline route, it is likely to share the same area of distribution along the line as *A erioloba* (Figure 3). • The ECO and contractor must familiarise themselves with this tree – see Appendix A • Prior to site clearing, the area must be surveyed for the occurrence of these trees. If the tree is found within the construction footprint, it can only be removed or pruned with a permit from the Department of Forestry and Fishery (DAFF). • The tree is not expected to occur in great numbers and is unlikely to grow higher than 4-7m (Alia & Milton, 2003). • The tree apparently occurs at lower densities in area of high stocking rates, in response to browsing pressure. • Pruning the trees are preferred to clear felling.
T373- 391 (765kV) and T357- 373(400kV).	Nationally Protected *Combretum imberbe* tree species; • The ECO and contractor must familiarise themselves with this tree – see Appendix A • Prior to site clearing, the area must be surveyed for the occurrence of these trees. If the tree is found within the construction footprint, it can only be removed or pruned with a permit from the Department of Forestry and

Tower numbers	Impact and Mitigation
	Fishery (DAFF). • These trees can only be removed or pruned with a permit from the Department of Forestry and Fishery (DAFF). • Pruning the trees are preferred to clear felling. • Coppicing regrowth from harvested stumps in *C. imberbe* is high. The height at which this tree is pruned is important as it influences the coppicing ability. Stump mortality generally results when trees are harvested close to the ground, thereby subjecting coppicing shoots to intensive domestic livestock herbivory and fire damage (Clarke 1997). A harvesting height of **one meter** appears most advantageous to survival and coppicing potential (Herrman *et al,* 2003). • The contractor must be able to identify these trees – see Appendix A.
T 341 to 377 (765kV); and T 327 to 360 (400kV)	Nationally Protected *Scelrocarya birrea* subsp *caffra* tree species: • These trees can only be removed or pruned with a permit from the Department of Forestry and Fishery (DAFF). It is estimated that about a 448* individuals can occur along the route with the highest occurrence between: T 341 to 377 (765kV); and T 327 to 360 (400kV) • Pruning the trees are preferred to clear felling. • If the tree is pruned, the tree is able to coppice even from cut stumps and fallen over, partly dead trees (Seymour & Milton, 2003). It can also multiplies by root suckers. However, the coppices out of cut stumps are highly sensitive to browsing by goats /cattle and presumably other browsers, which substantially reduced biomass and hampers regeneration from old tree stumps (Seymour & Milton, 2003). • Prune the trees beyond the goat / cattle browsing line. • If the pruned trees can be protected from browsing or pruned high enough, re-growth can be very successful. • The contractor must be able to identify these trees – see Appendix A.
Plants of conservation concern:	
All Towers	*Pre-construction and construction* A number of plants of conservation concern not identified at the time of the field survey, has a possibility of occurring along the proposed routes. Some of these plants are easily overlooked when not in flower or dormant. • The contractors and workers should familiarize themselves with the species that could possibly occur

Tower numbers	Impact and Mitigation
	(Appendix A). • Note that the bulb species are dormant in winter and should be searched for in summer and preferably during the species flowering time. • Prior to site clearing, the area must be surveyed for the occurrence of these species. If the species are found within the construction footprint, it can only be removed or pruned with a permit from the local conservation department. • Conserve the plants *in situ* where possible. • For the duration of construction and stringing, cordon of the plants with clearly visible markers, prohibiting trampling or access to the plants • The persistence of the plant should be monitored by the appointed ECO • Remove cordon after completion of construction and stringing activities • Where the plant is deemed to be under threat from construction activities, the bulb should be relocated to suitable habitat in proximity to its original locality. • A general permit must be obtained from NW DEDECT to be able to remove and relocate these plants if found within the construction footprint. • If any additional species are found for which uncertainty exist (e.g. not a common species along the line), a botanist / ecologist should be contacted for an opinion. The ECO should take photographs (including close ups) of all parts of the plant and send to the specialist for speedy identification. Once identified, the appropriate action should be taken to conserve the species if identified to be of conservation concern. • Once the position of the tower numbers are marked and access established, it is advised that the construction footprints be assessed by the ECO / contractor to determine if all species observed and that must be removed, have permits in place for their removal.
Confirmed between T 374and T375 (765Kv); and T357-358 (400Kv). Likely to occur from: T359-391 (765 kV); and T343-373 (400kV)	The Declining plant species *Boophane distichia* and *Hypoxis hemerocallidea* was observed. However, it is thought that more individuals could occur sporadically along the line. • Note that the bulb species are dormant in winter and should be searched for in summer and preferably during the species flowering time. • Prior to site clearing, the area must be surveyed for the occurrence of these species. If the species are found within the construction footprint, it can only be removed or pruned with a permit from the local conservation department. • The contractors and workers must be familiar with this plant (Appendix A).

