

Vegetation survey for the Proposed Nkosi City Development on a portion of the Farm Mpakeni 961 JU, Mpumalanga Province



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Verification statement

This communication serves to verify that the flora report compiled by Corné Niemandt has been prepared under my supervision, and I have verified the contents thereof.

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- am committed to biodiversity conservation but concomitantly recognise the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them.
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- act as an independent specialist consultant in the field of Botany.
- am subcontracted as specialist consultant by Bokamoso Environmental Consultants for the Proposed Nkosi City Development on a portion of the Farm Mpakeni 961 JU in this report.
- have no financial interest in the proposed development other than remuneration for work performed.
- have or will not have any vested or conflicting interests in the proposed development.
- undertake to disclose to Bokamoso Environmental Consultants and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014.



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Declaration of independence:

I, the above mentioned specialist investigator responsible for conducting this particular specialist vegetation survey, declare that:

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1. INTRODUCTION

Bokamoso Environmental: Specialist Division was commissioned to conduct a survey of the vegetation of the site for the proposed Nkosi City development situated on a portion of the Farm Mpakeni 961 JU, Mpumalanga Province. The site is scheduled for mixed-use development, including business, industrial, agriculture, social housing and institutional.

The objective of this survey was to determine which species occur in the study site. Special attention was given to possible habitats of Red and Orange List plant species that may occur in the study site. Red Listed species include Critically Endangered, Endangered and Vulnerable (IUCN, 2012)¹, and species of conservation concern (SCC)² occurring on or near the study area. Furthermore, the ecological status of the vegetation and sensitive habitats of the site were investigated.

2. OBJECTIVES OF THE STUDY

- To assess the habitat component of the study site and ecological status of the vegetation;
- To identify and list the plant species occurring on the site and indicate whether they are Threatened species;
- To indicate ecological sensitive areas and habitat connectivity of the study area;
- To highlight the potential impacts of the existing abattoir on the flora of the study area; and
- Provide recommendations to mitigate negative impacts and enhance positive impacts should the existing abattoir become operational again.

3. SCOPE OF THE STUDY

This report:

- Lists all plant species, including alien species, recorded during the site visit;
- Comments on ecological sensitive areas and habitat connectivity;
- Comments on impacts affecting the flora of the study area;
- Evaluates the conservation importance and significance of the study area with special emphasis on the status of threatened species; and
- Provides recommendations to mitigate negative impacts, should the proposed development be approved.

4. LIMITATIONS OF THIS STUDY

Even though considerable care is taken to ensure accuracy and professionalism of this ecological scoping assessment, environmental assessment studies are limited in scope, time and budget. Several years are needed to derive a 100% accurate report based on intensive field collecting and observations where all seasons are considered to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

The desktop study made up the largest part of the data used to conclude the distribution of Threatened species which were sourced by making use of the SANBI species list (POSA, 2009). Any

¹ <http://www.iucnredlist.org/technical-documents/categories-and-criteria>

² SCC are species that have a high conservation importance and include not only Red Listed species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

limitations in the above mentioned data basis will in effect have implications on the findings and conclusion of this assessment.

Therefore, Bokamoso Environmental: Specialist Division cannot accept responsibilities for conclusions and mitigation measures made in good faith with the limited available information at the time of the directive. This report should be viewed and acted upon considering these limitations.

5. STUDY AREA

5.1 Study Site

The proposed Nkosi City development is situated on a portion of the Farm Mpakeni 961 JU, Mbombela Local Municipality, Mpumalanga Province. The site is located at 25°24'26.62"S, 31°13'4.96"E directly adjacent the townships of Daantjie, Pienaar and Aldie to the west and Luphisi to the east. Phakane, Zwelisha and Clau-Clau townships are located north-west of the site. The site can be accessed on the west via an unnamed road running through Daantjie (Figure 1).

The Kruger National Park is approximately 5km east and Mthethomusha Game Reserve is approximately 3km south-east of the study site. The N4 freeway between Nelspruit and Malelane is approximately 10km south of the study site, and the R538 which connects White River and the N4 is approximately 12km west of the study site. The Kruger Mpumalanga International Airport is located approximately 10km west of the site.

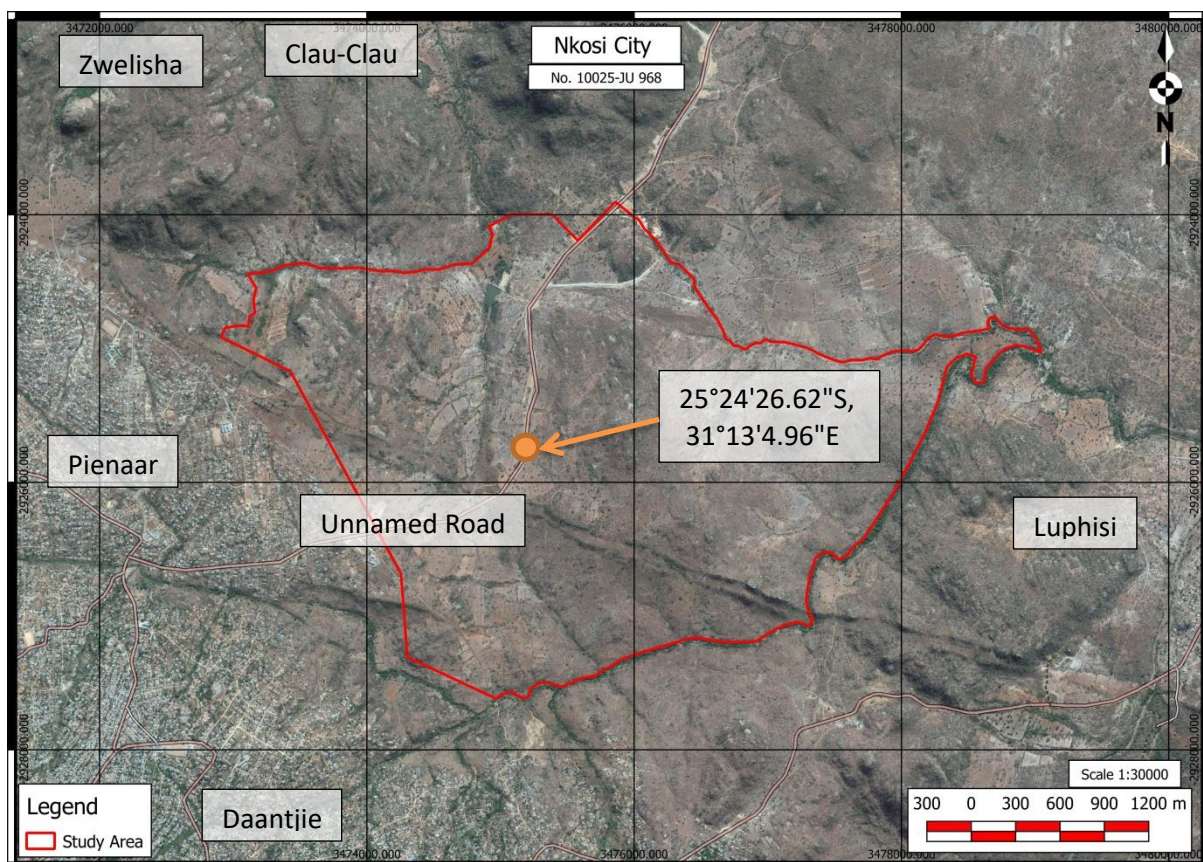


Figure 1: Locality map of study site.

5.2 Regional Vegetation

The study area is located in the 2531AC Quarter Degree Square (QDS) in the Malelane Mountain Bushveld and Pretoriuskop Sour Bushveld both with a conservation status of Least Concern. The Malelane Mountain Bushveld covers the largest part of the site with Pretoriuskop Sour Bushveld covering only a section towards the north-east of the site.

