

**Proposed Housing Development:
Hekpoort, Gauteng**

**Vegetation Assessment in Support of the Environmental
Authorisation and Water Use License Process**

Date: January 2020

Report drafted on behalf of

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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.

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

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

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2020.01.23
Date

COMPLIANCE WITH THE APPENDIX 6 OF THE AMENDED 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain-	Appendix D
a) details of- <ul style="list-style-type: none"> i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; 	
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Preceding page and separate provincial document
c) an indication of the scope of, and the purpose for which, the report was prepared;	1. Introduction -p1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	2 Methodology
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	2 Methodology
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	5 Vegetation Vulnerability / Sensitivity – p24
g) an identification of any areas to be avoided, including buffers;	5 Vegetation Vulnerability / Sensitivity – p24
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 11 Sensitivity map – p26
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	1.2 Assumptions – p2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	6. Impact assessment – p29 7. Conclusion – p35
k) any mitigation measures for inclusion in the EMPr;	6. Impact assessment – p34
l) any conditions for inclusion in the environmental authorisation;	6 Impact assessment
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	6. Impact assessment – p29 7. Conclusion – p35
n) a reasoned opinion- <ul style="list-style-type: none"> i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; 	7. Conclusion – p35
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	NA
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	NA
q) any other information requested by the competent authority.	-

EXECUTIVE SUMMARY

Dimela Eco Consulting was appointed by GA Environment (Pty) Ltd to undertake a vegetation assessment of a site in Hekpoort (Gauteng) that is proposed for a housing project. The land belongs to the Mogale City Local Municipality. The projects forms part of the Rapid Land Release Programme for the Gauteng Department of Human Settlements.

The vegetation investigation involved desktop studies, a field survey and a report indicating amongst others:

- Supply background information on the site relating to conservation plans, protected areas and threatened ecosystems;
- Report and map describing the vegetation communities found on the site and immediate surrounds and its conservation importance and function within the landscape;
- Discussion of plants of conservation concern that could be present on the site, as well as those confirmed to occur during the field survey;
- Map indicating confirmed or potential habitat for plant species that are of conservation concern as well as ecologically sensitive vegetation groupings; and
- Assessment and report on the impacts that the proposed development could have on the vegetation on site and directly adjacent thereto, as well as mitigation measures to limit or negate these perceived impacts.

The site visit was undertaken on the 8th of January 2020. Good summer rain preceded the site visit and therefore was not seen as a limitation. Limited background information was available at the time of writing this report and no layout plans were available yet.

The proposed site is located on the farm Hekpoort 504JQ within the town Hekpoort, Gauteng Province. The Hekpoort Post Office is situated just east of the site. The R560 road between Hekpoort and Skeerpoort and the Hartbeespoort Dam in the north-east site, divides the site into a narrow northern section and a wider southern section. The site falls within the quarter degree square 2527DC. The proposed development area covers about 73.3 hectares. The site is situated approximately 7 km south of the Magaliesberg Protected Natural Environment and 2 km north of the Cradle of Humankind. The site falls within the Magaliesberg Biosphere Reserve.

The south-western corner of the site is the highest at an elevation of 1300m. The site slopes gently north-westwards towards the Magalies River that flows through the most north-westerly tip of the site. The site falls within the Vulnerable Moot Plains Bushveld but is situated outside of any listed ecosystem. According to the Gauteng Conservation Plan a portion of the site is situated within an Ecological Support Area (ESA), while the portion along the Magalies River falls within a Critical Biodiversity Area (CBA).

Most of the site was historically cultivated or planted with pasture. Agricultural infrastructure and the residential area of KwaJanenyane is present on either side of the R560 road that bisects the site. Cattle and sheep graze the land north of the R560 road.

Due to the historic cultivation on much of the site, the vegetation was modified from the reference state of Moot Plains Bushveld and comprised mainly of secondary grassland or pasture. Although it is unsure when cultivation ceased, it is likely that some areas were not cultivated in the last 10 years and therefore the vegetation could be classified as indigenous as per Listing Notices in terms of sections 24(2) and 240 of the National Environmental Management Act, 1998). Other than the secondary grassland, riparian vegetation is present in the north-western point of the site along the Magalies River.

The table below summarises the vegetation delineated on the site, its perceived sensitivity and applicable mitigation measures to reduce developmental impacts on the site.

Broad vegetation community	Importance and vulnerability	Gauteng Conservation Plan Category	Main mitigation measures
Riparian vegetation	High	CBA: Irreplaceable	<ul style="list-style-type: none"> • No development should take place along the riparian area. • Prevent edge effects into the riparian area from surrounding development. • This vegetation should be incorporated as open space and conserved and managed as such. • No activities may proceed within or in proximity to the river without a Water Use License permitting the activity.
Secondary grassland	Medium to Low-medium	Partly situated in and ESA	<ul style="list-style-type: none"> • Development within the secondary grassland must not impact on buffer areas to the Magalies River and associated riparian vegetation of high sensitivity. • Plan the layout in such a way as to maintain an open space corridor through the site towards the Magalies River, thereby maintaining the function of an ESA. Open space within the development can also contribute as steppingstones through the developed areas, provided that it is maintained in a natural to semi-natural state e.g. parks. • Planned fencing / boundary walls of the site should take cognisance of ecological processes and allow for the

Broad vegetation community	Importance and vulnerability	Gauteng Conservation Plan Category	Main mitigation measures
			movement of insects and smaller fauna that are imperative for pollination and seed distribution.
Degraded and severely modified	Low	ESA	<ul style="list-style-type: none"> The area comprises some indigenous trees between residential and agricultural buildings, and could be developed, while retaining as many indigenous trees as possible. The layout plan must incorporate open space or green corridors to continue to function of an ESA.

The secondary grassland and degraded and severely modified land can be considered for development, except areas bordering the riparian vegetation of high sensitivity. Parts of the secondary grassland falls within an ESA which increases these areas to medium sensitivity. The functionality of the ESA can be protected by creating open spaces within or along the proposed development, while maintaining the farming open space along the riparian area in its current state.

The vegetation around housing and farming infrastructure was considered irreversibly modified from the reference state and not sensitive to development. It must be noted that these areas fall within an ESA and that if they are developed, the continued functionality of the ESA must be maintained by providing open spaces within the development.

The riparian area may not be developed and must be protected from edge effects during construction and operation. It is advisable to set the development as far back from the riparian area as possible.

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1. INTRODUCTION

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1.1 Terms of reference

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- Supply background information on the site relating to conservation plans, protected areas and threatened ecosystems;
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- Map indicating confirmed or potential habitat for plant species that are of conservation concern as well as ecologically sensitive vegetation groupings; and
- Assessment and report on the impacts that the proposed development could have on the vegetation on site and directly adjacent thereto, as well as mitigation measures to limit or negate these perceived impacts.

1.2 Assumptions and Limitations

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. Threatened species are usually also cryptic species that are easily overlooked when not in flower. This assessment relied on a site visit undertaken on the 8th of January 2020. Good summer rain preceded the site visit and therefore was not seen as a limitation. Limited background information was available at the time of writing this report and no layout plans were available yet.

2. METHODOLOGY

The assessment entailed a literature review which included short listing plants of conservation concern that could potentially occur on or near the site. The methodology used is shortly summarised below.

2.1 Literature Review

The description of the regional vegetation relied on literature from Mucina & Rutherford (2006). Plant names follow Germishuizen *et al* (2006) and the following reference books were used to assist with plant

identification: Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002) and Bromilow (2010).

2.2 Definitions

Standardised definitions, as recommended by Lexicon for Biodiversity Planning in South Africa by the South African National Biodiversity Institute (SANBI) were used to describe the state of vegetation and ecological condition (SANBI, 2016).

Natural or near natural:	An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem (good ecological condition).
Semi-natural or moderately modified	An ecological condition class in which ecological function is maintained even though composition and structure have been compromised (Fair ecological condition).
Severely or irreversibly modified	An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem (Poor ecological condition).

Indigenous vegetation was regarded as indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years (Listing Notices in terms of sections 24(2) and 24D of the National Environmental Management Act, 1998).

2.3 Field survey

The site visit took place on the 8th of January 2020. Good summer rain fell during December and rainfall was not considered a limitation. Prior to the site visit, the vegetation was delineated into homogenous units on currently available Google Earth imagery. As most of the site was historically cultivated, 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. Random transects were walked and vegetation recorded (see sample point map, Appendix A). Plant identification and vegetation description relied on species recorded in the sampling points along the walked transects.

2.4 Mapping

Mapping was done by comparing georeferenced ground survey data to the visual inspection of available Google-Earth Imagery and in that way extrapolating survey reference points to the entire study area. Delineations are therefore approximate, and due to the intricate mosaics and often gradual mergers of

vegetation associations, generalisations had to be made. Mapped associations will thus show where a certain vegetation unit is predominant, but smaller inclusions of another vegetation association in this area do exist but have not been mapped separately.

2.4 Sensitivity Analysis

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). Vegetation is thus an important determination of the biodiversity of an area. The vegetation sensitivity assessment aimed to identify whether the broad vegetation associations present on the site are of ecological importance as it is amongst others:

- Situated in a listed ecosystem or threatened vegetation unit;
- Habitat or potential habitat to plant species of conservation concern, protected plants or protected trees as well as the probability of such species to survive or re-establish itself following disturbances, and alterations to their specific habitats;
- Situated within ecologically sensitive features such as wetlands, riparian areas or ridges, koppies and inselbergs,
- In good ecological condition and functional.

This implies that the sensitivity, not only aspects that currently prevail in the area should be taken into consideration, but also if there is a possibility of a full restoration of the original environment and its biota, or at least the rehabilitation of ecosystem services resembling the original state after an area has been significantly disturbed. The criteria and weighting scores used to determine the vegetation sensitivity, function and conservation importance are given in Appendix A.

3. BACKGROUND TO THE STUDY SITE

3.1 Locality

The proposed site is located on the farm Hekpoort 504JQ within the town Hekpoort, Gauteng Province. The Hekpoort Post Office is situated just east of the site. The R560 road between Hekpoort and Skeerpoort and the Hartbeespoort Dam in the north-east site, divides the site into a narrow northern section and a wider southern section (Figure 1). The following five (5) Portions of the Farm Hekpoort 504 JQ forms the proposed site: Portion 79; 91; 96; 321; and Portion 322. The site falls within the quarter degree square 2527DC. The proposed development area covers about 73.3 hectares.

The site is situated approximately 7 km south of the Magaliesberg Protected Natural Environment and 2 km north of the Cradle of Humankind (Figure 1). The site falls within the Magaliesberg Biosphere Reserve (Figure 2).

