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# **Strategic assessment of environmental issues and identification of environmentally sensitive areas in SDA 3, Polokwane Municipality**

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## TOPOGRAPHY

The Polokwane area form part of the Pietersburg Plateau or Plain and is situated to the south of the Soutpansberg and to the east of the Waterberg plateau. Structurally it is unlike either of the two Waterberg areas, for it is almost entirely a gneiss surface, similar in rock structure to the greater part of the Limpopo valley and the eastern Lowveld. It is separated from these areas, however, by the Waterberg features on the west and north and by the Great Escarpment on the east. It is thus essentially a region forming part of the great South African plateau, but it lies at a lower level than the adjacent highlands, and so can hardly be termed a plateau, as it is often called. The regional stratigraphy and geological structures are indicated on map 1.

The southern portion of the plain is highveld in nature and, largely on account of its higher rainfall and lower temperatures, is the best farming land of the plain. Even so, Polokwane has a rainfall of only about 478mm and the whole area suffers from its surface aspect, given by the down-slope to the north and west. This produces a rain-shadow effect, which condemns the greater part of the plain to a rainfall of less than 380mm. In the absence of rivers large enough to form important storage dams the plain is therefore suited for cultivation only in the southern portion, and even as pasture land the rest of the area is climatically handicapped.

The area covered by the proposed Strategic Development Area is traversed by numerous non-perennial streams and drainage lines ó see topographical map.

Parts of the area are also characterized by numerous sensitive areas like outcrops and wetland areas.

The highest point in the identified area occurs at an altitude of 1407 meters above sealevel. This area forms part of the sensitive outcrop areas surrounding the reservoirs.

## DRAINAGE

The study area is located in the Limpopo Catchment Management Area (CMA), and falls in Quaternary Catchment Area A71A.

The study area is drained mainly by means of surface run-off (sheetflow) with storm water from the area collecting along the tar roads. The landscape drains in a westerly direction towards the Sand River and its tributaries.

### *Regional stratigraphy*

According to the available geological information, the northern and eastern portions of the study area is underlain by leucocratic migmatite and gneiss, grey and pink hornblende- and biotite-rich gneiss, grey biotite-rich gneiss with minor muscovite-rich granite, pegmatite and gneiss, collectively known as the **Hout River Gneiss**. A localised pocket of talc-chlorite- and amphibolite-chlorite schist and amphibolite, known as the **Mothiba Formation** of the Pietersburg Group, Murchison Supergroup, occurs in isolated areas of the study area. The area is generally soil-covered, deemed to represent hillwash.

The banded character of the gneiss leads to a variable weathering profile, where less weathered, moderately hard core-stones or bands may occur within a soil-like material. Quartz-rich zones will also undergo less weathering than its mica-rich counterpart. The orientation of these bands (i.e.: vertical or horizontal) may also lead to the occurrence of deeply weathered zones within generally less weathered material.

The landtype map illustrates the regional geological setting of the study area.

## ***Geological structures***

The available geological information indicates the presence of several roughly northeast-southwestwardly striking **dolerite dyke** intrusions throughout the area in which the site is located (Figure 2). These dykes may be visible at surface as thin, roughly linear, discontinuous bands of rounded dolerite boulders.

An east-west trending, discontinuous linear feature deemed to represent a **shear zone** along which crustal displacement has taken place occurs to the south of the site. It is possible that this feature may have altered the rock material underlying the study area to a degree (e.g.: re-melting and re-crystallization of the strata, deformation of the rock layers, etc.).

## ***Regional Geohydrology Potential***

The following aquifers systems are defined within the study area, and are deemed significant during the assessment of the groundwater resources in the area.

The gneiss formation generally defines a **low groundwater potential**, with higher local potential developed in specific target areas. This local higher groundwater potential is associated with regional geological structures and associated deeper weathering. Typical borehole yields are as low as 0.2L/sec but well sited boreholes may yield up to 1.5L/sec on a 24 hour pumping cycle.

