Proposed Coal Mine on the Farm Droogenfontein 241 IR Portions 26, 46 and 47, Delmas, Mpumalanga.

Vegetation Assessment

Date: October 2013

Report drafted on behalf of

Classic Environmental Management Services (CEMS)

For:

Shangoni Management Services

Block C8

Block@Nature

472 Botterklapper Street

The Willows

Tel +27 (0)12 807 7036

Fax +27 (0)12 807 1014

Report drafted by:

Dimela Eco Consulting

Contact: Antoinette@dimela-eco.co.za *or*

DimelaEcoConsulting@gmail.com

Indemnity

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. R543 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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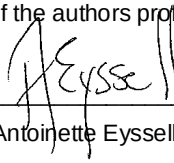
Dimela Eco Consulting undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

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

EXECUTIVE SUMMARY

Dimela Eco Consulting was contracted by Classic Environmental Management Services (CEMS) to undertake a vegetation assessment for Shangoni Management Services Pty (Ltd) to inform a coal mining application on the farm Droogenfontein in proximity to the town of Delmas, Mpumalanga.

The terms of reference were as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the proposed sites;
- Plant identification and the description of actual vegetation groupings found on the proposed site, compared to the expected natural state as listed in the national vegetation map;
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed “red data plants”) and sensitive vegetation groups; and
- Where applicable, recommend mitigation measures and recommendations to limit the perceived impact(s) on vegetation.

The assessment was undertaken on portion 46, 47 and 26 of the farm Droogenfontein 242 IR. Portion 46 and 47 were situated about 13km west of the town of Delmas in the Mpumalanga Province, just south of the R555 road between Delmas and Springs. Portion 26 is situated further east, about 15km south-west of Delmas. Portion 46 and 47 comprised about 8ha, while portion 26 comprise approximately 130ha. The portions are situated in the quarter degree square 2628BA.

Existing literature indicated that three vegetation types converge in the area of the sites assessed: Soweto Highveld Grassland, Eastern Highveld Grassland and Andesite Bushveld. The two Grassland types are nationally classified as Endangered due to cultivation, mining and urbanisation within the grassland.

Due to the site being largely transformed by agricultural activities, the natural vegetation was limited to the perceived wetland areas on portion 26. The vegetation observed on site was grouped as follows:

1. Transformed grassland and cultivated areas;
2. Secondary grassland with seepage areas; and
3. Moist grasslands / vegetation associated with watercourses.

The study found that the vegetation sensitivities on site comprised the vegetation associated with wetland conditions as well as the adjacent portion of secondary grassland with seepages on portion 26. No primary Soweto Highveld or Eastern Highveld grassland was observed. A protected plant species, the 'Declining' *Crinum bulbispermum* was observed in a large population occurring within the wetland, which adds to the sensitivity of this portion of the site assessed. The vegetation on portion 46 and 47 was degraded and classified as transformed with no plants of conservation concern occurring.

If the development proceed, mitigation measures as set out in this report should be adhered to as a minimum. The most important being the in situ conservation of protected species, where possible.

According to the MBCP, the majority of the site is classified as 'No Natural Habitat Remaining, or 'Least concern'. However, a section on the southern extent of Portion 26 is classified as 'Important and Necessary' to reach the conservation targets of resources. The observed vegetation sensitivities were compared to the Mpumalanga Biodiversity Conservation Plan which classified the terrestrial biodiversity of as being of low conservation concern in the province as a whole, with a portion of the wetland on portion 26 classified as "Important and necessary" to reach conservation targets. However, this assessment found that local sensitivities such as the wetland, its associated function as well as the population of *Crinum bulbispermum*, exist on the site, worth of conservation efforts.

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1.1 Terms of reference

The terms of reference were as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the proposed sites;
- Plant identification and the description of actual vegetation groupings found on the proposed site, compared to the expected natural state as listed in the national vegetation map (Mucina & Rutherford, 2006);
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed “red data plants”) and sensitive vegetation groups; and
- Where applicable, recommend mitigation measures and recommendations to limit the perceived impact(s) on vegetation.

1.2 Methodology

The assessment entailed a literature review which included short listing plants of conservation concern that could potentially occur on the site, a field survey, the analysis of data collected and reporting. The methodology used is listed in Appendix A. the field survey was undertaken in October 2013, after the first rains.

1.3 Assumptions and Limitations

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. According to the Mpumalanga Minimum Requirements for Biodiversity Assessment (Mpumalanga Tourism and Parks Agency, 2008):

> *“A floristic (plant) survey must be conducted during the growing season of all species that may potentially occur (this may require more than one season’s survey in order to identify flowering species) with two (2) visits undertaken (November & February). Visits during other seasons will be determined by the flowering and fruiting times of species that do not occur during the summer.”*

However, one season survey was undertaken on the 17th of October 2013. The large wetland area on portion 26 of the farm Droogenfontein 242IR was burnt at the time of both survey with grass species just beginning to emerge. This hampered positive identification of species.

2. BACKGROUND TO THE STUDY SITE

2.1 Locality

The assessment was undertaken on portion 46, 47 and 26 of the farm Droogenfontein 242 IR. Portion 46 and 47 were situated about 13km west of the town of Delmas in the Mpumalanga Province, just south of the R555 road between Delmas and Springs. Portion 26 is situated further east, about 15km south-west of Delmas (Figure 1). Portion 46 and 47 comprised about 8ha, while portion 26 comprise approximately 130ha. The portions are situated in the quarter degree square 2628BA.

2.1 Climate

The Delmas-area receives about 570mm of rain per year, occurring mainly during summer with the highest rainfall recorded in January. The average maximum daily temperature ranges from 17°C in June to 26.0°C in January. During the winter months, the night time temperature can drop to about 1°C on average. Frost is frequent.

2.3 Land Use

Portion 46 and 46 comprised small holdings. Both portions contained houses and outbuildings. The northern section of portion 46 was ploughed in the past and now contain secondary grassland used for grazing. An artificial dam is also situated on this section of portion 46. The southern part of portion 46 as well as open land on portion 47 is used also used for grazing. The grass was grazed short and included numerous weedy species. These two portions are surrounded by cultivated maize fields.

Most of portion 26 and its surrounds are used for maize cultivation. The area not currently ploughed comprised wetland areas that shows sign of grazing. Historic aerial imagery indicated that parts of the larger wetland area was also ploughed in the past – probably during dry years when the area was not too saturated to plough. A small cemetery is situated in the northern-eastern corner of the site. The dirt roads forming the western and southern boundary of portion 26 were recently upgraded and soil berms and culverts constructed, likely to aid drainage of the roads due to the wetland conditions.

2.4 Topography and Hydrology

The landscape on portion 46&47 is relatively flat, with an artificial dam situated in the northern section of portion 46. Portion 26 slopes gently towards the south-west to where the wetland area is situated (Figure 2). According to the National Freshwater Ecosystems Priority Areas spatial layer, a wetland area stretch from the south-western portion of the site towards the north-eastern corner (Figure 2).