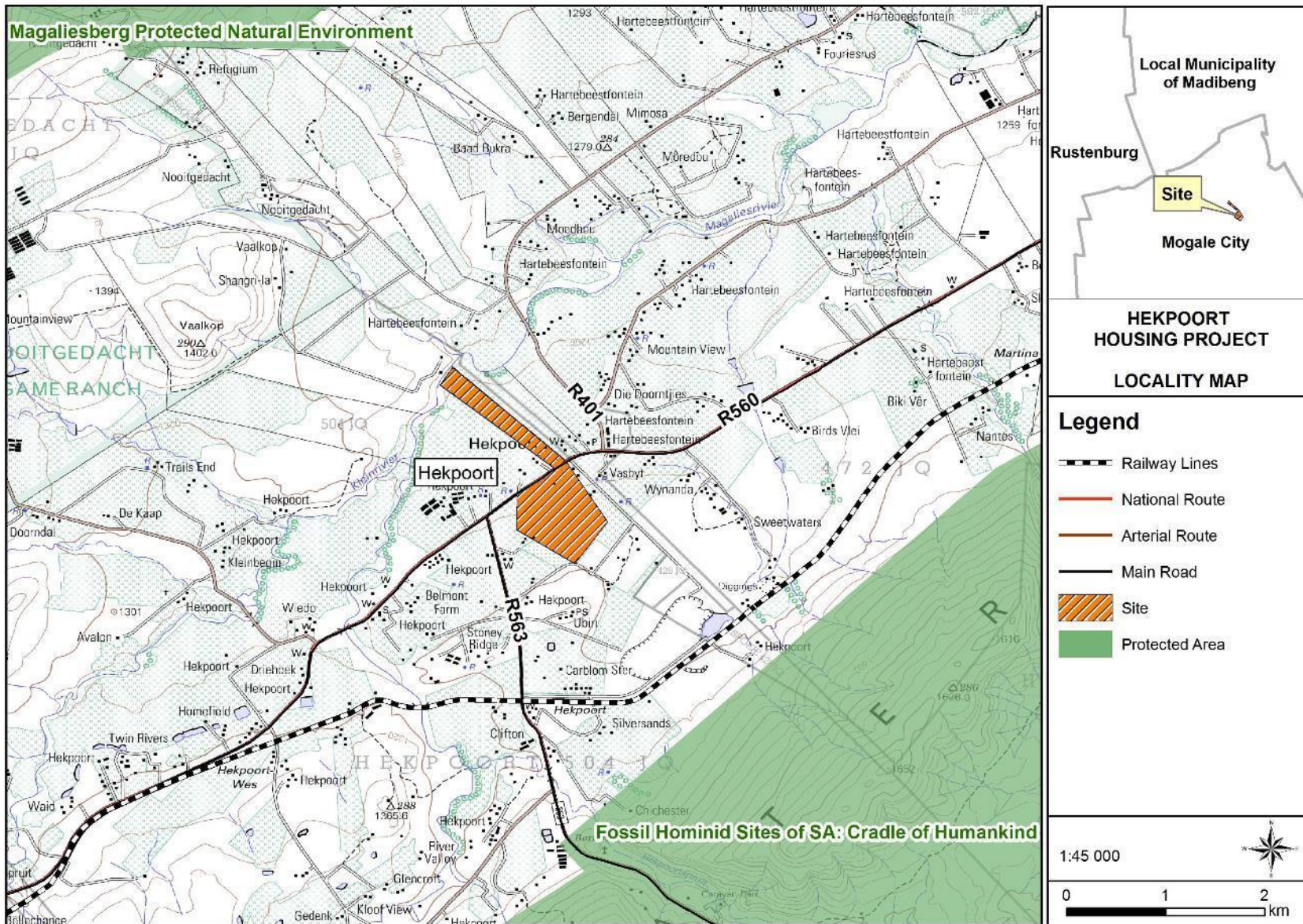


Figure 1: Locality map

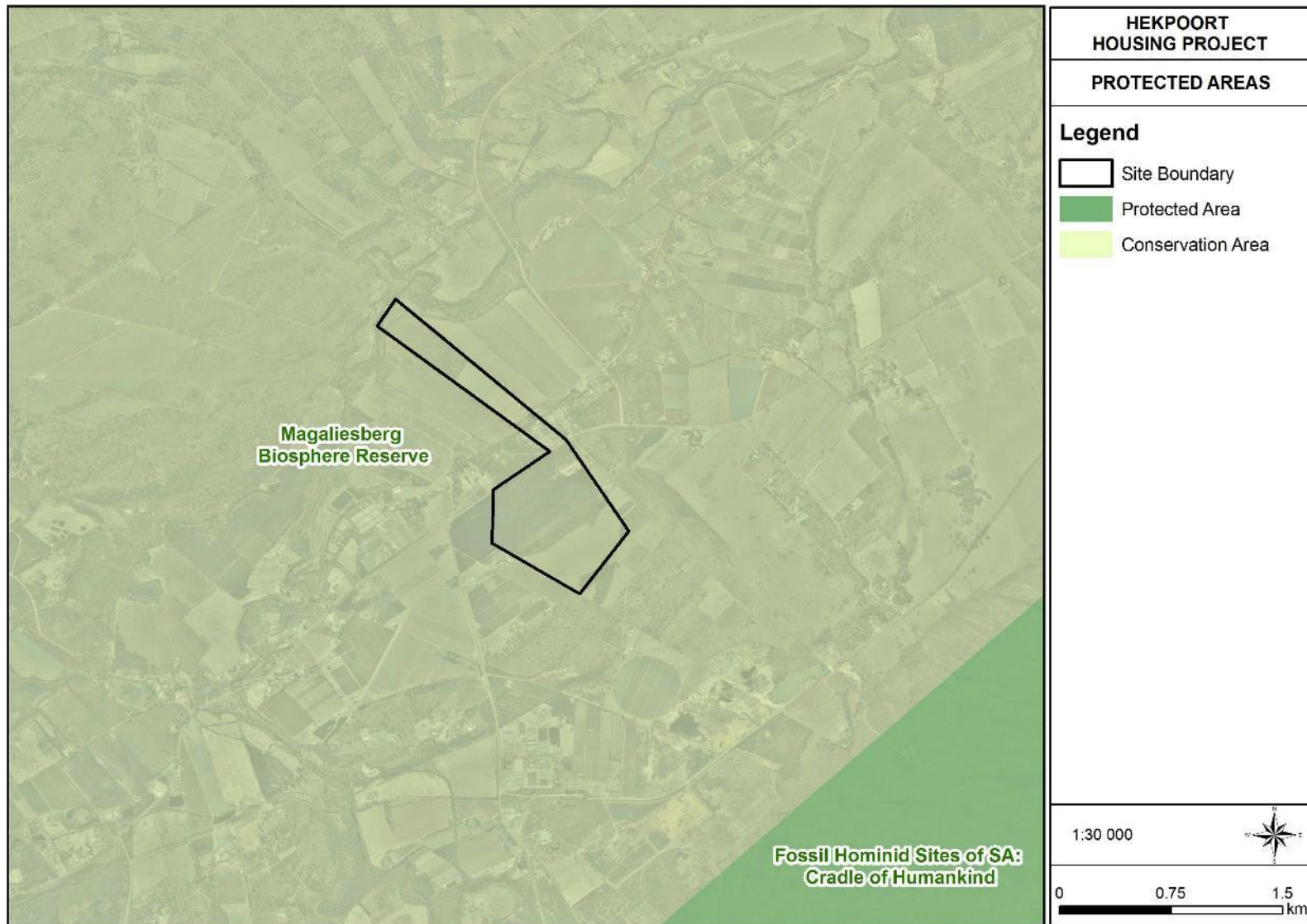


Figure 2: The site falls within the Magaliesberg Biosphere Reserve

3.2 Topography and Hydrology

The south-western corner of the site is the highest at an elevation of 1300m. The site slopes gently north-westwards. As per existing spatial layers, the Magalies River flows through the most northerly tip of the site at an elevation of 1263m, the lowest point on the site (Figure 3).

3.3 Overview of historic vegetation type

The site is situated within the Savanna biome of South Africa and in specific within the Central Bushveld Bioregion. The Savanna biome is the largest biome in southern Africa, occupying over one-third of the surface area of the country (Mucina & Rutherford, 2006). It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are commonly known as Bushveld (Mucina & Rutherford, 2006). Summer rainfall coupled with winter fire and regular grazing ensures that the grass layer remains dominant. In addition, the lack of enough rainfall prevents the upper layer (trees) from dominating. However, where grazing intensity is high, and fire frequencies low, the tree layer could become increasingly dominant.

The Central Bushveld Bioregion (a bioregion is a vegetation organisation level between that of vegetation type and biome) comprises several vegetation types. The site falls within the historic extent of the Moot Plains Bushveld vegetation type which comprises open to closed, low, often thorny savanna dominated by various species of *Vachellia* and *Senegalia* in the bottomlands and plains as well as woodlands of varying height and density on the lower hillsides (Figure 4). The herbaceous layer is dominated by grasses (Mucina and Rutherford, 2006). Any disturbances to the vegetation could modify the vegetation from this reference state. Typical species expected to occur in undisturbed Moot Plains Bushveld are listed in Table 1.

Table 1: Typical species occurring in the Moot Plains Bushveld (Mucina and Rutherford, 2006)

Small Trees:	<i>Vachellia nilotica</i> (d), <i>V. tortilis</i> subsp. <i>heteracantha</i> (d), <i>Searsia lancea</i> (d).
Tall Shrubs:	<i>Buddleja saligna</i> (d), <i>Euclea undulata</i> (d), <i>Olea europaea</i> subsp. <i>africana</i> (d), <i>Grewia occidentalis</i> , <i>Gymnosporia polyacantha</i> , <i>Mystroxydon aethiopicum</i> subsp. <i>burkeanum</i> .
Low Shrubs:	<i>Aptosimum elongatum</i> , <i>Felicia fascicularis</i> , <i>Lantana rugosa</i> , <i>Teucrium trifidum</i> .
Succulent Shrub:	<i>Kalanchoe paniculata</i> .
Woody Climber	<i>Jasminum breviflorum</i> .
Herbaceous Climber	<i>Lotononis bainesii</i>
Graminoids:	<i>Heteropogon contortus</i> (d), <i>Setaria sphacelata</i> (d), <i>Themeda triandra</i> (d), <i>Aristida congesta</i> , <i>Chloris virgata</i> , <i>Cynodon dactylon</i> , <i>Sporobolus nitens</i> , <i>Tragus racemosus</i>
Herbs:	<i>Achyroopsis avicularis</i> , <i>Corchorus asplenifolius</i> , <i>Evolvulus alsinoides</i> , <i>Helichrysum nudifolium</i> , <i>H. undulatum</i> , <i>Hermannia depressa</i> , <i>Osteospermum muricatum</i> , <i>Phyllanthus maderaspatensis</i> .

The Moot Plains Bushveld is transformed mainly by cultivation and urban and built-up areas, however, infestation by alien plants including *Cereus jamacaru*, *Eucalyptus* species, *Jacaranda mimosifolia*, *Lantana camara*, *Melia azedarach* and *Schinus* species contribute to the degradation of this vegetation type which is classified as being Vulnerable to further transformation of its original extent (Mucina and Rutherford, 2006).

