

Client:

**Bigen Africa Services (Pty) Ltd**

Project:

**Vegetation and Wetland  
Assessment for the proposed  
development on Klippoortjie  
112 IR**

Date:

2014/03/04

Revision:

01



SPEC CC

Spatial Ecological Consulting

André Grobler

B.Sc hons UP

Pri.Sci.Nat 400009/09

Ina Venter MSc UP

Pr.Sci.Nat 400048/08

## *Table of Contents*

---

1	Introduction .....	5
2	Legislative and policy framework .....	5
2.1	Constitution of South Africa (Act 108 of 1996).....	5
2.2	National Environmental Management Act (Act 107 of 1998) .....	5
2.3	National Environmental Management: Biodiversity Act (Act 10 of 2004) .....	5
2.4	Conservation of Agricultural Resources Act (Act 43 of 1983) .....	5
2.5	The National Water Act (Act 36 of 1998) .....	6
3	Location and study area description.....	6
3.1	Location .....	6
3.2	C-Plan .....	6
3.3	Vegetation types.....	9
3.4	Water resources.....	9
4	Methods.....	10
4.1	Desktop Assessment and Wetland Delineation.....	10
4.2	Vegetation .....	10
4.3	Wetland Health.....	10
4.4	Ecological Importance and Sensitivity (EIS) .....	11
5	Results.....	11
5.1	Vegetation .....	11
5.1.1	Transformed area .....	11
5.1.2	Grassland .....	11
5.1.3	Pan.....	11
5.2	Invasive plant species.....	17
5.3	Medicinal species.....	18
5.4	Threatened and Protected species .....	18

5.5	Wetland.....	18
5.5.1	Hydrogeomorphic and general description of wetland.....	18
5.5.2	Wetland delineation.....	18
5.5.3	Present Ecological State.....	19
5.5.4	Ecological Importance and Sensitivity.....	19
5.5.5	Conservation Importance.....	19
5.6	Buffers.....	20
6	Sensitivity and conservation importance.....	20
7	Impacts and Recommendations.....	21
7.1	Site plan and design phase:.....	21
7.2	Stormwater:.....	21
7.3	Construction phase:.....	22
7.4	Pollution.....	22
7.5	Buffer zone:.....	22
7.6	Invasive species:.....	23
8	Conclusion.....	23

*List of Figures*

---

Figure 1.	Locality of the site.....	7
Figure 2.	Sensitive areas according to C-Plan.....	8
Figure 3.	Vegetation types on site according to Mucina & Rutherford (2006).....	9
Figure 4.	Weedy vegetation in the transformed area.....	12
Figure 5.	Buildings and power lines in the transformed area.....	12
Figure 6.	Grassland area in the south-western portion of the site.....	13
Figure 7.	Mining in the pan to the north of the site.....	13
Figure 8.	Identified vegetation units on site.....	14

### *List of Tables*

---

Table 1. Present Ecological State used to define the health of wetlands from Macfarlane 2009.....	10
Table 2. Plant species recorded on site.....	15
Table 3. Invasive species and proposed invasive species recorded on site.....	17
Table 4. Medicinal plant species recorded on site.....	18
Table 5. Wetland Importance and Sensitivity scoring summary.....	19
Table 6. Sensitivity of the vegetation units on site.....	21

### *List of Addendums*

---

Addendum A – PES calculation for the wetland unit

Addendum B – EIS calculation for the wetland

### *Specialists*

---

<b>Aspect Investigated</b>	<b>Specialist</b>	<b>Qualifications &amp; SACNASP</b>	<b>Date of field survey</b>
Wetland and Vegetation Assessment	Ina Venter (CE) Pr.Sci.Nat.	M.Sc (Botany) Botanical Science: 400048/08	4 February 2014
Wetland and Vegetation Assessment Review	Andre Grobler Pr.Sci.Nat.	B.Sc Hons (Botany) Ecological Science: 400009/09	4 February 2014

## 1 Introduction

Spatial Ecological Consulting CC (SPEC) was approached by Bigen Africa Services (Pty) Ltd to conduct a vegetation and wetland assessment for the proposed development on Klippoortjie 112 IR. The site is located adjacent to a pan utilised for gold mining activities.

## 2 Legislative and policy framework

### 2.1 Constitution of South Africa (Act 108 of 1996)

The Constitution of South Africa (Act No. 108 of 1996) place a duty on the State and the citizens to protect the environment. Section 24 provides that:

*“Everyone has the right –*

*(b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that*

*i) prevent pollution and ecological degradation;*

*ii) promote conservation; and*

*iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.*

### 2.2 National Environmental Management Act (Act 107 of 1998)

Section 2 of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) lists the principles of the Act and includes the protection of sensitive and stressed ecosystems. The regulations for Environmental Impact Assessments (EIAs) are included under this act and are listed in regulations 543 to 547 of 18 June 2010.

### 2.3 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) addresses amongst others:

- Biodiversity planning and monitoring;
- Protection of threatened or protected ecosystems;
- Protection of threatened or protected species;
- The control of alien species, invasive species and genetically modified organisms.

Species that are classified as threatened and/or protected are listed in Government Gazette 151 of February 2007 and the regulations are included in Government Gazette 152 of February 2007, with the most recent amendment in Government Notice 576 of July 2011.

Threatened ecosystems in need of protection are listed Government Notice 1002 of December 2011.