<table>
<tr><th colspan="2">Tower numbers</th><th>Impact and Mitigation</th></tr>
<tr><td colspan="2"></td><td>• A general permit must be obtained from NWDEDECT to be able to remove these plants if found within the construction footprint.
• Conserve the plants in situ where possible.
• For the duration of construction and stringing, cordon of the plants with clearly visible markers, prohibiting trampling or access to the plants
• The persistence of the plant should be monitored by the appointed ECO
• Remove cordon after completion of construction and stringing activities
• Where the plant is deemed to be under threat from construction activities, the bulb should be relocated to suitable habitat in proximity to its original locality.
• If these plants cannot be preserved in their current locality, they should be removed as part of a rescue and rehabilitation plan.</td></tr>
<tr><td colspan="2">Likely occurrence at:
T336 (400kV) and T374 (375kV).</td><td>It is likely that the wetland areas at these towers provide suitable habitat for the Near Threatened Stenostelma umbelluliferum. The inconspicuous nature of this species makes it easy to be overlooked. This plant's habitat is limited to deep black turf mainly near drainage lines on vertic soils with high clay content in grassland or savannah.
• The contractors and workers should familiarize themselves with the species that could possibly occur (Appendix A).
• Prior to site clearing, the area must be surveyed for the occurrence of these species. If the species are found within the construction footprint, it can only be removed or pruned with a permit from the local conservation department.
• Conserve the plants in situ where possible.</td></tr>
<tr><td colspan="3">Riparian Vegetation and vegetation associated with watercourses such as wetlands:</td></tr>
<tr><td>765kV</td><td>400kV</td><td rowspan="2">Preconstruction and construction
• Crossing of riparian systems is only permitted at existing/ approved crossing points, taking due care to prevent additional / new impacts.
• Planning of construction site must include eventual rehabilitation / restoration of indigenous vegetative cover
• No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a pylon footprint and no access roads can be considered. This is subjected to authorization by means of a water use license.
• Ensure placement of footprints outside 1:100 year floodlines.</td></tr>
<tr><td>T 344
T 345

T 359
T 360
T 362
T 374</td><td>T 330
T 331
T 336
T 343
T 344
T 345</td></tr>
</table>

Tower numbers		Impact and Mitigation
T 377 T 392 T393 T394 T400-404 T422 T425 T427	T 360 T 374 T375 T376 T380-384 T402 T405 T409	• Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent access to sensitive riparian vegetation. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the tower/pylon • Consider the various methods of stringing and select whichever method(s) that will have the least impact on watercourses e.g. shooting a pilot cable and pull cables with a winch, or flying cables over • Stringing should preferably not make use of vehicles in watercourses. If unavoidable, plan stringing activities to take place within the drier winter months and use equipment with the smallest possible footprint e.g. quad bikes • Plan stringing through watercourses to take place at pre-determined points such as where the wetland width (and thus area to be impacted) is the smallest • Remove as little riparian vegetation as possible
Conservation areas – Mankwe Wildlife Reserve		
T 359 to T373(765kV); and T343 to356 (400kV**).**		The powerlines traverse the Mankwe Wildlife Reserve. This area should be seen as highly sensitive. The fauna and flora are managed and conserved and therefore threatened or rare species is more likely to occur here. As no access was possible at the time of the field survey, the following must be done: • The ECO and contractor must familiarise themselves with threatened plant species that are likely to occur in Mankwe. Once access is granted, the area must be surveyed for the occurrence of threatened plant species and protected tree species. • Here it is imperative that these plants be conserved *in situ* and only be removed (with permit authorisation) if absolutely necessary. • For the duration of construction and stringing, cordon of the plants with clearly visible markers, prohibiting trampling or access to the plants (note that the cordons should not pose a threat to animals that occur in the area) • The persistence of the plant should be monitored by the appointed ECO • Remove cordon after completion of construction and stringing activities
Bush Clearing for commercial gain		
T341 to 359 (765kV); and		In the northern extent of the line (around the Sandfontein settlement), people harvesting wood was observed. The