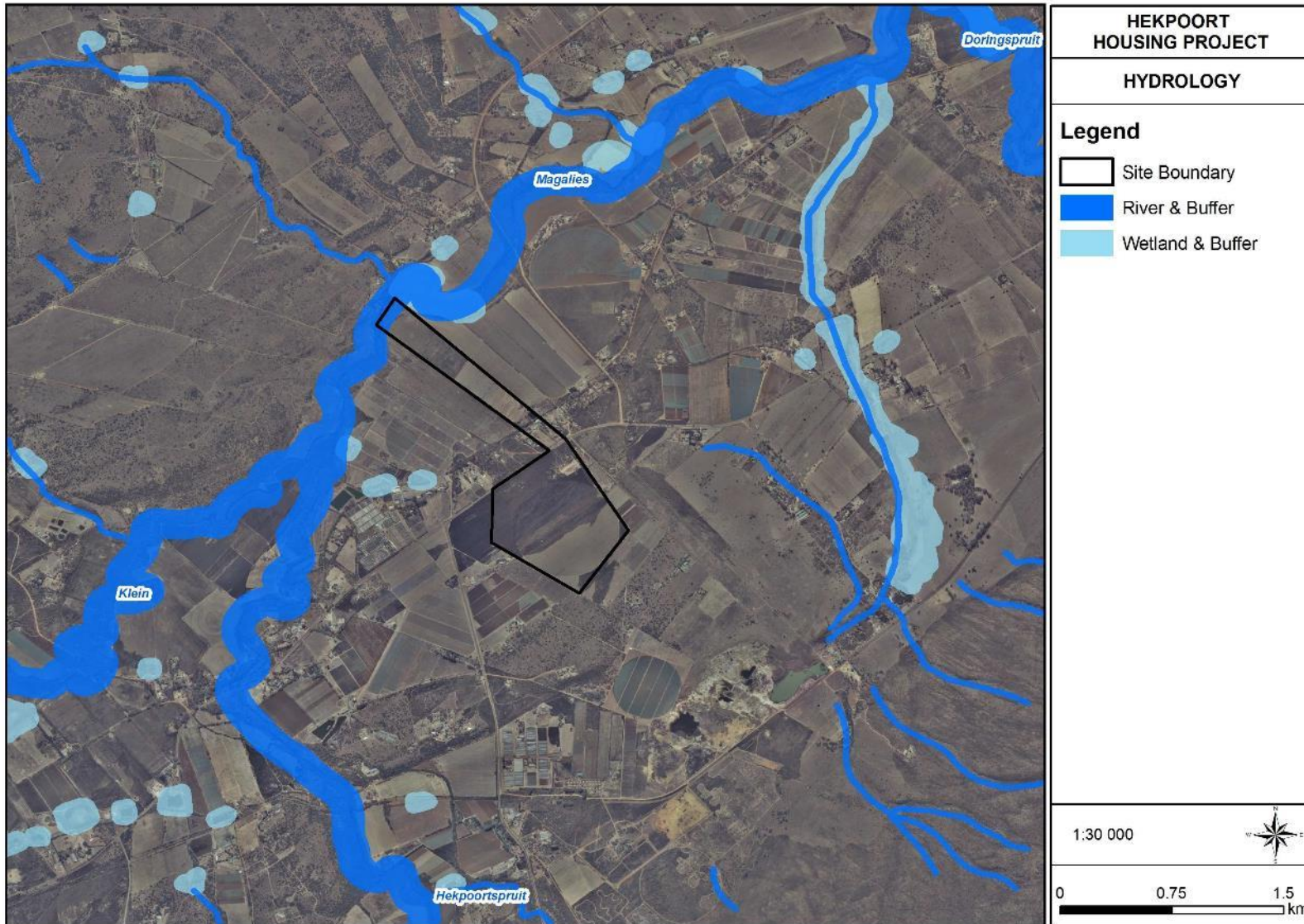


Figure 3: Hydrology of the area in which the site is located

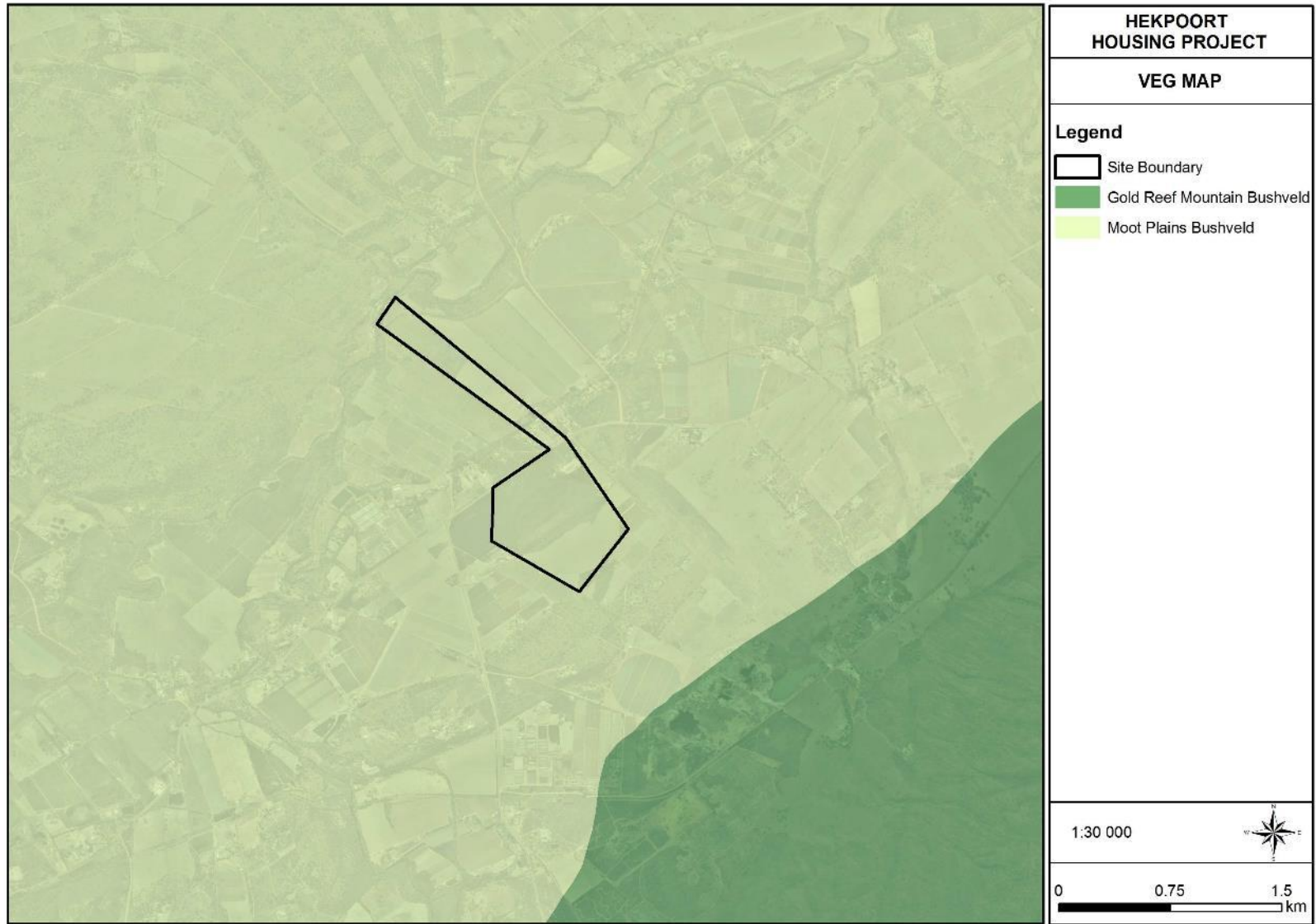


Figure 4: The site falls within the historic extent of the Moot Plains Bushveld

3.4 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 site is situated is *not* situated in a listed ecosystem. However, it is situated near the Vulnerable Magaliesberg Hekpoort Mountain Bushveld in the north and the Endangered Witwatersberg Skeerpoort Mountain Bushveld in the south (Figure 5).

3.5 Gauteng Conservation Plan

The Gauteng Conservation Plan (Version 3.3) (GDARD, 2011) classified areas within the province based on its contribution to reach the conservation targets within the province. These areas are grouped as Critical Biodiversity Areas (CBAs) or Ecological Support Corridors (ESAs). The CBAs comprise 'Irreplaceable' areas that must be conserved and areas classified as 'Important' to reach the conservation targets of the Province. ESA's are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. (ESAs) to ensure sustainability in the long term.

According to the Gauteng Conservation Plan (version 3.3) (Cplan), a portion of the site is situated within and ESA, while the portion along the Magalies River falls within a CBA: Irreplaceable (Figure 6).

3.6 Gauteng Ridges

Ridges are protected environments within Gauteng (GDACE, 2006). Ridges are thus of conservation concern and development within such areas are restricted, depending on the classification of each ridge. The Gauteng Development Guideline for Ridges (GDACE, 2006) classified ridges into four classes based on the percentage of the ridge that has been transformed.

Although the site is in proximity to class 1 ridges, no ridges or outcrops are present on the site (Figure 7).

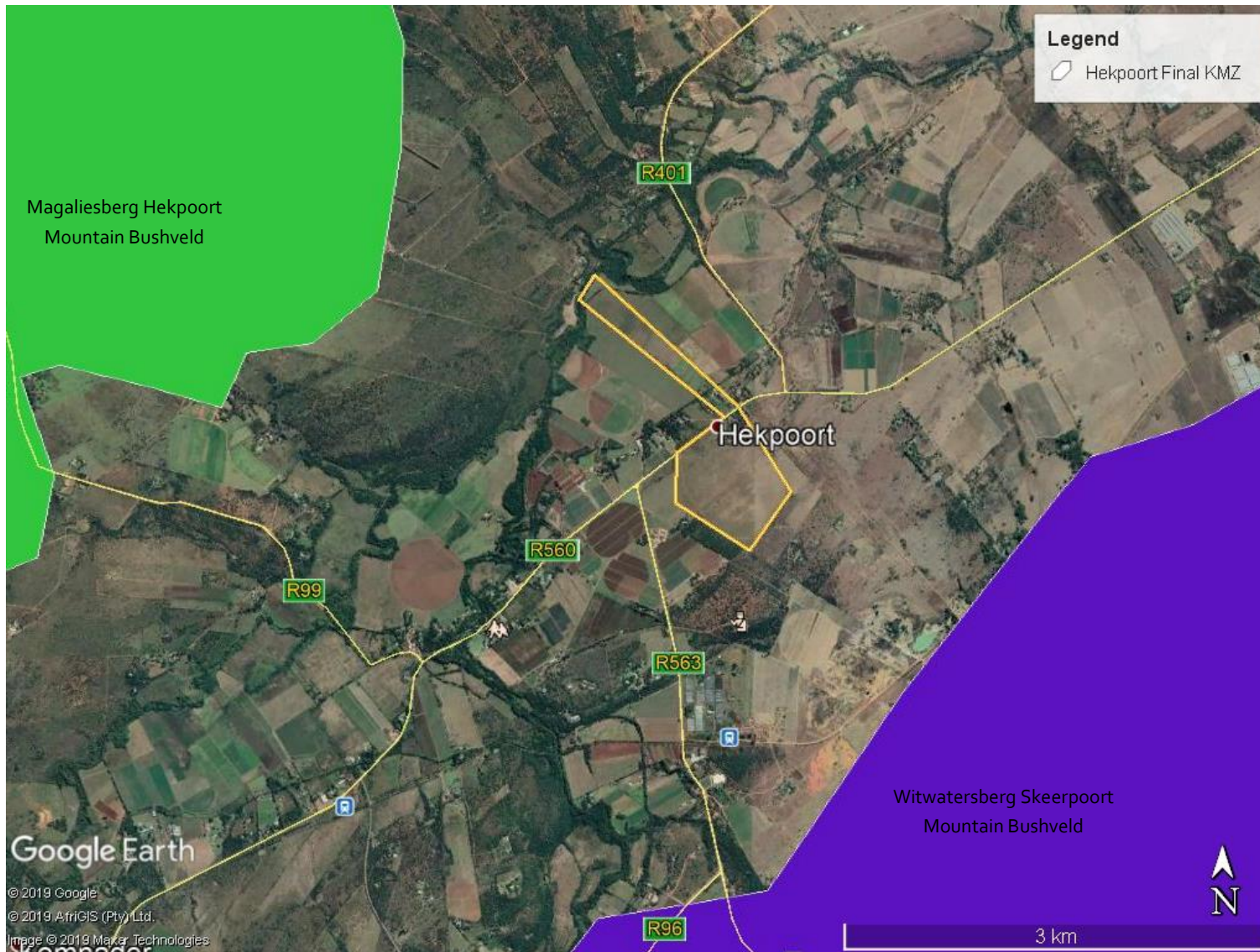


Figure 5: The site falls between two listed ecosystems

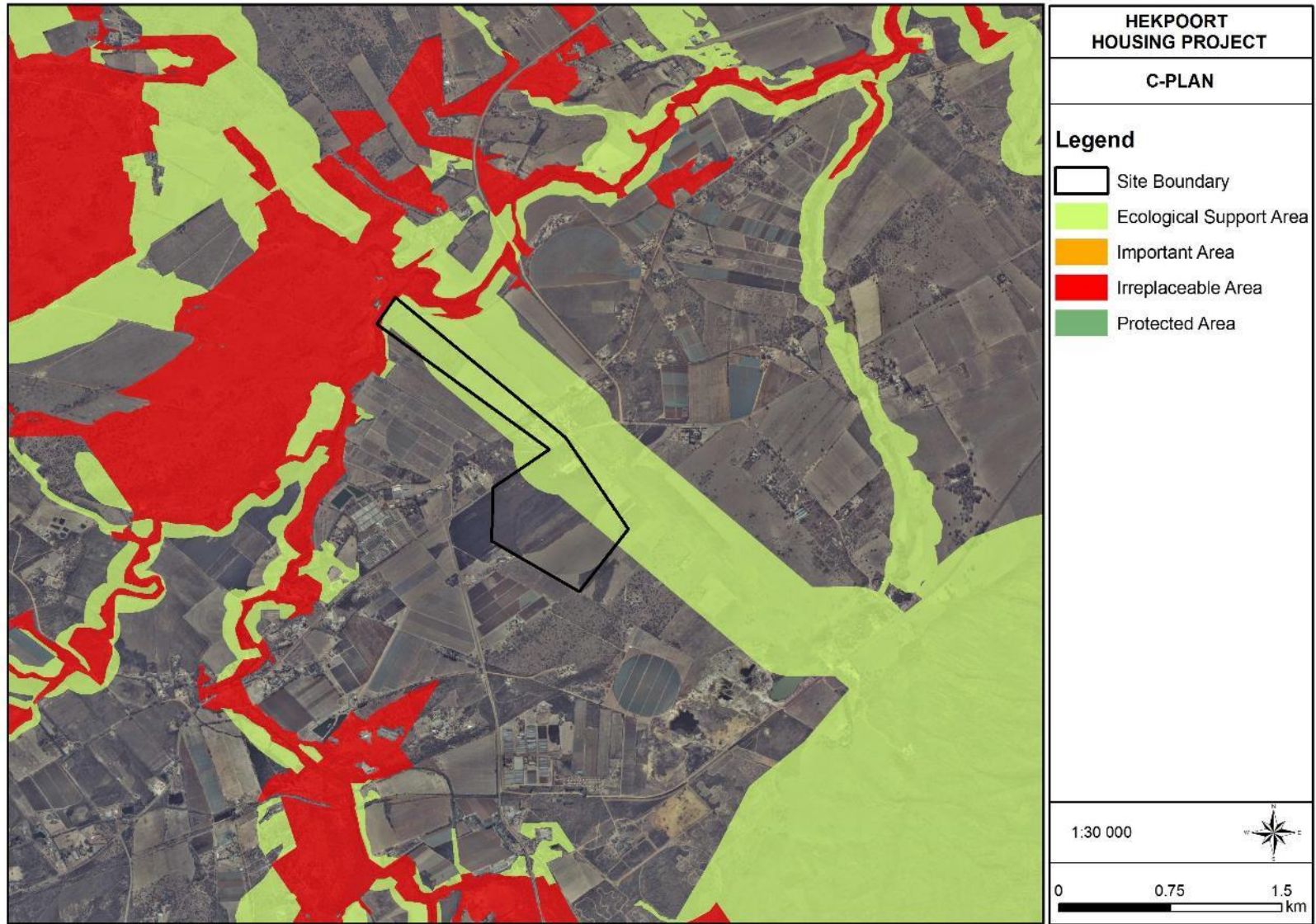


Figure 6: The proposed housing site in relation to the Gauteng Conservation Plan.

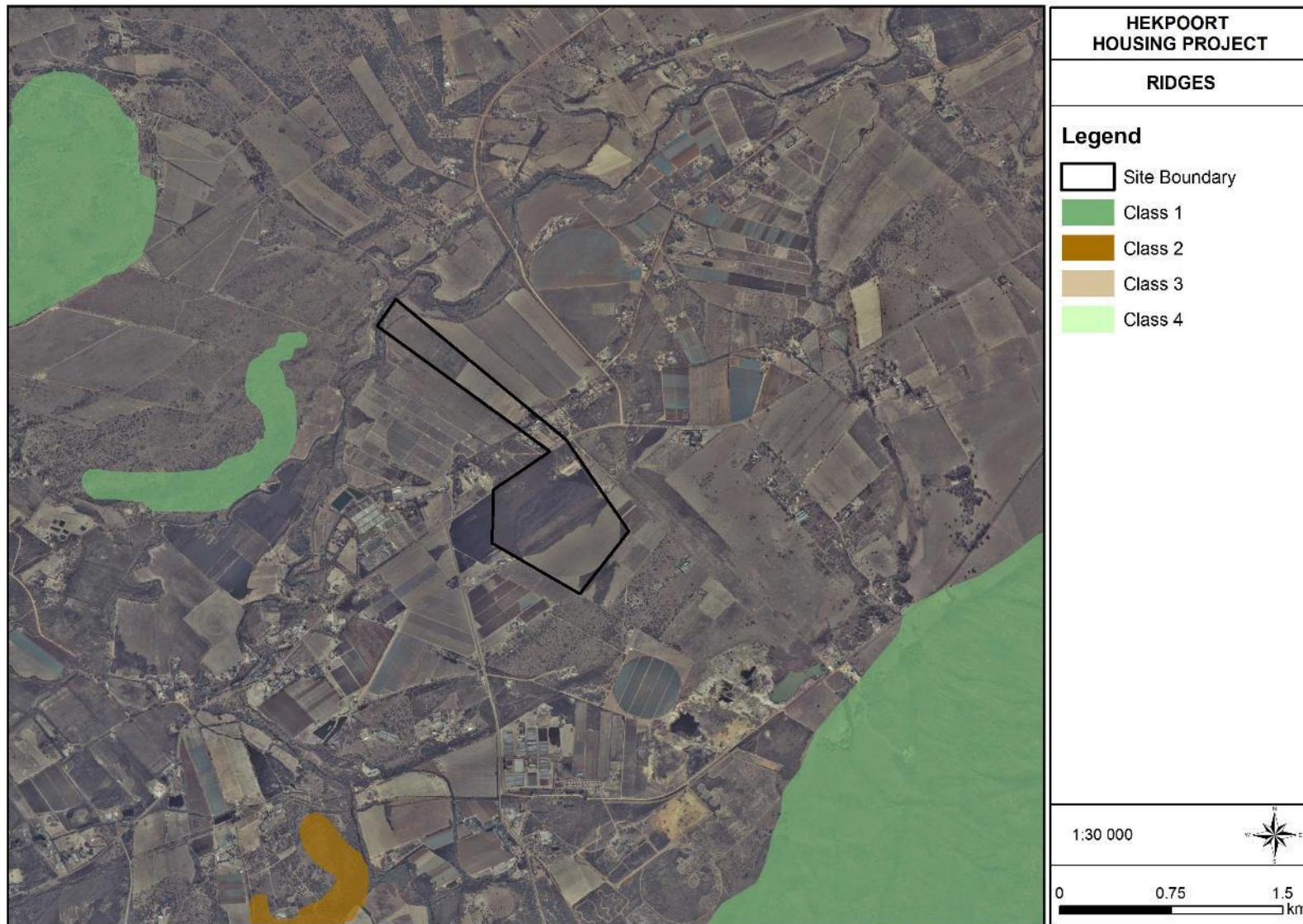


Figure 7: The site in relation to the Gauteng Ridges

4. RESULTS OF THE ASSESSMENT

4.1 Land use and disturbances

Historical Google Earth imagery indicate that the majority of the site was cultivated by 2004, with a centre pivot area south of the R560 (Figure 8). Most cultivation seemingly ceased by 2014.

