

# RIDGE STUDY FOR PROPOSED CONSTRUCTION AND MAINTENANCE OF THE RAND WATER 3KM Q6 PIPELINE WITH A DIAMETER OF 1400 MM FROM THE RAND WATER EIKENHOF PUMP STATION TO MEREDALE RESERVOIR AS PART OF THE INLET AND OUTLET PIPE AND ITS ASSOCIATED INFRASTRUCTURES.

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## DECLARATION OF INDEPENDENCE

I, Divhani Mulaudzi, Registered Specialist, declare that i:

- Act as an independent specialist consultant in the field of botany, ecology and vegetation science;
- Am assigned as specialist by **Maanakana Projects and Consulting** for this proposed project;
- I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work stipulated in the terms of reference;
- Have or will not have any vested interest in the proposed activity proceeding;
- Have no and will not engage in conflicting interests in the undertaking of the activity;
- Undertake to disclose to the client and the competent authority any material, information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations;
- Will provide the client and competent authority with access to all information at my disposal, regarding this project; whether favourable or not.



Date: 27/09/2016

Divhani Mulaudzi

## Table of Contents

DECLARATION OF INDEPENDENCE .....	2
Introduction.....	5
Project description.....	5
Scope of study .....	5
Project locality.....	5
Objective of the habitat study .....	7
Characteristic study site (area) .....	7
The study area falls within the Soweto Highveld Grassland (GM 8).....	7
Climate .....	8
Methodology.....	12
Habitat characteristics .....	12
Mammals .....	13
Avifauna .....	14
Ecological conditions of the ridge Of Portions 7-16, 18-24, 26-35, 57 and the Remainder of Vlakdrift 163 IQ.....	15
Limitations .....	16
Results and discussions.....	16
Conclusions.....	21
Photographic representation and characteristics of the study site .....	22
References .....	24

## List of figures

Figure 1. Approximate locality map and study area.....	6
Figure 2. Climate of the Soweto region .....	8
Figure 3. The warmest month of the year is January, with an average temperature of 20.4 °C. June is the coldest month, with temperatures averaging 9.0 °C.....	8
Figure 4. Location and route alignment of the proposed pipelines.....	11
Figure 5. Outcrop of rock [hillocks] or piles of large rocks or boulders (regarded as favourable habitat) .....	14
Figure 6. Rocky ridge at the South westerly direction from Eikenhof pump station heading to the Meredale reservoir.....	22
Figure 7. Flat Plain in the vicinity of the route alignment with grazing animals .....	22
Figure 8. Dolomitic rock at the ridge within the site .....	23
Figure 9. <i>Aloe greatheadii</i> var. <i>davyana</i> (Fortunately, although thousands of these plants are destroyed annually due to development, neither of the two varieties is threatened yet.) .....	23

## List of Tables

Table 1. Four classes of ridges in Gauteng Province and the percentage of transformation ..	9
Table 2. List of ridge vegetation communities on site and summary of dominant plant species recorded from each community surveys.....	17
Table 3. Summary of characteristic species of the vegetation communities of the study site	18
Table 4. summary of estimate of ecological conditions of the vegetation communities of the study site; categorised as Very Low, Low, Moderate, High, Very High, and Confirmed.....	19

## **Introduction**

### **Project description**

Proposed construction and maintenance of the Rand Water 3km Q6 pipeline with a diameter of 1400 mm from the Rand Water Eikenhof pump station to Meredale reservoir as part of the inlet and outlet pipes and its associated infrastructures, within City of Johannesburg, Gauteng Province.

### **Scope of study**

- ✓ Survey in terms of site visits to note key elements of habitats on the site
- ✓ Vegetation surveys
- ✓ Development of literature
- ✓ Field observations to evaluate the ecological conditions of the ridges