Tower numbers	Impact and Mitigation
T327 to 343 (400kV)	harvesters collected bakkie-loads of what seemed to include *Combretum imberbe*. It is illegal to harvest this species. • Eskom should explore the possibility of employing these small enterprises in pruning the servitude area. • This should be coupled with education with regards to protected tree species, the law and penalties.

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6. GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Conservation concern (Plants of..)	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al*, 2009).
Habitat	Type of environment in which plants and animals live
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
In Situ	"In the place" In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Mitigation	The implementation of practical measures to reduce adverse impacts
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.

APPENDIX A: PLANT ID TABLES

Table 7: Plants of conservation concern confirmed to occur along the route corridors

Scientific Name	Status / protection	Suitable Habitat
Boophane disticha **Poison Bulb**	**Declining**	**Open woodland-grassland, often in rocky places**
Flowers appear before the leaves in early spring to early summer  		
Hypoxis hemerocallidea **African Potato**	**Declining**	**Open woodland, sometimes close to drainage lines and wetlands**
Typical star formation of leaves as seen from the top, yellow flowers in early spring and summer. 		

***Scadoxis puniceus* Paintbrush**	**Provincially protected in NW**	**Shady areas in coastal bush, ravines and forest, it**


Plants are dormant in winter. Leaves and flowers appear at the same time in Spring. Stems are purple speckled. Grows in light shade under trees – particularly in riparian areas

Orbea lutea	Provincially protected in NW	Grow in scrub, savanna (Acacia and mopane veld) and grassland at altitudes of 500–1500 m in full sun or semi-shade.


Can form a mat of 50cm, stems have 4 corners (4hoekig) with tows of teeth – might be purplish. Yellow, pungent smelling flowers from Jan to April.
(flower image from http://www.ispot.org.za/node/161962?nav=search
(member: Lizze)

Combretum imberbe **Leadwood / Hardekool**	**National Protected Tree**	**Open woodland along drainage lines or open veld. Sometimes in heavy clay**

Bark cracked into rectangular blocks, young twigs seems spiny, leaves grey green, fruits 4 winged



Sclerocarya birrea **subsp *caffra* Marula**	**National Protected Tee**	**Woodland in sandy loam**


Large, prominent trees, compound leaves with a terminal leaflet and characteristic Marula fruit. Bark flacking

Aloe marlothii **Mountain Aloe**	**Provincially protected in the North West**	**Bushveld and mountainous areas. Usually where frost is infrequent.**
Single stemmed Aloe, usually 2-4 m tall (occasionally up to 6 m), with old dried leaves remaining on the stem below the upper living leaves. Spines on upper and lower surface of leaves. Inflorescences slanted, carried almost horizontally		

Table 8: Plans of conservation concern that potentially occur

Scientific Name	Status / protection	Suitable Habitat
Drimia saguinea	Near threatened	Open veld and scrubby woodland in a variety of soil types.
Highly poisonous bulb that has a deep-red colour, a portion visible above ground, whitish-green flowers appear in spring before the leaves.   		
Stenostelma umbelluliferum	Near Threatened	The inconspicuous nature of this species makes it easy to be overlooked. This plant's habitat is limited to deep black turf mainly near drainage lines on vertic soils with high clay content in grassland or savanna
Large tuberous rootstock, milky latex where when damaged, the fruit is a follicle carried upright, usually solitary in an umbel with longitudinal bands of different shades of green. The seeds are flat and brown and have a white tuft of hairs (coma).		