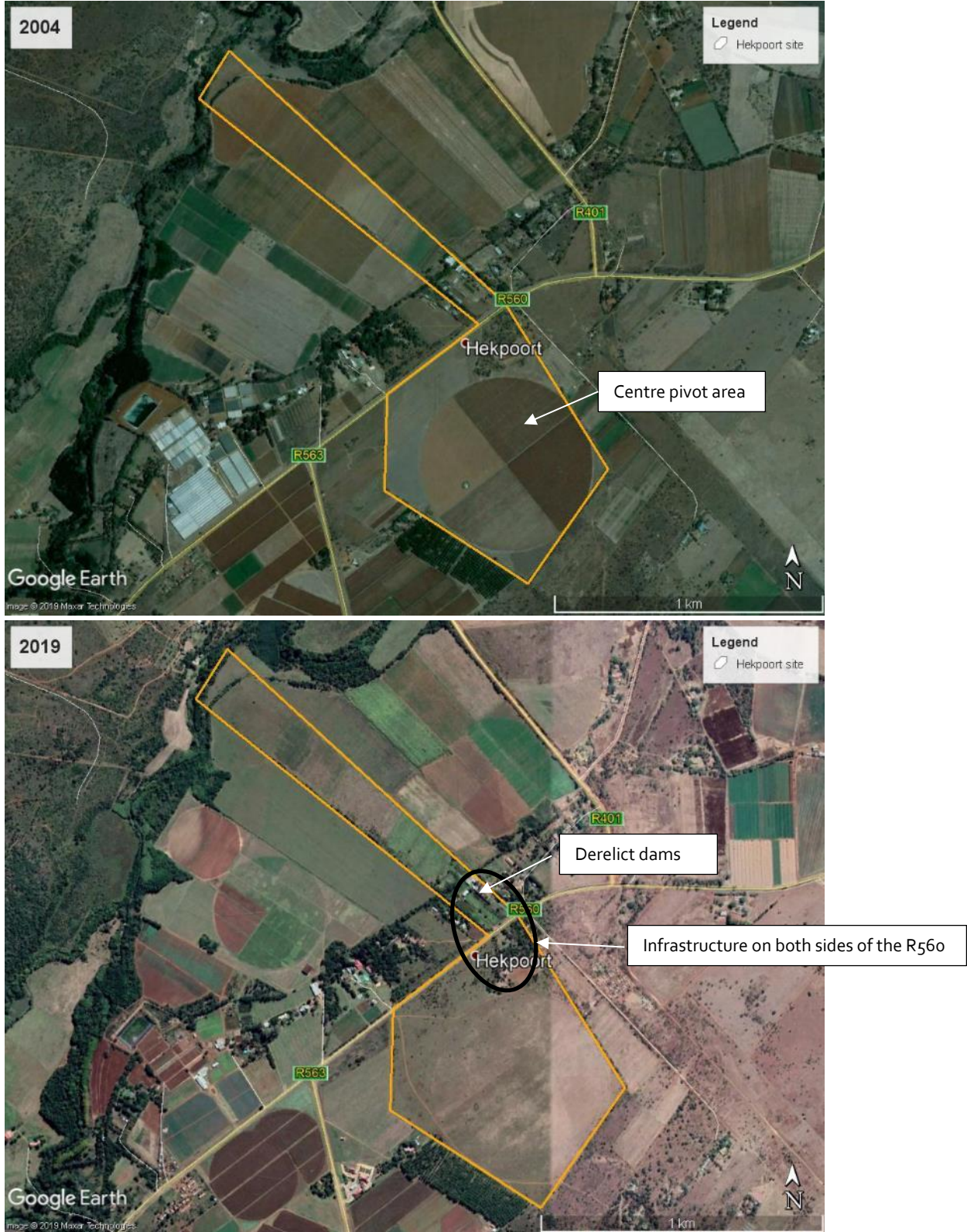


Figure 8: Google Earth aerial imagery dated 2004(top) and 2019 (below)

Infrastructure were only present north and south of the R560 road and comprised houses south of the R560 and a soccer field (Photograph 1). This residential area is called KwaJanenyane or Supply and occurs within the site boundaries. The informal housing area of Lethabong occurs on the east of the site.



Photograph 1: Houses and a soccer field directly south of the R560 (KwaJaneyane)

Houses, farm infrastructure and cattle pens are situated just north of the R560 (Photograph 2). Land north of the R560 was being used for cattle and sheep grazing, as well as for poultry rearing. Portions of the vegetation north of the R560 was dominated by the weedy *Gomphocarpus fruticosus* (milkweed). At the time of this assessment, the farmer (tenant) was in the process of removing this plant manually to improve grazing.



Photograph 2: Infrastructure north of the R560

Derelict earthen dams, overgrown with invasive species such as *Pennisetum clandestinum* (kikuyu) and *Cestrum leavigatum* (inkberry) are present. Farming is the main land use around the site. Vegetation around the site was also historically cultivated.



Photograph 3: Derelict dams overgrown with invasive species

4.2 Vegetation Survey Overview

Vegetation associations identified during this study are based on the overall similarity in vegetation structure, species composition, and abiotic features such as moistness. Each broad vegetation grouping is discussed below and geographically represented in Figure 9. Plant species that were recorded at sample points at the time of the site visit are listed in Appendix B.

Due to the historic cultivation on much of the site, the vegetation was modified from the reference state of Moot Plains Bushveld and comprised mainly of secondary grassland and pasture. Although it is unsure when cultivation ceased, it is likely that some areas were not cultivated in the last 10 years and therefore the vegetation could be classified as indigenous as per Listing Notices in terms of sections 24(2) and 240 of the National Environmental Management Act, 1998). Other than the secondary grassland, riparian vegetation was recorded in the north-western point of the site along the Magalies River.

The following vegetation groups were distinguished and discussed below:

1. Riparian vegetation;
2. Secondary, semi-natural grassland; and
3. Severely modified vegetation (areas around infrastructure)

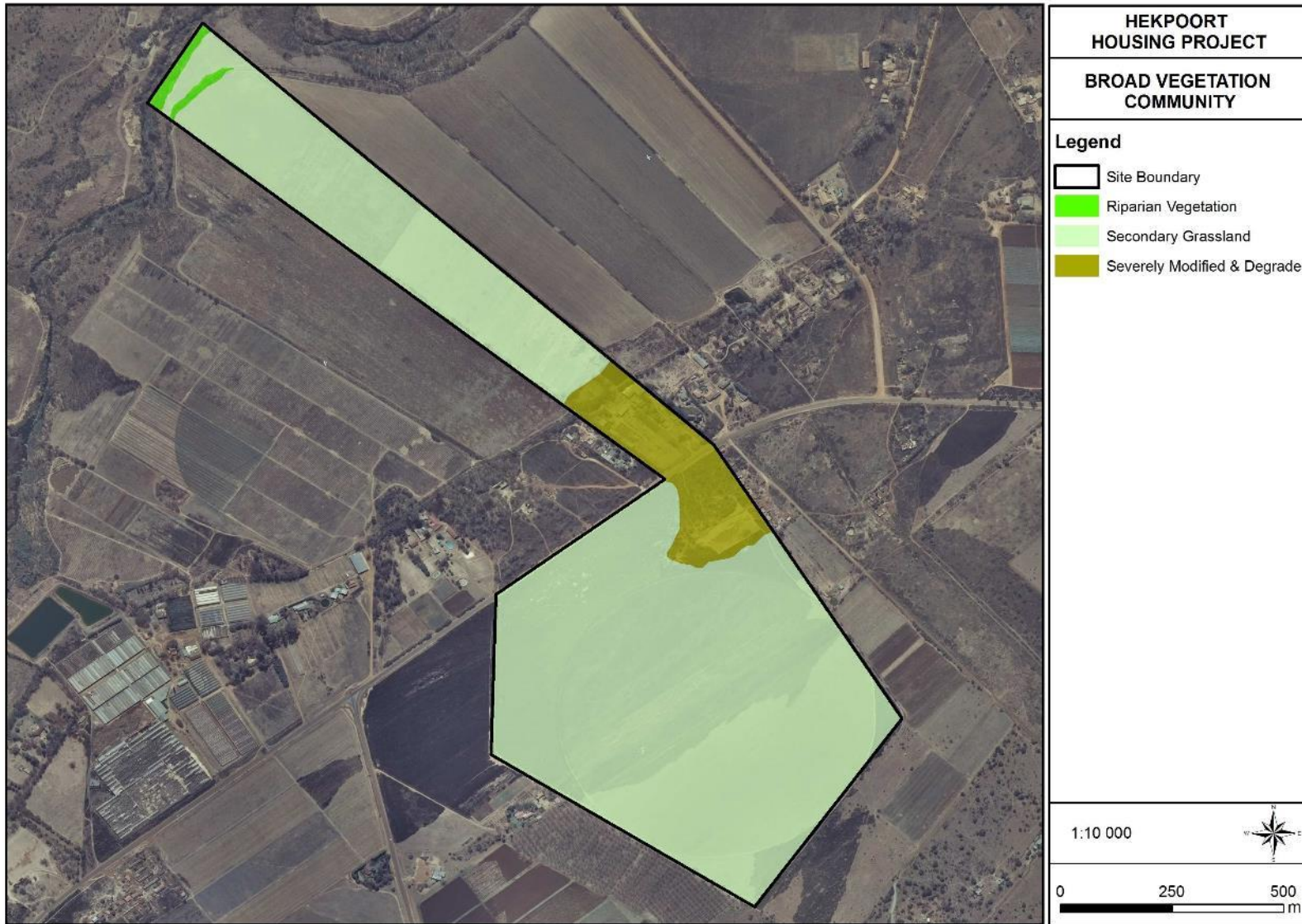


Figure 9: Broad vegetation groups on the site. The vegetation around the site was historically cultivated.

4.2.1 Riparian vegetation

The riparian zone is the area adjacent to a river or water body that forms part of the river ecosystem and is characterized by inundation or flooding frequently to support vegetation distinct from surrounding areas (River Health Programme, 2011). Riparian habitat refers to the extent of a river's footprint and includes the physical structure, as well as the vegetation associated with the river. This is commonly characterised by alluvial soils, and more vigorous plant growth (DWAF, 2005). Watercourses, and its vegetation, are protected environments.

The vegetation around the Magalies River in the north-west corner of the site was classified as riparian vegetation. The riparian area split before the site (Figure 9; Photograph 4). The main river flowed on the boundary of the site and contained some water, while the split from the main channel was dry at the time of this assessment. However, the vegetation in both channels were similar.



Photograph 4: Riparian areas on the site

The vegetation was dominated by the tall growing trees *Celtis africana* (white stinkwood) and *Combretum erythrophyllum* (Table 1). Less dominant species included *Gymnosporia buxifolia*, *Salix mucronata* (wild willow), *Searsia pyroides* (common wild current) and *Diospyros lycioides* (blue bush). The sedge *Cyperus sexangularis* were recorded along the riparian edge. Grasses included *Paspalum* species, *Hyperthelia tamba*, *Phragmites australis* and *Setaria megaphylla*. Limited invasive species were recorded (e.g. *Melia azedarach*, *Solanum mauritianum* and *Sesbania punicea*).

The vegetation is in a natural state with potential to support species of conservation concern. No protected or threatened plant species were recorded at the time of the site visit. The Gauteng Declining tree, *Ilex mites*, likely grows along the Magalies River, but was not recorded along the site boundary.

4.2.2 Secondary grassland and pasture (modified vegetation)

Secondary grassland comprises grasslands that have undergone extensive modification and a fundamental shift from their original state (e.g. bushveld to cultivated areas), but have then been allowed to return to a 'grassland' state (e.g. when old cultivated lands are re-colonised by a few grass species). Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver. In addition, the site falls in bushveld and the grassland stage is transitional to attaining bushveld vegetation. The pioneer tree *Vachellia karroo* was colonising the secondary grassland on the site, which could result in secondary bushveld over time.

Cultivation took place on much of the site. It is assumed that the centre pivot area south of the R560, as well as parcels north of the R560 were cultivated and/ or planted with pasture. These past activities resulted in patches of grassland dominated by different grass species which are palatable and was subsequently used for pasture. The most dominant grasses were *Eragrostis curvula* (weeping love grass), *Digitaria eriantha* (Smutsvinger grass), *Cynodon dactylon* (couch grass) and *Urochloa panicoides* (garden Urochloa). Based on the dominance of these species, the secondary grassland and pasture was subdivided into four subgroups. These groups shared similar species and were characterised by a low forb diversity.