### **Project locality**

Figure 1 below



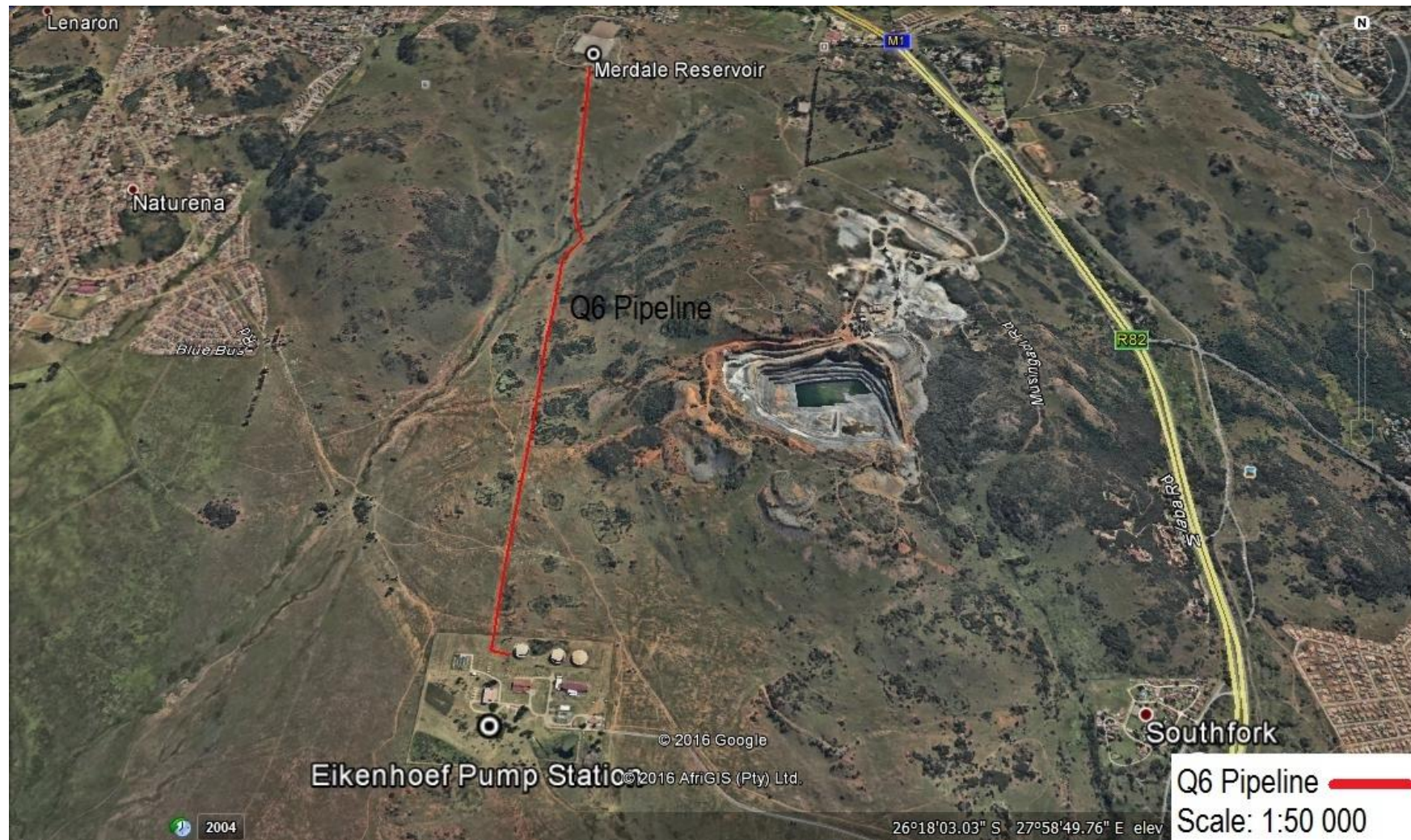


Figure 1. Approximate locality map and study area

## Objective of the habitat study

The objectives of the habitat study on ecological conditions are to provide the following

- ✓ Outline of the present habitats
- ✓ Outline vegetation assemblages (communities) present with an estimate of the dominant species and that are present at rocky ridges
- ✓ Estimate degradation and impacts of disturbances on the vegetation
- ✓ Functional aspects of the ecosystems on site
- ✓ Outline compositional aspects of exotic species, indigenous pioneer species and indigenous plant species of ecological concerns and higher status based on the broad subjective observations and quantitative surveys.

## Characteristic study site (area)

**The study area falls within the Soweto Highveld Grassland (GM 8).**

Vegetation and landscape characteristics; It occurs on gently to moderately undulating landscape on the Highveld plateau, supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra*. In places not disturbed, only scattered small wetlands, narrow stream alluvial, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover. Only a handful of patches statutorily conserved or privately conserved. Almost half of the area already transformed by cultivation, urban sprawl, mining and building of road infrastructure, dams has flooded some areas (Mucina & Rutherford, 2006).