Images from http://www.plantzafrica.com/plantqrs/stenostelumbel.htm

Boscia albitrunca Shepard' Tree / Witgat	National Protected Tree	Dry areas with low rainfall, usually on deep sand
The tree trunk is distinctly smooth and white or whitish grey with bare stem, rounded evergreen grown, could have a stunted appearance. The fruit ripens to a smooth yellow. Flowers are yellowish green and heavily scented (July-Nov). *Easily confused with Boscia foetida that occurs abundantly in the studies area. The flowers of B foetida are fowl smelling and the tree is usually larger and without the distinct white trunk.*		

APPENDIX B: ALIEN INVASIVE PLANT SPECIES

Opuntia ficus-indica –confirmed to occur sporadically in woodland vegetation, mainly south of Sptiskop substation

Sweet Prickly Pear

- Much branched, succulent shrub or trees;
- Dark green, cladodes;
- Red-orange to yellow flowers;
- Pieces should not be carted away and discarded, as this is one of the most common ways in which new infestations begin

Plant sap and fruits of some species are poisonous

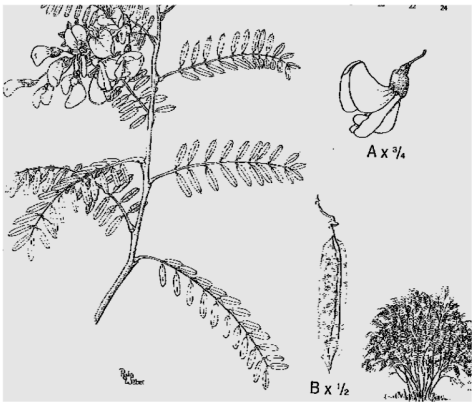
Whole plant is poisonous (some fruit are edible)

Sesbania punicea – likely occurrence in al riparian vegetation

Red Sesbania

- Deciduous shrub or small tree with slender branches
- Dark green, drooping pinnate leaves, ending in tiny, pointed tips
- Red-orange pea-like flowers in September to March
- Brown seed pods, four winged with the tip sharply pointed.

Whole plant is poisonous



Argemone mexicana* and *A ochroleuca* – *likely to invade disturbed soils post construction

Mexican Poppies

- An annual, spiny herb
- Grey or bluish green and spiny leaves with prominent white vein
- Stem exude yello sap when cut
- Flowers yellow to creamy white from Sept –Jan

Whole plant and seeds are poisonous, Sap and spines are skin irritants

Nicotiana glauca* – *likely to occur in riparian vegetation

Wild Tobacco

- Evergreen, slender shrub or small tree, blue-green all over.
- Blue-green leaves are leathery on long petioles (leave stalk)
- Flowers are tubular yellow to light orange, drooping clusters, all year
- Invades road sides, riverbanks and waste lands

Sesbania bispinosa* – *likely to colonise disturbed areas in black clay soils

Spiny Sesbania

- Herb, between 1 and 3m tall and slender
- Compound leaves
- Yellowish flowers with purple/burgundy markings (image)
- Fruit a glaborous pod, thin and constricted between the seeds

APPENDIX C: CURRICULUM VITAE OF SPECIALIST

Specialist consultant and owner:	**ANTOINETTE EYSSELL (Pr Sci Nat)**
	Sole proprietor of Dimela Eco Consulting
Main specialisation:	Vegetation Assessments
Professional membership:	South African Council of Natural Scientific Professionals
	Registered as Professional Natural Scientist (Ecology)
	Registration number 400019/11
Contact details:	(+27)83 6426 295
	Antoinette@dimela-eco.co.za *or*
	DimelaEcoConsulting@gmail.com

EXPERIENCE AND SPECIALISATION

- Vegetation assessments;
- Vegetation overviews or scans;
- Strategic ecological assessments;
- Mitigation measures to reduce impacts on the natural environment;
- Ecological management plans (including alien vegetation management);
- Specialist input: ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data; and
- Review of ecological reports.