The four groups are as follows and shortly described below:

1. *Eragrostis curvula* grassland
2. *E curvula* – *Gomphocarpus fruticosus* grassland
3. *Digitaria eriantha* grassland
4. *Cynodon dactylon*-*Urochloa panicoides* grassland

Eragrostis curvula grassland

The historic centre pivot area south of the R560 was dominated by the grass *Eragrostis curvula* which colonises disturbed areas or fallow land. It is also a good grazing grass and also sowed as pasture (Figure

9; Photograph 5). Other grass species included *Melinis repens* (Natal Red Top), *Themeda triandra* (red grass), *Heteropogon contortus* (spear grass) and *Aristida congesta* (three-awn) (Appendix B).

The forb diversity was low including species such as *Hermannia depressa*, *Indigofera cryptantha*, *Scabiosa columbaria* and *Pollichia campestris*. The small sedge, *Cyperus rotundus* occurred sporadically. Bushveld trees, notably the pioneer *Vachellia karroo* (sweet thorn), were recolonising the grassland. The tree layer was the highest along the south-eastern boundary where trees such as *Searsia lancea*, *Gymnosporia buxifolia* and the shrub *Grewia flava* were colonising the secondary grassland.

No plant species of conservation concern were recorded in walked transects and sampled areas at the time of the site visit.



Photograph 5: *Eragrostis curvula* grassland south of the R560 road

E. curvula – *Gomphocarpus fruticosus* grassland

The land closest to the riparian areas were dominated by the grass *Eragrostis curvula*. The weedy shrub *Gomphocarpus fruticosus* (milkweed) dominated large parts of this grassland (Photograph 6). This

grassland is being cleared from this troublesome weed, although it is still dominant in proximity to the river.

Other grass species recorded here include *Themeda triandra*, *Aristida congesta*, *Cynodon dactylon* and *Bothriochloa inculpta* (pinhole grass). Forbs recorded were limited and included *Rhynchosia caribea*, *Vigna vexillata*, *Albucca virens* subsp *virens* (bosui) and *Hilliardiella oligocephala* (bitterbossie). No plant species of conservation concern were recorded in sampled areas and none are expected to occur.



Photograph 6: *E curvula* – *G fruticosus* grassland

Digitaria eriantha grassland

Digitaria eriantha (Smutsvinger grass), a good grazing grass, was dominant around the historic centre pivot area, south of the R560 (Photograph 6). It was likely planted as pasture (Photograph 7). Other grasses recorded here included patches of *Themeda triandra* and *Cynodon dactylon*, *Aristida congesta* and *Urochloa masombicensis*. The forb diversity was low, however, the following were recorded: *Polygala hottentota*, *Nidorella anomala*, *Hermannia depressa* and *Felicia muricata*. *Vahellia karroo* (sweet thorn) was colonising the grassland, particularly along the R560 road.

No plant species of conservation concern were recorded in sampled areas and none are expected to occur.



Photograph 7: *Digitaria eriantha* grassland south of the R560 road

Cynodon dactylon- *Urochloa panicoides* grassland

The land currently used for grazing by cattle and sheep grazing, north of the R560, was dominated by the two grasses *Cynodon dactylon* (couch grass) and *Urochloa panicoides* (garden Urochloa) (Photograph 8).



Photograph 8: Grazed *C dactylon* -*U panicoides* grassland

This grassland supported limited forbs of which most were pioneer and weedy species such as *Amaranthus hybridus*, *Gomphrena celosiodes*, *Argemone ochroleuca*, *Tribulus terrestris* (common devil's thorn), *Helichrysum rugulosum* and *Verbena officinalis*. *V. karroo* encroaches into the grassland.

4.2.3 Severely modified and degraded vegetation

Modified landscapes are regarded as areas where the vegetation structure and composition have been compromised and are not representative of the reference state, in this case, Moot Plain bushveld (SANBI, 2016). Modified land can range from moderately modified to severely or irreversibly modified. Subsequently, these areas are usually of a poor to fair ecological condition.

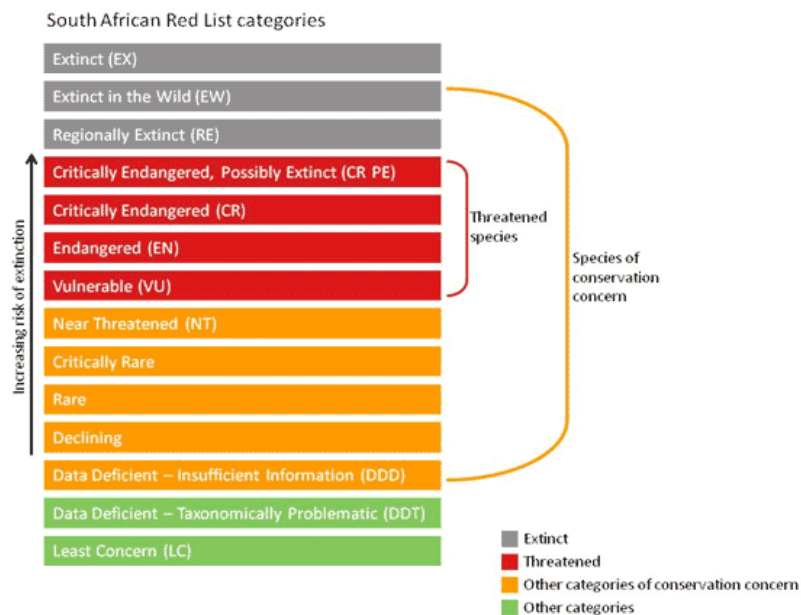
The vegetation surrounding the farm infrastructure and residential areas were degraded and modified from the reference state of Moot Plain Bushveld and in a poor ecological condition. Indigenous trees were noted e.g. *Vachellia karroo*, *Combretum erythrophyllum* and *Searsia lancea*, however, the grass and forb layer were degraded. North of the R560, the vegetation was dominated by the invasive *Pennisetum clandestinum* (kikuyu) (Photograph 9). Ornamental plants and invasive species such as *Mirabilis jalapa*, *Amaranthus hybridus* and *Ligustrum* species were common. No plant species of conservation concern were recorded in sampled areas and none are expected to occur.



Photograph 9: Severely modified and degraded vegetation

4.3 Plant Species 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 10). 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 10: Threatened species and species of conservation concern (Gauteng)

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) and information received from the Gauteng Department of Agriculture and Rural Development (GDARD) for the quarter degree square (qds) 2527DC. A list of nine (9) plants of conservation concern that were previously recorded in the quarter degree square (qds) that the project area is situated in and for which suitable habitat is present within or close to the project area, is given in Appendix C.

Most of these species are associated with the south-facing, quartzitic slopes of the Magaliesberg, situated about 7km north of the site, or with riparian habitats. None of these species were recorded. Only the riparian vegetation could be suitable habitat for *Boweia volubilis* and *Ilex mites*.

4.4 Protected plants

4.4.1 NEMBA Threatened or Protected Plant Species (TOPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild soon, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as 'Restricted Activities', are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species.

At the time of this assessment, no TOPS listed species were recorded within the proposed development footprint or are expected to occur.

4.4.2 Provincially Protected Plants

Several provincially protected plants are listed in the Transvaal Nature Conservation Ordinance Act No. 12 of 1983. These plants are not to be removed, damaged, or destroyed without permit authorisation from Gauteng Department of Agriculture and Rural Development (GDARD). No protected plant species were recorded on the site.

4.5 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).

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. On 29 July 2016 the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 864 of 2016). The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, 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 proximity to a watercourse. Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

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.

The alien plant species identified on the study site are listed in Appendix B. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- (a) notify the competent authority in writing
- (b) take steps to manage the listed invasive species in compliance with
 - (i) section 75 of the Act;
 - (ii) the relevant invasive species management programme developed in terms of regulation 4; and
 - (iii) any directive issued in terms of section 73(3) of the Act.

The table below lists the category 1 invasive species on the site and the main area of occurrence.

Table 2: Category 1b alien invasive species recorded on the site

Species	Common name	Area of occurrence
<i>Argemone ochroleuca</i>	Mexican Poppy (White)	Secondary grassland (<i>C dactylon-U panicoides</i> grassland)
<i>Arundo donax</i>	Giant Reed	Riparian area and Secondary grassland (<i>Digitaria eriantha</i> grassland)
<i>Campuloclinium macrocephalum</i>	Pom-Pom Weed	Secondary grassland (all)
<i>Cestrum laevigatum</i>	Inkberry	Secondary grassland, riparian area and severely modified and degraded vegetation
<i>Ipomoea purpurea</i>	Morning Glory	Riparian vegetation
<i>Melia azedarach</i>	Syringa	Riparian vegetation
<i>Mirabilis jalapa</i>	Four-o'clocks	Riparian vegetation and severely modified and degraded vegetation
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Adjacent to the riparian area, one large individual
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Severely modified and degraded vegetation
<i>Sesbania punica</i>	Red Sesbania	Riparian vegetation
<i>Solanum mauritianum</i>	Bugweed	Riparian vegetation
<i>Verbena officinalis</i>	Verbain	Secondary grassland: <i>E curvula -G fructicosa</i> grassland and <i>C dactylon-U panicoides</i> grassland)

5. VEGETATION VULNERABILITY AND IMPORTANCE

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.

5.1 Rating and Analysis of Vegetation Importance

In order to determine the vegetation condition and importance on the site, weighting scores as listed below (Table 3) were applied. Vegetation of conservation importance were classified based on the findings of the study and the criteria as listed in Appendix A. The sensitivity analysis results were classified as per Table 4, geographically represented in Figure 11 and discussed below.

Table 3: Weighting scores

Scoring	Sensitivity	Explanation
13-18	High	<ul style="list-style-type: none"> • Development within these areas is not supported. • Impacts are difficult to mitigate, if at all • Such features usually protected by legislation or guiding policies.
12	Medium-high	<ul style="list-style-type: none"> • Development within these areas is undesirable and impacts are difficult to mitigate, if at all. • Impacts must be avoided or managed by an ecological management plan
7-11	Medium	<ul style="list-style-type: none"> • Development within these areas could proceed with limited impact to sensitive vegetation, provided that appropriate mitigation measures are taken. • High impact developments should be considered with caution, if at all. Development must be restricted in footprint and impacts managed and mitigated by an approved management plan. Edge effects to higher sensitivity classes in its proximity must be mitigated / prevented.
6	Low-medium	<ul style="list-style-type: none"> • Developable areas that are connected to sensitive features. • Edge effects must be presented.
0-5	Low	<ul style="list-style-type: none"> • Most types of development can proceed within these areas with little to no impact on conservation worthy vegetation. Edge effects to other proximate sensitivity classes must be mitigated / prevented.

Table 4: Scoring of vegetation delineated within the site

Broad vegetation community	Conservation Status of regional Vegetation* unit	Predominant state	Protection by legislation/ legislation/ policies	Plants of conservation concern	Ecological Function	Conservation Importance / unique habitat	Total Score out of max of 18	Importance and vulnerability
Riparian vegetation	2	2	3 ESA, CBA and river	2	3	3	15	High
Secondary grassland	1	1	1 or 2 where in an ESA	1	1	1	6 / 7	Low- medium to Medium
Severely modified and degraded	0	0	2 ESA	0	0	0	2	Low

*not applicable to areas devoid of natural vegetation

5.2 Discussion

5.2.1 High sensitivity

The riparian vegetation was classified as being of high ecological importance. Riparian areas are protected ecosystems provided for in the National Water Act (Act no 36 of 1998). The riparian vegetation is considered important for the maintenance of ecosystem integrity and prevent flooding. Activities within and in proximity to watercourses (Regulation 1199 of the National Water Act, 1998 (Act 36 of 1998)) are subjected to strict mitigation measures and authorisation from the competent authority in order to protect and sustainably utilise South Africa's water resources. The riparian vegetation forms part of a CBA: irreplaceable and is the only vegetation on the site that is likely to support plant species of conservation concern.