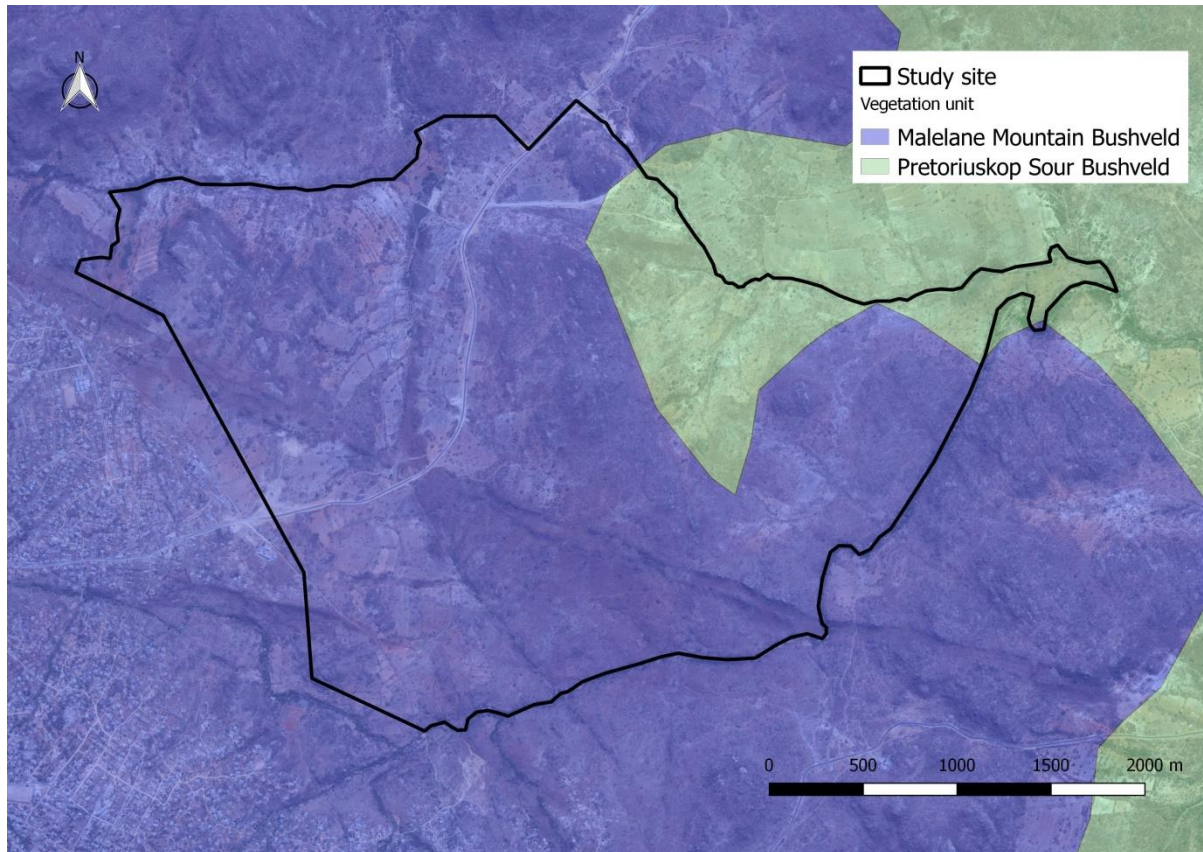


Figure 2: Vegetation units map (Mucina and Rutherford, 2006).

The **Malelane Mountain Bushveld** vegetation unit occupies the high lying areas north of Malelane and Kaapmuiden, including Berg-en-Dal Restcamp areas as far north as the hill Sithongwane in the Kruger National Park. It also includes the Krokodilpoortberge both north and south of the Crocodile Gorge. The vegetation comprises open savanna on mountains and higher-lying slopes, with an open to dense short mountain bushveld on rocky outcrops and lower-lying areas. Altitude and aspect are important in determining species composition in this mountainous terrain.

Approximately 39% is statutorily conserved in the Kruger National Park and a further 6% conserved in the Mthethomusha Nature Reserve. At least 4% is transformed, mainly by cultivation and urban and built-up areas. This is, however, considered to be underestimated due to the expanding built-up areas (personnel observation). Scattered alien plants include *Lantana camara*, *Jacaranda mimosifolia*, *Melia azedarach*, *Solanum mauritianum*, *Sesbania punicea*, *Ricinus communis* and *Psidium guajava*. Two broad groups of plant communities are recognised, namely the high-lying open savannas and the low-lying closed savannas. The transition between these two community complexes is at an altitude of about 700m (Mucina and Rutherford, 2006).

The low-lying closed savanna is characterised by the following species:

- **Tall Trees:** *Pterocarpus angolensis*
- **Small Trees:** *Acacia caffra*, *A. davyi*, *Combretum molle*, *Dombeya rotundifolia*, *Faurea saligna*, *Heteropyxis natalensis*, *Kirkia wilmsii*, *Sterculia murex*, *Acacia swazica*, *Combretum collinum* subsp. *suluense*, *C. zeyheri*, *Englerophytum magalismsontanum*, *Ficus abutilifolia*, *Maytenus undata* (woodland form), *Mimusops zeyheri*, *Pterocarpus rotundifolius*, *Searsia leptodictya*, *Terminalia sericea* and *Vitex obovata* subsp. *wilmsii*.
- **Succulent Tree:** *Euphorbia cooperi*
- **Tall Shrubs:** *Acalypha glabrata*, *Croton madandensis*, *Diospyros lycioides* subsp. *sericea*, *Grewia monticola*, *Olea europaea* subsp. *africana* and *Strychnos spinosa*.
- **Low Shrubs:** *Barleria rotundifolia*, *Orthosiphon labiatus* and *Polygala producta*.
- **Succulent Shrub:** *Aloe spicata*
- **Woody Climbers:** *Bauhinia galpinii*, *Dalbergia armata* and *Pterolobium stellatum*.
- **Woody Succulent Climber:** *Senecio pleistocephalus*
- **Herbaceous Climbers:** *Coccinia rehmannii* and *Rhynchosia caribaea*.
- **Graminoids:** *Bothriochloa radicans*, *Enneapogon scoparius*, *Eragrostis rigidior*, *Eustachys paspaloides*, *Heteropogon contortus*, *Themeda triandra*, *Tristachya leucothrix* and *Urochloa mosambicensis*.
- **Geophytic Herb:** *Drimia altissima*
- **Succulent Herb:** *Plectranthus cylindraceus*
- **Epiphytic Succulent Herb:** *Ansellia africana*

The high-lying open savanna is characterised by the following species:

- **Small Trees:** *Acacia davyi*, *Combretum molle*, *Heteropyxis natalensis*, *Hippobromus pauciflorus*, *Sterculia murex*, *Acacia natalitia*, *Bersama lucens*, *Combretum kraussii*, *Cussonia spicata*, *Ekebergia capensis*, *Faurea rochetiana*, *Ficus ingens*, *Pavetta edentula*, *Searsia leptodictya* and *Vitex obovata* subsp. *wilmsii*.
- **Tall Shrubs:** *Olea capensis* subsp. *enervis*, *Canthium inerme*, *Searsia pentheri* and *Vernonia myriantha*.
- **Low Shrubs:** *Flemingia grahamiana*, *Helichrysum kraussii*, *Acalypha villicaulis*, *Asparagus virgatus*, *Diospyros galpinii*, *Helichrysum lepidissimum*, *Polygala producta*, *Tenrhynea phyllicifolia* and *Vernonia crataegifolia*.
- **Succulent Shrub:** *Aloe spicata*
- **Woody Climber:** *Dalbergia armata*
- **Graminoids:** *Bothriochloa radicans*, *Enneapogon scoparius*, *Eragrostis rigidior*, *Andropogon eucomus*, *Eustachys paspaloides*, *Heteropogon contortus*, *Panicum natalense*, *Themeda triandra*, *Tristachya leucothrix*, *Urochloa mosambicensis*.
- **Herbs:** *Becium obovatum* and *Indigofera sanguinea*.
- **Geophytic Herb:** *Drimia altissima*
- **Succulent Herb:** *Stapelia gigantea*
- **Epiphytic Succulent Herb:** *Ansellia africana*

The **Pretoriuskop Sour Bushveld** vegetation unit occurs mostly as open tree savanna that is characterised by the prominence of *Dichrostachys cinerea* and *Terminalia sericea* (Mucina & Rutherford 2006). The area is classified as open savanna with various *Acacia* species present and occurs on the upland areas. The geology is mainly granite from the Nelspruit Suite and the soil is shallow to medium deep. This vegetation unit has a conservation target of 19% of which some 40% is conserved in the Kruger National Park. About 16% transformed by cultivation and by the development of settlements. Alien species of concern include *Lantana camara*, *Solanum mauritanium*, *Opuntia stricta*, and *Psidium guajava* (Mucina and Rutherford, 2006).