MEMBERSHIPS IN PROFESSIONAL SOCIETY

- Professional Natural Scientist (*Pr. Sci. Nat.*) with the South African Council for Natural Scientific Professionals (SACNASP)
  Registration number 400019/11

EDUCATIONAL QUALIFICATIONS

- M.Sc Environmental Science, University of Pretoria (2010)
  Dissertation: *Land cover change and its effect on future land uses*
- B. Sc (Hons) Horticulture, University of Pretoria (1999-2000)
  Dissertation: *Horticultural uses of the indigenous Barleria species*
- B. Sc (Agriculture) Horticulture, University of Pretoria (1993-1996)

EXAMPLES OF SOME PAST PROJECTS

PROJECT NAME	INDUSTRY / CLIENT	DATE	ADDITIONAL INFORMATION
Rangeview Section 24 G Rectification:	Mogale City Local Municipality.	April 2009	Facilitation of the Rectification Process for the unlawful commencement or continuation of the listed activities in terms of

PROJECT NAME	INDUSTRY / CLIENT	DATE	ADDITIONAL INFORMATION
Vegetation Assessment			section 24G of the National Environmental Management Act (Act no 107 of 2006). The study involved the assessment of vegetation communities in terms of ecological function and conservation value as well as extent of impact due to unlawful activities.
ESKOM Hendrina	ESKOM	February 2010	Ground truth the final route alignment to inform possible amendments and the Environmental Management Plans (EMP) with regards to sensitive areas, plants or faunal species and suitable mitigation measures for construction and operation.
Olifantsvlei Cemetery (Gauteng)	Johannesburg City Parks	April 2010	Vegetation assessment and identification and mapping of a small population of *Kniphofia typhoides* (Near Threatened)
Kyalami Gardens	Developer	October 2010	Verify an outdated report as well as search for plants of conservation concern that might occur on the site. An isolated patch of primary Egoli Granite Grassland was mapped and added as an addendum to the historic report.
Nzikazi Ecological Investigation (Nelspruit, Mpumalanga)	Neighbourhood Development Company	July 2010	The terms of reference were to: • Determine the ecological status quo of the planning area and surrounds, including the pressures threatening the natural environment within the study area; • Highlight potential ecological concerns and no-go areas for development within the planning area; • Gain an understanding of where areas of degradation and interference are located in order to place future development in areas of less ecological function and conservational importance; and • Identify opportunities for improving the ecological status quo of the area.
Polokwane SEA (inform Eskom infrastructure expansion)	ESKOM Distribution	September 2010	Provided a Status Quo of the ecology of the study area and rate the ecological sensitivity and the constraint it poses towards the proposed linear developments according to set criteria. Discussed the potential impacts associated with power line and/or substation construction on the ecology of the study are and provided mitigation and/or recommendations for decreasing the environmental impact of proposed power distribution and generation within the study area.
Alien vegetation identification, eradication and monitoring plans	Mooiplaats Colliery	September 2011	Identify alien invasive species and extent on site and develop an eradication and monitoring plan
Vegetation Assessment for Solar Panels	Schmidsdrift, Northern Cape	January 2012	Delineation of vegetation communities, determine vegetation sensitivities and survey for plants of conservation concern. Report on potential impacts and mitigation measures to limit