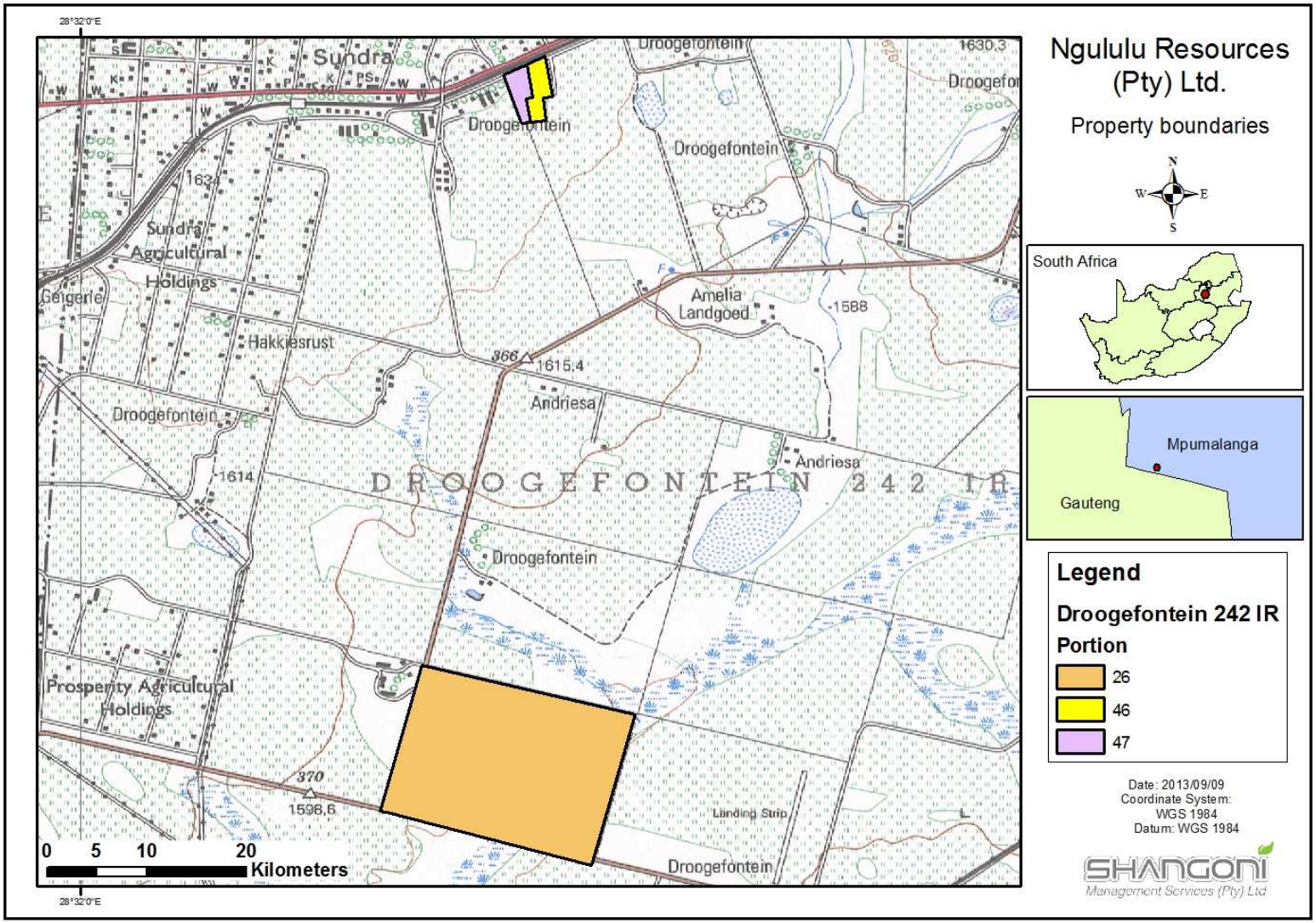


Figure 1: Locality map of the proposed site for the University of Nelspruit

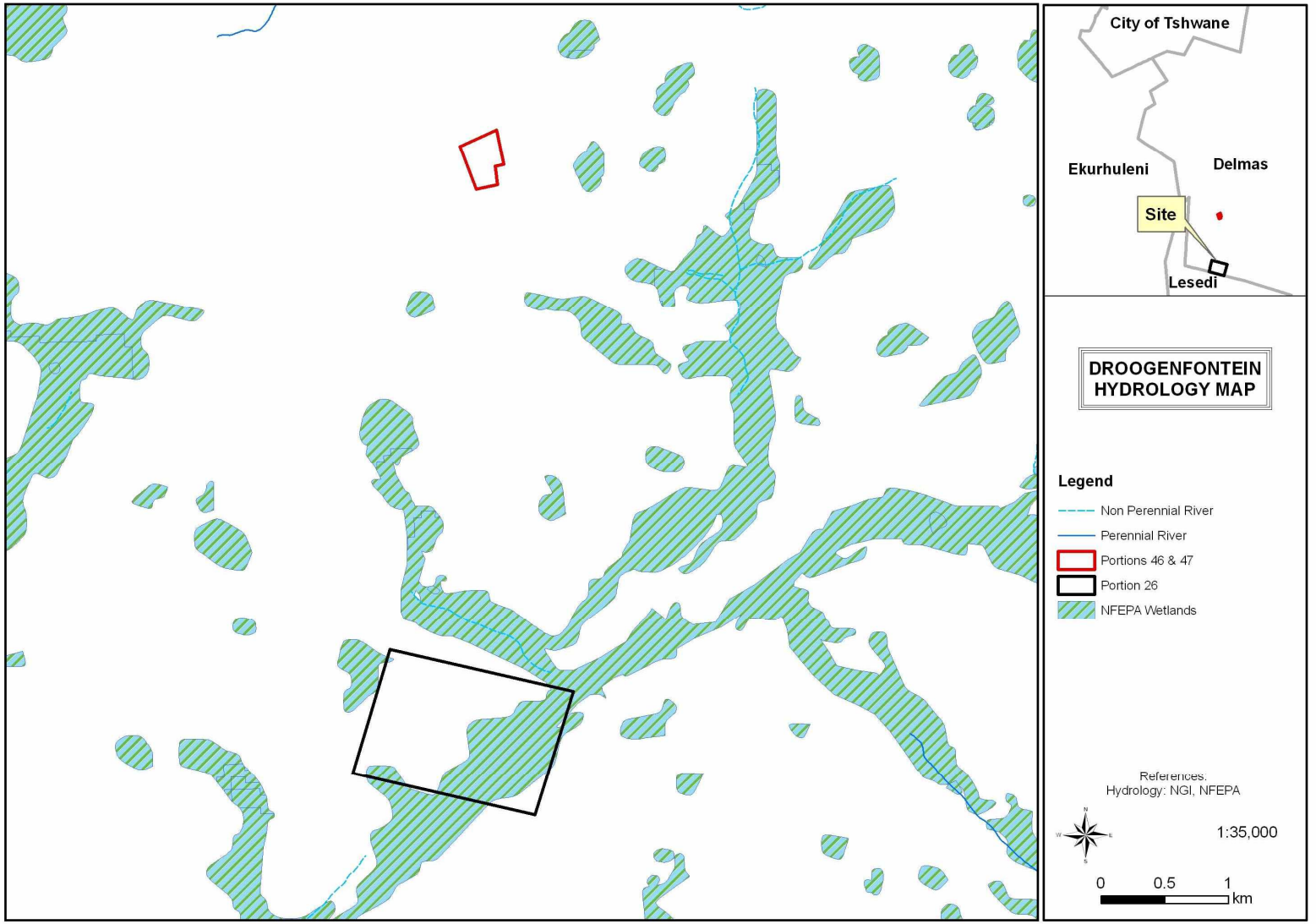


Figure 2: Hydrology map (as per existing national spatial layers)

2.5 National Vegetation Map

The study site is situated within the Grassland and Savanna Biome of South Africa (Mucina & Rutherford, 2006). Summer rainfall combined with dry winters with frost and marked diurnal temperature variations in the Grassland Biome are unfavourable to tree growth and therefore grasslands comprise mainly of grasses and plants with perennial underground storage organs, for example bulbs and tubers and less trees. The Savanna Biome 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 Grassland and Savanna Biome consists of various different vegetation types. The assessed sites are situated over three of these. Two vegetation types are situated within the Grassland Biome and in specific the Mesic Highveld Grassland Bioregion (a bioregion is a vegetation organisation level between that of vegetation type and biome). The remaining vegetation type forms part of the Savanna Biome where it intrudes into the Grassland. Table 1 summarises the vegetation types along with their national conservation status. The extent of the vegetation on this site is geographically represented in Figure3.

Table 1: Vegetation types that is expected to occur on site, as per the Vegetation Map of Southern Africa (Mucina & Rutherford, 2006).

Biome	Bioregion	Vegetation Type	Description and Conservation Status
Grassland	Mesic Highveld Grassland Bioregion	1. Soweto Highveld Grassland	Short to medium-high, dense tufted grassland dominated by *Themeda triandra* (Red Grass). *Endangered.* A limited area of the original extent of this vegetation is conserved in reserves. Much of the vegetation has been transformed by cultivation, coal mining and urban development. In addition, the vegetation has a high grazing potential due to the dominance of Red Grass and are often overgrazed.
		2. Eastern Highveld Grassland	The vegetation comprises species rich grassland on slightly undulating plains that contain and pan depressions. Grassland comprise short grassland dominated by species such as *Eragrostis, Themeda, Aristida, Digitaria* etc. *Endangered.* Only a small portion of this grassland type is conserved in nature reserves. However, the grassland is highly cultivated and transformed by urban development, plantations and mining in the area.

Biome	Bioregion	Vegetation Type	Description and Conservation Status
Savanna	Central Bushveld	3. Andesite Mountain Bushveld	The vegetation comprise dense, thorny bushveld with a well-developed grass layer on hill slopes and valleys. Least Threatened. About 7% of the original extent of this vegetation type is conserved on reserves. Transformation is currently low.

2.6 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: critically endangered (CR), endangered (EN), Vulnerable (VU) or Protected (Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). The ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The listed ecosystems incorporates the South African Vegetation Map (Mucina and Rutherford, 2006) as indicated in 2.5, as well as national forest types recognised by the Department of Water Affairs (DWA), priority areas identified in a provincial systematic biodiversity plan, or high irreplaceability forests patches or clusters systematically identified by DWA in order to determine ecosystems in need of protection.

Both the Soweto Highveld Grassland and the Eastern Highveld Grassland are ‘Endangered’ vegetation unit, but is listed as ‘Vulnerable’ ecosystems based on irreversible loss of natural habitat (Government Gazette 34809, 2011). The remaining natural habitat is less than 60% of the original extent, with more than 20% significantly degraded. *Note that this is only applicable to intact, natural vegetation.th*

<u>Implications of listing threatened ecosystems</u>

There are four main types of implications of listing an ecosystem:

- Planning related implications, linked to the requirement in the Biodiversity Act for listed ecosystems to be taken into account in municipal Integrated Development Plans (IDPs) and Strategic Development Frameworks (SDF)s;
- Environmental authorisation implications, in terms of the National Environmental Management Act (NEMA) and Environmental Impact Assessment (EIA) regulations;
- Proactive management implications, in terms of the National Environmental Management Biodiversity Act (NEMBA); and
- Monitoring and reporting implications, in terms of the NEMBA.