### 2.4 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Conservation of Agricultural Resources Act includes control measures that apply to (Section 6):

- The cultivation of virgin soil;
- The protection and utilisation of vegetation;
- The grazing capacity of the veld;
- Control of weeds and invasive plants;
- The restoration and reclamation of eroded land and other disturbances to the land;
- The protection and restoration of wetlands.

## 2.5 The National Water Act (Act 36 of 1998)

The National Water Act mandates the Minister of Water Affairs and Forestry to ensure that water is *protected, used, developed, conserved, managed* and *controlled* in a sustainable and equitable manner for the benefit of all persons.

The Minister of Water Affairs and Forestry, supported by the Department of Water Affairs, acts as the public trustee of the nation's water resources. In doing so the Water Act must ensure that the nations' water resources are protected, used, developed, managed and controlled in a way that takes into account-

- meeting basic human needs both present and future;
- promoting equitable access and beneficial use
- facilitating social and economic development;
- protecting ecosystems and biodiversity; and
- reducing and preventing pollution and degradation.

This practically implies that there has to be enough water to meet the Ecological Reserve, this is the amount and quality of water that will maintain basic human needs and ecosystem services at a level that will be sustainable.

## 3 Location and study area description

### 3.1 Location

The site is located adjacent to Reigerpark, to the north-west of Reigerpark and to the south of the Angelo Pan. The site is located to the east of Elsburg Road and adjacent to, and to the west of, St Anthony's road (Figure 1).

### 3.2 C-Plan

The pan is indicated as an Ecological Support Area, with a few patches indicated as Important Area (Figure 2). C-Plan does not indicate anything else of importance on site. It should however be noted that the pan is currently used for gold mining. The sediment in the pan is being processed to extract gold. The pan is therefore very disturbed and less importance as an Ecological Support Area and as an Important Area. The importance of the pan will increase again once mining has stopped and the pan has been rehabilitated.

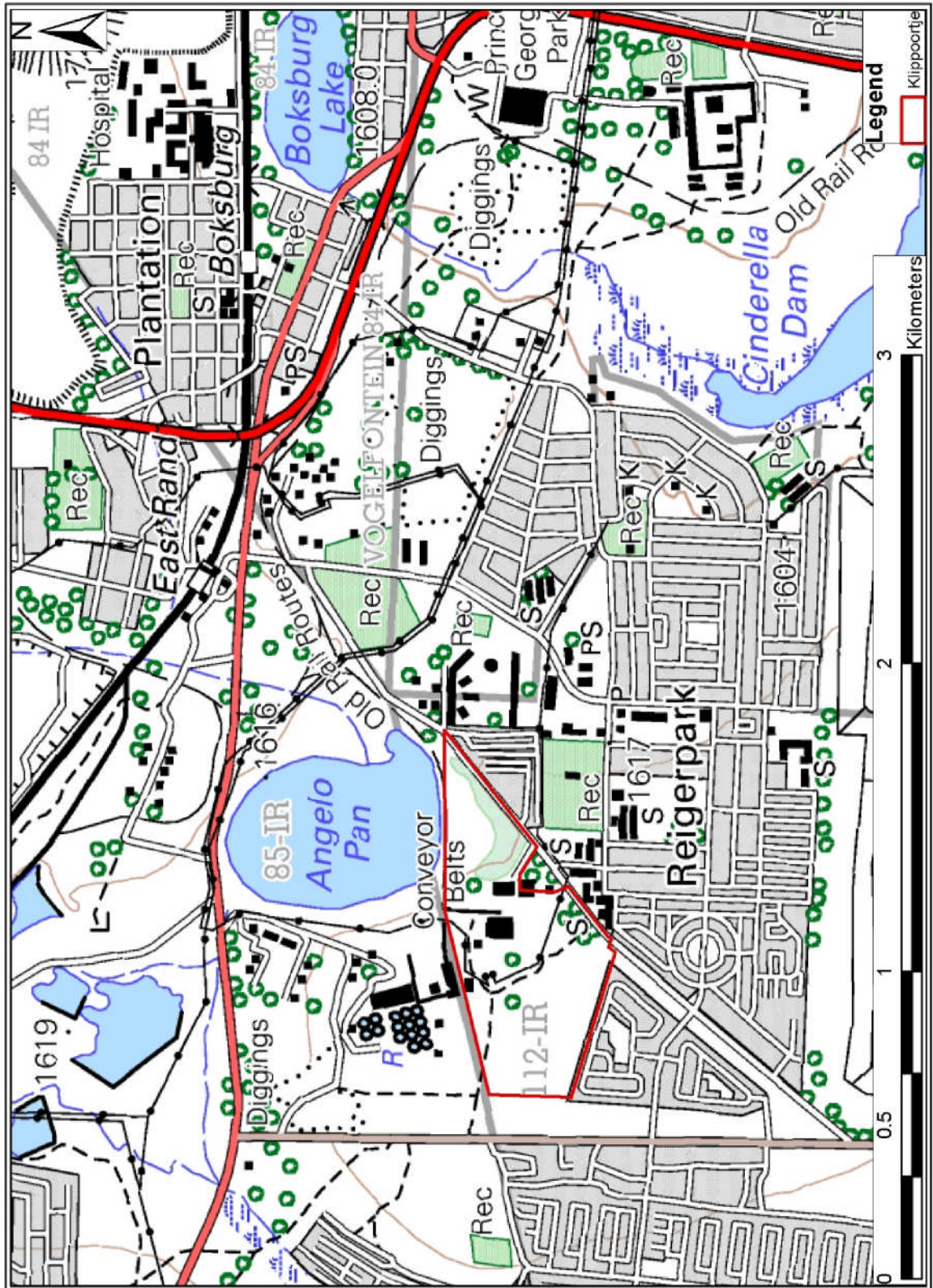


Figure 1. Locality of the site.