The geological contact between the **Hout River Gneiss** and the **Mothiba Formation** may present a suitable target for groundwater development. The formations individually exhibit a low groundwater potential however, along the contact boreholes with yield in the order of 0.5L/sec over a 24 hour period may be developed.

It should be noted that a number of **migmatite** samples were identified and collected on the site. These indicate a very **high degree of metamorphism**, possibly associated to the regional shear zone identified in the area. The high degree of metamorphism has an inverse relationship on the groundwater potential, thus the area is deemed to exhibit a **low potential** for the development of boreholes in excess of 0.2L/sec (15m<sup>3</sup>/day).

**No pegmatite**, associated with an increased groundwater potential in the gneiss was found during the site visit. Thus the primary target will be restricted to the geological contact zones and the associated weathering.

## ***CLIMATE***

The study area falls within rainfall zone A7A, with an annual precipitation of 475 mm. The main rainfall period is between November and March, with occasional showers during the winter months. The mean annual evaporation for the area is in the order of 1 919 mm per year. Mean annual temperatures for January are approximately 28 °C and those in July 17°C.

The Polokwane area climate can be summarised as follows (LSoER, 2004):

**Table 1 Average temperature, humidity and rainfall for Polokwane**

Year	Average annual temperature (°C)	Average annual humidity (%)	Average annual rainfall (mm)
1993	18,6	58,6	356,3
1994	17,7	55,6	381,6
1995	18,3	62,1	678,0
1996	17,5	70,7	869,4
1997	17,8	69,5	584,8
1998	18,4	62,3	438,2
1999	17,7	64,3	368,8
2000	17,0	69,4	637,4
2001	17,5	66,9	480,6
2002	18,3	60,0	254,6
2003	18,1	57,1	151,8

A massive variance between 151 and 869 mm per annum was experienced during the last 10 years. This indicates that certain practices like dry land farming are not advisable in the area. The recent droughts over the past few years also indicated that a water shortage is a very real factor during dry cycles and contingency plans are needed to curb this challenge. Irrigation of crops, gardens and sport fields should be carefully planned and sustainable yields of water resources determined to ensure that water resources are not over exploited.

**Table 2 Average Climate and Rainfall for Polokwane**

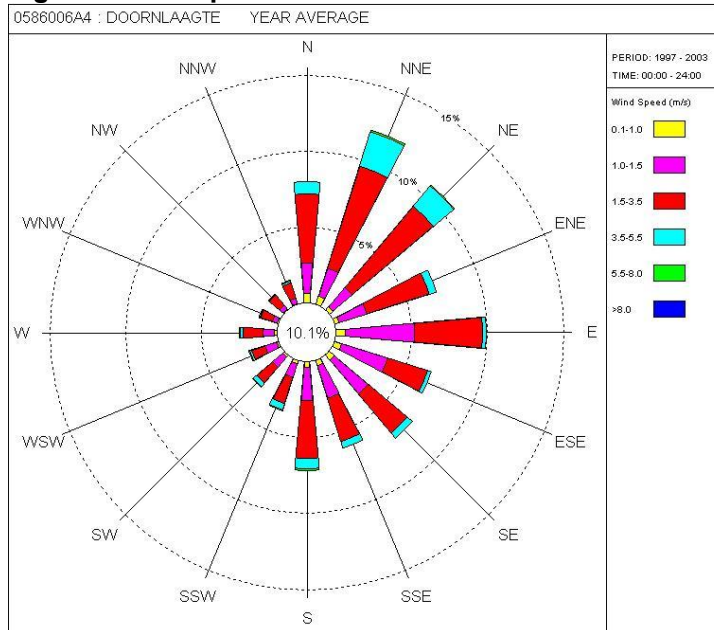
Position: 23° 52' S 29° 27' E							
Height: 1230m							
Period: 1961-1990							
Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	36	28	17	10	82	10	79
February	36	28	17	11	60	8	61
March	34	27	15	8	52	8	57
April	34	24	12	4	33	6	57
May	32	22	8	1	11	2	39
June	27	20	5	-4	5	1	26
Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
August	32	22	7	-1	6	1	37
September	34	25	10	0	17	2	39
October	37	26	13	5	43	7	55
November	36	27	15	7	85	10	53
December	35	27	16	9	81	11	74
Year	37	25	12	-4	478	65	79

The temperatures are very mild and stable with a minimum variance between maximum and minimum making Polokwane an ideal living place with regard to temperature.