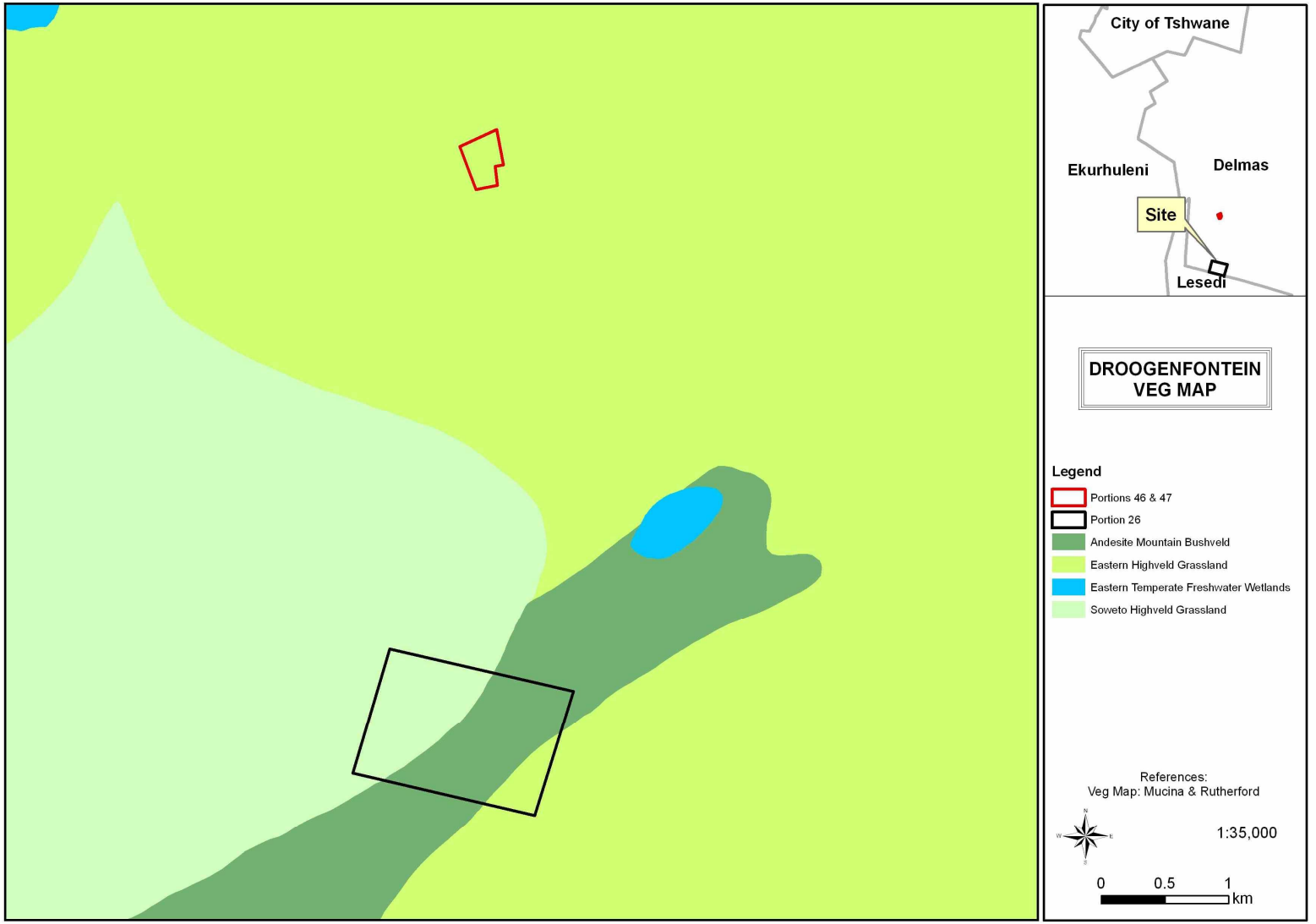


Figure 3: Regional vegetation as- per existing spatial layers

2.7 Mpumalanga Biodiversity Conservation Plan (MBCP)

The study site is situated within Mpumalanga Province. However, the southern boundary of portion 26 is on the border of Mpumalanga and Gauteng Provinces. The Mpumalanga Biodiversity Conservation Plan (MBCP) groups the terrestrial biodiversity assets of Mpumalanga into six conservation categories, based on the measured distribution of hundreds of biodiversity and ecological features throughout the province which are analysed for rarity and response to the pressures of various forms of land-use that diminish them. The conservation categories are:

1. Protected areas currently under formal biodiversity protection;
2. Irreplaceable areas, in urgent need of Protected Area status;
3. Highly Significant areas, requiring strict land-use controls;
4. Important and Necessary areas, requiring special care;
5. Areas of Least Concern, providing areas for development; and
6. Areas with No Natural Habitat remaining, providing preferred sites for all forms of development.

In addition to the above conservation categories, important ecological corridors have also been delineated for the province. The purpose of the ecological corridors is to provide intact mega-pathways for long-term biological movement, and they are selected primarily along river lines and altitude gradients in order to provide for the natural retreat and advance of plants and animals in response to environmental change.

According to the MBCP, the majority of the site is classified as 'No Natural Habitat Remaining, or 'Least concern' (Figure 4). However, a section on the southern extent of Portion 26, as well as a small portion on the western boundary are classified as 'Important and Necessary' to reach the conservation targets of resources.

Accompanying each of these conservation categories indicated above are broad land-use guidelines. Table 2 indicates the suitability of the biodiversity categories present on site to what is assumed the proposed land use will be classified as. It follows that due to the Important and Necessary area present on portion 26, surface mining is unlikely to be permitted by the Mpumalanga conservation authority.

Table 2: Types of land-use suited to each biodiversity conservation category present on site.

Types of Land Use	Important and Necessary	Least concern	No natural habitat
Underground Mining	R	Y	Y
Surface Mining	N	R	R

Y – Yes, permitted

N – No, not permitted, actively discouraged activity

R – Restricted by compulsory, site-specific conditions and controls when unavoidable, not usually permitted

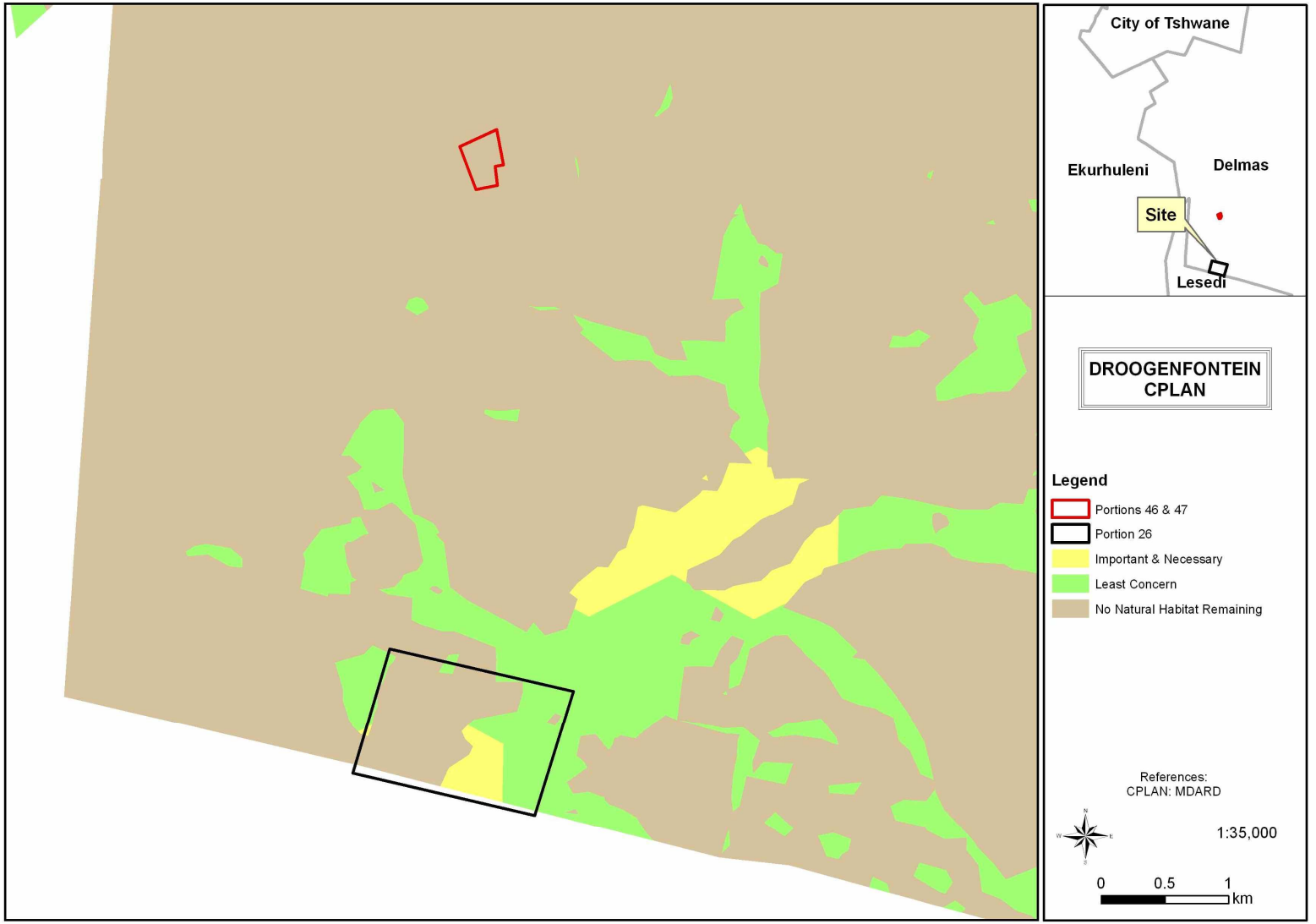


Figure 4: The site in relation to the Mpumalanga Biodiversity Conservation Plans (MBCP), terrestrial categories

3. RESULTS OF THE FIELD ASSESSMENT

3.1 Vegetation groupings on the site

Due to the site being largely transformed by agricultural activities, the natural vegetation was limited to the perceived wetland areas on portion 26. The vegetation observed on site was grouped as follows and represented in Figure 5:

1. Transformed grassland and cultivated areas;
2. Secondary grassland with seepage areas; and
3. Moist grasslands / vegetation associated with watercourses.

A record of plant species observed at the time of the field survey is listed in Appendix B.

3.1.1 Transformed land

The transformed land was characterised by vegetation that no longer comprised the natural species diversity and included the cultivated lands, the small holdings as well as the grazed grassland on portion 46 and 47 of the small holdings (Photograph 1). Within these areas the natural grassland species composition was transformed and included monocultures (maize), pasture and planted alien invasive plant species such as *Pinus* species (Pine).