Important taxa:

- ✓ **Graminoids:** *Andropogon appendiculatus* (d), *Brachiaria serrata* (d), *Cymbopogon pospischillii* (d), *Cynodon dactylon* (d), *Elionurus muticus* (d), *Eragrostis capensis* (d), *E. chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. planiculmis* (d), *E. racemosa* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Setaria nigrirostris* (d), *S. sphacelata* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Andropogon schirensis*, *Aristida adscensionis*, *A. bipartita*, *A. congesta*, *A. junciformis* subsp. *galpinii*, *Cymbopogon caesius*, *Digitaria diagonalis*, *Diheteropogon amplexans*, *Eragrostis micrantha*, *E. superba*, *Harporchloa falx*, *Microchloa caffra*, *Paspalum dilatatum*;
- ✓ **Herbs:** *Hermannia depressa* (d), *Acalypha angustata*, *Berkheya setifera*, *Dicoma anomala*, *Euryops gilfillanii*, *Geigeria aspera* var. *aspera*, *Graderia subintergra*, *Haplocarpha scaposa*, *Helichrysum miconiifolium*, *H. nudifolium* var. *nudifolium*, *H. rugulosum*, *Hibiscus pusillus*,

*Justicia anagalloides*, *Lippia scaberrima*, *Rhynchosia effusa*, *Schistostephium crataegifolium*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*;

✓ **Geophytic herbs:** *Haemanthus humillis* subsp. *hirsutus*, *H. montanus*;

✓ **Herbaceous climber:** *Rhynchosia totta*; Low shrubs: *Anthospermum hispidulum*, *A. rigidum* subsp. *pumilum*, *Berkheya annectens*, *Felicia muricata*, *Ziziphus zeyheriana*.

## Climate

The summer here have a good deal of rainfall, while winter have very little. According to Köppen and Geiger, this climate is classified as Cwb. The average annual temperature is 15.8 °C in Soweto. Precipitation here averages 750 mm ([www.saws.gov.za](http://www.saws.gov.za)).

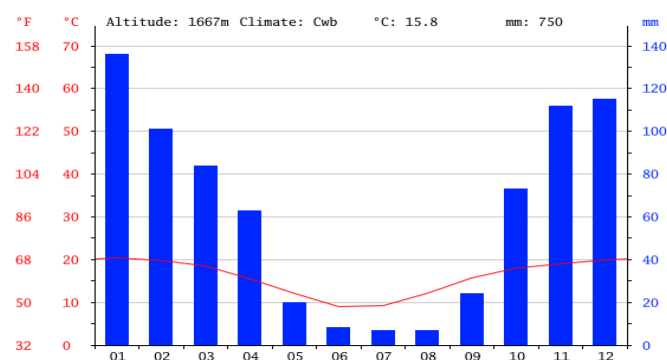


Figure 2. Climate of the Soweto region

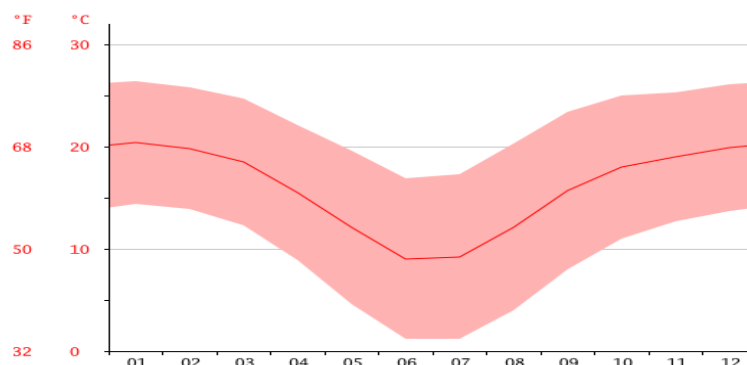


Figure 3. The warmest month of the year is January, with an average temperature of 20.4 °C. June is the coldest month, with temperatures averaging 9.0 °C.