Severe storms and heavy downpours occur during the summer months as indicated by the 79 and 74 mm maximum in 24 hours respectively measured in January and December. Flooding and erosion are therefore severe threats and proper planning is needed to ensure that no development is placed within the 1:100 year flood line, storm water management is planned and managed correctly and the erosion hazard is properly addressed in areas where soils are more susceptible to erosion.

According to Midgely, 1994, the evaporation rate is 1700 - 1800mm per annum. This is above average and is an indication that croplands, gardens and sport fields will need a lot of water if irrigated.

**Figure 1 Wind pattern for Polokwane**



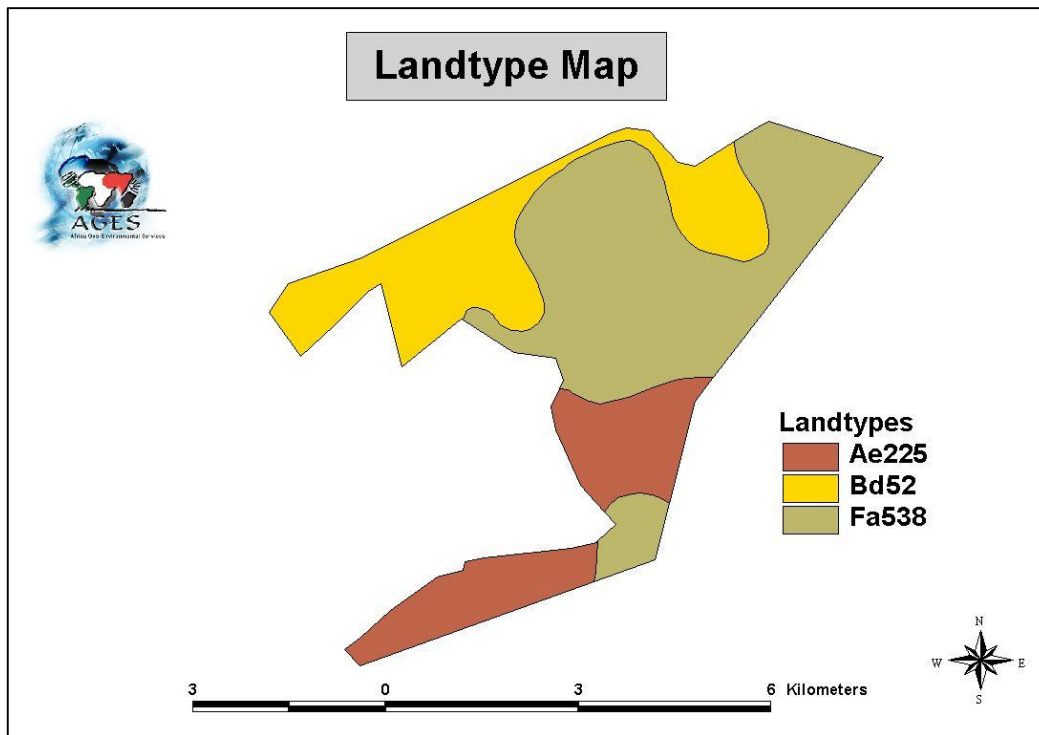
The wind pattern indicates that any development that causes air pollution or odours should be positioned on the northwestern, western or southwestern side of the city to reduce the impact on the densely populated areas.

**Landtypes, Geology & Soils**

The landtype, soil and geological formation of the area as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000) are presented in Table 1. However, it must be noted that soil types are mostly determined by position on the landscape. A landtype map indicates the location of the landtypes in the area.