Photograph 1 Transformed and grazed areas on portion 46 (top) and portion 47(below)

Although the grazed areas were burnt or grazed short, grasses such as *Eragrostis curvula* (Weeping Love Grass) and *Cynodon dactylon* (Couch Grass) were recognised but that the species diversity is assumed to be low. No natural vegetation remains and no plants of conservation concern occurs within transformed land (Photograph 1).

3.1.2 Secondary Vegetation with seepages

Portion 26 included a portion of secondary grassland. Secondary grasslands develop where the original, primary (undisturbed) grassland vegetation was removed (e.g. by cultivation). After such disturbances cease, pioneer grassland species colonise the disturbed areas leading to a secondary grassland state as opposed to the primary (climax) state prior to any disturbances. In the absence of any further disturbances, continuous succession should theoretically lead to the development of the original climax (or primary) state of the grassland. However, primary grasslands are species rich ecosystems, which once disturbed, are difficult, if not impossible to restore. Although grasslands can be re-created to comprise a number of grass species, the diversity of forbs and geophytes are not easy to attain.

From historic aerial images it was evident that the south-western corner of portion 26 was ploughed at some stage. At the time of the survey, the secondary grassland was grazed and partially burnt (Photograph 2). Although the grass species was not recognisable, it was thought that as a minimum the following grass species would be present: *Themeda triandra* (Red Grass), *Aristida congestus* (Three-awn), *Setaria spachelata* and *Erogrostis curvula* (Weeping Love Grass). The grass *Cynodon dactylon* (Couch Grass) was positively identified as well as *Imperata cylindrica* (Cotton Wool Grass). Cotton Wool Grass favours moist soils and can be indicative of wetland conditions. Within the secondary grassland, the patchy occurrence of this grass coincided with seepage areas possibly linked to the wetland area directly west thereof (Photograph 2) (Limosella, 2013).

Photograph 2: Secondary grassland with *Imperata cylindrica* (Cotton Wool Grass) (arrows) in seepage areas

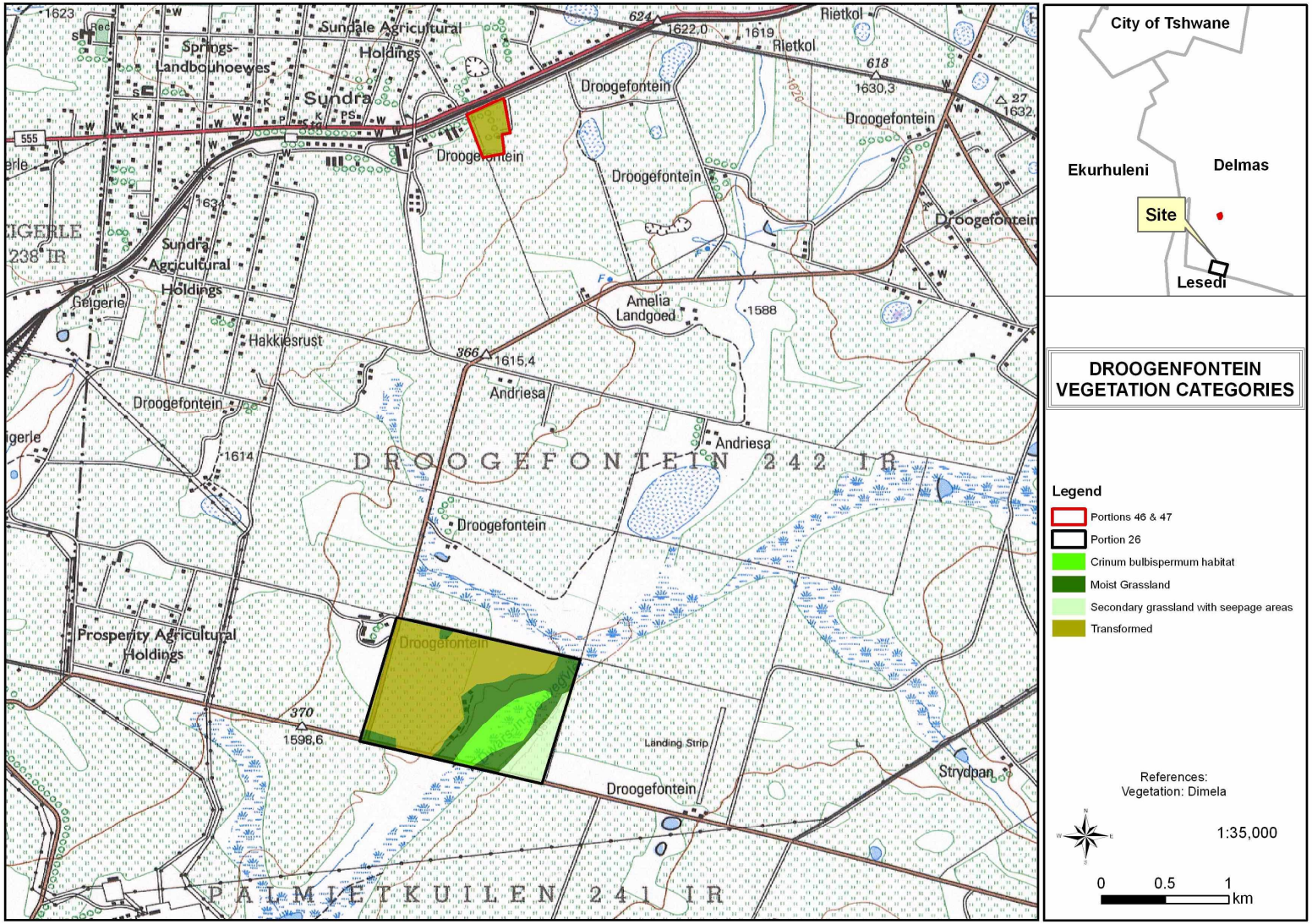


Figure 5: Vegetation groupings on the site

The herbaceous layer included *Hermannia depressa* (Rooi-opslag) which in large numbers could be indicative of overgrazing and trampling (Van Wyk & Malan, 1997). Other species were *Helichrysum nudifolium*, *Berkheya setifera, Jamesbrittenia aurantiaca* (Cape Saffron) and *Bulbine narcissifolia.*

Although secondary grassland is not expected to host a large species diversity, the species diversity was low. However, it is possible that some species were still dormant at the time of the field survey and therefore this should be seen as the minimum and not exact species diversity.

3.1.3 Vegetation associated with watercourses

As per the National Water Act (Act No 36 of 1998), a wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil. Vegetation indicative of wetland conditions was also observed on portion 26.

A large wetland area stretched from the mid southern boundary of portion 26 to the north-eastern corner and beyond. This vegetation was burnt at the time of the field survey (Photograph 3). The grass layer was not recognisable but the following specie was thought to occur: *Sporobulus* species*, Erarostis plana* (Tough Love Grass), *Aristida aequiglumis, Andropogon appendiculatus, Paspalam dilatatum* and *Setaria* species. In addition, sedges such as *Typha capensis* and *Schoenoplectus* species also likely occur here.

However, the fire stimulated a number of herbaceous species to flower. The species observed include *Falkia oblanga. Hermannia erodioides, Hypoxis filiformis* and *Arctotis arctotoides* (Photograph 4; Appendix B)*.*

Photograph 3: Burnt wetland area

Photograph 4: ***Arctotis arctotoides, Falkia oblonga and Hermannia erioides***

Although not yet in flower, a population of the bulb *Crinum bulbispermum* (River Lily) was found within the wetland area (Figure 5; Photograph 5). This species is a protected plant species as its medicinal use is leading to a decline in numbers nationally (see section 3.2).

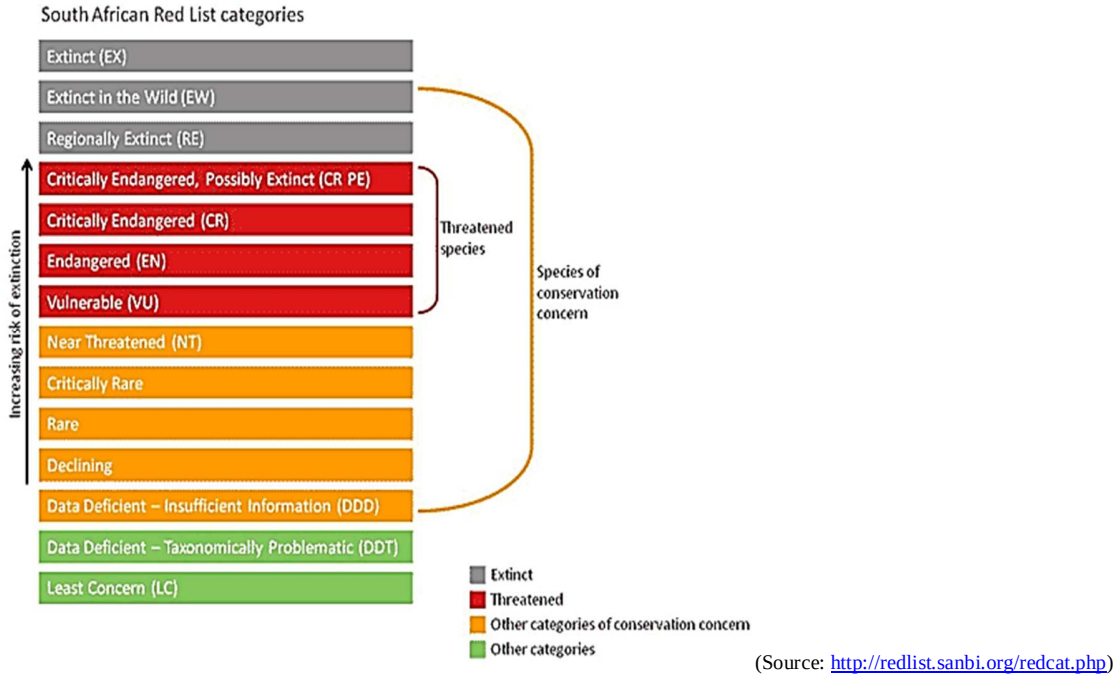
Although the species diversity is likely not high, the vegetation remains functional to prevent soil erosion, regulate water flow and to provide habitat to numerous fauna and flora species. A smaller portion of moist grassland was found on the south-western corner of the site. While *Crinum bulbispermum* was not observed here, the bulbs might still have been dormant. Some dumping and excavation (likely from the recent road works) as well as alien invasive plant species were observed at the edge of the moist grassland, while the small wetland area on the northern boundary was encroached by the maize cultivation.