5.2.2 Medium to low-medium sensitivity

The secondary grassland is modified from the reference state of Moot Plains Bushveld. The species diversity within these grasslands were low and no plant species of conservation concern were recorded or are expected to occur. However, the vegetation contributes to open space, ground water recharge and soil protection. In the absence of further disturbances, the secondary grasslands could become bushveld over time. Despite this, the secondary grassland was not considered vulnerable or sensitive to the proposed development and it scored a low-medium sensitivity. Parts of the secondary grassland falls within an ESA which increases these areas to medium sensitivity (Figure 6; Table 4). The functionality of

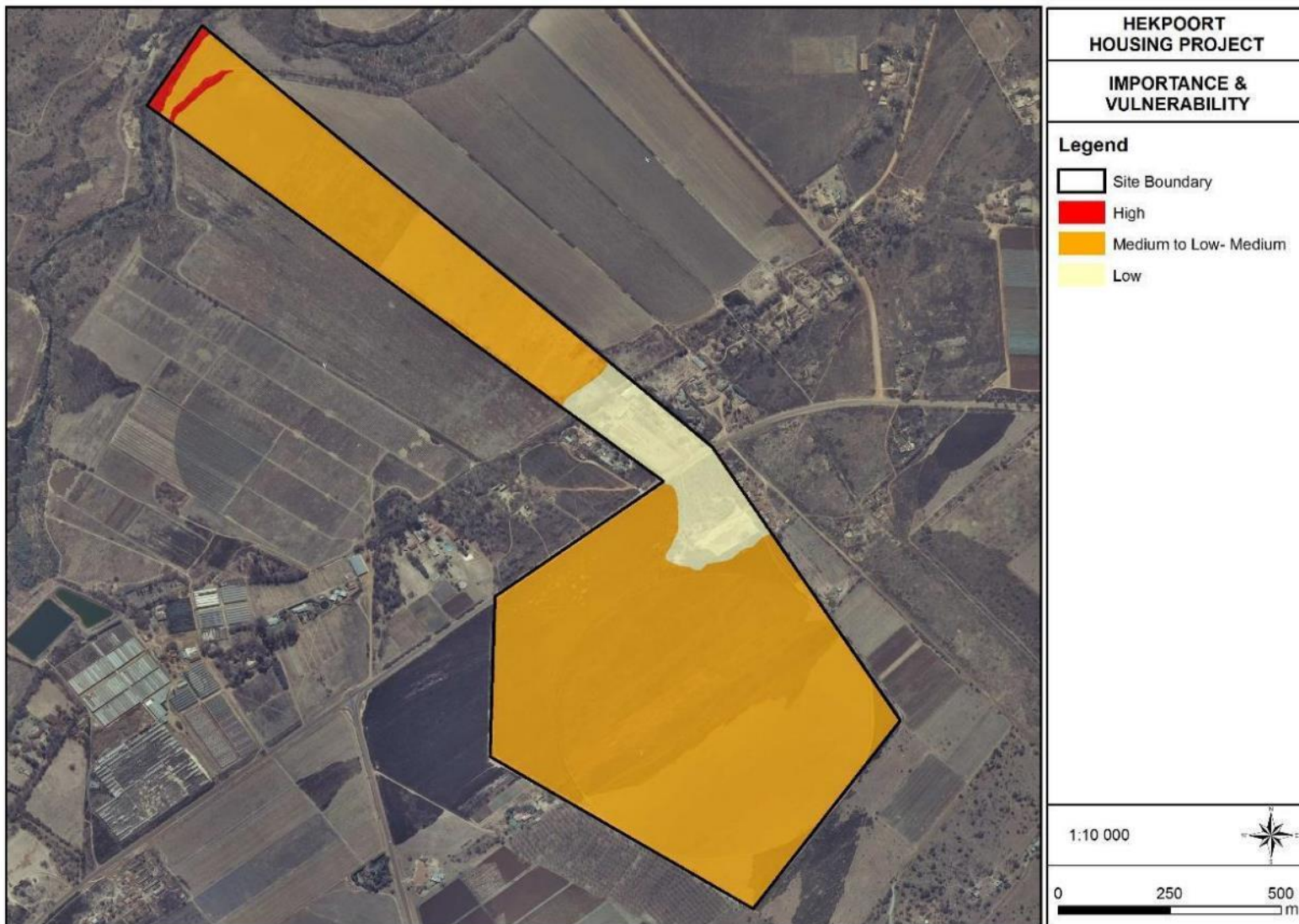


Figure 11: Sensitivity Map.

the ESA can be protected by creating open spaces within or along the proposed development, while maintaining the farming open space along the riparian area in its current state.

5.2.3 Low sensitivity

The vegetation around housing and farming infrastructure was considered irreversibly modified from the reference state and not sensitive to development. It must be noted that these areas fall within an ESA and that if they are developed, the continued functionality of the ESA must be maintained by providing open spaces within the development.

6. IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for many 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 needs 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.

6.1 Assessment Criteria

The possible impacts, as described in the next section, were assessed based on the Significance Rating. The Significance of the impact is calculated as follows and rating significance is explained below:

$$\text{Significance} = \text{Consequence (Extent + Duration+ Magnitude)} \times \text{Probability}$$

- I. The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- II. The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- III. The **duration**, wherein it will be indicated whether
 - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - medium-term (5–15 years) – assigned a score of 3;
 - long term (> 15 years) - assigned a score of 4; or
 - permanent - assigned a score of 5;
- IV. The **consequences (magnitude)**, quantified on a scale from 0-10, where

- 0 is small and will have no effect on the environment,
 - 2 is minor and will not result in an impact on processes,
 - 4 is low and will cause a slight impact on processes,
 - 6 is moderate and will result in processes continuing but in a modified way,
 - 8 is high (processes are altered to the extent that they temporarily cease), and
 - 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- V. The **probability** of occurrence, which shall describe the likelihood of the impact occurring. Probability will be estimated on a scale of 1–5, where
- 1 is very improbable (probably will not happen),
 - 2 is improbable (some possibility, but low likelihood),
 - 3 is probable (distinct possibility),
 - 4 is highly probable (most likely) and
 - 5 is definite (impact will occur regardless of any prevention measures).
- VI. The **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- VII. The **status**, which will be described as either positive, negative or neutral.
- VIII. The degree to which the impact can be reversed.
- IX. The degree to which the impact may cause irreplaceable loss of resources.
- X. The degree to which the impact can be mitigated.

The **significance** weightings for each potential impact are as follows:

- **< 30 points: Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **30-60 points: Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **60 points: High** (i.e. where the impact must have an influence on the decision process to develop in the area).

6.2 Impact Assessments

The tables below list the activities that could impact on the vegetation because of the proposed development, as well as impacts that may be associated with the operation thereof. The tables also list recommended mitigation measures to limit the impacts.

No decommissioning phase is envisaged and therefore not discussed. Mitigation measures should be incorporated into the Environmental Management Programme. *Note that no layout plan was available at the time of this assessment.*

6.2.1 Destruction of secondary grassland and fragmentation

<p>Nature: Vegetation on the study site will need to be removed for the construction of the proposed development and its associated infrastructure. The removal of vegetation from the site could also lead to a loss in the current ecological function as an ESA and a general loss of species and genetic diversity, increasing fragmentation and leading to smaller patches of vegetation prone to edge effects. Areas that will not be developed, but that may be impacted on by construction related activities (e.g. where building materials are stored) must also be considered. In addition, the illegal disposal of construction material such as oil, cement etc. or vehicle access could destroy vegetation and compact soil.</p>		
<p>Direct Impacts:</p> <ul style="list-style-type: none"> • Destruction of semi-indigenous vegetation • Potential increase in runoff and erosion • Potential spread of alien invasive vegetation • Potential contamination of soils with hydrocarbons and/or other pollutants <p>Indirect Impacts:</p> <ul style="list-style-type: none"> • Increase of fragmentation and edge effects into surrounding vegetation • Change in surface and groundwater flow • Fragmentation 		
CONSTRUCTION PHASE	Without mitigation	With mitigation
Probability	Definite (5)	Probable (3)
Duration	Permanent (5)	Medium term (3)
Extent	Site (2)	Site, excluding open spaces incorporated into layout (1)
Magnitude	High (8)	Low (4)
Significance	75 (High)	24 (Low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE (assuming construction mitigation was implemented)		
Probability	Probable (3)	Probable (3)
Duration	Permanent (5)	Medium term (3)
Extent	Site and surrounds (3)	Limited to Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	42 (Medium)	24 (Low)
Status (positive or negative)	Negative	Negative

Reversibility	Moderate	Moderate to high
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, open space must be incorporated into the development to maintain a functional ecological corridor towards the Magalies River	
<p>Mitigation:</p> <p>Planning phase</p> <ul style="list-style-type: none"> Plan the layout in such a way as to maintain an open space corridor through the site towards the Magalies River, thereby maintaining the function of an ESA. Open space within the development can also contribute as steppingstones through the developed areas, provided that it is maintained in a natural to semi-natural state e.g. parks. Development within the secondary grassland must not impact on buffer areas to the Magalies River and associated riparian vegetation of high sensitivity. Ideally the land north of the R560 should be maintained in its current agricultural state to ensure a buffer and corridor towards the Magalies River, while development south of the R560 should include open space. Development must be concentrated to reduce fragmentation and ensuring the functionality of ESAs and CBAs No areas of high sensitivity should be fragmented and low impact development in such areas must be manageable e.g. hiking trails, bird hides. Planned fencing / boundary walls of the site should take cognisance of ecological processes and allow for the movement of insects and smaller fauna that are imperative for pollution and seed distribution. <p>Construction:</p> <ul style="list-style-type: none"> An independent Ecological Control Officer (ECO) should be appointed to oversee construction. Planning of the construction site must incorporate eventual rehabilitation of areas destroyed by construction and that does not contain infrastructure. A perimeter fence must be erected around the works area to prevent access to sensitive environs such as the riparian vegetation. Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. Ideally, the construction areas should be fenced off. Maintain site demarcations in position until the cessation of construction work. Only remove vegetation where necessary and retain vegetation in place for as long as possible prior to removal. A vegetation rehabilitation plan should already be implemented during construction to rehabilitate areas of grassland that will be affected by edge effects. Such a plan should use indigenous species from the study area and must restore disturbed areas beyond the footprint of the infrastructure to what it was prior to construction, thereby making the impact on the remainder of the site negligible in the long term. Due to the dry climate, natural colonisation could take a long time, in which vegetation may degrade further or become dominated by encroacher or invasive plant species. Therefore, timeous rehabilitation is imperative. Even in the event of good rains, annual pioneer plants are short-lived and therefore an 		

effort must be made to keep as many shrubs in place as possible or to replace these as part of rehabilitation.

- The grassland can be removed as sods and stored within transformed vegetation or other disturbed areas. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
 - Grasses that naturally occur in the area should be sown / hydroseeded in the disturbed footprint.
- Where topsoil needs to be removed, store such in a separate area where such soils can be protected until they can be re-used for post-construction rehabilitation where applicable. Never mix topsoil with subsoils or other spoil materials.
 - Maintain site demarcations in position until the cessation of construction work.
 - After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction.
 - Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
 - Ensure there is a method statement in place to remedy any accidental spillages immediately

Operational:

- Rehabilitate construction camps and any other grassland vegetation that was impacted on by the construction. Use grass sods that were removed prior to construction to rehabilitate the construction footprints. Sods must not be stored for lengthy periods and should not be stacked on top of each other or on top of grazed and moist grasslands. The sods should preferably be removed during the winter months and replanted by springtime latest.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, livestock or pedestrian access.
- Ensure that maintenance work to fences does not take place haphazardly, but according to a fixed plan, using formal access roads. Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.
- No activities may impact negatively on the grassland vegetation on or adjacent to the site.

Cumulative impacts: Loss of secondary grassland and open space (ESA) within Gauteng

Residual Risks:

- Fragmentation of natural habitats by fencing and housing.
- Localised alteration of soil surface characteristics and loss of flora.
- The colonisation of the disturbance footprint by alien invasive plant species.

6.2.2 Destruction or degradation of riparian vegetation

Nature: The construction will likely require the removal or of vegetation in proximity to the watercourse, and depending on the layout, removal of vegetation within the watercourse. This will impact on the health and functioning of the vegetation within the watercourse. Construction could also result in pollution of the watercourse or destruction of the only suitable habitat for plant species of conservation concern.

	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Long-term (4)	Short-term (2)
Extent	Site and downstream (3)	Site (2)
Magnitude	High (8)	Low (4)
Significance	45 (medium)	16 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Probable (3)
Duration	Medium term (3)	Short term (2)
Extent	Site and downstream (3)	Site (2)
Magnitude	Moderate (6)	Low (4)
Significance	36 (medium)	24 (low)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	High	Moderate
Can impacts be mitigated?	Yes. Avoidance of direct impacts to the riparian vegetation and a buffer area as delineated by a wetland specialist. Prevent indirect impacts by excluding the riparian area from the development and construction planning	
<p><i>Planning Phase:</i></p> <ul style="list-style-type: none"> No activities may proceed within or in proximity to the river without a Water Use Authorization permitting the activity. The layout of the proposed development should avoid the river. The riparian vegetation should be conserved as recreational open space and be fenced in an ecologically friendly manner to allow for the movement of species and managed. <p><i>Construction Phase:</i></p> <ul style="list-style-type: none"> The river and associated buffer zones should be fenced during the construction phase to prevent any human activity from encroaching into these areas. Monitoring of the fences is important to ensure no infringement of the fences occurs. Input of sediment during construction activities should be prevented at all cost. Mitigation for this potential impact includes total avoidance of the riparian areas and the establishment of vegetation as soon as possible after construction. Pollution of the surface and groundwater. Mitigation for this potential impact includes: <ul style="list-style-type: none"> In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately; 		

- Store all litter carefully so it cannot be washed or blown into the water course;
- Construction vehicles are to be maintained in good working order to reduce the probability of leakage of fuels and lubricants;
- A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas;
- Storage of potentially hazardous materials should be above any 100-year flood line or the functional wetland boundary (and its associated buffer zone). These materials include fuel, oil, cement, bitumen etc.;
- Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils;
- Concrete is to be mixed on mixing trays only, not on exposed soil;
- Concrete and tar shall be mixed only in areas which have been specially demarcated for this purpose;
- After all the concrete / tar mixing is complete all waste concrete / tar shall be removed from the batching area and disposed of at an approved dumpsite;
- All construction materials liable to spillage are to be stored in appropriate structures with impermeable flooring; Portable septic toilets are to be provided and maintained for construction crews. Maintenance must include their removal without sewage spillage;
- Under no circumstances may ablutions occur outside of the provided facilities; and
- No uncontrolled discharges from the construction crew camps to any surface water resources shall be permitted. Any discharge points need to be approved by the relevant authority.

Operational:

- After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction.
- Ensure that the vegetation disturbed during construction is rehabilitated and prevent the colonisation of the disturbed area by invasive alien plant species.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular and pedestrian access until such time that rehabilitation was successful.
- If the riparian area is incorporated not the development, it must be properly fenced as open space for residents and incorporated in the open space planning of the development. This area must be managed for conservation and no commercial activities may impede on these areas. A management plan for the area should be implemented including monitoring and rehabilitation of pollution, erosion and degradation.

Cumulative impacts:

- Loss of functionality of the vegetation within the watercourse, as well as erosion due to edge effects.

Residual Risks:

- Erosion, pollution of the watercourse and invasion by alien invasive plant species.