**Table 1. Landtypes, soils and geology of the area**

Landtype	Soils	Geology
Ae225	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Biotite granite-gneiss, migmatite, pegmatite, lava and pyroclasts
Bd52	Plinthic catena: eutrophic; red soils not widespread, upland duplex and marginalitic soils rare	Leucocratic migmatite and gneiss, grey and pink hornblende-biotite gneiss, grey biotite gneiss; minor muscovite - bearing granite, pegmatite and gneiss of the Hout River Gneiss
Fa538	Glenrosa and/or Mispah forms (other soils may occur), lime rare or absent in the entire landscape	Leucocratic migmatite and gneiss, grey and pink hornblende-biotite gneiss, grey biotite gneiss; minor muscovite-bearing granite, pegmatite and gneiss of the Mount River Gneiss. Grey and pink biotite granite of the Turfloop Granite



**Table 2. Summary of soils within landtypes**

SOIL CLASSES	SOIL TYPES	SOIL SERIES	DEPTH (m - m)	ADVERSE CHARACTERISTICS	HILL CRESTS	UPPER SIDE SLOPES	SIDE SLOPES	FOOT SLOPES	VALLEY FLOORS
<b>LAND TYPE Ae225</b>									
<b>SANDY APEDAL SOILS:</b>	Hutton	26, 36	0.40 - 1.20	Relatively high permeability			70	40	15
	Hutton	27, 37	0.60 - 1.20	Potentially compressible and/or collapsible topsoil			10	45	15
							<b>80</b>	<b>85</b>	<b>30</b>
<b>CLAYEY SOILS:</b>	Shortlands	21	0.60 - 1.20	Expansive			10	5	7
	Rensburg / Katspruit	20 / 10	0.65 - 1.20						15
	Valsrivier	31, 41	0.80 - 1.20					5	8
	Valsrivier	30	0.90 - 1.00						4
							<b>10</b>	<b>10</b>	<b>34</b>
<b>SHALLOW, ROCKY SOILS:</b>	Glenrosa	16	0.10 - 0.25	Soil-rock mixture at shallow depth			10		
							<b>10</b>		
<b>UNCONSOLIDATED SOILS</b>	Oakleaf	26, 36, 46	0.90 - 1.20	Potentially compressible and/or collapsible topsoil				5	15
	Dundee	10	0.60 - 1.20						12
	Inhoek	11	0.90 - 1.20						4
								<b>5</b>	<b>31</b>



SOIL CLASSES	SOIL TYPES	SOIL SERIES	DEPTH (m - m)	ADVERSE CHARACTERISTICS	HILL CRESTS	UPPER SIDE SLOPES	SIDE SLOPES	FOOT SLOPES	VALLEY FLOORS
<b>LAND TYPE Bd52</b>									
BEDROCK OUTCROP:	-	-	-	Excavatability problems	10			3	1
SANDY APEDAL SOILS:	Hutton	26, 36	0.30 - 1.00	Relatively high permeability	15			15	5
	Clovelly	26, 36	0.40 - 0.70		5			15	35
					20			30	40
FERRUGINIZED SOILS:	Avalon / Bainsvlei	26, 36 / 36	0.30 - 1.00	Seasonal perched water tables				10	30
				Excavatability problems					
								10	30
SHALLOW, ROCKY SOILS:	Glenrosa	14, 15, 17	0.10 - 0.40	Soil-rock mixture at shallow depth	15			15	4
	Mispah	10	0.10 - 0.20	Shallow bedrock	50			27	
					65			42	4
UNCONSOLIDATED SOILS:	Oakleaf	16, 36, 46	0.60 - 1.20	Potentially compressible and/or collapsible topsoil				5	15
								5	15
OTHER:	Cartref / Griffen / Valsrivier / Westleigh		0.10 - 0.70	-	5			5	5
					5			5	5
<b>LAND TYPE Fa538</b>									
BEDROCK OUTCROP:	-	-	-	Excavatability problems	40	90	10	3	1