Photograph 5: ***Crinum bulbispermum*** **on portion 26**

3.2 Plants of Conservation Importance

3.2.1 Nationally Protected Plants (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 6). These plants are also referred to as Red Listed plants. 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 6: 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), information from the Mpumalanga Tourism and Parks Agency (MTPA) and relevant literature pertaining to the area. Of these, suitable habitat for 2 species were present on the studied site, of which one, *Crinum bulbipsermum*, was confirmed to occur. This species is classified as 'Declining' meaning that it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened status, but there are threatening processes causing a continuing decline of the species. If the decline continuous, these plants will become threatened. The species is thus declining but the population has not yet reached a threshold of concern. It is advised that the habitat of this species is protected and where the removal of the plants are absolutely necessary, that the species be relocated to suitable habitat in conserved areas or the plants should be rescued and used as mother stock for medicinal plant cultivation programmes (Raimondo *et al,* 2009). A protective buffer area of

200m is recommended around these plants. It must also be noted that the survival of this population is also linked to the hydrology of the wetland area. If the wetland would for some reason dry out, this species is unlikely to persist.

The other species that could potentially occur is *Kniphofia typhoides*. This species is classified as Near Threatened and are thus on the verge of becoming extinct. *K. typhoides* grows in heavy, black clay soil, in low lying marshy ground in pans and vlei's. It is usually associated with climax *Themeda triandra* grassland. However, the author has observed this species in historically ploughed and disturbed areas before. The clayey nature of soil within parts of the wetland could be suitable habitat for this species. At the time of this assessment, the vegetation was burnt and therefore the likelihood of the plant occurring cannot be ruled out.

3.2.2 Provincially Protected Plants

A number of plants are provincially protected by the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998). Other than *Crinum bulbispermum*, no other provincially protected species was observed. However, the secondary grassland and moist grassland on portion 26 may support the following species which could have been dormant at the time of the study:

- *Gladiolus* species; and
- *Watsonia* species

3.3 Medicinal Plant Species

Rising demand for medicinal plants has led to increased pressure on wild plant populations. This combined with shrinking habitats, means that many species in South Africa are now facing local extinction (Botha *et al,* 2004). The demise of medicinal plant species holds dire consequences both socially and ecologically. People stand to lose their medicine, and in the case of traditional healers and plant gatherers, their livelihoods (McKean, unknown). Medicinal plants that are highly utilised will soon become extinct as they are harvested from natural environments or destroyed by development and mining. The trade in medicinal plants is high and it is unlikely that, at current levels of exploitation, the sustainable supply of medicinal plants will ever meet the demand. Therefore it is important to be able to identify areas that could potentially support, or provide plants to the medicinal plant trade (Emery *et al*, 2002).

A minimum of 5 plants known to be used medicinally were recorded on the site (Appendix B).

3.4 Alien Invasive Plant Species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also

degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

3.4.1. Legislation

National Environmental Management: Biodiversity Act (NEMBA)

Alien and Invasive Species Regulations, as well as a draft list of categories of invasive species in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) was published in the Government Gazette No. 32090, in April 2009. On 19 July 2013, a declared list of alien invasive species including prohibited, category 1a and category 1b species was published under the new NEMBA regulations (Government Gazette No 36683, 19 July 2013). The species indicated as category 1a and 1b cannot be propagated, grown, bought or sold by the industry without a permit, while some species must be destroyed and are prohibited.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) – note that the new regulations published on 19 July 2013 only makes provision for category 1 invaders:

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Conservation of Agricultural Resources Act (CARA)

The amended Regulations (Regulation 15, as amended in March 2001) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) identifies three categories of problem plants:

Category 1 (Declared weeds): plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish plant, maintain, propagate or sell/import any category 1 plant species;

Category 2 (Declared invaders): are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and

Category 3 (Declared invaders): plants are ornamentally used and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30 m of a 1:50 year flood line and must be prevented from spreading.

Land users have to control these plants by means of the methods prescribed in the Act. Unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse.

The alien plant species identified on the study site are listed in Appendix B. Category 1 species follow the new NEMBA regulations, while the remainder are in accordance with CARA.

3.4.2. Status quo of invasion on site

The alien plant species identified on the study site are listed in Appendix B. Category 1 species follow the new regulations, while the remainder are in accordance with CARA. Portion 46 & 47 contain numerous exotic species usually planted as ornamentals. Most of these species are not invasive. Categorised invasive species on portion 46 & 47 include *Pinus patula* (Pine) and *Opuntia* species (Prickly Pear).

The wetland area on portion 26 contained annual and biannual invasive species such as *Verbena brasilliensis* and *Crisium vulgare* (Scotch Thistle) as well as large specimens of *Eucalyptus* cf *camaldulensis* (Red River Gum).

4. VEGETATION IMPORTANCE AND SENSITIVITY

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof. The vegetation sensitivity assessment aims to identify whether the vegetation within the study area is of conservation concern and thus sensitive to development as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Protected by national or provincial legislation;
- Habitat or potential habitat to plants species of conservation concern, protected plants or protected trees;
- Situated within ecologically sensitive features such as wetlands or riparian areas; and
- Natural, untransformed and un-fragmented natural vegetation.

4.1 Sensitivity Ratings and Analysis

In order to determine the sensitivity of the vegetation observed on the study site, weighting scores as listed below (Table 3; Appendix A) were applied. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity to development. Sensitive vegetation or areas of conservation importance were classified based on the findings of the study and the criteria as listed in Appendix A.

Table 3: Weighting scores

Scoring	13-18	7-12	0-6
Sensitivity	High	Medium	Low

Table 4: Scoring of vegetation that occur within the study area

Vegetation	Conservation Status of regional Vegetation unit	Listed Ecosystem	Legislated protection	Plants of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18
Transformed grasslands	N/A	N/A	0	0	0	0	0
Secondary grasslands with seeps	2	1	3	2	3	2	13
Moist grassland / wetland vegetation	2	2	3	2	3	3	15

As per Table 4, the transformed land scored low ratings, while the secondary grassland and moist grassland / wetland areas scored the highest ratings. The significance and implications of the sensitivity rating is discussed below, while the sensitivities are geographically represented in Figure 7.

4.1.1 Vegetation of Low Sensitivity

Vegetation with low sensitivity is generally degraded and disturbed vegetation with little ecological function and is usually species poor (most species are usually exotic). This vegetation has little or no conservation potential and comprise of the transformed and grazed areas (Figure 7). No plants of conservation occurred in these areas.