6. METHODS

6.1 Desktop Study

Species list

The PRECIS list of plants recorded in the 2531AC QDS was obtained from SANBI (Plants of Southern Africa: an online checklist) (POSA, 2009)³. This list was consulted to verify the record of occurrence of the plant species seen on the site.

Red List species

Information about the Red Listed species that occur in the 2531AC QDS was obtained from Mpumalanga Tourism and Parks Agency⁴. The Red List of South African Plants (SANBI, 2016)⁵ and SANBI: Plants of Southern Africa (SANBI, 2016) were also consulted. Eleven Red List plant species could potentially occur on or surrounding the study site (Annexure A).

Mpumalanga Biodiversity Conservation Plan (2007)

The Mpumalanga Biodiversity Conservation Plan (MBCP) (Ferrar and Lötter, 2007) was consulted for biodiversity features in the province to guide conservation and land-use decisions for sustainable developments. Furthermore, the Mpumalanga Biodiversity Sector Plan (Mpumalanga Tourism and Parks Agency, 2014a) and MBSP Terrestrial Assessment (Mpumalanga Tourism and Parks Agency, 2014b)⁶ were consulted to identify spatial priority areas and/or biodiversity features important to the study site.

From the maps generated (Figures 3), the study site is located in the following biodiversity priority areas:

- Ecological Support Area: Protected Area Buffer (Entire site)
- Other Natural Areas (Prevalent)
- Heavy modified (Some sections of site)
- Moderately modified – old lands (Small portion of site)

³ <http://newposa.sanbi.org/> replaces the previous database

⁴ Obtained from Mervyn Lötter (personal communication)

⁵ <http://redlist.sanbi.org/>

⁶ <http://bgis.sanbi.org/MBSP>

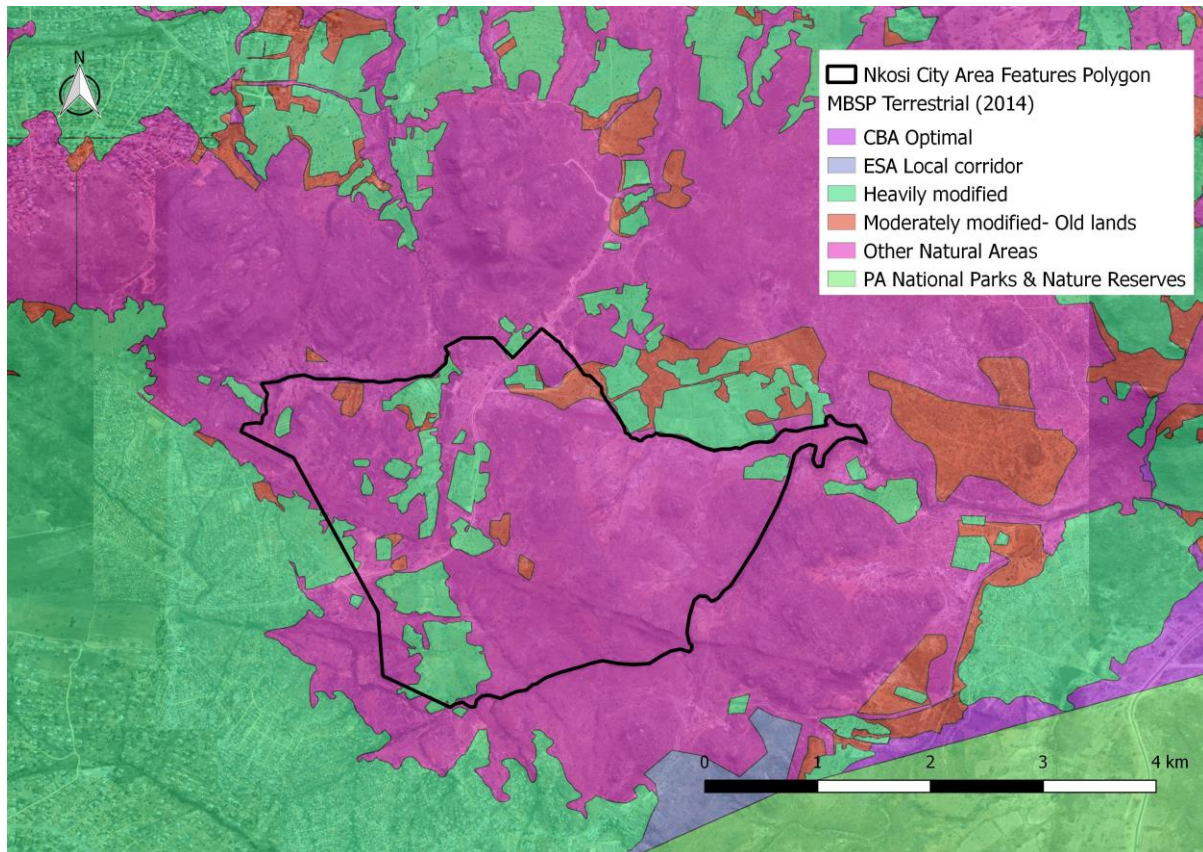


Figure 3: MBSP Terrestrial Assessment (2014) to identify spatial priority areas located in the study site.

Protected Trees

A desktop study was done to determine the possible presence of protected tree species for the study site to be marked in accordance with the legislation. The following twelve species relevant to the proposed study site were identified:

- ***Sclerocarya birrea* subsp. *caffra* (Marula) (2531AC)**
- *Boscia albitrunca* (Shepherd's tree) (2531CA)
- *Catha edulis* (Bushman's tea) (2530BD)
- ***Elaeodendron transvaalense* (Bushveld saffron) (2531AC)**
- ***Combretum imberbe* (Leadwood) (2531CB)**
- *Curtisia dentata* (Assegai) (2531CA)
- ***Philenoptera violacea* (Apple-leaf) (2531AC)**
- ***Pterocarpus angolensis* (Kiaat) (2531AC)**
- ***Breonadia salicina* (Matumi) (2531AC)**
- ***Pittosporum viridiflorum* (Cheesewood) (2531AC)**
- *Prunus africana* (Red Stinkwood) (2531CA)
- *Sideroxylon inerme* subsp. *inerme* (White milkweed) (2531CA)

Of these 12 species, seven species (indicated in bold above) has a high likelihood to occur on the study site as they have been recorded in the 2531AC QDS and/or in the Malelane Mountain

Bushveld and/or Pretoriuskop Sour Bushveld. The remaining five species have been recorded in the adjacent QDSs. All these protected trees are protected under the National Forest Act, 1998 (No 84 of 1998) and it should be noted that an application needs to be submitted prior to the damage, cutting, pruning or removing of any individual of a protected tree.

6.2 Site Visit

A site visit was conducted from 9 to 12 May 2017. For each study unit identified, a species list was compiled for all plants recorded. Field guides such as those by Germishuizen and Meyer (2003), Koekemoer *et al.* (2014), Pooley (1998), van Ginkel *et al.* (2011), van Oudtshoorn *et al.* (2014), van Wyk and Malan (1998) and van Wyk (2013) were used to identify the species. The H.G.W.J. Schweickerdt Herbarium, University of Pretoria, was also visited to confirm the correct identification of species if needed.

The SANBI: Plants of Southern Africa (SANBI, 2016)⁷ species list was consulted for the record of species that have been collected in the 2531AC QDS. A total of 550 species have been recorded in the 2531AC QDS.