Figure 2. Sensitive areas according to C-Plan.





Figure 3. Vegetation types on site according to Mucina & Rutherford (2006).

### 3.3 Vegetation types

According to Mucina and Rutherford (2006) the site falls in the Soweto Highveld Grassland vegetation type. This vegetation type has medium to high, dense tufted vegetation, dominated by *Themeda triandra* with several grasses such as *Elionurus muticus*, *Eragrostis racemosa*, *Tristachya leucotrix* and *Heteropogon contortis* also present (Mucina & Rutherford, 2006). The vegetation type is classified as Endangered in Mucina and Rutherford (2006) and as Vulnerable in the NEMBA list (2011).

The pan adjacent to the site falls within the Eastern Temperate Freshwater Wetland vegetation type. The vegetation type is present in flat landscapes, in shallow depressions, temporarily flooded grasslands and temporary water bodies. The vegetation type is dominated by aquatic or hygrophilous vegetation, often with different zones. The vegetation type has not been evaluated for threatened status, but only 5% of the vegetation type is conserved. Several alien and invasive plant species are present in this vegetation type (Mucina & Rutherford, 2006). The remaining vegetation communities on the wetlands fall within this vegetation type. The vegetation type is classified as Vulnerable in the NEMBA list (2011). No evaluation of the threatened status of this vegetation type is included in Mucina and Rutherford (2006).

### 3.4 Water resources

The site is located in quaternary catchment C22B. The catchment includes the Boksburg Lake and the Elsburgspruit. The Angelo Pan is located adjacent to the site, to the north. An old furrow enters the pan on the northern side.

## 4 Methods

The site visit was conducted by two specialists on 4 February 2014. Indicators of wetland conditions in the soil and vegetation were noted. A survey of the plant species on site was also completed.

### 4.1 Desktop Assessment and Wetland Delineation

A vegetation assessment was completed on the site in 2008. This assessment was reviewed prior to the site visit and the information used for a baseline.

Aerial photographs of the site was scrutinised prior to the site visit for an indication of the wetland boundaries and vegetation types on site. Wetlands outside were delineated based only on the aerial photographs of the site, but the wetland boundaries on site were verified in the field.

The wetlands on site were delineated using the Department of Water Affairs (DWA) guidelines for wetland delineation (DWAF 2005). The indicators used in the delineation of the wetland include the soil, vegetation and topography of the site.

### 4.2 Vegetation

The vegetation assessment completed on the site in 2008 was used as a baseline assessment for this assessment. Additional information, including additional species data, was collected for the site. Mapping of the vegetation groups on site are refined during this assessment.

### 4.3 Wetland Health

In order to assess the health of the wetland at present the tool Wet-Health was used. This tool was developed for use by experienced wetland scientists. The Level 1 Wet-Health assessment was used on site. The Present Ecological State (PES) is used to define the health of a wetland (Table 1) and is determined for the hydrology, geomorphology and vegetation of the wetland. A combined score for the wetland can be obtained, but this is not recommended (Macfarlane *et al*, 2009).

**Table 1. Present Ecological State used to define the health of wetlands from Macfarlane 2009.**

Description	Combined impact score	PES Category
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F

#### 4.4 Ecological Importance and Sensitivity (EIS)

The EIS were calculated using the new draft DWA guidelines and model, as developed by Mark Rountree, but not yet published. Information was used from the SIBIS and VEGMAP products. A mean score between 0 and 4 is obtained, with 0 as the lowest and 4 as the highest score. No classification of the scores is given; the score is a linear score. These draft guidelines and model, was prescribed by the DWA, and is merely a more complete iteration of the previous Kleynhans model.

## 5 Results

### 5.1 Vegetation

Three vegetation units were identified on site:

- Transformed area
- Grassland
- Pan

#### 5.1.1 Transformed area

The majority of the site can be considered to be transformed. The vegetation in this area is very weedy with several alien and pioneer species. The indigenous species on site are also common species. Depressions are present on the site and these contain some wetland species. These areas are not wetland areas, but man-made depressions that occasionally contain water. These areas are therefore included in the transformed unit.

Several disturbances are present in this unit, mostly soil dumping and excavations, but some dirt roads and tracks, buildings and large patches of invasive trees are also present. Some ploughing may also have been present in the past. In terms of vegetation condition and diversity the sensitivity of this area is considered to be low.

#### 5.1.2 Grassland

This vegetation unit is restricted to a single patch on the south-western portion of the site. The grassland is in a fair condition, but appears to have been ploughed sometime in the past. The ploughing probably took place more than 20 years ago. The species diversity is lower than expected in primary grassland and signs of ploughing are visible on site and on the aerial photographs of the site. A few species has however returned to the site, which is not expected in a recently disturbed site. In terms of vegetation condition and diversity the sensitivity of this area is considered to be low.

#### 5.1.3 Pan

The pan is located outside the site, but borders on the site on the north-eastern portion. The vegetation in the pan is dominated by *Phragmites australis* with only a few other species present on the edges of the wetland. The pan sediment is currently being mined and gold extracted from the sediment. It is assumed that once the mining activities are completed that the pan will be rehabilitated.