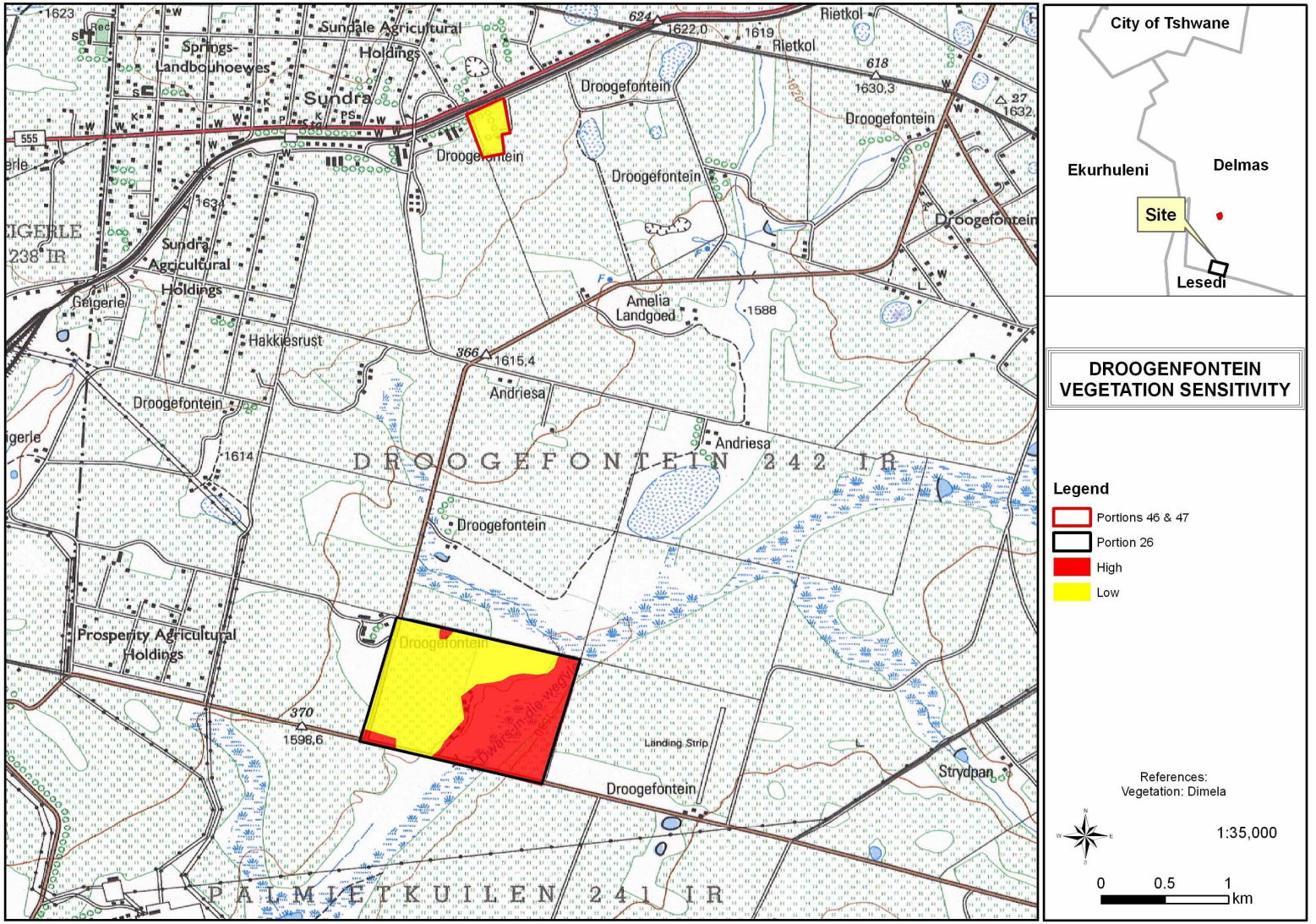


Figure 7: Vegetation sensitivity map

4.1.2 Vegetation of High Sensitivity

Secondary grassland with seepages

Although the secondary grassland is expected to have a moderate to low species diversity, seepage areas are embedded in the secondary grassland. Seepage areas indicate wetland conditions and are therefore protected by national legislation. In addition, the vegetation also plays a role as catchment to the larger wetland area and are important to maintain ecological corridors for the movement and survival of species within a landscape fragmented by agriculture. The secondary grasslands also falls within the recommended 200m protective buffer of the *Crinum bulbispermum* population.

Moist grassland / Wetland areas

All watercourses are protected environments in South Africa (National Water Act) and subsequently the plant species within and around watercourses that contribute to the health and functioning of the watercourses (Limosella Consulting, 2013). This vegetation should also be protected and rehabilitated where needed. Furthermore, the moist grassland provides habitat to the Declining *Crinum bulbispermum* and is potential habitat to the Near Threatened *Kniphofia typhoides*.

4.2 Vegetation Sensitivity Compared to the MBCP

The observed vegetation sensitivities were compared to the Mpumalanga Biodiversity Conservation Plan (MBCP) (Figure 4 and Figure 7). The MBCP classified the terrestrial biodiversity of as being of low conservation concern in the province as a whole, with a portion of the wetland on portion 26 classified as “Important and necessary” to reach conservation targets. However, this assessment found that local sensitivities such as the wetland, its associated function as well as the population of *Crinum bulbispermum*, exist on the site, worth of conservation efforts.

5. IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for a large number of ecological services provided for by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts need to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

5.1 Expected Impacts

The main impact expected by the proposed development, is the removal of surface vegetation that could lead to erosion and subsequent sedimentation within the wetland areas, as well as the destruction of the wetland areas and *Crinum bulbispermum* population.

5.2 Impact Assessment Criteria

The possible impacts on vegetation were assessed based on the following:

5.2.1 Extent of the Impact

A description of whether the impact is restricted to the development footprint, the study site (extending only as far as the study site), or whether the impact will extend beyond the study area and its immediate surroundings, regional, or to a national scale.

5.2.2 Duration of the Impact

- Short term: the impact will disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase
- Short to Medium term: the impact will be relevant to the end of a construction phase
- Medium term: the impact will last up to the end of the development phases, where after it will be entirely negated
- Long term: the impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter
- Permanent: this impact is not reversible and human intervention e.g. rehabilitation, is unlikely to negate the impact sufficiently (e.g. acid mine drainage)

5.2.3 Intensity

This indicates the degree to which the impact changes or could change the conditions or quality of the environment. This was qualified as:

- Low: the impact alters the affected environment in such a way that the natural processes or functions are not affected
- Medium: the affected environment is altered, but functions and processes continue, albeit in a modified way
- High: function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

5.2.4 Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as:

- Improbable: low likelihood, the chance of this impact occurring is between 0 and 25%. However, mitigation measures might be needed in the event of this impact occurring.
- Probable: a distinct possibility, the chance of this impact actually occurring is approximately 50% and therefore it needs to be mitigated

- Highly probable: the impact is most likely to occur and the planning phase must address the relevant mitigation measures to limit the impact
- Definite: this impact will occur regardless of any prevention measures, or is currently occurring. Mitigation measures or contingency plans must be implemented to contain the impact.

5.2.5 Significance with and without mitigation

Without mitigation measures (WOMM):

- Low: the impact is of little importance, but may require some mitigation
- Medium: the impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels
- High: the impact is of major importance and mitigation is essential. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable.

With mitigation measures (WMM):

- Low: the impact will be mitigated to the point where it is of limited importance
- Medium: despite the successful implementation of the mitigation measures that reduce the negative impacts to acceptable levels, the negative impact remains significant. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw
- High: The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

“The mitigation hierarchy is inherently proactive. It illustrates the steps that should be followed to firstly avoid, then minimize, then repair or restore, and finally compensate for or offset the negative effects of any development on biodiversity” (SANBI, 2012). Therefore in areas of high conservation importance, avoidance of the impacts should be considered first. Within the studied area, much of the assumed area to be impacted is of Low concern, except for the vegetation associated with wetland areas, as well as its surrounding catchment. Mitigation measures to limit impacts and conserve the ecological function of these areas should thus be included in the Environmental Management Plan (EMP). From the perspective of minimizing impacts on biodiversity and ecosystem services, on-going rehabilitation and monitoring of the indigenous vegetation during construction offers significant benefits over rehabilitation only after completion of construction (SANBI, 2012). This approach effectively reduces the time during which negative impacts endure and any associated risks.

5.3 Impacts Assessment

Table 5 lists the expected impacts on the vegetation as a result of the proposed development, as well as potential impacts during the operational phase and closure. The impacts are also assessed in Table 5 below and suitable mitigation measures are given in Section 5.4.

Table 5: Assessment of impacts associated with the construction and operation of an open cast mine

Phase	Impact	Source	Extent	Duration	Intensity	Probability of occurrence	Significance	
							WOMM	WMM
A: Operation	1. Destruction of moist grassland / wetland area	• Clearing of the vegetation and change of the soil hydrology • Dumping of overburden on moist grasslands	Study site	Permanent	High	Highly probable	High	Medium
	2. Destruction of plant species that are 'Declining'	• Mining activity within the moist grasslands as well as edge effects onto adjacent moist grasslands • Drawdown of water table	Open cast footprint and immediate surroundings	Long term	High	Highly probable	High	Medium - Low
	3. Deterioration of the vegetation associated with wetlands surrounding the site	• Deterioration of vegetation in wetland areas around the site- due to edge effects, sedimentation, compaction or increased pollutants	Study site and downstream	Long term	Medium to High	Probable	High	Medium to Low
	4. Loss of the ecological function of the moist grasslands	• Destruction of the vegetation • Polluted water reaching the wetland areas • Lack of natural vegetation and the subsequent loss of the ecological function	Site	Permanent	High	Probable	High	Medium
	5. Possible increase in exotic and invasive vegetation	• Alien vegetation spreading into disturbed / stockpiled soils	Study site and surrounds	Long term	Medium	Probable	Medium	Low

Phase	Impact	Source	Extent	Duration	Intensity	Probability of occurrence	Significance	
							WOMM	WMM
B: Closure	6. Possible increase in exotic and invasive vegetation	• Lack of adequate rehabilitation	Study site and therefore surrounding area	Long term	Medium	Probable	Medium	Low
	7. Lack of functional vegetation	• Lack of adequate rehabilitation • Lack of monitoring and corrective follow-up action	Study site	Long term	Medium	Probable	Medium	Low
	8. Deterioration of the watercourse	• Lack of adequate rehabilitation • Polluted water reaching the downstream wetlands. watercourses	Regional	Long term	High	Probable	High	Medium
	9. Acid Mine Drainage	• Flow or seepage, of polluted water from old mining areas	Regional	Long term	High	Highly probable	High	High

5.4 Mitigation Measures

A: Construction & Operation

5.4.1 Destruction of moist grasslands

The mining footprint and infrastructure will inevitably impact on the wetland areas and secondary grassland with seepages on the site. In addition, the illegal disposal of construction material such as oil, cement etc., as well as overburden will destroy the vegetation and its ability to absorb pollutants.

Mitigation measures

- The wetland conditions as delineated by the wetland specialist should be regarded as sensitive (Limosella, 2013).
- Mining within a wetland area will require a water use license.
- Planning of the mining phases must incorporate on-going rehabilitation.
- The 'Declining' plants must be removed if situated within the planned mining and associated infrastructure footprint. These plants should be replanted during rehabilitation, only if its habitat (moist grasslands) will be recreated. If the plants cannot be conserved *in situ* or replanted as part of rehabilitation, the plants must be relocated to conserved areas. These plants can only be removed and relocated with permission (permit) from the Mpumalanga Tourism and Parks Agency (MTPA).
- A vegetation rehabilitation plan should be implemented. Grassland can be removed as sods and kept in suitable growing conditions. The sods must preferably be removed during the winter months and latest springtime. Relocation of the sods should be into suitable moist growing conditions. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks. These sods can be used in the eventual rehabilitation of the open cast footprint.
- Workers may not remove flora and neither may anyone collect seed from the plants without permission from the local authority.