Each study unit was further scrutinised for the occurrence of alien plant species (Bromilow, 2010) and any form of disturbance. Alien species are included in the species lists (in bold in the relevant tables) as they suggest the particular state of each study unit. For each alien species the Category is indicated according to the *Alien and Invasive Species lists* (NEMBA Alien and Invasive Species Lists, 2016).

For each plant species, the medicinal properties were assessed (van Wyk *et al.*, 2013). Medicinal plants are marked with an asterisk in the respective tables. Harvesting of medicinal plants causes a decline in numbers of the particular species and, therefore, threatens the conservation of these species.

7. RESULTS

7.1 Study units

Five study units were identified for this report (Figure 4):

1. Bushveld
2. Watercourse
3. Disturbed Bushveld
4. Dam
5. Transformed Areas

No survey was conducted for the Transformed Areas as it has been modified to agricultural lands, graveyards, illegal sand mining activities and erosion.

The Watercourse runs along the south- eastern boundary of the site.

⁷ <http://newposa.sanbi.org/>

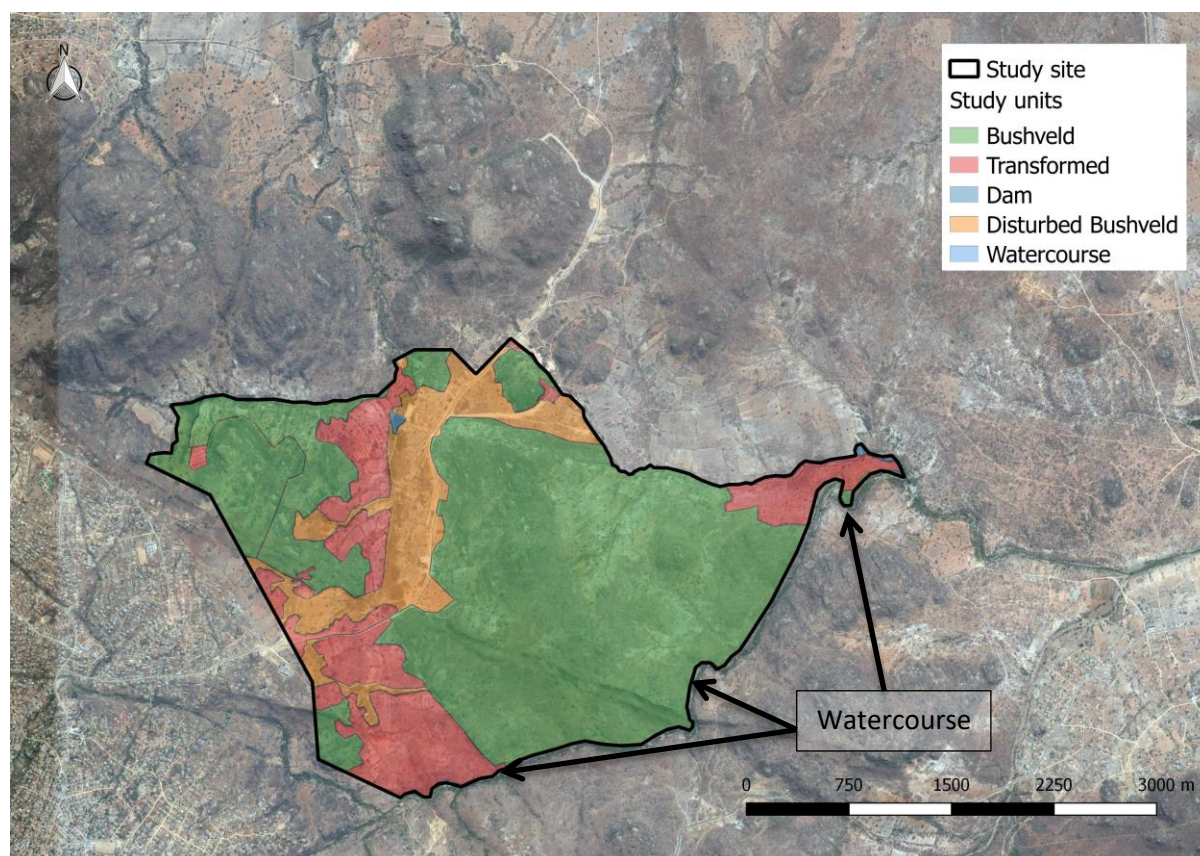


Figure 4: Study units identified. The Watercourse runs along the south-eastern boundary of the site.

7.2 Medicinal and Alien plant species

The total number of plant species, medicinal species and alien species recorded per study unit are listed in Table 1.

Table 1: The total number of plant species, the number of medicinal species and alien species recorded per study unit.

| Study unit | Total number of species per unit | No. of medicinal species per unit | No. of alien species per unit |
|--------------------|----------------------------------|-----------------------------------|-------------------------------|
| Bushveld | 90 | 18 | 5 |
| Watercourse | 46 | 5 | 15 |
| Disturbed Bushveld | 47 | 11 | 5 |
| Dam | 25 | 3 | 9 |

The number of alien plant species per Category is indicated in Table 2. For each alien species the Category is indicated according to the amended Alien and Invasive Species (AIS) lists (NEMBA Alien and Invasive Species Lists, 2016) in Government Notice 40166 in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). The AIS Regulations list 4 different categories of invasive species that must be controlled, managed or eradicated:

Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.

Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited.

Category 2: Invasive species or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Species include commercially important species such as pine (*Pinus* spp.), wattle (*Acacia* spp.) and gum (*Eucalyptus* spp.) trees. Plants in riparian areas are Category 1b.

Category 3 Invasive species which may remain in prescribed areas and provinces. Further planting, propagation or trade is however prohibited. Plants in riparian areas are Category 1b.

Alien plant species and their respective Category are indicated in bold in the species lists (Tables 3 to 6).

Table 2: Number of alien plant species per study unit.

| Study unit | CAT 1a | CAT 1b | CAT 2 | CAT 3 | Not declared invasive |
|--------------------|--------|--------|-------|-------|--------------------------|
| Bushveld | 0 | 4 | 0 | 0 | 1 |
| Watercourse | 0 | 9 | 1 | 0 | 5 |
| Disturbed Bushveld | 0 | 3 | 0 | 0 | 2 |
| Dam | 0 | 5 | 0 | 0 | 4 |

7.3 Red List plant species and Species of Conservation Concern (SCC)

The Red List of South African Plants (SANBI, 2016)⁸, SANBI: Plants of Southern Africa (SANBI, 2016) and information obtained from the Mpumalanga Tourism and Parks Agency was consulted for information on Red List plant species. Eleven Red List plant species and six SCC could potentially occur on or surrounding the study site (Annexure A). As mentioned earlier, SCC are species that have a high conservation importance and which are not included in the Red List Categories⁹.

7.4. Bushveld

7.4.1. Composition

The Bushveld is characteristic of the Malelane Mountain Bushveld which covers the greatest part of the site and the Pretoriuskop Sour Bushveld located to the north-eastern corner of the site (Figure 5). Several indigenous species of different growth forms were recorded during the survey. A total of 90 species were recorded in this unit (Table 3). Dominant species include *Aloe* spp., *Aristida adscensionis*, *Combretum* spp., *Dichrostachys cinerea*, *Eragrostis* spp., *Hyperthelia dissoluta*, *Macledium zeyheri*, *Pterocarpus angolensis*, *Sclerocarya birrea*, *Senegalia caffra*, *Strychnos* cf. *spinosa*, *Terminalia sericea* and *Vachellia nilotica*.