Figure 4. Weedy vegetation in the transformed area.



Figure 5. Buildings and power lines in the transformed area.



Figure 6. Grassland area in the south-western portion of the site.



Figure 7. Mining in the pan to the north of the site.

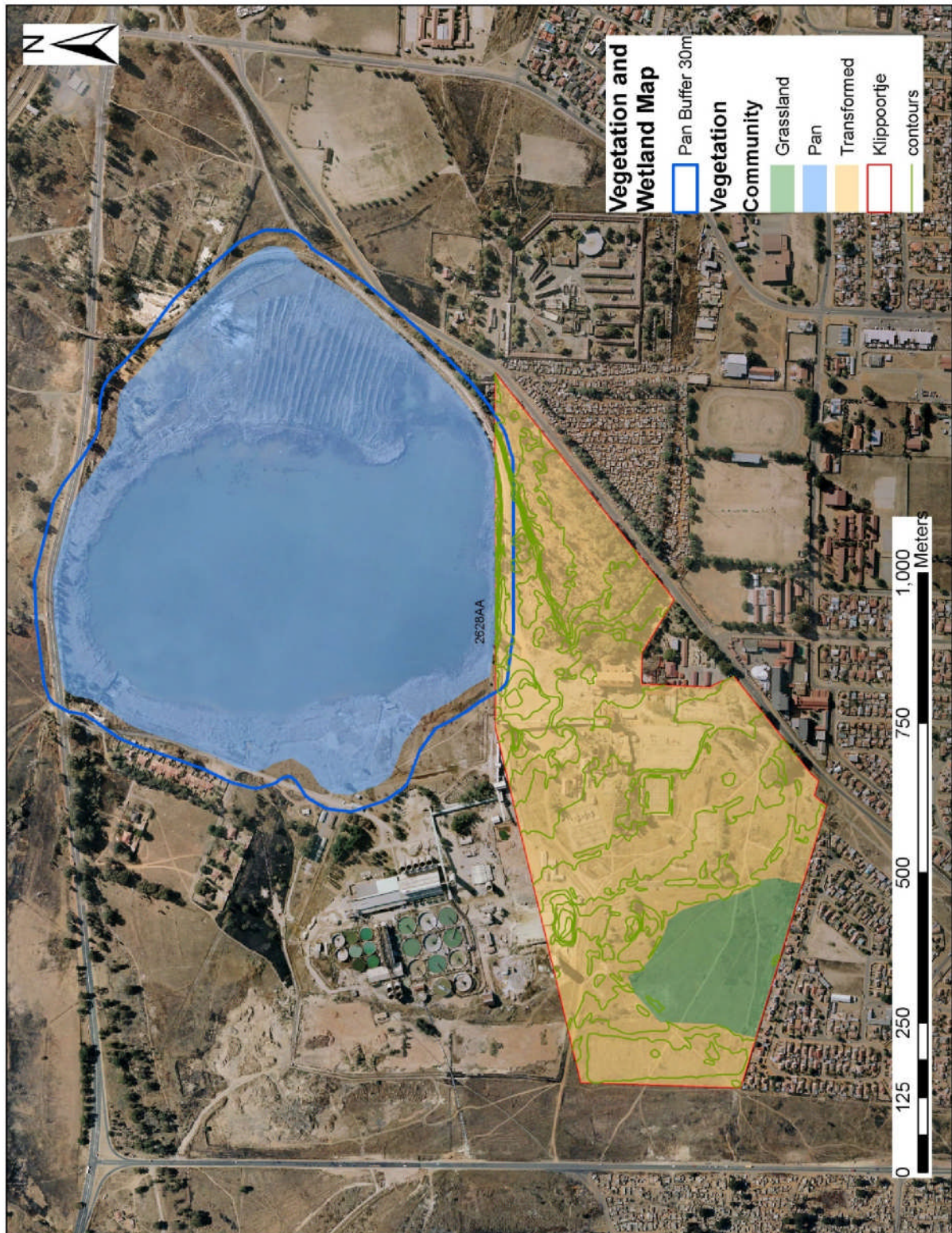


Figure 8. Identified vegetation units on site.

Table 2. Plant species recorded on site.