5.4.2 Destruction of 'Declining' plant species

The 'Declining' plant species (*Crinum bulbispermum*) is situated within the moist grassland on portion 26 of the study site. It is likely that the mining activities will necessitate the removal and relocation of this species. It must also be noted that *Kniphofia typhoides* (Near Threatened), may also occur on the site.

Mitigation Measures

- The presence / absence of *K typhoides* in wetland areas should be confirmed during its flowering time (likely February)
- Where possible, the *Crinum bulbispermum* plants should be conserved *in situ* and their survival monitored during spring and summer for the duration of the operation and at least 3 years after closure.

- Implement a Plant Rescue and Rehabilitation Plan: Where the *Crinum bubispermum* plants are deemed to be under threat from the open cast footprint, the plants should be removed by a qualified specialist and replanted into suitable conserved areas, or maintained under suitable growing conditions until such time that it can be replanted as part of rehabilitation. The survival of these plants in their new habitat must be monitored for at least five years and corrective action taken, when it is found that the plants are not adapting. Note that these plants may only be removed with the permission of the provincial authority (MTPA).
- *Crinum bulbispermum* should be removed when dormant (winter months) and relocated prior to first growth in spring. The bulbs should not be watered during winter.
- Workers may not tamper or remove these plants and neither may anyone collect seed from the plants without permission from the local authority.
- It must be noted that plant removal and relocation measures are no substitute for *in situ* conservation and, although they may appear to be effective in the short term, have a net effect of shrinking the distribution of the species and increasing their vulnerability to extinction.

5.4.3 Deterioration of vegetation in moist grasslands and downstream

The removal of surface vegetation and overburden will expose the soils, which in rainy events could wash down into the remaining moist grasslands or wetland areas downstream, causing sedimentation on site and likely in downstream watercourses. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from nearby alien invasive trees can spread easily into these eroded soils or moist grasslands. Although the moist grasslands are likely to absorb a fair amount of pollutants, they have a finite capability to do so, depending on the hydrology, geomorphology and vegetation of the moist grassland.

Mitigation measures

- No construction / activities should be undertaken within the moist soils until a Water Use License was granted by the Department of Water Affairs (DWA).
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005).
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to work areas.
- Prevent polluted water from reaching the watercourse and surrounding moist grasslands.
- Trucks and equipment should only be washed in dedicated areas and the dirty water is not allowed to discharge into the watercourse or surrounding natural vegetation.
- During rehabilitation, 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. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area.

5.4.4 Loss of ecological function of the watercourse and moist grasslands

Polluted water or sediment reaching moist grasslands will have detrimental effects on the vegetation and hydrology downstream. Soil erosion could lead to increased sedimentation and turbidity, which could then reduce water storage capacity, smother vegetation, and decrease oxygen concentration. In addition, the lack of natural vegetation could drastically reduce water holding capacity and the subsequent loss of the ecological function of the vegetation as catchment to the watercourse. Soil erosion could also alter water flow rates into and out of wetlands, thereby impacting local hydrology. This could have a cumulative impact on plants within these areas as well as downstream from the site.

Mitigation measures

- Cordon off the main mine infrastructures from the surrounding natural vegetation and wetland areas to prevent any disturbances into the surrounding areas.
- Contain sediment and turbidity at the open cast and work sites by installing diversion or containment structures.
- Place and maintain erosion control barriers as appropriate to prevent sedimentation into the watercourse and moist grasslands.
- Keep sediment barriers in place until restoration is complete.
- Stockpile topsoil and organic surface material such as root mats separately from overburden and return it to the surface of the restored site where feasible.
- Systematically remove vegetation as needed, storing it in a manner to retain viability, and replacing it after operation where feasible.
- Rehabilitate on an ongoing basis.
- All overburden and soils shall be left in a configuration which is in accordance with accepted conservation practices and which is suitable for the proposed subsequent use of the land.
- An ecologically sound, storm water management plan must be implemented, including all measures as set out above.

5.4.5 Possible increase in exotic and invasive vegetation

The seed of alien invasive plant species that occur on and in the vicinity of the open cast mining activities, could spread into the disturbed and stockpiled soils. Also, the vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site.

Mitigation measures

- Alien invasive species that were identified within the study area should be removed. 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 mine operation and after closure.
- Manual / mechanical removal is preferred to chemical control.

- All construction and operation 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.

B: Closure

5.4.6 Possible increase in exotic and invasive vegetation

If rehabilitation of the indigenous vegetation after closure is unsuccessful or it is not enforced, exotic and invasive vegetation will increase after mine closure.

Mitigation measures

- 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 five years.
- The area should be re-landscaped and resemble the land form prior to the open cast activities.
- The areas should be planted within indigenous vegetation typical of the area.

5.4.7 Lack of establishment of functional vegetation

Lack of adequate rehabilitation could result in an area of vegetation with a low basal cover, prone to erosion and invasion by exotic and invasive plant species. In addition, the vegetation will stay in a pioneer stage and are unlikely to become more functional through succession.

Mitigation measures

- The area should be re-landscaped and resemble the land form prior to the open cast activities.
- The areas should be planted with indigenous vegetation typical of the area and monitored to ensure that the vegetation progresses through succession stages.
- Monitoring of the rehabilitation success as well as the survival of *Crinum bulbispermum* on the site should take place for at least five years and include corrective follow-up action.
- It is recommended that Landscape Functional Analysis (LFA) forms part of the rehabilitation and monitoring process. Landscape function analysis is a process-based technique that was developed specifically to track post-disturbance recovery of ecosystems. It aims to restore specific and measurable elements of ecosystem function rather than focusing purely on attaining floristic targets and thresholds e.g. nutrient cycling, increase in vegetation patches and infiltration are measured (Tongway & Hindley, 2004).

5.4.8 Deterioration of the watercourse and moist grasslands

Lack of adequate rehabilitation could result in an area of vegetation with a low basal cover, prone to erosion. Soil erosion could also alter water flow rates thereby impacting local hydrologic

processes. In addition, polluted water from the mine footprint can reach the watercourse and moist grassland.

Mitigation measures

- Rehabilitation and potential erosion problems should be monitored for at least 5 years after closure.
- Monitoring should result in corrective action taken immediately to remediate erosion or failed rehabilitation.
- Prevent groundwater recharge and ensure that rehabilitated areas are free draining.
- Topsoil should not be compacted during the rehabilitation process.
- Keep sediment barriers in place until restoration and rehabilitation is complete.
- Prevent grazing from livestock within the first 2 to 3 years after rehabilitation and prevent access to rehabilitated areas until such time that rehabilitation was successful.
- If the plants were replanted as part of rehabilitation, the survival of the population of the 'Declining' *Crinum bulbispermum* must be monitored and if the plants are under threat, they should be removed with the permission of the approving authority and transplanted to suitable habitat.

5.4.9 Acid Mine Drainage

Coal mining generates sulphuric acid as a result of a chemical reaction between an iron sulphide mineral (pyrite) present in the coal and its host rocks and oxygen-bearing water (infiltrated rain water) (McCarthy and Pretorius, 2009). The mining method used has a significant impact on the acid generated. In opencast mining the rock mass is completely fragmented, maximizing the contact between water and rock, and is therefore the most acid producing mining method (McCarthy and Pretorius, 2009). Acid water produced in the mines may seep out at surface, where further reactions with oxygen occur, precipitating iron and generating yet more acid that will pollute watercourses.

Mitigation measures

- Backfill or re- contour strip-mined or contour-mined areas with excess excavation material generated during construction (TEEIC).
- Shafts and boreholes must be sealed to reduce possibility of fires. Additionally, if flooding is used as a method of reducing the potential for acid mine drainage, the entire coal seam must be inundated and reinforcement of key areas of the mine must be undertaken to accommodate water flow in advance of flooding (INAP, 2010).
- There is only limited data on the long term effectiveness of these methods of mitigation and of any acid mine drainage treatments. Therefore, thorough monitoring of biological, hydrologic, and geochemical conditions must take place (Jennings, et al., 2008). Monitor activities near aquifer recharge areas especially closely, to reduce potential contamination of the aquifer (TEEIC).
- Divert surface water (clean water) flowing towards the site of pollution.
- Prevent groundwater infiltration to a potentially polluting site.

- Prevent hydrological water seepage into the affected areas and controlled placement of Acid Mine Drainage (AMD) generating waste.

6. CONCLUSION

The study found that the vegetation sensitivities on site comprise the vegetation associated with wetland conditions as well as the adjacent portion of secondary grassland with seepages on portion 26. In addition, the persistence of the 'Declining' *Crinum bulbispermum* population occurring within the wetland adds to the sensitivity of this portion of the site assessed.

The vegetation on portion 46 and 47 was degraded and classified as transformed with no plants of conservation concern occurring.

If the development proceed, mitigation measures as set out in this report should be adhered to as a minimum. The most important being the in situ conservation of protected species, where possible.

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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
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
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.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Decreaser Grass	Grass species that decrease when veld is either overgrazed or underutilised. These species are usually preferred by grazers such as *Themeda triandra* and *Digitaria eriantha*
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
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).
Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible
Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space

Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future
Endemic	Naturally only found in a particular and usually restricted geographic area or region
Exotic species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Forb	A herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live
Increaser I Grass	Grass species that occur abundantly in underutilised veld – can grow without defoliation. These are usually unpalatable grasses
Increaser II Grass	Grass species that increase in over utilised (overgrazed) veld, include pioneer and sub-climax species
Increaser III Grass	Grass species that are common in overgrazed veld. These are usually unpalatable grasses that outcompete the palatable grasses when overgrazed.
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
Near Threatened	A Taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al*, 2009).
Plant community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat *et al*, 2004)
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.
Threatened	Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities

Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. *Now termed Plants of Conservation Concern*
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al,* 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future(Raimondo *et al*, 2009)
Water Course	According to the National Water Act (Act No.36 of 1998), a watercourse means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows.