⁸ <http://redlist.sanbi.org/>

⁹ Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD)

Table 3: Species recorded in the Bushveld.

| Species | Invasive category |
|--|-------------------|
| <i>Abrus precatorius</i> subsp. <i>africanus</i> | |
| <i>Aeollanthus</i> cf. <i>buchnerianus</i> | |
| <i>Aloe barbertoniae</i> ¹ | |
| <i>Aloe greatheadii</i> var. <i>davyana</i> * ¹ | |
| <i>Aloe petricola</i> ¹ | |
| <i>Aristida adscensionis</i> | |
| <i>Aristida congesta</i> subsp. <i>congesta</i> | |
| <i>Aristida congesta</i> subsp. <i>barbicollis</i> | |
| <i>Asclepias</i> sp.* | |
| <i>Asparagus</i> cf. <i>laricinus</i> * | |
| <i>Bauhinia galpinii</i> | |
| <i>Bonatea</i> cf. <i>antennifera</i> ¹ | |
| <i>Boophone disticha</i> * ¹ | |
| <i>Bothriochloa radicans</i> | |
| <i>Bryophyllum delagoense</i> | 1b |
| <i>Catharanthus roseus</i>* | 1b |
| <i>Ceratotheca triloba</i> | |
| <i>Chloris gayana</i> | |
| <i>Combretum collinum</i> subsp. <i>suluense</i> | |
| <i>Combretum molle</i> | |
| <i>Combretum zeyheri</i> | |
| <i>Crabbea</i> cf. <i>angustifolia</i> | |
| <i>Cymbopogon</i> cf. <i>caesius</i> | |
| <i>Cucumis zeyheri</i> | |
| <i>Dichanthium annulatum</i> var. <i>papillosum</i> | |
| <i>Dicerocaryum senecioides</i> | |
| <i>Dichrostachys cinerea</i> subsp. <i>nyassana</i> * | |
| <i>Eragrostis</i> sp. | |
| <i>Eragrostis gummiflua</i> | |
| <i>Eragrostis superba</i> | |
| <i>Euclea</i> cf. <i>natalensis</i> | |
| <i>Eulophia</i> sp. ¹ | |
| <i>Euphorbia ingens</i> | |
| <i>Euphorbia</i> sp. | |
| <i>Faurea saligna</i> ¹ | |
| <i>Geigeria burkei</i> subsp. <i>burkei</i> | |
| <i>Gladiolus</i> sp. ¹ | |
| <i>Gnidia kraussiana</i> var. <i>kraussiana</i> | |
| <i>Grewia</i> sp. | |
| <i>Gymnosporia</i> cf. <i>senegalensis</i> | |
| <i>Helichrysum nudifolium</i> * | |
| <i>Helichrysum</i> cf. <i>rugulosum</i> | |
| <i>Heteropogon contortus</i> | |
| <i>Hibiscus</i> cf. <i>lunarifolius</i> | |
| <i>Hyparrhenia hirta</i> | |

| | |
|---|----|
| <i>Hyperthelia dissoluta</i> | |
| <i>Hypoxis hemerocallidea</i> * | |
| <i>Kalanchoe paniculata</i> | |
| <i>Lantana camara</i> | 1b |
| <i>Ledebouria</i> sp. | |
| <i>Litogyne gariepina</i> | |
| <i>Macledium zeyheri</i> subsp. <i>zeyheri</i> | |
| <i>Monsonia angustifolia</i> | |
| <i>Olea europaea</i> subsp. <i>africana</i> * ¹ | |
| <i>Pachypodium saundersii</i> ¹ | |
| <i>Panicum maximum</i> | |
| <i>Pavonia</i> cf. <i>burchellii</i> | |
| <i>Pelargonium luridum</i> * | |
| <i>Pellaea calomelanos</i> var. <i>calomelanos</i> * | |
| <i>Peltophorum africanum</i> | |
| <i>Philenoptera violacea</i> ² | |
| <i>Polygala hottentotta</i> | |
| <i>Pterocarpus angolensis</i> ^{1,2} | |
| <i>Rhynchosia</i> sp. | |
| <i>Sansevieria hyacinthoides</i> * | |
| <i>Scadoxus puniceus</i> * ¹ | |
| <i>Sclerocarya birrea</i> subsp. <i>caffra</i> * ² | |
| <i>Searsia leptodictya</i> | |
| <i>Senecio oxyriifolius</i> subsp. <i>oxyriifolius</i> | |
| <i>Senecio venosus</i> | |
| <i>Senegalia caffra</i> | |
| <i>Senegalia nigrescens</i> | |
| <i>Sesbania punicea</i> | 1b |
| <i>Solanum panduriforme</i> | |
| <i>Sporobolus africanus</i> | |
| <i>Sterculia murex</i> ¹ | |
| <i>Striga</i> cf. <i>asiatica</i> | |
| <i>Strychnos</i> cf. <i>spinosa</i> | |
| <i>Terminalia sericea</i> * | |
| <i>Themeda triandra</i> | |
| <i>Tylosema fassoglense</i> | |
| <i>Vachellia davyi</i> | |
| <i>Vachellia nilotica</i> subsp. <i>kraussiana</i> | |
| <i>Vachellia swazica</i> | |
| <i>Wahlenbergia undulata</i> | |
| <i>Xerophyta</i> cf. <i>retinervis</i> * | |
| <i>Zanthoxylum capense</i> * | |
| <i>Zinnia peruviana</i> | |
| <i>Ziziphus mucronata</i> subsp. <i>mucronata</i> * | |

Alien species indicated in bold; Medicinal species indicated with (*)

¹ Species protected under Mpumalanga Nature Conservation Act (No. 10 of 1998)

² Protected trees according to National Forest Act (No. 84 of 1998)

7.4.2. Medicinal and Alien plant species

Eighteen medicinal and five alien species have been recorded in the study unit (Table 3). Four alien species are listed as Category 1b invasive (Table 2 and 3).

7.4.3. Red List species and Protected Trees

The study unit has suitable habitat for Red List species, protected trees and provincial protected plants. During the survey two SCC, 13 species listed as protected plants according to the Mpumalanga Nature Conservation Act (No. 10 of 1998) and three protected trees according to the National Forest Act (No. 84 of 1998) were recorded in this unit (Table 3). The necessary permits need to be acquired from the competent authority for the protected trees which should be relocated to other suitable habitats either on site or in the surrounding area which is protected from developments.

7.4.4. Sensitivity and Connectivity

The Bushveld is considered sensitive as the greatest part of the unit is still in a natural condition and several Red List and protected tree species occur in the unit. Connectivity is not hindered to the south-east and north-east, but townships surround the rest of the study unit. This study unit has a high conservation importance and ecological sensitivity, especially the ridge system towards the northwest of the study site.



Figure 5: Natural Bushveld indicating herbaceous cover and woody cover at the back.

7.5. Watercourse

7.5.1. Composition

The vegetation of this unit is for the greatest part still in a good ecological condition (Figure 6 and 7). The Watercourse consists of non-perennial rivers which eventually connect with a perennial river in the Kruger National Park. Along the Watercourse numerous alien species occur (Figure 8). The vegetation is dense and characterised by cyperoids, forbs, trees and graminoids. A total of 46 species were recorded during the survey (Table 4). Dominant species include *Cyperus longus*, *Persicaria* sp., *Phragmites australis*, *Ricinus communis*, *Schoenoplectus* sp., *Typha capensis* and *Xanthium strumarium*.