Species	Type	Alien	Grassland	Transformed area		Mined pan
				Disturbed site	Excavation with water	
<i>Acacia karroo</i>	Tree	N			x	
<i>Acacia mearnsii</i>	Tree	Y			x	
<i>Acacia melanoxylon</i>	Tree	Y			x	
<i>Acer species</i>	Tree	Y		x		
<i>Albuca setosa</i>	Forb	N	x			
<i>Albuca species</i>	Forb	N	x			
<i>Amaranthus hybridus</i>	Forb	Y		x		
<i>Andropogon chinensis</i>	Grass	N	x			
<i>Anthericum fasciculatum</i>	Forb	N	x			
<i>Aristida congesta</i>	Grass	N	x			
<i>Aristida stipitata</i>	Grass	N	x			
<i>Bidens pilosa</i>	Forb	Y	x	x		
<i>Brachiaria serrata</i>	Grass	N	x			
<i>Canna species</i>	Forb	Y		x		
<i>Chamaecrista species</i>	Forb	N	x			
<i>Chenopodium alba</i>	Forb	Y		x	x	
<i>Commelina africana</i>	Forb	N	x			
<i>Conyza bonariense</i>	Forb	Y		x	x	x
<i>Cortaderia selloana</i>	Grass	Y		x	x	
<i>Crabbea angustifolia</i>	Forb	N	x			
<i>Cyanotis spesiosa</i>	Forb	N	x			
<i>Cynodon dactylon</i>	Grass	N	x		x	
<i>Cyperus cf rupestris</i>	Sedge	N	x			
<i>Cyperus congestus</i>	Sedge	N			x	
<i>Cyperus esculentus</i>	Sedge	Y	x	x		
<i>Datura ferox</i>	Shrub	Y		x		
<i>Datura stramonium</i>	Shrub	Y		x		
<i>Dichapetalum cymosum</i>	Shrub	N	x			
<i>Digitaria eriantha</i>	Grass	N			x	
<i>Eragrostis curvula</i>	Grass	N	x			
<i>Eragrostis gummiflua</i>	Grass	N	x			
<i>Eragrostis inamoena</i>	Grass	N	x			
<i>Eucalyptus cinerea</i>	Tree	Y		x	x	
<i>Eucalyptus species</i>	Tree	Y		x		x
<i>Fimbristylus species</i>	Sedge	N	x			
<i>Flaveria bidentis</i>	Forb	Y		x		
<i>Geigeria burkei</i>	Forb	N		x		
<i>Gomphocarpus species</i>	Shrub	Y			x	
<i>Helianthus annuus</i>	Forb	Y		x		
<i>Helichrysum species</i>	Forb	N	x			

<i>Heteropogon contortis</i>	Grass	N	x			
<i>Hyparrhenia hirta</i>	Grass	N		x	x	
<i>Imperata cylindrica</i>	Grass	N			x	
<i>Ipomoea purpurea</i>	Forb	Y		x		
<i>Justicia anagaloides</i>	Forb	N	x			
<i>Lantana camara</i>	Shrub	Y		x		
<i>Ledebouria species</i>	Forb	N	x			
<i>Lippia javanica</i>	Shrub	Y			x	
<i>Medicago sativa</i>	Shrub	Y			x	
<i>Melia azedarach</i>	Tree	Y		x		
<i>Melinis repens</i>	Grass	N		x	x	
<i>Mellilotis alba</i>	Shrub	Y			x	
<i>Mirabilis jalapa</i>	Shrub	Y		x		x
<i>Monsonia burkei</i>	Forb	N	x			
<i>Morus species</i>	Tree	Y		x		
<i>Panicum species</i>	Grass	N			x	
<i>Paspalum dilatatum</i>	Grass	Y			x	
<i>Pelargonium luridum</i>	Forb	N	x			
<i>Pennisetum clandestinum</i>	Grass	Y	x	x		
<i>Phragmites australis</i>	Grass	N				x
<i>Phytolacca octandra</i>	Shrub	Y			x	x
<i>Plantago lanceolata</i>	Forb	N		x	x	
<i>Pogonarthria squarrosa</i>	Grass	N			x	
<i>Pollygalla hottentotta</i>	Forb	N			x	
<i>Populus alba</i>	Tree	Y	x		x	
<i>Populus nigra</i>	Tree	Y		x	x	
<i>Prunus persica</i>	Tree	Y		x		
<i>Pseudognaphalium luteo-album</i>	Forb	Y	x	x		
<i>Schinus molle</i>	Tree	Y			x	
<i>Sckhrurhia pinnata</i>	Forb	Y		x	x	
<i>Searsia lancea</i>	Tree	N			x	
<i>Senecio inornatus</i>	Forb	N			x	
<i>Senecio species</i>	Forb	N	x			
<i>Sida species</i>	Forb	N		x		
<i>Solanum mauritianum</i>	Shrub	Y				x
<i>Solanum panduriforme</i>	Forb	Y			x	
<i>Solanum sisymbriifolium</i>	Forb	Y	x	x	x	
<i>Sporobolus africanus</i>	Grass	N			x	
<i>Sporobolus species</i>	Grass	N			x	
<i>Tagetes minuta</i>	Forb	Y	x	x	x	
<i>Tagetes species</i>	Forb	Y		x		
<i>Tamarix species</i>	Tree	Y			x	
<i>Themeda triandra</i>	Grass	N	x		x	
<i>Typha capensis</i>	Forb	N				x
<i>Verbena aristigera</i>	Forb	Y			x	



<i>Verbena bonariense</i>	Forb	Y		x	x	
<i>Verbena officinalis</i>	Forb	Y			x	
<i>Verbena species</i>	Forb	Y	x			
<i>Walafrida densiflora</i>	Forb	N	x			
<b>Total</b>	<b>89</b>					
Trees	14					
Shrubs	11					
Sedges	4					
Forbs	38					
Grasses	22					
<b>Alien species</b>	<b>44</b>					

## 5.2 Invasive plant species

Invasive plant species are listed under the Conservation of Agricultural Resources Act (CARA). These species are controlled under this act.

According to CARA all category 1 species must be removed. Category 2 species may only remain if a permit has been obtained from the Department of Agriculture. If no permit has been obtained the plants must be removed. Where a "X" is included in the CARA class this is a proposed invasive species, but the species has not been included in a published list yet. The species is therefore not legally controlled yet. Invasive species observed are included in Table 3.