Ridges are specialized by high spatial heterogeneity due to the range of differing aspects (North, South, East, West and variations thereof), slopes and altitudes resulting in differing soil characteristics (for example depth, moisture, temperature, drainage, nutrient content), light and hydrological



conditions. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987).

Variations in aspect, soil drainage (Burnett *et al.* 1998) and elevation/altitude (ranges from 1360-1620m but largely 1500-1560m (Primack, 1995) have been found to be specifically important predictors of biodiversity. All ridges in Gauteng have been classified into four classes (Table 1) based on the percentage of the ridge that has been transformed (mainly through urbanization) using the 1994 CSIR/ARC Land cover data. The study area falls within Class 2 of the Gauteng ridges (Gauteng C-Plan Ver. 3.3).

Table 1. Four classes of ridges in Gauteng Province and the percentage of transformation

Ridge type	% of Gauteng Ridges	Policy
Class 1 (0-5% transformed) includes Suikerbosrand & parts of Magaliesberg.	51%	(a) The consolidation of properties on Class 1 ridges is supported. (b) Further development activities and subdivisions will not be permitted on Class 1 ridges. Only low impact activities with an ecological footprint of 5% or less will be permitted in the 200 metres buffer zone of the ridge.
Class 2 (5-35% transformed) includes parts of Magaliesberg, World Heritage sites, Klipriviersberg, Bronberg, Skurweberg	28%	(a) The consolidation of properties on Class 2 ridges is supported. (b) The subdivision of property on Class 2 ridges will not be permitted. Development activities and uses that have a high environmental impact on a Class 2 ridge will not be permitted. (d) Low impact development activities, such as tourism facilities, which comprise of an ecological footprint of 5% or less of the property, may be permitted. (The ecological footprint includes all areas directly impacted on by a development activity, including all paved surfaces, landscaping, and property access and service provision). (e) Low impact development activities on a ridge will not be supported where it is feasible to undertake the development on a portion of the property abutting the ridge.
Class 3 (35-65% transformed) Includes Northcliff/ Roodepoort/ Krugersdorp ridge	9%	(a) The consolidation of properties on Class 3 ridges is supported. (b) The guidelines for Class 2 ridges will be applied to areas of the ridge that have not been significantly impacted on by

		<p>human activity.</p> <p>The guidelines for Class 4 ridges will be applied to areas of the ridge that have been significantly impacted on by human activity.</p>
Class 4 (65-100% transformed) includes Melville Koppies & Linksfield ridge	11%	<p>The consolidation of properties on Class 4 ridges is supported.</p> <p>(b) The subdivision of property on Class 4 ridges will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more.</p> <p>Further development activities will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more.</p>

A class 2 rocky ridges was mapped (GDARD, C-Plan) in the study area adjacent to the pipeline proposed site. Site visits confirmed that a rocky ridge enters most parts of the study site from the Eikenhof pump station heading to the South easterly direction to Meredale reservoir. Culverts crossing a perennial stream and non-perennial stream have been identified along the pipeline route. Heritage Bushmen stone walls were present on site and access roads along the pipeline route were also identified on site.