Table 4: Species recorded in the Watercourse.

| Species | Invasive category |
|--|-------------------|
| <i>Ageratum conyzoides</i> | 1b |
| <i>Arundo donax</i> | 1b |
| <i>Asclepias curassavica</i> | |
| <i>Bidens pilosa</i> | |
| <i>Carex austro-africana</i> | |
| <i>Combretum erythrophyllum</i> | |
| <i>Crabbea</i> cf. <i>angustifolia</i> | |
| <i>Crinum</i> sp. | |
| <i>Cucumis zeyheri</i> | |
| <i>Cynodon dactylon</i> | |
| <i>Cyperus</i> sp. | |
| <i>Cyperus dives</i> | |
| <i>Cyperus longus</i> var. <i>tenuiflorus</i> | |
| <i>Cyperus esculentus</i> var. <i>esculentus</i> | |
| <i>Datura stramonium</i>* | 1b |
| <i>Diospyros mespiliformis</i> | |
| <i>Echinochloa pyramidalis</i> | |
| <i>Eragrostis gummiflua</i> | |
| <i>Hibiscus</i> cf. <i>lunarifolius</i> | |
| <i>Hyparrhenia filipendula</i> | |
| <i>Kalanchoe rotundifolia</i> | |
| <i>Kyllinga</i> cf. <i>melanosperma</i> | |
| <i>Lasiosiphon</i> cf. <i>burchellii</i> | |
| <i>Lantana camara</i> | 1b |
| <i>Leersia hexandra</i> | |
| <i>Myroxylon aethiopicum</i> subsp. <i>schlechteri</i> | |
| <i>Melia azedarach</i> | 1b |
| <i>Melinis repens</i> | |
| <i>Nymphaea nouchali</i> | |
| <i>Persicaria</i> cf. <i>lapathifolia</i> | |
| <i>Phragmites australis</i> | |

| | |
|---|-----------|
| <i>Pycreus muricatus</i> | |
| <i>Ricinus communis</i>* | 2 |
| <i>Senna cf. septemtrionalis</i> | 1b |
| <i>Schoenoplectus</i> sp. | |
| <i>Sorghum bicolor</i> | |
| <i>Sporobolus africanus</i> | |
| <i>Sporobolus pyramidalis</i> | |
| <i>Tagetes minuta</i> | |
| <i>Tithonia rotundifolia</i> | 1b |
| <i>Typha capensis</i> * | |
| <i>Xanthium strumarium</i> | 1b |
| <i>Xanthium spinosum</i> | 1b |
| <i>Zanthoxylum capense</i> * | |
| <i>Zantedeschia</i> sp.* ¹ | |
| <i>Zinnia peruviana</i> | |

Alien species indicated in bold; Medicinal species indicated with (*)

¹ Species protected under Mpumalanga Nature Conservation Act (No. 10 of 1998)

² Protected trees according to National Forest Act (No. 84 of 1998)

7.5.2. Medicinal and Alien plant species

Five medicinal and fifteen alien species were recorded during the site visit (Table 4).

7.5.3. Red List species and Protected Trees

The study unit has suitable habitat for Red List species and species of conservation concern (Annexure A). Although no Protected Trees were recorded during the survey, it is likely for at least two species to occur along the Watercourse.

7.5.4. Sensitivity and Connectivity

The Watercourse is in a reasonably good ecological condition which should be excluded from development. Connectivity to the east is not limited. Major impacts of concern include erosion, alien vegetation and illegal abstraction of water. This study unit has a high conservation importance and ecological sensitivity.



Figure 6: The Watercourse on the study site dominated by *Cyperus* spp. and some tree species.



Figure 7: Watercourse towards the north dominated by *Schoenoplectus* and *Phragmites* species.



Figure 8: Alien species such as *Ageratum conyzoides* in the watercourse.

7.6. Disturbed Bushveld

7.6.1. Composition

The Disturbed Bushveld is not characteristic of the vegetation units described above, mainly because of roads, rubbish dumping, and alien vegetation (Figure 9). Soil erosion and loss of natural vegetation is of concern. Increased edge effects from the road and agricultural lands could cause a decrease in species diversity and richness. A total of 47 species were recorded during the survey (Table 5). Dominant species include *Agave americana*, *Aloe greatheadii*, *Aristida adscensionis*, *Dichrostachys cinerea*, *Eragrostis* spp., *Hyperthelia dissoluta*, *Macledium zeyheri*, *Sclerocarya birrea* and *Vachellia nilotica*.

Table 5: Species recorded in the Disturbed Bushveld.

| Species | Invasive category |
|--|-------------------|
| <i>Agave americana</i> subsp. <i>americana</i> | |
| <i>Aloe greatheadii</i> var. <i>davyana</i> * ¹ | |
| <i>Aristida adscensionis</i> | |
| <i>Aristida congesta</i> subsp. <i>congesta</i> | |
| <i>Asclepias</i> sp.* | |
| <i>Asparagus</i> cf. <i>laricinus</i> * | |
| <i>Bauhinia galpinii</i> | |
| <i>Bonatea</i> cf. <i>antennifera</i> ¹ | |
| <i>Catharanthus roseus</i>* | 1b |

| | |
|---|----|
| <i>Ceratotheca triloba</i> | |
| <i>Combretum collinum</i> subsp. <i>suluense</i> | |
| <i>Combretum molle</i> | |
| <i>Combretum zeyheri</i> | |
| <i>Crabbea</i> cf. <i>angustifolia</i> | |
| <i>Cucumis zeyheri</i> | |
| <i>Dichrostachys cinerea</i> subsp. <i>nyassana</i> * | |
| <i>Eragrostis</i> sp. | |
| <i>Eragrostis gummiflua</i> | |
| <i>Eragrostis superba</i> | |
| <i>Helichrysum nudifolium</i> * | |
| <i>Helichrysum</i> cf. <i>rugulosum</i> | |
| <i>Heteropogon contortus</i> | |
| <i>Kalanchoe paniculata</i> | |
| <i>Lantana camara</i> | 1b |
| <i>Macladium zeyheri</i> subsp. <i>zeyheri</i> | |
| <i>Monsonia angustifolia</i> | |
| <i>Panicum maximum</i> | |
| <i>Pellaea calomelanos</i> var. <i>calomelanos</i> * | |
| <i>Peltophorum africanum</i> | |
| <i>Sclerocarya birrea</i> subsp. <i>caffra</i> * ² | |
| <i>Searsia leptodictya</i> | |
| <i>Senecio oxyriifolius</i> subsp. <i>oxyriifolius</i> | |
| <i>Senecio venosus</i> | |
| <i>Senegalia caffra</i> | |
| <i>Senegalia nigrescens</i> | |
| <i>Senna</i> cf. <i>petersiana</i> * | |
| <i>Sesbania punicea</i> | 1b |
| <i>Solanum panduriforme</i> | |
| <i>Themeda triandra</i> | |
| <i>Tylosema fassoglense</i> | |
| <i>Vachellia davyi</i> | |
| <i>Vachellia nilotica</i> subsp. <i>kraussiana</i> | |
| <i>Vachellia swazica</i> | |
| <i>Wahlenbergia undulata</i> | |
| <i>Xerophyta</i> cf. <i>retinervis</i> * | |
| <i>Zinnia peruviana</i> | |
| <i>Ziziphus mucronata</i> subsp. <i>mucronata</i> * | |

Alien species indicated in bold; Medicinal species indicated with (*)

¹ Species protected under Mpumalanga Nature Conservation Act (No. 10 of 1998)

² Protected tree according to National Forest Act (No. 84 of 1998)



Figure 9: Rubbish dumping and alien species in the Disturbed Bushveld.

7.6.2. Medicinal and Alien plant species

Eleven medicinal and five alien species have been recorded during the survey (Table 5).

7.6.3. Red List species and Protected Trees

It is not expected that Red List species occur on site, but protected trees (NFA, 1998) and protected species (MNCA, 1998) were recorded during the survey. The necessary permits need to be acquired from the competent authority should any of these species be affected by the proposed development. The mentioned species (Table 5) should be relocated to other suitable habitats either on site or in the surrounding area which is protected from developments.

7.6.4. Sensitivity and Connectivity

The unit has low sensitivity, but protected trees and protected species occur in this unit. Edge effects increase from the road towards the interior of the unit, which causes an increase in alien species numbers and density.

7.7. Dam

7.7.1. Composition

The vegetation at the Dam is a mixture of indigenous and alien species (Figure 10). Cattle were observed drinking from the Dam (Figure 11), which is one of the mechanisms of spreading alien species. A total of 25 species were recorded in the study unit (Table 6). Dominant species include *Cynodon dactylon*, *Sporobolus africanus*, *Ludwigia cf. octovalvis*, *Persicaria cf. lapathifolia*, *Sesbania cf. bispinosa* and *Phragmites australis*.