**Table 3. Invasive species and proposed invasive species recorded on site.**

<b>Species</b>	<b>Category</b>
<i>Acacia mearnsii</i>	2
<i>Acacia melanoxylon</i>	2
<i>Canna species</i>	1
<i>Cortaderia selloana</i>	1
<i>Datura ferox</i>	1
<i>Datura stramonium</i>	1
<i>Eucalyptus cinerea</i>	2
<i>Eucalyptus species</i>	2
<i>Ipomoea purpurea</i>	3
<i>Lantana camara</i>	1
<i>Melia azedarach</i>	3
<i>Mirabilis jalapa</i>	X3
<i>Morus species</i>	3
<i>Pennisetum clandestinum</i>	X2
<i>Phytolacca octandra</i>	X1
<i>Populus alba</i>	2
<i>Populus nigra</i>	X2
<i>Schinus molle</i>	X3
<i>Solanum mauritianum</i>	1
<i>Solanum sisymbriifolium</i>	1

<i>Tamarix species</i>	3
------------------------	---

### 5.3 Medicinal species

Several medicinal plant species are present in South Africa and are still used for medicinal purposes by various communities. It is therefore necessary to note what species may be of medicinal value on site. Medicinal plant species recorded on the site are included in Table 4.

Table 4. Medicinal plant species recorded on site.

Species
<i>Acacia karroo</i>
* <i>Datura stramonium</i>
* <i>Gomphocarpus species</i>
<i>Helichrysum species</i>
<i>Pelargonium luridum</i>
<i>Typha capensis</i>

\*Alien species

### 5.4 Threatened and Protected species

No threatened or protected species were observed on site or is expected to be present on site. Due to the level of disturbance on site it is unlikely that any species of conservation importance will be present on site.

### 5.5 Wetland

#### 5.5.1 Hydrogeomorphic and general description of wetland

No wetlands are present on the site although some of the artificial depressions on site contain some wetland species. A large pan is located adjacent to the site to the north. The pan sediment is currently being mined for gold extraction. A road has been constructed along the northern boundary of the site, between the site and the pan. This road appears to be raised. Sewage from a leaking line flows along the eastern border of the site and into the pan. The sewage dams up a bit against the road along the northern boundary.

#### 5.5.2 Wetland delineation

Access was not available to the adjacent property and the pan, especially since the pan is being mined at present. The delineation and information supplied is therefore based on the aerial photographs of the site and observations made from the road next to the pan.

##### 5.5.2.1 Vegetation

The vegetation in the pan is dominated by *Phragmites australis* with several weeds present on the edges of the pan.

##### 5.5.2.2 Topography

The pan is located in a depression in the landscape, where a pan is expected to occur.

### 5.5.2.3 Soil

The soil in the wetland is mostly sediment that originated from mine dumps to the north of the site. Several layers of silt are clearly visible in the excavations in the wetland.

### 5.5.2.4 Conclusion

A pan is present to the north of the site. Several impacts are however present, including mining of the wetland. The delineation of the pan is mostly based on the aerial photographs of the site.

## 5.5.3 Present Ecological State

**Hydrological** – The hydrology of the wetland has a PES score of E, which is severely modified. The most significant impact is the excavation activities in the wetland, but the build-up nature of the surrounding areas and possible contributions from leaking sewage and storm water also contributes.

**Geomorphology** – The geomorphology of the wetland has a PES of C, which is moderately modified. Sedimentation took place in the pan over a number of years and this is expected to have significantly changed the profile of the wetland. Several excavations are also present.

**Vegetation** – The vegetation of the pan has a PES of E. Most of the surface of the pan has been affected by several activities and no area remains unaffected. Invasive species are present along the entire edge of the pan and large portions of the wetland have been cleared of vegetation by the mining activities.

## 5.5.4 Ecological Importance and Sensitivity

The EIS is a broader index, and is used to gauge the value of larger systems. The wetland has an Ecological Importance and Sensitivity (EIS) score of 0.8. This is a value between 0 and 4, with 0 being very low and 4 very high. The wetland therefore has a low EIS score. This is mostly due to the mining taking place in the wetland and the lack of diversity.

The Hydro-functional Importance of the wetland has a score of 1.8, which is also a moderate score. This score due to the probably sediment retention and nutrient and toxicant removal functions of the wetland.

The direct human benefits of the wetland are low with a score of 0.2.

**Table 5. Wetland Importance and Sensitivity scoring summary.**

	<b>Importance</b>	<i>Confidence</i>
<b>ECOLOGICAL IMPORTANCE &amp; SENSITIVITY</b>	<b>0.8</b>	4.0
<b>HYDRO-FUNCTIONAL IMPORTANCE</b>	<b>1.8</b>	4.0
<b>DIRECT HUMAN BENEFITS</b>	<b>0.2</b>	5.0

## 5.5.5 Conservation Importance

All wetlands are considered to be of conservation importance. The wetlands on site can therefore be considered to be of high conservation importance.

## 5.6 Buffers

A buffer is an area of land (next to a sensitive feature or ecosystem) designated as such and used to 'dilute' impacts from adjacent developments and activities in order to protect or preserve the sensitive feature or ecosystem. The size of the buffer zone is determined by the extent and magnitude of the impact from the adjacent activities or development and the sensitivity of the feature to be protected. Different buffer zones have been proposed for the protection of wetlands and rivers in South Africa, mostly ranging between 30m and 100m.

The Gauteng Department of Agriculture and Rural Development (GDARD) require a 30m buffer around wetlands inside the urban edge. A 30m buffer is therefore applicable to the site (GDARD 2012).