PROJECT NAME	INDUSTRY / CLIENT	DATE	ADDITIONAL INFORMATION
			impacts.
Vegetation Assessment: ESKOM powerlines	• Jaguar-Kookfontein (Gauteng) • Powerline deviation around open cast mining (Middelburg)	Feb-May 2012	Survey the proposed route options and compare the floral assemblages that are expected to occur within the area to the actual vegetation found to be present along the route options. Map the localities of plants of conservation concern that was identified during the field survey or suitable habitat where these plants could potentially occur. Assess impacts and determine route alignment that is likely to have the least impact on sensitive vegetation.
Protected tree identification	Kranspoort road upgrade	March 2012	Identify and record localities, species and numbers of protected trees along an area earmarked for road upgrade.
Ground-truth final ESKOM route alignment	Dhuva-Minerva route deviation	March-April 2012	Walk proposed route alignment and identify sensitive vegetation issues and pylon positions that might need to be moved.
Vegetation base line study and input into Biodiversity Action Plan	Kumba Iron Ore (Anglo)	April-May 2012	Undertake a gap analysis and review of existing information and update by assessing the vegetation during the summer months and suggesting monitoring plots, information to e collected and areas where sensitive vegetation should avoided and managed.

EMPLOYMENT HISTORY

Nov 2011 – current
Vegetation specialist and sole proprietor: Dimela Eco Consulting

Sep 2007 – Nov 2011
Vegetation Specialist at Strategic Environmental Focus (SEF)

- Undertake ecological assessment and in specific, vegetation assessments.
- Vegetation assessments;
- Vegetation overviews or scans;
- Strategic ecological assessments;
- Mitigation measures to reduce impacts on the natural environment;
- Ecological management plans (including alien vegetation management);
- Specialist input: ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data; and
- Review of ecological reports.

Aug 2003 – Sep 2007
Snr Environmental Education Officer: Environmental Education Centre, Pretoria National Botanical Garden, South African National Biodiversity Institute (SANBI)

- Plan, Implement and facilitate the Outreach Greening Programme in Tshwane.
- Raise awareness on South African biodiversity in previously disadvantaged communities.
- Develop resources and relevant teaching and learning support materials for the Outreach Greening Programme and for the mentorship of student-interns on the programme.

- Network with authorities, partners, sponsors and funders of the programme.
- Train, assist, manage and support student-interns.
- Manage the Outreach Greening Programme in an effective and accountable manner so as to ensure the sustainability of the various projects.
- Carry out administrative and finance related tasks in support of the programme
- Manage the Tshwane Greening The Nation Project (SANBI).
- National and international presentations on the value and purpose of the SANBI Outreach Greening programme(s).

Jun – Jul 2003
Horticultural Trainer: 17 Shaft Training Centre, Johannesburg

- Facilitation of practical and theoretical training sessions.
- Development of teaching resources.
- Evaluation and motivation of students.
- Monitoring of the College's hydroponics system for agricultural purposes.
- Assist in structuring the learning programme as the college's horticultural section was then still in its infant stages.

May 1997 – Mar 2002
Horticulturist: Pretoria National Botanical Garden (NBI)

- Manage nursery staff.
- Research pertaining to the propagation of indigenous plants.
- Accession of plants.
- Growing indigenous plants and maintenance of pant collections.
- Research and grow plants known to be difficult to propagate.
- Manage prorogation- and retail nursery.
- Plant identification and horticultural advice to the public.

OTHER RELEVANT QUALIFICATIONS / SKILLS

Courses:

- 2012: Soil Classification and Wetland Delineation (Terra Soil)
- 2007: ISO 14000 Advanced EMS Auditors Course (SGS & University of Pretoria)
- 2007: Introduction into Forestry Stewardship Council (FSC) (University of Pretoria)
- 2006: Permaculture training course (S.E.E.D)
- 2005: Project Management Course (Wildlife and Environment Society of South Africa (WESSA) Umgeni Valley)
- 2004: Grass and plant identification courses
- 2004: Tsoga 1 (course in speaking Sepedi)
- 1999: Certificate in Seed Science (University of Pretoria)

Presentations:

- July 2007: Environmental Education in a changing world, World Environmental Education Conference (WEEC), Durban
- September 2006: Environmental Education, BGCI Conference, Oxford England