Table 6: Species recorded at the Dam.

| Species | Invasive category |
|--|-------------------|
| <i>Bothriochloa insculpta</i> | |
| <i>Chloris virgata</i> | |
| <i>Cynodon dactylon</i> | |
| <i>Datura stramonium</i>* | 1b |
| <i>Echinochloa pyramidalis</i> | |
| <i>Eragrostis gummiflua</i> | |
| <i>Flaveria bidentis</i> | 1b |
| <i>Gomphrena celosioides</i> | |
| <i>Gymnosporia</i> sp. | |
| <i>Lantana camara</i> | 1b |
| <i>Leonotis</i> sp. | |
| <i>Ludwigia cf. octovalvis</i> | |
| <i>Persicaria cf. lapathifolia</i> | |
| <i>Phragmites australis</i> | |
| <i>Philenoptera violacea</i> ² | |
| <i>Sclerocarya birrea</i> subsp. <i>caffra</i> ^{*2} | |
| <i>Senna cf. pendula</i> | 1b |
| <i>Sesbania cf. bispinosa</i> | |
| <i>Solanum panduriforme</i> | |
| <i>Sporobolus africanus</i> | |
| <i>Tribulus terrestris</i> | |
| <i>Typha capensis</i> * | |
| <i>Vachellia davyi</i> | |
| <i>Vachellia swazica</i> | |
| <i>Xanthium strumarium</i> | 1b |

Alien species indicated in **bold**; Medicinal species indicated with (*)

¹Species protected under Mpumalanga Nature Conservation Act (No. 10 of 1998)

²Protected tree according to National Forest Act (No. 84 of 1998)

7.7.2. Medicinal and Alien plant species

Three medicinal and nine alien species have been recorded during the survey (Table 6).

7.7.3. Red List species and Protected Trees

It is not expected that Red List species occur on site, but two protected trees (NFA, 1998) and protected species (MNCA, 1998) were recorded during the survey. The necessary permits need to be acquired from the competent authority should any of these species be affected by the proposed development. These species should be relocated to other suitable habitats either on site or in the surrounding area which is protected from developments.

7.7.4. Sensitivity and Connectivity

Several impacts, including alien vegetation and cattle trampling, affects the Dam. The dam wall towards the north and transformed area limits connectivity. The Dam should be maintained and excluded from development activities to ensure ecological functioning. Should any construction work be done rehabilitation should ensure reestablishment of natural vegetation. The Dam is moderately sensitive.



Figure 10: Dam with indigenous and alien vegetation.



Figure 11: Cattle observed in the Dam.

8. FINDINGS

The study site is located in the Malelane Mountain Bushveld and Pretoriuskop Sour Bushveld both with a conservation status of Least Concern. The study site is further located in an Ecological Support Area: Protected Area Buffer (entire site) and classified as Other Natural Areas (greatest part of site) according to MBSP Terrestrial Assessment. The *Protected Area Buffer* mentioned refers to the 10km buffer area for the Kruger National Park (KNP) located to the east of the study site. This buffer area is critical for the well-being of the KNP as it acts as an ecological support area, for example, to ensure optimal ecological functioning, for the migration of species and to ensure that edge effects from surrounding developments are minimal.

The Bushveld is considered sensitive as there is natural vegetation with minor disturbances and high biodiversity (Figure 11). Two Species of Conservation Concern (*Boophone disticha* and *Hypoxis hemerocallidea*), 13 species listed as provincial protected plants (Tables 3-6) and three protected trees (Tables 3-6) were recorded in this unit. The unit has suitable habitat for an additional four protected tree species.

The Watercourse is still in a good ecological condition, but alien vegetation, erosion and illegal abstraction of water are of concern. From an ecological perspective, the Watercourse has a high conservation importance and ecological sensitivity (Figure 11). Accordingly, the associated buffer areas should be determined by a qualified aquatic specialist and should be excluded from development.

The Disturbed Bushveld is not characteristic of the Malelane Mountain Bushveld and Pretoriuskop Sour Bushveld as it has been modified by roads, rubbish dumping, and alien vegetation. The unit has low sensitivity (Figure 12).

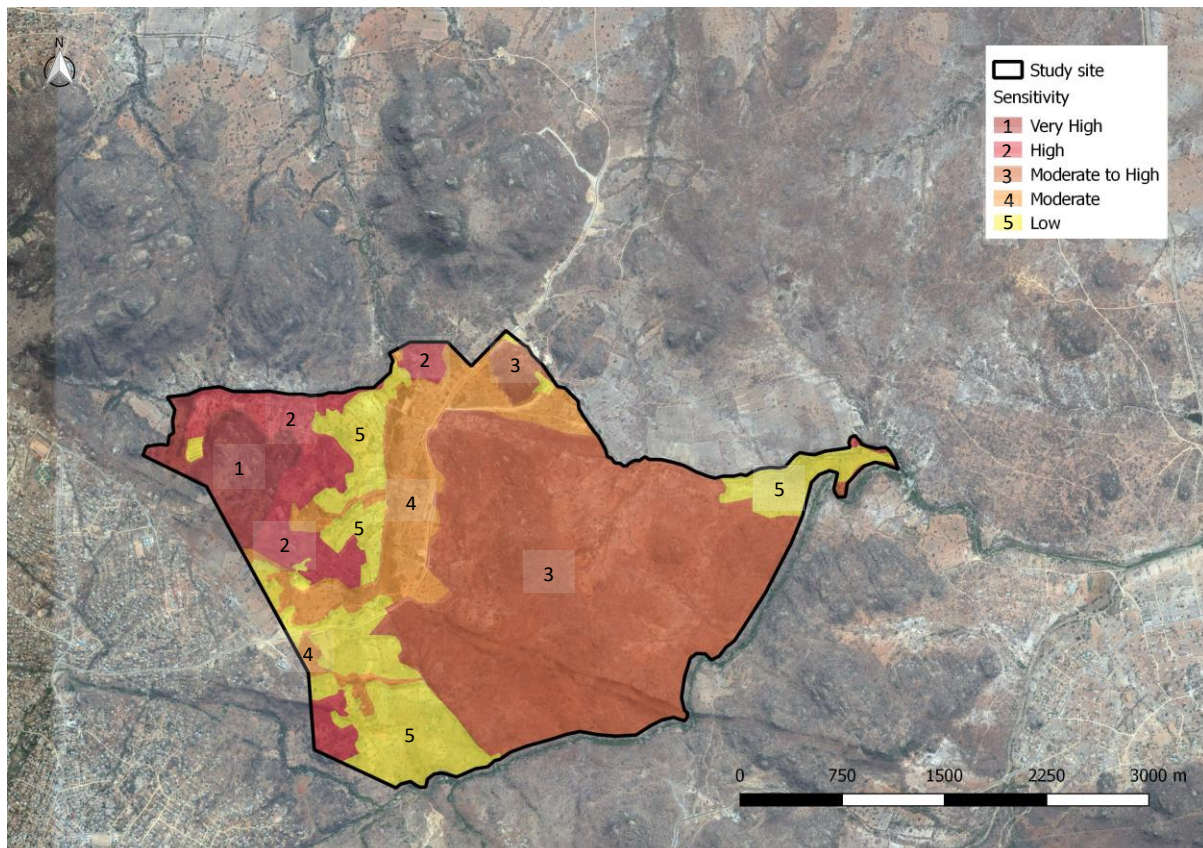


Figure 12: Sensitivity map of study site.

9. RECOMMENDATION AND MITIGATION MEASURES

The following general recommendations and mitigation measures are suggested for the study area:

- An appropriate management authority should be identified that must be contractually bound to implement the Environmental Management Programme (EMPr) and ROD during the operational phase of the development and be informed of their responsibilities in terms of the EMPr and ROD;
- The EMPr should comply with the requirements according to the competent authority;
- The attached sensitivity map (Figure 11) should be used as a guideline;
- Areas indicated as sensitive in the attached sensitivity map are suggested to be excluded from development, although low density development could be considered in the Bushveld if large open spaces are left for the protection of species and their habitats, and impacts are kept to a minimum. It is, however, critical that no development take place in or close to watercourses without permission from the competent authority. Construction camps and associated construction activities should be located on areas of low sensitivity;
- No personnel or vehicles may be permitted in ecologically sensitive areas such as the Watercourse and ridge areas in the Bushveld, except for those authorised to do so;

- A post-construction alien and invasive control, monitoring and eradication programme must be implemented along with an on-going programme to ensure persistence of indigenous species. A qualified botanist/ecologist should compile and supervise the implementation of this programme;
- Construction activities at or close to wetlands, watercourses and water bodies should be limited. A qualified wetland/aquatic specialist should delineate the wetland and indicate appropriate buffer zones;
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Where active rehabilitation or restoration is mandatory for terrestrial systems, it should make use of indigenous plant species native to the study site, but would otherwise be destroyed during clearing for development purposes. The species selected should strive to represent habitat types typical of the ecological landscape prior to construction;
- Only plant species that are indigenous to the natural vegetation of the study area should be used for landscaping. As far as possible, plants naturally growing on the development site, but would otherwise be destroyed during clearing for development purposes, should be incorporated into landscaped areas. Forage and host plants required by pollinators should also be planted in landscaped areas;
- In order to minimize artificially generated surface storm-water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.