## 6 Sensitivity and conservation importance

The sensitivity map of the site was compiled according to the following categories:

- a) **No-Go:** These areas are of such value that no development should take place in this system. This includes areas of primary vegetation, which is protected on a regional or national level as areas that is irreplaceable or areas that are incompatible with the proposed land use. Permanent and seasonal wetlands are included herein for the range of impacts expected by the proposed development.
- b) **High:** Good vegetation cover exists, with no severe impacts noted and little problem plant or weed species, for instance a low percentage of plants associated with overgrazing and / or mechanical disturbance, as well as a healthy looking A-horizon (which means good organic content). No or slight management intervention or land use is required to return vegetation to pristine condition. Vegetation that is a good representation of a threatened vegetation type is also included in this category, even if a few alien and invasive species are present. Temporary wetlands are included here for the range of impacts expected by the proposed development
- c) **Moderate:** Signs of overgrazing, some shift in species composition, some degree of soil degradation. Management Intervention is required, but may also recover if natural processes occur and the impact is removed.
- d) **Low:** Extensive soil erosion, plant cover dominated by noxious and / or grazing resistant species. Somewhat diverted climax plant communities. Will not recover without serious management intervention, if ever. This also includes areas with very low plant species diversity such as cultivated pastures.

Table 6. Sensitivity of the vegetation units on site.

Unit	Vegetation sensitivity	Wetland sensitivity	Combined
Transformed	Low	Low	Low
Grassland	Low	Low	Low
Pan	Low	High	High

## 7 Impacts and Recommendations

### 7.1 Site plan and design phase:

- No development may take place inside the watercourse areas or their buffer areas.
- The maximum level of water in the rehabilitated pan must be calculated and a 30m buffer applied around this area. This calculation must take future development around the pan into account.
- The watercourse area and its buffer zones must be incorporated into an open space system with an applicable management plan.
- The new development will above and beyond the above increase the hard surfaces and remove vegetation and habitat, with the corresponding surface flow changes, the resulting impact will be net negative.
- In order to mitigate the above impacts as far as possible, the following needs to be done:
  - Drainage from the hard surfaces must be diffuse and the outflows must be protected from erosion.
  - Impermeable surfaces should be minimised and permeable paving used wherever possible.
  - Energy dissipaters must be in place to lower the risk of erosion.

### 7.2 Stormwater:

- Stormwater generated as a result of the development may not be focused on a specific area and directly released into the watercourse on site. It has to flow off the property dispersed over a large area or the flow must be attenuated in another way, designed by the engineers, to not cause erosion at that specific location.
- A comprehensive stormwater management plan must be compiled, indicating the management of all surface runoff generated on site as a result of the development (construction and operational phases). The plan must include the sediment and erosion control structures, as well as the “end of pipe” practices that will be applied on site.
- The plan must indicate how the natural release and retention of surface runoff will be simulated to prevent degradation of the wetland. These measures must at least cater for the 2 year rainfall event, but preferably for the 10 year rainfall event. Larger events will be captured in the engineered drainage system.
- Special care must be taken during construction to ensure that sediment rich stormwater does not enter the wetland and riparian areas.

- Mechanisms must be in place during the construction and operational phases to prevent erosion and to dissipate water energy.
- Stormwater must be attenuated on site and the stormwater must be clean before it enters the natural system, including the pan adjacent to the site. Artificial wetlands can also be used to clean the stormwater. This will have to be incorporated into the stormwater design.
- Due to the disturbed nature of the pan and the activities on site, the pan can also be reinstated to deal with the stormwater, but will require a Water Use license.
- The soil is sandy and offers the potential for significant water storage, however if the vegetation is removed between the houses, the soil will soon cap and form a crust that will increase run-off beyond what will be predicted by the normal models' assumptions. It is important to ensure vegetation cover as widely as possible, to improve the potential water quality emanating from the site. Other options are focused ingress vegetated channels adjacent the roads following the contours. These bioswales will:
  - conduct water,
  - increase ingress in the soil,
  - use the water via the plants
  - Create the first step for bioremediation of the water emanating from the site.

### 7.3 Construction phase:

- No activity such as temporary housing and temporary ablution facilities may take place within the watercourse buffer areas.
- The no-go areas must be fenced and clearly indicated as such.
- Any spillages of hazardous materials must be cleaned immediately and reported.
- Erosion and sediment control measures must be in place at all times.

### 7.4 Pollution

- All effluent from the site must be disposed of in a sufficient municipal system or alternative system. If the municipal system is used, sufficient capacity must be available.
- Any oil leaks on the construction vehicles must be fixed as soon as possible. Drip trays must be available and used on site.
- All hazardous materials, including oil and fuel, must be stored in a bunded area and measures taken to ensure that the soil are not polluted.

### 7.5 Buffer zone:

- According to the guideline for biodiversity assessments (GDARD 2012) a 30 m buffer zone is required around all wetlands within the urban edge.
- No aspect of the development will be allowed to occur within the buffer zone, including parking, stormwater attenuation and temporary and permanent structures.
- We would advise that an application be made to reinstate this wetland to a constructed wetland dealing with stormwater and pollution, even though this will likely be objected to by the authorities.