APPENDIX A: METHODOLOGY

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), McMurtry *et al* (2008) and Bromilow (2010). The study was undertaken in accordance with the Mpumalanga Minimum Requirements for Biodiversity Assessment (Mpumalanga Tourism and Parks Agency, 2008). Aerial images (Google Earth) were assessed prior to the field survey in order to identify areas where disturbances took place, homogenous areas and areas where wetland conditions were likely to occur.

Field survey:

The field survey was undertaken on the 17th of October 2013. The field survey focussed on identifying natural and untransformed vegetation, unique features that could indicate local sensitivities such as threatened and protected plants, as well as sensitive ecological features such as wetlands, ridges and rivers that are essential for the maintenance of ecosystems and ecological processes. The survey focussed on remaining natural vegetation within the site and its immediate surroundings (Figure A1).

Figure A1: Samples areas on Portion 46 & 47(Google Earth imagery, 2013)

Figure A2: Sample areas on portion 26 (Google Earth imagery, 2013)

Plots were sampled within the homogenous areas and random transects were walked along the proposed pipeline route, while representative sample areas were surveyed. Within the sample plots, all identifiable species were recorded as well as their cover abundance. Transects concentrated on moving through environmental gradients encountered and was continued until few or no new species were encountered. Any additional information on any other feature thought to have ecological significance within the site, such as dominant species cover abundance, soil type, erosion, rocky cover, alien/exotic/invasive plants, as well as plant species of conservation concern and/or their habitat was also recorded. Plant identification and vegetation description relied on species recorded in the sampling areas along the walked transects.

Vegetation Sensitivity

The following criteria and weighting was used to determine the vegetation sensitivity, function and conservation importance:

1. The status of the regional vegetation that is expected to occur on the study site, only where natural vegetation is still remaining.

Conservation status*	Scoring
Critically Endangered	3
Endangered	2
Vulnerable	1
Least threatened	0

*This scoring is not applicable (N/A) for areas devoid of natural vegetation.

2. Whether the study area is situated within a Listed Ecosystem in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004).

Listed Ecosystem*	Scoring
Primary state	3
Sub-climax state	2
Secondary state	1
No natural vegetation remaining	0

3. Whether the vegetation or ecological feature is protected by legislation:

Listed Ecosystem*	Scoring
National legislation	3
Provincial policies and guidelines	2
Municipal or other protection	1
No legislated protection	0

4. The presence of suitable habitat for plants of conservation concern as well as the actual occurrence thereof.

Suitable habitat / presence	Scoring
Confirmed presence	3
Confirmed presence of Declining species and Suitable habitat and some likelihood of occurrence of Threatened species	2
Suitable habitat but unlikely to occur	1

Suitable habitat / presence	Scoring
No suitable habitat	0

5. Ecological Function: areas important to ecological processes such as ecological corridors, hydrological processes and important topographical features such as ridges.

Ecological function	Scoring
High: Sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.	3
Medium to high: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with a high degree of connectivity with other ecological systems OR disturbed vegetation connected to an ecological and protected system e.g. ridge, wetland or river	2
Medium: Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree or limited connectivity with other ecological systems	1
Low: Degraded and highly disturbed vegetation with little ecological function	0

6. Conservation Importance: indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area (degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation.

Ecological importance	Scoring
High: Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. OR protected ecosystems e.g. wetlands, riparian vegetation etc These areas should be protected	3
Medium to high: Ecosystems with intermediate levels of species with the possible occurrence of threatened species	2
Medium: Ecosystems with intermediate levels of species diversity without any threatened species.	1
Low: Areas with little or no conservation potential and usually species poor (most species are usually exotic).	0

APPENDIX B: PLANT SPECIES

The table below lists the plant species that were observed per site. Note that the species diversity is likely higher. However at the time of the survey (April), grasses were grazed and some forbs have already seeded or were dormant.

M=plants known to be used medicinally **P**=provincially / national protected plant **D**=declining plant species

x=species was observed in vegetation grouping – if no indication, then it is assumed to occur

Specie name	Common Name	Relevant Notes	Moist grassland	Secondary
Herbaceous plants				
Arctotis arctotoides		Grassland and sometimes in vlei's	x	
Berkheya radula	Boesmanrietjie	Moist grassland and vlei's	x	
Berkheya setifera (M)	Rasperdisseldoring	Grassland, usually in large colonies.		x
Bulbine narcissifolia	Strap-leaved Bulbine	Poor soils in grassland, proliferation an indication of overgrazing.		x
Chaetacanthus cf setiger		Grassland, often in rocky / moist places	x	x
Crinum cf bulbispernum(P) (D) (M)	Orange River Lily	Moist soils, usually along rivers and vleis	x	
Falkia oblonga		Mat forming perennial herb, wet places in grassland	x	
Geigeria burkei	Vermeerbos	Common in overgrazed and disturbed areas		x
Haplocarpa scaposa (M)	Tonteldoosbossie	Grassland, often in moist places	x	x
Helichrysum nudifolium (M)	Hottentot's tea	Grassland		x
Helichrysum rugulosum (M)		Grassland, often in vlei's		x
Hermannia erodioides		Grassland usually in vleis	x	
Hermannia depressa	Rooi-opslag / Creeping Hermannia	Grassland, also in trampled and overgrazed areas		x
Hypoxis filiformis	Grass Star Flower	In moist areas.	x	
Jamesbrittenia aurantiaca	Cape Saffron	Grassland, moist places	x	
Nidorella anomala		Grassland, often occurring in groups in moist areas.	x	
Selago densiflora		Grassland and bushveld.		x
Number of herbaceous species identified or minimum likely to occur = 17			**10**	**9**

Specie name	Common Name	Relevant Notes	Moist grassland	Secondary
GRASSES				
Andropogon appendiculatus	Vlei Bluestem	Occurs in moist places, often associated with shady areas.		
Aristida aequiglumis	Three-awn	Looks like *A junciformis*. Open grassland, moist areas		
Aristida congesta subsp congesta	Tassel Three-awn	Disturbed, overgrazed or farmed land. Increaser II grass		x
Cymbopogon pospischilii	Narrow-leafed Turpentine Grass	Grassland.		x
Cynodon dactylon	Couch grass	Most soils, usually in disturbed areas. Increaser II grass		x
Eragrostis chloromelas	Narrow Curly leaf	Open Grassland.	x	
Eragrostis curvula	Weeping Love Grass	Mostly occurs in disturbed areas / sown as pasture. Increaser II grass	x	x
Eragrostis plana	Tough Love Grass	Disturbed areas, mostly in moist patches. Increaser II grass	x	
Eragrostis racemosa	Narrow Heart Love Grass	Various habitats, mostly sandy or rocky moist soils. Increaser II	x	
Hyparrhenia hirta	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass		x
Imperata cylindrica	Cotton Wool Grass	Mostly in moist soils. Increaser I grass	x	x
Melinis repens	Natal Red Top	Disturbed grassland. Increaser II grass		x
Microchloa caffra	Pincushion Grass	Grow on shallow, rocky soil, often in overgrazed veld. Often found near vlei's.		x
Paspalum dilatatum	Dallis Grass	Introduced grass, moist areas in vlei's and close to rivers	x	
Setaria sphacelata var. sericea	Golden Bristle Grass	Moist, disturbed areas	x	
Sporobulus africanus	Ratstail Dropseed	Disturbed places close to water or in road verges. Increaser III grass	x	
Number of grasses identified or minimum likely to occur= 13			**8**	**8**
SEDGES				
Schoenoplectus specie		Moist areas, southern section of site	x	

Specie name	Common Name	Relevant Notes	Moist grassland	Secondary
Typha capensis	Bulrush	Grows in marshy areas and along watercourses.	x	
Bulbostylis hispidula subsp. *pyriformis*		can occur as weed in rice / maize fields		x
Number of sedges identified or minimum likely to occur = 3			**2**	**1**
TREES				
Searsia (Rhus) lancea	Karee	Grassland and bushveld		t
Total number of indigenous trees identified = 1			**0**	**1**
INVADERS				
Acacia cf melanoxylon	Blackwood	Category 2 (CARA) -		P46&47
Acer	Maple	Exotic		P46&47
Cirsium vulgare	Scotch Thistle	Category 1 (CARA)	x	
Eucalyptus camaldulensis	Red River Gum	Category 2 (proposed 1b in draft NEMBA list)	x	
Opuntia species	Sweet Prickly Pear	Category 1 (CARA)		
*Pinus species**	Pine	Declared weed, Category 2 (Henderson, 2001).	x	P46&47
Quercus sp	Oak	Exotic		
Verbena brasiliensis		Common weed of disturbed and moist places, declared category 1b invader	x	
Number of exotic / invasive plants identified = 7			**4**	**0**

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: Vegetation Assessment	Mogale City Local Municipality.	April 2009	Facilitation of the Rectification Process for the unlawful commencement or continuation of the listed activities in terms of section 24G of the National Environmental Management Act (Act no yes07 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.

PROJECT NAME	INDUSTRY / CLIENT	DATE	ADDITIONAL INFORMATION
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 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 20y12	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)

Jun – Jul 2003

Horticultural Trainer: 17 Shaft Training Centre, Johannesburg

May 1997 – Mar 2002

Horticulturist: Pretoria National Botanical Garden (NBI)

OTHER RELEVANT QUALIFICATIONS / SKILLS

Courses:

- 2012: Tools for wetland assessment, Rhodes University
- 2012: Introduction into landscape Functional Assessment (LFA)
- 2012: Soil Classification and Wetland Delineation (Terra Soil)
- 2007: ISO yes4000 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 yes (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