6.2.3 Potential increase in invasive vegetation

Nature: The seed of alien invasive plant species that occur on and in the vicinity of the construction areas could spread into the disturbed and stockpiled soil. Also, the construction 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		
	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long-term (4)	Short-term (2)
Extent	Local Area (2)	Site bound (1)
Magnitude	High (8)	Low (4)
Significance	56 (medium)	21 (low)
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Highly probable (4)	Improbable (2)
Duration	Long term (4)	Short term (2)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	High (8)	Low (4)
Significance	56 (medium)	14 (low)
Status (positive or negative)	Negative	Positive –removal of such species
Reversibility	Moderate	High
Irreplaceable loss of resources?	High	Moderate
Can impacts be mitigated?	Yes	
Mitigation:		
<i>Construction:</i>		
<ul style="list-style-type: none"> • Alien invasive species, in particular category 1b species that were identified on site must be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. • All alien seedlings and saplings must be removed as they become evident for the duration of construction. • All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO. • If filling material is to be used, this should be sourced from areas free of invasive species. 		
<i>Operational:</i>		
<ul style="list-style-type: none"> • Only use indigenous species for rehabilitation and garden or open space layouts. • Rehabilitation within the grassland should include a suitable, indigenous seed mix. The area should be monitored to ensure that indigenous species colonise the disturbance footprint and that infestation by alien and invasive species are prevented. • Remove alien invasive species from the disturbance footprint as soon as they become apparent. 		

Cumulative impacts: Several invasive species are present within the area that the proposed development is situated in. Therefore, if mitigation measures to limit and prevent the spread of alien species are not implemented, the cumulative impact could lead to remaining natural vegetation transformed by alien plant species.

Residual Risks: Re-infestation in areas initially cleared.

7. CONCLUSION

Most of the study site comprised secondary grassland that was historically cultivated and used for grazing. The secondary grassland is modified from the reference state of Moot Plains Bushveld and the species diversity within these grasslands were low. Although no plant species of conservation concern were recorded or are expected to occur, the vegetation contributes to open space, ground water recharge and soil protection. Despite this, the secondary grassland was not considered vulnerable or sensitive to the proposed development and it scored a low-medium sensitivity. Parts of the secondary grassland falls within an ESA which increases these areas to medium sensitivity. The functionality of the ESA can be protected by creating open spaces within or along the proposed development, while maintaining the farming open space along the riparian area in its current state.

The vegetation around housing and farming infrastructure was considered irreversibly modified from the reference state and not sensitive to development. It must be noted that these areas fall within an ESA and that if they are developed, the continued functionality of the ESA must be maintained by providing open spaces within the development.

The riparian area may not be developed and must be protected from edge effects during construction and operation. It is advisable to set the development as far back from the riparian area as possible.

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9. GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Conservation concern (Plants of..)	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see Threatened), Extinct in the wild, Data deficient, Near threatened , Critically rare, Rare and Declining . These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining <u>extant</u> 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.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
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 <i>et al</i> , 2009).
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
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.
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Irreversibly modified	An ecological condition class in which the ecosystem has been modified completely, with an almost complete loss of composition and structure. All or most ecosystem function has been destroyed and the changes are irreversible. Can apply to a site or an ecosystem.
Mitigation	The implementation of practical measures to reduce adverse impacts
Moderately modified	An ecological condition class in which ecological function is predominantly unchanged even though composition and structure have been compromised. Equates to a fair ecological condition or semi-natural
Natural	Unmodified. No significant changes in composition, structure or function have taken place. Good ecological condition.
Near Natural	Small changes in composition and structure may have taken place, but ecosystem functions are essentially unchanged. Good ecological condition
Near Threatened	A Taxon is Near Threatened when available evidence indicates that 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 <i>et al</i> , 2009).
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.
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. <i>Now termed Plants of Conservation Concern</i>
Semi-natural	Ecological function is predominantly unchanged even though composition and structure have been compromised. Fair ecological condition
Severely modified	An ecological condition class in which loss of composition, structure and ecological function is extensive. The land is in a poor ecological condition.
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 <i>et al</i> , 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 <i>et al</i> , 2009)

APPENDIX A: METHODOLOGY

A1 Sample point map



Figure 12: Sample point map

A2 Vegetation Sensitivity Evaluation

The following criteria and weighting were 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 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. Predominant state or condition of the vegetation

Vegetation condition	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:

Legislation	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 of red listed species (Threatened)	3
Confirmed presence of Orange listed (Near threatened, Declining), and Suitable habitat and some likelihood of occurrence of Threatened species	2
Suitable habitat but unlikely to occur	1
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

Weighting scores

Scoring	13-18	12	7-11	6	0-5
Sensitivity	High	Medium-high	Medium	Low-medium	Low

APPENDIX B: PLANTS SPECIES RECORDED

- 1= species recorded
- M= medicinal properties
- P= provincially protected
- D= declining
- NT=near-threatened

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
Trees					
<i>Acacia (Vachellia) karroo (M)</i>	Sweet Thorn	Widespread, often proliferate in overgrazed areas	1	1	1
<i>Celtis africana</i>	Stinkwood	Wooded areas or bush clumps, usually on dolomite	1		
<i>Combretum erythrohyllum</i>	River Bushwillow	Grassland and bushveld, usually along rivers or streams	1		1
<i>Diospyros lyciodes subsp lycoides</i>		Grassland, bushveld and rocky areas	1		
<i>Euclea crispa subsp crispa</i>	Blue Guarri	Rocky slopes, kloofs, along rivers and forest margins		1	
<i>Gymnosporia buxifolia</i>	Common Spike Thorn	Widespread, often as pioneer in disturbed places	1	1	1
<i>Salix mucronata (M)</i>	Wild willow	Along streams, widespread	1		
<i>Searsia lancea</i>	Sour Karee	Grassland and bushveld	1		1
<i>Searsia pyroides</i>	Common Wild Currant	Mountain grassland, bushveld, grassland - wide range of habitats	1	1	
<i>Ziziphus mucronata</i>	Buffalo-thorn	Widespread, in various habitats		1	
Total number of tree species = 10			8	5	4
Grasses					
<i>Aristida congesta</i>	Tassel Three-awn	Disturbed, overgrazed or farmed land. Increaser II grass		1	1
<i>Bothriochloa insculpta</i>	Pinhole Grass	Grows mostly in disturbed areas, also where water accumulates. Increaser II		1	

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Cynodon dactylon</i>	Couch grass	Most soils, usually in disturbed areas. Increaser II grass, palatable		1	1
<i>Digitaria eriantha</i>	Finger Grass	Sandy, rocky soil in arid areas or next to rivers/vlei's in areas with higher rainfall. Planted for pasture		1	
<i>Diheteropogon amplexus</i>	Broad-leaved Bluestem	Open grassland as well as open areas within bushveld. Mostly in poor rocky slopes. Decreaser		1	
<i>Eragrostis curvula</i>	Weeping Love Grass	Mostly occurs in disturbed areas / sown as pasture. Increaser II grass		1	1
<i>Eragrostis plana</i>	Tough Love Grass	Disturbed areas, mostly in moist patches. Increaser II grass		1	
<i>Eragrostis superba</i>	Saw-tooth love grass	Disturbed areas next to roads. Increaser II, palatable grass			1
<i>Eragrostis trichophora</i>	Hairy Love Grass	Disturbed areas, mostly in shallow and rocky soil, but also where rainwater accumulates		1	
<i>Heteropogon contortus</i>	Spear Grass	Rocky, sloped land and common on disturbed road reserves. Increaser II grass. Palatable in early summer		1	
<i>Hyparrhenia hirta</i>	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass			1
<i>Hyperrhenia tamba</i>	Blue Thatching Grass	Road reserves and where water accumulates, also next to rivers or outer edge of wetlands		1	
<i>Melinis repens</i>	Natal Red Top	Disturbed grassland. Increaser II grass.		1	1
<i>Panicum schinzii</i>	Sweet Grass	Near water such as vlei's or rivers (becomes a weed in cultivated land where rainwater accumulates)	1		
<i>Paspalum dilatatum</i>	Dallis Grass	Introduced grass, moist areas in vlei's and close to rivers. Sometimes planted for pasture	1		
<i>Phragmites australis</i>	Common Reed	Grows close to water sources such as rivers and wetlands.	1		
<i>Setaria megaphylla</i>	Broad-leaved bristle grass	Along rivers in low-lying areas or forests and in dense bushveld where there is plenty of moisture	1		

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Setaria pallida-fusca</i>	Garden Bristle Grass	Disturbed areas e.g. next to roads and where rainwater collect		1	
<i>Setaria verticillata</i>	Burr Bristle Grass	Grows in disturbed /overgrazed moist areas	1		
<i>Themeda triandra</i>	red grass	Undisturbed or disturbed open grassland. Decreaser Grass	1	1	
<i>Tragus berteronianus</i>	Carrot-seed grass	Pioneer, indicator of disturbance. Increaser II, annual grass		1	1
<i>Trichoneura grandiglumis</i>	Small Rolling Grass	Open grassland and bushveld, rocky slopes, flood plains or as a sub-climax grass in disturbed areas. Increaser II grass		1	
<i>Urochloa mosambicensis</i>	Bushveld Signal Grass	Disturbed areas such as farmland, also in compacted soils. Good grazing grass. Increaser II		1	
<i>Urochloa panicoides</i>	Garden Urochloa	Disturbed areas, farmed land and moist areas.		1	
Total number of grass species = 24			6	17	7
Climbers					
<i>Clematis brahiata</i>	Traveller's Joy	Bushy hillsides, particularly rocky places		1	
<i>Coccinia adoensis</i>		Bushveld, wooded areas in grassland. Climbing into shrubs and trees	1		
<i>Macrotyloma axillare</i>		Sandy soils in grassland and open woodland, sometimes in disturbed and cultivated places.		1	
<i>Pentarrhinum insipidum</i>	Donkieperske	Grassland and clumps of bush, often twining in fences. It is an aggressive grower and in slightly disturbed areas exhibits invasive tendencies.	1	1	
Total number of climbers = 4			2	3	0
Shrubs / Forbs					
<i>Albuca virens subsp virens (Ornithogalum tenuifolium)</i>	Bosui	Grassland		1	
<i>Aloe greatheadii var. davyana</i>	Spotted aloe; Highveld grass aloe	Grassland and bushveld. Often forming dense stands in overgrazed areas.		1	
<i>Asparagus sauveolens</i>	Bushveld Asparagus	Bushveld and thicket, rocky grassland	1		

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Asparagus suaveolens</i>		Shady places in between trees.	1		
<i>Buddleja salvifolia</i>	Sagewood	Along streams	1		
<i>Chamaecrista mimosoides (M)</i>	Fishbone Cassia	Grassland/bushveld		1	
<i>Commelina africana</i>		Widespread	1	1	
<i>Gomphocarpus fruticosus</i>	milkweed	Grassland, often along roadsides and abandoned cultivated fields, disturbed areas.		1	1
<i>Grewia flava</i>	Velvet Raisin	Bushveld and wooded grassland, often in drier areas and on Kalahari sand		1	
<i>Helichrysum rugulosum (M)</i>		Grassland, often in vlei's or patches in disturbed areas		1	
<i>Hermannia depressa</i>	Rooi-opslag / Creeping Hermannia	Grassland, also in trampled and overgrazed areas		1	
<i>Hilliardiella oligocephala (M)</i>	Bitterbossie	Grassland		1	
<i>Indigofera cryptantha</i>		Grassland and bushveld		1	
<i>Laggera decurrens (M)</i>	Silky Sage	Aromatic herb found along roadsides and disturbed areas		1	
<i>Nidorella hottentottica</i>		Grassland, often along roadsides. Sometimes in moist areas		1	
<i>Polygala hottentotta</i>	Small Purple Broom	Common in grassland, often in damp places		1	
<i>Rhynchosia caribaea (M)</i>		Grassland and bushveld. Mainly Pretoria/Magaliesberg area		1	
<i>Salvia runcinata</i>	Wildesalie	Grassland, under trees, often in disturbed areas or even vlei's		1	1
<i>Scabiosa columbaria</i>	Wild Scabiosa	Grassland, mainly in rocky areas		1	
<i>Senecio gregatus</i>		Grassland, often in moist places		1	
<i>Sida alba</i>	Flannel Weed	Disturbed places, often under trees (probably an indigenous specie)		1	1
<i>Solanum panduriforme</i>	Poison Apple	Disturbed places, often under trees (probably an indigenous specie)		1	
<i>Striga asiatica</i>	Witchweed	Grassland		1	

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Tolpis capensis</i>		Grassland, often in disturbed places		1	
<i>Tribulus terrestris</i>	Common Devil's Thorn / Dubbeltjie	Spreading weed in disturbed places		1	1
<i>Vigna vexillata</i>		Grassland		1	
<i>Xysmalobium undulatum</i>	Bitterhout	Moist grassland and vlei's		1	
Total number of forb species = 27			4	24	4
Sedges					
<i>Cyperus esculentus</i>		Weedy exotic in marshy or ploughed areas		1	1
<i>Cyperus rotundus</i> subsp <i>rotundus</i>	Purple nut-sedge	Moist areas, weedy in cultivated areas		1	
<i>Cyperus sexangularis</i>	Matjiesgoed	Along the edge of streams, rivers and pans, often in water, occasionally found growing in drier areas.	1		
Total number of sedge species = 3			1	2	1
Alien / Invasive Species					
<i>Amaranthus hybridus</i>	Common Pigweed	Disturbed areas		1	
<i>Argemone ochroleuca</i>	Mexican Poppy (White)	Category 1b		1	
<i>Arundo donax</i>	Giant Reed	Category 1b		1	
<i>Campuloclinium macrocephalum</i>	Pom-Pom Weed	Invasive weed, Category 1b		1	
<i>Cestrum laevigatum</i>	Inkberry	Category 1b			1
<i>Conyza albida</i>	Tall Fleabane	Weed		1	1
<i>Datura innoxia</i>	Thorn-apple	Invasive specie		1	1
<i>Eriobotrya japonica</i>	Loquat	Not Isited in Gauteng, but Cat 1b in Western Cape and forest biome			1
<i>Euphorbia heterophylla</i>	Wild poinsettia	Invasive weed			1
<i>Ficus carica</i>	Common fig				1