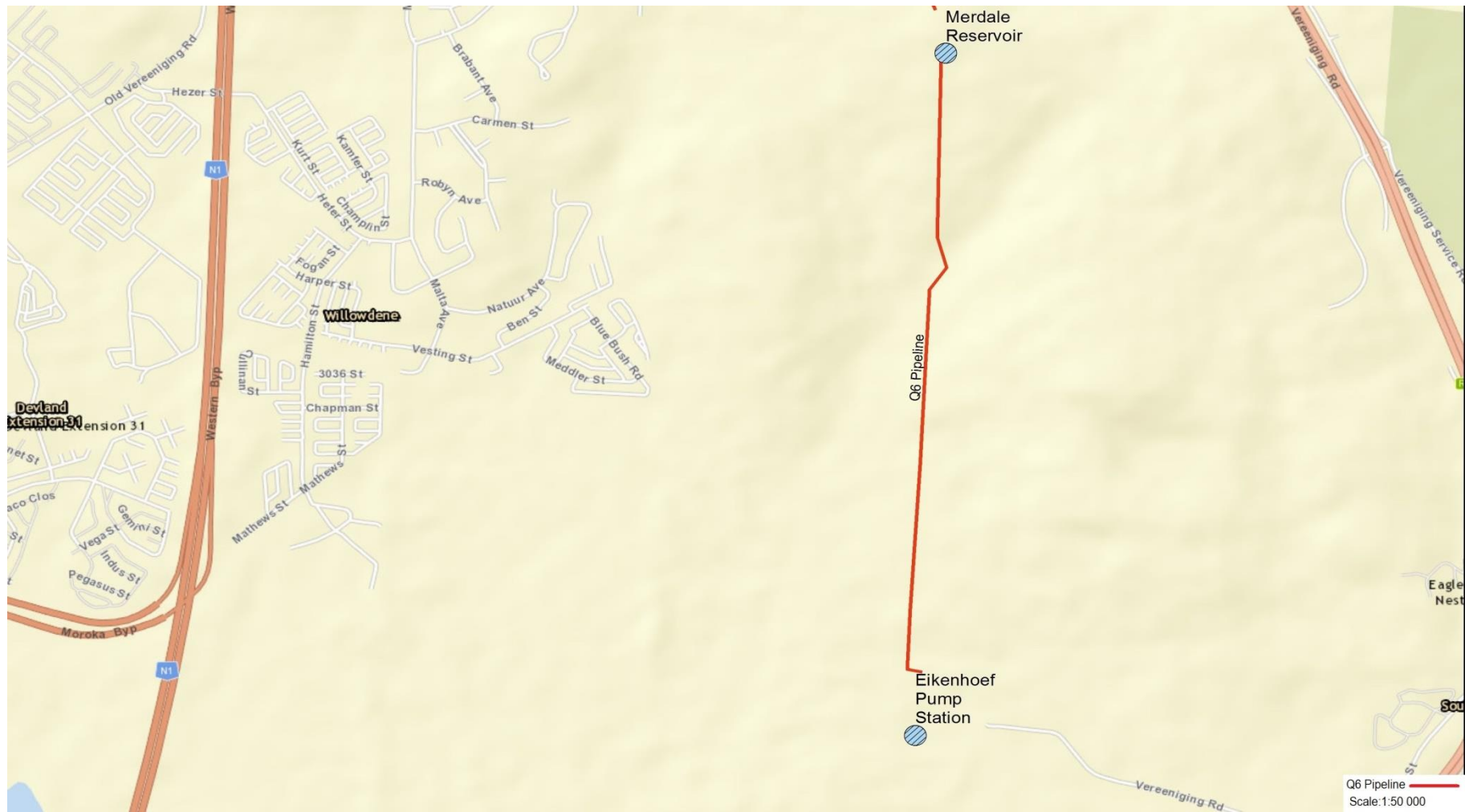


Figure 4. Location and route alignment of the proposed pipelines

## Methodology

The survey was conducted on the 12<sup>th</sup> of September 2016. The study sites were surveyed on foot and in the process sightings were recorded through random transect walks

## Habitat characteristics

The habitat was surveyed by means habitat assessment structure such as rockiness, slopes, plant structure/ or Physiognomy. Vegetation communities; relatively homogenous vegetation assemblages were identified based on overall appearance (mainly regarded physiognomy) and conspicuous dominant species (composition). Point counts, random sampling, and Releve' sampling methods were applied in apparent representative parts of the relatively homogenous vegetation communities to establish dominant plant species in the Bushveld.

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act 1998 (Act No 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity as well as the sustainable equitable and efficient use of biological resources.

Flora assessment consisted of two complementary approaches:

- ✓ A desktop analysis of literature review, photographs, topographical maps, and
- ✓ Google Earth imagery; and
- ✓ Site visits were conducted in August and data collection in September 2016.

Satellite imagery of the area was obtained from Google Earth and was studied in order to get a different dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialized habitats for example patches of undisturbed vegetation, river crossings and rocky ridges.

The vegetation map published in Mucina & Rutherford (2006) was consulted to identify vegetation units that are found in the study area. The desktop component of the study of the habitats of the Red-Data-Listed and other species of conservation importance known to occur in the area was conducted before the site visits. The habitats of the study areas were inspected in a random fashion, paying attention to areas that appeared to be sensitive. All general observations were noted such as trees, shrubs, grasses and herbs (forbs). The habitats suitable for Red Data listed species known to occur in the area were examined intensively for the presence of such species. Attention was also paid to the

occurrence of alien species and declared weeds. Field guides such as Van Wyk *et al.* (1997) was utilised during the field work. Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants with no known useful economic purpose that should be eradicated. Invader plants also considered by the Act can also be of alien origin but may serve useful purposes as ornamentals as sources of timber or may have other benefits such as medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- ✓ *Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.*
- ✓ *Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.*
- ✓ *Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.*

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Bromilow 1995 & 2010).