SOIL CLASSES	SOIL TYPES	SOIL SERIES	DEPTH (m - m)	ADVERSE CHARACTERISTICS	HILL CRESTS	UPPER SIDE SLOPES	SIDE SLOPES	FOOT SLOPES	VALLEY FLOORS
SANDY APEDAL SOILS:	Hutton	36	0.30 - 0.90	Relatively high permeability	15	3	46	27	6
	Hutton / Clovelly	33 / 33	0.20 - 0.50				6	8	
	Hutton / Clovelly	34 / 34	0.50 - 0.80				7	8	14
	Clovelly	36	0.40 - 1.20				3	14	6
					15	3	62	57	26
FERRUGINIZED SOILS:	Avalon / Pinedene	36 / 36	0.80 - 1.20	Seasonal perched water tables				12	27
	Bainsvlei	36	0.50 - 0.80	Excavatability problems				4	6
								16	33
SHALLOW, ROCKY SOILS:	Mispah	10	0.10 - 0.30	Soil-rock mixture at shallow depth	30	5	11	4	
	Glenrosa	14, 17	0.20 - 0.50		15	2	7	2	
	Cartref	11	0.60 - 0.80	Shallow bedrock				4	5
					45	7	18	10	5
CLAYEY SOILS:	Shortlands	10	0.80 - 1.20	Expansive			10	5	
							10	5	
UNCONSOLIDATED SOILS:	Oakleaf	16, 36	0.70 - 1.20	Potentially compressible and/or collapsible topsoil				9	35
								9	35

## Flora

### Vegetation Types

The site is situated within the Pietersburg Plateau False Grassveld as described by Acocks (1988) and consists of open, clumpy Sourish Mixed Bushveld dominated by *Acacia rehmanniana* and *Acacia tortilis* on Turfloop Granite. The terrain morphology is slightly undulating plains. Bredenkamp & Van Rooyen in Low & Rebelo (1996) described the vegetation of the area further as Mixed Bushveld, the common vegetation of the Central Bushveld Region. The most recent classification according to Mucina *et al.* (2005), show the vegetation of the site to be part of the Polokwane Plateau Bushveld. This vegetation type occurs on moderately undulating plains with short open tree layer with a well developed grass layer to grass plains with occasional trees at higher altitudes. Hills and low mountains of the Mamabolo Mountain Bushveld are embedded within this unit.

### State of the vegetation

The vegetation of the site varies from natural to slightly degraded. The more natural areas include open plateau bushveld with bushclumps and outcrops, while the more degraded areas include old fields and drainage channels. The more natural areas can either be classified as moderate or highly sensitive areas as discussed in the later sections. The degraded areas can be clearly identified by the presence of various exotic weeds and pioneer grass species in the herbaceous layer, while the woody layer is characterized by the encroachment by species such as sickle bush and umbrella thorn and the invasion by exotic species such as *Melia azedarach*, prickly pear and queen-of-the-night. Some areas of littering and dumping of building rubble and garden refuse were also observed. The degraded areas have a low sensitivity where unlimited development can be supported.

### Biogeographically important taxa (Central bushveld endemics)

Graminoid: *Mosdenia leptostachys*

Herb: *Oxygonum dregeanum*

Geophytic herb: *Ledebouria crispa*

### Red data plant species

The following plant species of concern occur in the area and should be monitored over the longer term.

Species	Conservation Status	Habitat
<i>Euphorbia clivicola</i>	Critically endangered	Rocky outcrops (warm slopes)
<i>Euphorbia groenwaldi</i>	Endangered	Rocky outcrops (warm slopes)
<i>Lythops lesliae</i>	Least Concern	Rocky areas (Polokwane game reserve)
<i>Ceropegiae stentiae</i>	Vulnerable	Drainage areas & floodplains
<i>Ledebouria crispa</i>	Vulnerable	

A buffer zone should be kept from these species' habitat. Habitats of the *Euphorbia* species are around the outcrops near the reservoirs.