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Gomphrena celosoides</i>	Prostrate Globe Amaranth	Cosmopolitan Weed		1	1
<i>Hibiscus trionum</i>	Bladderweed	Invasive weed in disturbed places.		1	
<i>Ipomoea purpurea</i>	Morning Glory	Invader, Category 1b	1		1
<i>Lantana camara</i>	Lantana	Form dense impenetrable thickets, replacing indigenous vegetation. Declared Category 1b invasive (NEMBA)		1	1
<i>Ligustrum species</i>	Privet	Category 3			1
<i>Melia azedarach</i>	Syringa	Category 1b (3 in urban areas)	1		
<i>Mirabilis jalapa</i>	Four-o'clocks	Category 1b invader	1		1
<i>Morus alba</i>	Mulberry	Invader, Category 3	1		
<i>Oenothera rosea</i>	Rose Evening Primrose	Moist, disturbed places, often in shade		1	
<i>Oenothera stricta</i>	Yellow Evening Primrose	Weed along roadsides and disturbed areas		1	
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Category 1b	1		
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Category 1b in wetlands and protected areas			1
<i>Plantago lanceolata</i>	Narrow-leaved Plantain	Introduced weed, usually in disturbed places		1	1
<i>Prunus armeniaca</i>	Apricot				1
<i>Schkuhria pinnata</i>	Dwarf Marigold	Weedy annual herb from S America		1	1
<i>Sesbania punica</i>	Red Sesbania	Category 1b	1		
<i>Sigesbesckia orientalis</i>	St Pauls Wort	Widespread weed in forest margins, waste areas and gardens	1		
<i>Solanum mauritianum</i>	Bugweed	Category 1b	1		
<i>Solanum nigrum</i>	nastergal	Invasive species (category 3, CARA)		1	
<i>Solanum seaforthianum</i>	Potato Creeper	Creeper, invading wooded areas	1		
<i>Sorghum halepense</i>	Johnson Grass	Category 2			1

Species	Common name	Habitat notes	Riparian	Secondary	Degraded
<i>Tagetes minuta</i>	Khaki Weed	Weed in disturbed places. Has become naturalised and due to the vast amount of seed set, difficult to control			1
<i>Verbena officinalis</i>	verbain	Category 1b (NEMBA)		1	
<i>Verbena tenuisecta</i>	Fine-leaved Verbena	Common in disturbed places		1	
<i>Zinnia peruviana</i>	Wildejacobregop	Naturalised Weed		1	1
<i>Yucca gloriosa</i>	Spanish dagger	Planted as ornamental			1
Total number of alien and invasive species = 36			9	17	19

APPENDIX C: PLANTS OF CONSERVATION CONCERN

The species listed below have previously been recorded in the qds and are the most likely to occur on or in proximity to the site. However, most of these species are associated with the south-facing, quartzitic slopes of the Magaliesberg, situated about 7km north of the site, or with riparian habitats. None of these species were recorded. Only the riparian vegetation could be suitable habitat for *Boweia volubilis* and *Ilex mites*.

Species	Conservation Status	Habitat notes and <i>likelihood of occurrence</i>	Flowering period
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	Near threatened	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south. <i>No suitable habitat</i>	Sept-Jan
<i>Aloe peglerae</i>	Endangered	Grassland, in shallow, gravely quartzitic soils on rocky, north-facing slopes or summits of ridges from Magaliesberg to Witwatersberg. <i>No suitable habitat</i>	July-August
<i>Boophone disticha</i>	Declining (reclassified to LC nationally)	Rocky grasslands, but particularly in proximity or on rocky outcrops. <i>It was not recorded on site, although the grassland could support this species. Due to cultivation it is unlikely that this geophyte survived.</i>	Oct-Jan
<i>Boweia volubilis</i> subsp. <i>volubilis</i>	Vulnerable	Climber. Usually occurs along mountain ranges and in thickly vegetated river valleys. Often grows under bush clumps and in boulder screens it is often found in open and or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions. <i>Suitable habitat along the riparian area</i>	Sept-April
<i>Delosperma leendertziae</i>	Near Threatened	Rocky ridges, on rather steep south facing slopes of quartzite in mountain grassveld. <i>No suitable habitat</i>	Oct-April
<i>Drimia altissima</i>	Declining	Hot, dry bushveld and thicket <i>Vegetation on site was modified from the reference state of Moot Plains Bushveld which would have been suitable habitat to this species. If it was historically present, this geophyte would have been ploughed out during cultivation.</i>	Aug-Jan & May

Species	Conservation Status	Habitat notes and <i>likelihood of occurrence</i>	Flowering period
<i>Eucomis autumnalis</i>	Declining	Damp, open grassland and sheltered places between rocks. Up to 2450m. <i>No suitable habitat</i>	Nov-April
<i>Ilex mitis</i> var. <i>mitis</i>	Declining (reclassified to LC nationally)	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes. <i>Suitable habitat is present along the riparian edge, however, this species was not recorded there at the time of the site visit.</i>	Oct-Dec
<i>Prunus africana</i>	Vulnerable	Evergreen forests near the coast, inland mistbelt forests and afro-montane forests up to 2100m. This tree is exploited for the medicinal plant trade <i>No suitable habitat</i>	Dec-June

APPENDIX D: SPECIALIST QUALIFICATIONS

Curriculum Vitae

Antoinette Eyssell-Knox

Personal Information Summary

Name: Antoinette Eyssell-Knox
Highest qualification: MSc Environmental Science (2010), University of Pretoria
Professional membership: SACNASP Pr Sci Nat (400019/11) Ecological Science
Company: Dimela Eco Consulting
Contact details: Antoinette@dimela-eco.co.za
 Tel 083 642 6295

Professional Experience

1. Environmental Management:

I have been working in the field of environmental management as a vegetation specialist since the year 2007 (11 years). I have been self-employed since November 2011.

Nov 2011 – current: Dimela Eco Consulting
 Sep 2007 – Nov 2011: Strategic Environmental Focus (SEF)

Main field of work and experience include:

- Vegetation assessments, overviews or scans;
- Strategic ecological assessments;
- Ecological management, rehabilitation- and biodiversity action plans (including alien vegetation management);
- Specialist input: Gauteng and North-West Outlook Reports, ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data;
- Review of ecological reports; and
- Mentoring.

2. Environmental Education:

2011 – current: Writer of the ecology feature for the bimonthly Supernova Kids Magazine
 Aug 2003 – Sep 2007: Snr Environmental Education Officer, South African National Biodiversity Institute (SANBI), Pretoria National Botanical Garden

3. Horticulture

Jun – Jul 2003: Horticultural Trainer, 7 Shaft Training Centre, Johannesburg
 May 1997 – Mar 2002: Horticulturist, Pretoria National Botanical Garden (then NBI, now SANBI)

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)

Memberships and Affiliations

- SACNASP: Registered as a Professional Natural Scientist in the field of ecology since 2011 (Reg no 400019/11)
- Botsoc: Member of the Botanical Society of Southern Africa since 2013

Course History

- 2018: Asteraceae Identification Course
- 2015: SAGIC Invasive Species Consultant Training
- 2012: Tools for Wetland Assessment (Rhodes University – September 2012)
- 2012: Landscape Functional Assessment, introductory workshop with David Tongway and Prof Klaus Kellner (North West University)
- 2012: Soil Classification and Wetland Delineation (Terra Soil)
- 2007: ISO 14000 Advanced EMS Auditors Course (SGS & University of Pretoria)
- 2007: Introduction into Forestry Stewardship Council (FSC) (University of Pretoria)
- 2006: Permaculture training course (S.E.E.D)
- 2005: Project Management Course (Wildlife and Environment Society of South Africa (WESSA) Umgeni Valley)
- 2004: Grass and plant identification courses

Presentations

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

Selected Project Experience (2011 onwards)

1. Provincial Environmental Outlook Reports

- 2017-2018: Vegetation input: Gauteng Outlook Report
- in process*: Vegetation input: North-West Outlook Report

2. Open Space Planning

- Nov 2015: The proposed Kaalspruit Open Space Project, Thembisa, Gauteng. Kaalspruit River Rehabilitation Biodiversity Scan: (NuLeaf Planning and Environmental)

2015-2016: City of Johannesburg Open Space Planning – vegetation input for Linbro Park, Bassonia, Kyalami and Ruimsig areas (Iggdrasil)

3. Management- and Rehabilitation Plans

April-May 2012: Vegetation base line study and input into Biodiversity Action Plan for Kumba Iron Ore (Lidwala Consulting Engineers)

Jan 2015: Environmental Management Plan for the Krugersdorp Nature Reserve – vegetation section

Jan 2016: Tharisa Mine Railway Line – Vegetation rehabilitation plan (Limosella Consulting)

Sept 2016: General vegetation rehabilitation plan for the proposed Mezo Kitchens Panel Processing Facility (Shangoni)

Nov 2016: General Ecological Rehabilitation and Monitoring Plan for the N4 additional lane between: R52 Koster offramp & D1325 Marikana Interchange; and The R512 (Brits West Interchange) & K67 (Ga-Rankuwa Interchange) North West and Gauteng Provinces

Nov 2016: Biodiversity Management Plan: Afrisam (Sa) (Pty) Ltd, Dudfield Cement – vegetation input

June 2017: Rehabilitation planning for the Klip- Lower and Upper Rietspruit Water Management Units (Pregio, via Limosella Consulting)

Dec 2017: Eskom underground cable river crossings – vegetation input into rehabilitation plants (Envirolution)

4. Linear Infrastructure

March 2012: Kranspoort road upgrade Protected tree identification (Lidwala Consulting Engineers)

Oct 2012: Eskom: Perseus to Gamma Vegetation assessment (Mokgope Consulting)

March 2013: Diepsloot Eskom line and substation, Johannesburg (Envirolution)

Nov 2013: Masa Ngwedi 750kV and 400kV lines (Limpopo & North-West Provinces) Section D & E Vegetation Input for EMP (Mandara Consulting)

2013-2014 Eskom: Northern Alignments (Perseus in the Northern Cape to Juno in the Western Cape) (Mokgope Consulting)

Feb 2014: Meteor substation, as well as the 88kV line between the Pulsar, Meteor and Sonland substations, Sebokeng, (Nsovo Environmental Consulting)

Dec 2014: Upgrading of Internal Roads in Stinkwater, Hammanskraal (Gauteng) (GladAfrica)

Sept 2015: Railway Siding for GCMC Open Cast Mine, Lephalale (Limpopo)

Feb 2016: N4 - Additional lane between Brits and Rustenburg (Environamic)

Nov 2016: Aggeneis-Paulputs 400kV Powerline and Substations Upgrades

Feb 2017: Proposed Lulamisa to Diepsloot East to Blue Hills to Crowthorne 88kv Power Line / Cable and 2 Substations Gauteng (Envirolution)

May 2017: Proposed 132 kV Powerline Between Fochville Municipal Substation and an Existing Line, Gauteng Province (Envirolution)

5. Solar Developments

January 2012: Schmidtsdrift, Northern Cape Vegetation Assessment for Solar Panels (Nuleaf)

Aug 2015: Proposed Construction of A 75mw Solar Energy Facility Project, Limpopo Tshikovha Environmental and Communication Consulting

6. Mining

- April 2012: Rietfontein Open Cast Vegetation assessment (Cabanga Concepts)
Jan 2013: Vierfontein Colliery Vegetation assessment and EMP input (Cabanga Concepts)
Jan 2017: G&W Base and Industrial Minerals Koppies Betonite Mine Vegetation Assessment & Management Input Report (Cabanga Concepts)

7. Other Development

- Dec 2013: Marekele Bush camp – vegetation & fauna assessments (NuLeaf)
May 2013: Komati Power Station – Coal stockyard (EnviroLution)
April 2014: Blesboklaagte & Leeupoort Township development (Shangoni)
May 2014: Goldi Farm Composting Site, Section 24G Fauna and Flora assessment and Summary document (Shangoni)
Feb 2015: TOPIGS: Proposed Piggery, Mpumalanga (Shangoni)
May 2015: Kwaggasrant Recycling Facility Upgrade (Shangoni)
Oct 2016: Proposed piggery on portion 139 of the farm Honingnestkrans 269JR Vegetation and Fauna investigation (Methale Environmental Consulting)
Oct 2017: Ongoing Clinic Development & Proposed Emergency Medical Services Facility on Prt 79 of the farm De Wagendrift 417 JR Gauteng Province. (Methale Environmental Consultants)

8. Plant relocation and monitoring

- April 2014: Relocation of *C bulbipermum*, overlooked Colliery in Mpumalanga (Cabanga Concepts)
Feb 2017: Monitoring report for the relocated *Crinum bulbispermum* at Overlooked Colliery
May 2017: Relocation of protected plant species: Evander Mine
Feb 2018: Monitor populations of the Critically Endangered *Chlorophytum radula* at the Woodbush Plantation, Limpopo.

9. International:

- Oct 2009: Tatu, Nairobi: Vegetation Assessment (Kenya) (Lokisa Environmental Consulting)
Sept 2014: Vegetation input to the Regional Environmental and Social Assessment of Coal-based Energy Projects along the South Africa- Botswana Border (World bank Project, Mott MacDonald)

10. Mentorship:

- May 2017: Technical Peer Review of the vegetation section for the Emfuleni Bulk Water Supply Pipelines: Ecological Assessment. GIBB Engineering & Architecture (Pty) Ltd
Nov 2017: Mentorship and Technical Peer Review of the vegetation section for the Merensky-Kennedy Powerline: vegetation assessment GIBB Engineering & Architecture (Pty) Ltd