## **Mammals**

As the majority of mammals are secretive, nocturnal, hibernators, the distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on field guides, scientific literature and databases. This can be done irrespective of season. Site visits were conducted during the month of September and during the visits the observed and derived presence of mammals associated with the recognized habitat types of the study site were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals coupled with the qualitative and quantitative nature of recognised habitats. The adjoining properties were also scanned for important fauna habitats. During the site visits mammals were identified by visual sightings through random transect walks. Terrestrial and arboreal rats, mice, squirrels and Daisies (*Procavia capensis* (Rock hyrax) (See Figure 6) (non-violent small mammals) were visually sampled.



Figure 5. Outcrop of rock [hillocks] or piles of large rocks or boulders (regarded as favourable habitat)



Figure 6. *Procapia capensis* marked with red colour

## Avifauna

Site visits were conducted to record the presence of bird species associated with the habitat systems on the study site and to identify possible sensitive areas. Birds were identified visually due to limited time of study. Field guides such as Sasol Birds of Southern Africa (Sinclair *et al*, 2005) and the chamberlain guide to birding Gauteng (Marais & Peacock, 2008) were used during the site visit and the identification of bird species. The study sites were surveyed on foot and in the process sightings were recorded through random transect walks.



## Ecological conditions of the ridge of Portions 7-16, 18-24, 26-35, 57 and the Remainder of Vlakdrift 163 IQ

The veld condition is often an important aspect of overall ecological conditions at a chosen site. The veld condition can be determined in various ways. Two techniques that are commonly used are the ecological index which yields a veld condition index and the occurrence or absence of key grass species (Van Rooyen, 2002). Different veld condition assessment methods that have an ecological base have been proposed by various researchers in South Africa including Tainton & Booysen (1978), Hardy & Hurt (1989), Tainton (1988), Tainton, Edwards & Mentis (1980). These methods use key grass species or grass species with allocated ecological status to determine veld condition. Degradation models (Bosch & Gauch, 1991) can also be used to assess veld condition. Directly or indirectly, these methods are based more on responses of grass species to mega-herbivores and in addition at the higher rainfall areas also based on responses of grass species to fire.

A good veld condition is therefore close to a good rangeland condition which is not necessarily ideal for the conservation of smaller fauna and flora especially at ridges where soils are naturally poor in nutrients. For the purposes of this study the application of these methods are doubtful to apply for three main reasons.

1. Natural grassland on rocky ridges may contain a low frequency or abundance of grass species that are of high ecological status in terms of grazing by mega-herbivores even though a patch may be ideal for rare flora and smaller fauna. *For example Aristida* grass community which is inhabited by a number of grass species of lower ecological status. Threatened insect species often require habitats that are to some extent disturbed, for example the Brenton Blue Butterfly, *Orachrysops Niobe*.
2. The diversity of indigenous forb species and not necessarily grass species is often of paramount importance for smaller fauna and flora.
3. Especially within and on the fringes of urban areas pioneer forbs, shrubs and trees may be more important to indicate degradation of ecosystems than low ecological status grass species. Patches opened up by excavations do not necessarily follow the same succession pattern as patches that are opened up by overgrazing or fire.

## Limitations

- Some points of the study site were burnt as a result of veld fires and species identifications were not simple.
- The majority of threatened plant species is extremely seasonal and only flower during specific periods of the year.
- The majority of threatened faunal species are extremely secretive and difficult to survey, even during the field surveys conducted. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage and Plantago Lanceolata (Pty) Ltd can thus not accept responsibility for conclusions and mitigation measures made in good faith based on information gathered or databases consulted at the time of the investigation.
- It should be emphasized that the survey can by no means represent a full account of all the species and their abundances on the site.
- Full analyses, such as complete randomized sampling or detailed stratified random sampling, followed by detailed ordination analyses are not practical within the time constraint and objectives of the study.
- Survey methods and analyses were adapted to fulfil the objectives of the study within its practical limitations.
- The primary focus of the survey has been the site and the results of the larger study area could not be a substitute for any impact assessments in these areas outside the site with proposed footprint for development. The site was visited for the first time during August 2016 and September 2016 which comprises an optimal time of the year to document ecological conditions.