Regarding the protection of protected tree species according to the National Forests Act of 1998 (No. 84 of 1998):

- The National Forests Act of 1998 (Act No. 84 of 1998) should be adhered to strictly.
- *No person may cut, disturb, damage, destroy or remove any protected tree found on site (section 15 (1a) Act No. 84 of 1998) or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of (section 15 (1b) Act No. 84 of 1998) except under a licence granted by the Minister.* An application should be submitted to the competent authority regarding such matters.
- If a licence is obtained and protected trees are removed, it should be relocated to suitable habitat away from construction. The latter is, however, not considered viable as it is very costly, especially if numerous trees occur within the proposed development footprint, the survival rate is potentially low and further ecological issues may arise (such as soil compaction due to heavy moving equipment).
- It is suggested that the layout of the proposed development considers keeping most of the protected trees on site, especially large trees which are difficult and costly to move. In cases where this is not possible, the trees should either be relocated to suitable areas on site or as determined by the competent authority. Alternatively, a trade-off could be made that for every tree removed, two saplings/seedlings should be planted in suitable habitat on the study area.

- Protected trees found within the study area (i.e. necessitating the removal, felling or any disturbance or damage of protected trees) must be recorded with a GPS and enumerated.
- A relocation plan should be compiled as part of the permit application to ensure compliance and monitoring of protected trees on site. This should be compiled by a registered ecological specialist.

10. CONCLUSION

The vegetation of the greater part of the study site is still in a natural condition, with three protected tree species, thirteen species listed as protected plants in Mpumalanga and two SCC (Tables 3-6). It is possible that four additional protected trees may occur on the study site that might have been overlooked due to limited sampling time and seasonality. The presence of these species needs to be investigated prior to applying for a permit. Protected trees may not be removed without the proper permission and permits obtained from the relevant authority. Development cannot commence without the granting of a permit. Threatened species and/or SCC located on site should be relocated to suitable locations before construction activities commence. This should be discussed with the competent authority. Should the proposed development be approved, the above-mentioned recommendations should be included as part of the Environmental Management Programme, and implemented by the Environmental Control Officer. Furthermore, alien plant species, especially in Category 1 and 2 must be eradicated.

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The following information is to remain confidential and is not meant for the general public. Please do not distribute under any circumstances without the permission from the competent authority.

Annexure A: Red List Species (confidential)

The following Red List species could potentially occur on the study site.

| | Species | Status: RSA ¹ , IUCN ² | Distribution range and Habitat | Suitable habitat |
|----|----------------------------------|---|---|---------------------|
| 1. | <i>Aloe simii</i> | Critically Endangered | Sabie southwards to White River and around Nelspruit. Open woodland and grassland, along drainage lines and wetlands, 600-1100 m | Potentially |
| 2. | <i>Encephalartos laevifolius</i> | Critically Endangered | Restricted to high mountain peaks in eastern Mpumalanga and parts of Swaziland. Locally extinct in Limpopo, KwaZulu-Natal and Pondoland. Steep, rocky slopes in mistbelt grassland, 1300-1500 m. Located in several vegetation units, including Malelane Mountain Bushveld. | Potentially |
| 3. | <i>Siphonochilus aethiopicus</i> | Critically Endangered | Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Tall open or closed woodland, wooded grassland or bushveld. Located in several vegetation units, including Malelane Mountain Bushveld. | Yes |
| 4. | <i>Platycoryne mediocris</i> | Endangered | Nelspruit area. Mixed deciduous woodland, in shallow peaty soils over granite sheet rock, growing in a seasonally wet drainage line. Elsewhere it occurs in poorly drained grassland, 700-1750 m. Located in Malelane Mountain Bushveld and Legogote Sour Bushveld. | Yes |
| 5. | <i>Aloe kniphofioides</i> | Vulnerable | High altitude grasslands of Mpumalanga, KwaZulu-Natal and north-eastern Eastern Cape. Montane grassland. | Potentially |
| 6. | <i>Dioscorea sylvatica</i> | Vulnerable | Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga. Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs. Located in several vegetation units, including Malelane Mountain Bushveld. | Yes |
| 7. | <i>Prunus africana</i> | Vulnerable | From the southern Cape, through KwaZulu-Natal, Swaziland and northwards in to Zimbabwe. Evergreen forests near the coast, inland mistbelt forests and afro-montane forests up to 2100 m. | Potentially |
| 8. | <i>Curtisia dentata</i> | Near Threatened | Ranges from the Cape Peninsula to the Zimbabwe-Mozambique highlands. Evergreen forest from coast to 1800 m. | Potentially |
| 9. | <i>Dalbergia melanoxylon</i> | Near Threatened ² | This species occurs in a range of woodland habitats. | Yes – Highly likely |

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|-----|---|-------------------------------|--|------------------------|
| 10. | <i>Disa extingctoria</i> | Near Threatened | Swaziland to Tzaneen. Crest of the escarpment in damp grassland and swamps, 1000-1300 m. | |
| 11. | <i>Elaeodendron transvaalense</i> | Near Threatened | In South Africa it is restricted to eastern, summer rainfall areas from the KwaZulu-Natal coast northwards through eastern Mpumalanga into Limpopo and North West provinces. Savanna or bushveld, from open woodland to thickets, often on termite mounds. | Yes – Highly likely |
| 12. | <i>Acridocarpus natalitius</i> var. <i>natalitius</i> | Declining | It occurs in the northern Eastern Cape in the Pondoland region, along the KwaZulu-Natal eastern seaboard to Maputaland, Swaziland, Mpumalanga's lowveld, Limpopo and Mozambique. It is a common member of coastal forest, forest margins, bushveld and sand forest. It is sometimes found on rocky outcrops or open grassland. | Potentially |
| 13. | <i>Ansellia africana</i> | Declining | In South Africa confined to northern KwaZulu-Natal and Mpumalanga and Limpopo Lowveld. In hot dry mixed deciduous woodlands at medium to low altitudes, in riverine vegetation and miombo woodlands near rivers, on <i>Hyphaene</i> , <i>Adansonia</i> , <i>Colophospermum</i> , <i>Brachystegia</i> , <i>Parinari</i> , <i>Ficus</i> , <i>Terminalia</i> , <i>Uapaca</i> and <i>Albizia</i> spp., also sometimes on rocks in shade, rarely in forest, 0-2200 m. | Yes – Highly likely |
| 14. | <i>Boophone disticha</i> | Declining – (medicinal value) | <i>Boophone disticha</i> is widely distributed in all provinces of South Africa. It occurs in dry grassland and on rocky slopes and occurs mainly in summer rainfall regions. | Yes – Recorded on site |
| 15. | <i>Eucomis autumnalis</i> | Declining | Found throughout most of South Africa. Damp, open grassland and sheltered places from the coast to 2450 m. | Yes – Highly likely |
| 16. | <i>Gunnera perpensa</i> | Declining | Found throughout most of South Africa. Damp marshy area and vleis from coast to 2400 m. | Yes – Highly likely |
| 17. | <i>Hypoxis hemerocallidea</i> | Declining – (medicinal value) | Widespread in the eastern part of southern Africa from the Eastern Cape to Mozambique. Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant. | Yes – Recorded on site |

Annexure B: Specialist CV