## 7.6 Invasive species:

- Several species listed as alien invasive species are present on site.
- Under the Conservation of Agricultural Resources Act landowners are responsible for the invasive species on their properties.
- No invasive species may be present within 20m of a wetland and must be removed.
- Removal must take place in an appropriate manner, which includes:
  - Avoid disturbance to the soil.
  - Use only herbicides that are registered for use near water.
  - First clear alien vegetation that occurs singly, and then move on to gradually reduce the size of clumps of alien vegetation.
  - Do not clear all invasive species at once, since this will lead to large areas bare of vegetation and will lead to erosion and a large sediment load in the water. Aliens must be removed gradually over a long period and the trees replaced with indigenous trees.
  - Follow-up work maintenance of cleared areas will be needed, so include this in the landscape maintenance contractor's contract.
  - Do not damage any of the indigenous species on site.
- It is not a requirement that non-invasive alien species be removed.

## 8 Conclusion

The vegetation on site is mostly transformed and only a small portion of grassland is present on the south-western portion of the site. This grassland portion is also impacted upon by disturbances and signs of ploughing are present. A large pan is present adjacent to the site to the north. This pan is currently being mined but it is expected that the pan will be rehabilitated once mining is completed.

We are of the opinion that the condition of the pan and the surrounding catchment lends itself to the development of an intelligently designed constructed wetland as part of the stormwater system.

## References

Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza Publications, Pretoria.

Department of Agriculture and Rural Development. 2012. *GDARD Requirements for Biodiversity Assessments Version 2*. GDARD Directorate of Nature Conservation.

Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas.

Department of Water Affairs and Forestry. 2007. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Duthey et al. 1999. APPENDIX W4: IER (FLOODPLAIN WETLANDS) PRESENT ECOLOGICAL STATUS (PES) METHOD for Resource Directed Measures DWAF

Götze, A.R. 2008. Vegetation survey: Specialist vegetation diversity study on the Farm Middelwater 593 JQ, Portion 125 of the Farm Wildebeesthoek 310 JR and Portion 33 of the Farm Vissershoek 435 JQ, Rosslyn, Gauteng. Environment Research Consulting.

Mucina, L. & Rutherford, M.C. 2006. *Vegetation map of South Africa, Lesotho and Swaziland*. Strelitzia 19.

Pooley, E. 1998. *A field guide to wild flowers: KwaZulu-Natal and the Eastern Region*. Natal Flora Publications Trust.

Van Ginkel, C.E.; Glen, R.P.; Gordon-Gray, K.D.; Cilliers, C.J.; Muasya, M. & van Deventer, P.P. 2010. *Easy identification of some South African Wetland Plants*. Water Research Commission. TT479/10.

Van Oudtshoorn, F. *Guide to grasses of southern Africa*. Briza Publications. Pretoria.

Van Wyk, A.E. & Malan, S.J. *Veldgids tot die Veldblomme van die Witwatersrand- & Pretoria-gebied*. Struik Uitgewers. Kaapstad.



Addendum A – PES calculation for the wetland unit

## Addendum B – EIS calculation for the wetland

## Ecological Importance and Sensitivity

<b>ECOLOGICAL IMPORTANCE AND SENSITIVITY</b>	<b>Score (0-4)</b>	<b>Confidence (1-5)</b>	<b>Motivation</b>
<b>Biodiversity support</b>	<b>0.33</b>	3.67	
<i>Presence of Red Data species</i>	-	4.00	None were observed or are expected.
<i>Populations of unique species</i>	-	4.00	None were observed or are expected.
<i>Migration/breeding/feeding sites</i>	<b>1.00</b>	3.00	The site may occasionally be used as a feeding site.
<b>Landscape scale</b>	<b>0.80</b>	4.20	
<i>Protection status of the wetland</i>	-	5.00	The pan is being mined for gold at present.
<i>Protection status of the vegetation type</i>	<b>1.00</b>	4.00	The vegetation type of the pan is Least Threatened and the surrounding areas is Endangered. The area is however transformed and no natural vegetation persist.
<i>Regional context of the ecological integrity</i>	<b>1.00</b>	4.00	Wetlands in the area is fairly disturbed. The pan is being mined.
<i>Size and rarity of the wetland type/s present</i>	<b>1.00</b>	4.00	The pan is fairly large, but not not very rare.
<i>Diversity of habitat types</i>	<b>1.00</b>	4.00	The wetland is very weedy and with very little habitat diversity.
<b>Sensitivity of the wetland</b>	-	4.00	
<i>Sensitivity to changes in floods</i>	-	4.00	
<i>Sensitivity to changes in low flows/dry season</i>	-	4.00	
<i>Sensitivity to changes in water quality</i>	-	4.00	
<b>ECOLOGICAL IMPORTANCE &amp; SENSITIVITY</b>	<b>0.8</b>	4.0	

Hydro-functional Importance

HYDRO-FUNCTIONAL IMPORTANCE		Score (0-4)	Confidence (1-5)	
Regulating & supporting benefits	Flood attenuation	0	4	
	Streamflow regulation	0	4	
	Water Quality Enhancement	Sediment trapping	4	5
		Phosphate assimilation	3	4
		Nitrate assimilation	3	4
		Toxicant assimilation	3	4
		Erosion control	1	3
	Carbon storage	0	4	
<b>HYDRO-FUNCTIONAL IMPORTANCE</b>		<b>1.8</b>	<b>4.0</b>	

Direct Human Benefits

DIRECT HUMAN BENEFITS		Score (0-4)	Confidence (1-5)
Subsistence benefits	Water for human use	0	5
	Harvestable resources	0	4
	Cultivated foods	0	5
Cultural benefits	Cultural heritage	0	4
	Tourism and recreation	0	5
	Education and research	1	5
<b>DIRECT HUMAN BENEFITS</b>		<b>0.2</b>	<b>5.0</b>