## Results and discussions

Table 1 discuss four (4) vegetation communities associated with ridges have been identified at the site with emphasis to ridge vegetation (Table 3).

Table 3 lists of the species with a high fidelity to the vegetation assemblages identified locally at the site. Fidelity classes from preferential, selective to exclusive are used to indicate habitat specificity locally at the site. Some of the species with a high fidelity are widespread in Gauteng but can be locally indicative of unique ecosystems. In the case of this study some species of global and national conservation concern show a high fidelity to the rocky area of the site (Table 4).

Table 2. List of ridge vegetation communities on site and summary of dominant plant species recorded from each community surveys

Plant communities	Location within the study site	Vegetation structure	Number of transects used	Available species	Relative frequency percentage
<i>Eragrostis racemosa</i> - <i>Helichrysum miconiifolium</i> (Least Concern) community	Slopes above the Eikenhof pump station heading to the Meredale reservoir facing the Southerly direction of the starting point of the pipeline	Mainly grass layer with some shrubs	3	<i>Cymbopogon pospischillii</i> , <i>Cynodon dactylon</i> , <i>Elionurus muticus</i> , <i>Eragrostis capensis</i> , <i>E. chloromelas</i> , <i>E. curvula</i> , <i>E. plana</i> , <i>E. planiculmis</i> , <i>E. racemosa</i> , <i>Heteropogon contortus</i> , <i>Setaria nigrirostris</i> , <i>Themeda triandra</i> , <i>Helichrysum miconiifolium</i> (Least Concern) RDL	69
<i>Themeda triandra</i> - <i>Celtis africana</i>	High slopes, rocky outcrops	Mainly grass layer with woodlands	6	<i>Celtis africana</i> <i>Themeda triandra</i>	53
<i>Acacia dominated woodland</i>	Lower slopes and koppies of the study site. Rocky quarzitic outcrops in bushveld	Acacia-dominated woodland, and open woodland with patches of small scattered Acacia trees, Shrubs, herbs, Grasses and diverse in structure.	4	<i>Acacia karoo</i> , <i>Ziziphus zeyheriana</i> , <i>Searsia sp</i> , <i>Berkheya annectens</i> (Least concer) RDL	38
<i>Rivers and associated riparian zones</i>	Perennial and non-perennial streams present on site	Middle location of the pipeline route. and floodplains	2	<i>Geophytic herbs: Haemanthus humillis subsp. hirsutus</i> , <i>H. montanus</i> ; <i>Herbaceous climber: Rhynchosia totta</i> .	80

Table 3. Summary of characteristic species of the vegetation communities of the study site

Description of vegetation communities	Characteristic species with high degree of fidelity, including species that appear to be locally exclusive, selective or preferential in the study area		
	Species	Growth form of species	Fidelity
<i>Eragrostis racemosa-Helichrysum miconiifolium</i> (Least Concern) community	<i>Eragrostis racemosa</i>	Grass	Preferential
	<i>Helichrysum miconiifolium</i> (Least Concern) RDL	Herb	Preferential
	<i>Heteropogon contortus</i>	Grass	Preferential
	<i>Cynodon dactylon</i>	Grass	Preferential
	<i>Cassonia spicata</i> (protected) trees	Woody plant	Preferential
<i>Themeda triandra- Celtis africana</i>	<i>Celtis africana</i>	Woody Shrubs	Preferential
	<i>Dombeya rotundifolia</i>	Woody	Preferential
	<i>Searsia sp,</i>	Woody	Preferential
	<i>Berkheya annectens</i> (Least concern) RDL	Woody	Preferential
	<i>Heteropogon contortus</i>	Graminoids	Preferential
	<i>E. racemosa</i>	Graminoids	Preferential
	<i>Themeda triandra</i>	Graminoids	Preferential
<i>Acacia dominated woodland</i>	<i>Acacia karoo,</i>	Woody shrubs	Preferential
	<i>Ziziphus zeyheriana,</i>	Woody	Preferential
	<i>Searsia sp</i>	Woody shrubs	Preferential

<b>Rivers and associated riparian zones</b>	<i>Geophytic herbs: Haemanthus humillis subsp. hirsutus,</i>	Herbs	Exclusive
	<i>H. montanus;</i>	Herbs	Exclusive
	<i>Herbaceous climber</i>	Herbs	Exclusive
	<i>Rhynchosia totta.</i>	Herbs	Exclusive
	<i>Eucalyptus sp</i>	Exotic woody	Exotic

Table 4. summary of estimate of ecological conditions of the vegetation communities of the study site; categorised as Very Low, Low, Moderate, High, Very High, and Confirmed.

<b>Vegetation communities</b>	<b><i>Eragrostis racemosa-Helichrysum miconiifolium</i> (Least Concern) community</b>	<b><i>Themeda triandra- Celtis africana</i> community</b>	<b>Acacia dominated woodland community</b>	<b>Rivers and associated riparian zones community</b>
<b>Probability of unique habitat of threatened plant species</b>	Low	Confirmed (very high)	Very Low	High
<b>Unique habitat for plant species not threatened but of conservation concern</b>	Low	Low	Low	Low
<b>Diversity of indigenous plant species</b>	High	High	High	High
<b>Unique habitat for threatened fauna</b>	Low	Low	Low	Low
<b>Cover of indigenous plant species</b>	High	High	High	High
<b>Grazing importance</b>	High	High	Moderate	Moderate
<b>Connectivity, intactness</b>	Very high	High	HIGH	High
<b>Sensitivity (in terms of rocky ridges)</b>	Very high	Very high	Very high	Very high
<b>*Ecologically negative edge effects to surrounding areas</b>	Low	Low	Low	Low

- Ecologically negative edge effects are those edge effects that compromise the overall ecological function and integrity of an area, for example a high frequency of alien invasive species is a negative edge effect to surrounding areas because the source may easily lead to contamination of surrounding areas.
- The flatter plateau areas associated with the rocky ridges as well as upper slopes of the rocky ridges appear to be disturbed and contain open vegetation with short grass in many spots and areas with a high frequency of bushveld. A high frequency of indigenous trees is present in communities and structurally consists of grasses, herbs and shrubs. Many areas of these communities have been transformed with the existing pipeline. No threatened plant or animal species are anticipated to be members of these communities at the site.
- The *Themeda triandra* – *Celtis africana* assemblage is diverse, structurally in terms of various growth forms (trees, grasses, herbs, shrubs well represented) as well as in diversity of indigenous plant species. Two threatened plant species of high conservation priority, *Aloe greatheadii* var. *davyana* (Fortunately, although thousands of these plants are destroyed annually due to development, neither of the two varieties is threatened yet.) and *Helichrysum miconiifolium* (Least Concern) have been identified to be part of this assemblage.



## Conclusions

From Eikenhof pump station to the Meredale reservoir, rocky ridges are Class 3 rocky ridge systems with 38% natural state and 53% urbanised. Rocky ridges at the southern parts of the site containing the *Eragrostis racemosa* –*Helichrysum miconiifolium* plant community. The rocky ridge at the South westerly direction of the site, containing the *Themeda triandra* – *Celtis africana* community is of very important and should be carefully conserved.

The vegetation cover at the rocky ridges should be included in the proposed development and be managed so that this vegetation can slow down water runoff and keep loss of soil down to natural levels.

The ridges that enters the river system of the site contains a strikingly unique plant community with a high diversity of indigenous plant species, a high structural diversity (of plant growth forms) and which include threatened and highly localised plant species. A high diversity of invertebrates is also suspected at this part of the site and possibly also smaller vertebrates depending on conservation management of this part of the site in future.

## Photographic representation and characteristics of the study site



Figure 6. Rocky ridge at the South westerly direction from Eikenhof pump station heading to the Meredale reservoir



Figure 7. Flat Plain in the vicinity of the route alignment with grazing animals



Figure 8. Dolomitic rock at the ridge within the site



Figure 9. *Aloe greatheadii* var. *davyana* (Fortunately, although thousands of these plants are destroyed annually due to development, neither of the two varieties is threatened yet.)

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