## Protected Tree Species

### Scientific Name

*Combretum imberbe*

*Elaeodendron transvaalensis*

*Sclerocarya birrea*

These tree species cannot be eradicated without a permit obtained from DWAF.

## Dominant Plant Communities

### 1. Open Umbrella thorn – red spike thorn - *Aloe* woodland with bushclumps

<b>Status:</b> Semi-disturbed woodland
<b>Need for rehabilitation</b> Low
<b>Conservation Priority:</b> Medium - Low



<b>Soil</b>	Varies between shallow to medium depth red-yellow sandy loam soils (Hutton / Glenrosah soils)	<b>Rockiness</b>	2 - 5%
<b>Dominant spp.</b>	<i>Acacia tortilis</i> , <i>Gymnosporia senegalensis</i> , <i>Themeda triandra</i> , <i>Aloe marlothii</i> , <i>Aloe davyana</i>		

### 2. Open Umbrella thorn – sickle bush plains

<b>Status:</b> Degraded woodland
<b>Need for rehabilitation</b> Low
<b>Conservation Priority:</b> Low



<b>Soil</b>	Red-Yellow sandy loam soils	<b>Rockiness</b>	<1%
<b>Dominant spp.</b>	<i>Acacia tortilis, Dichrostachys cinerea, Themeda triandra, Aristida</i>		

### 3. Drainage Channel & Floodplains

<b>Status:</b> Degraded grassland and open woodland
<b>Need for rehabilitation</b> High
<b>Conservation Priority:</b> Medium



<b>Soil</b>	High clay content, red apedal soils on floodplains, and black clayey soils in drainage channel	<b>Rockiness</b>	<1%
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<b>Dominant spp.</b>	<i>Hyparrhenia hirta, Rhus lancea, Acacia hebeclada, Paspalum urvillei, Typha capensis</i>
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### 4. Old Fields

<b>Status:</b> Disturbed open grasslands
<b>Need for rehabilitation</b> Low
<b>Conservation Priority:</b> Low



<b>Soil</b>	Red-yellow apedal soils	<b>Rockiness</b>	<1%
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<b>Dominant spp.</b>	<i>Hyparrhenia hirta, Aristida spp, exotic weeds</i>
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**5. *Acacia caffra* – *Gymnosporia buxifolia* open woodland (footslopes of outcrops)**

<b>Status:</b> Natural, open woodland
<b>Need for rehabilitation</b> Medium
<b>Conservation Priority:</b> Medium - Low



<b>Soil</b>	Shallow gravelly soils derived from Turfloop Granite / Gneiss (Glenrosah form)	<b>Rockiness</b>	5-10%
<b>Dominant spp.</b>	<i>Gymnosporia buxifolia</i> , <i>Ormocarpum trichocarpum</i> , <i>Acacia caffra</i> , <i>Themeda triandra</i>		

**6. *Aloe marlothii* – *Pappea capensis* Outcrop Areas**

<b>Status:</b> Rocky outcrop - broadleaf woodland
<b>Need for rehabilitation</b> Medium
<b>Conservation Priority:</b> High



<b>Soil</b>	Shallow rocky soils (Mispah, Glenrosa)	<b>Rockiness</b>	20 to 40%
<b>Dominant spp.</b>	<i>Aloe marlothii</i> , <i>Ormocarpum trichocarpum</i> , <i>Pappea capensis</i> , <i>Cassine aethiopicum</i>		

## Fauna

### Birds

The 3200 ha Pietersburg Nature Reserve is home to well over 200 species and it is possible to see over 70 species on a visit. The uniqueness of this reserve is the endemic Short-clawed Lark.

### Birding

The Short-clawed Lark is usually found in the grassland around "Aloe Ridge", and at the crossroads near the Warthog picnic site.

One of the most prominent features of the reserve is an "Aloe forest" on a small koppie. This area is particularly rewarding for birds such as Southern Black Tit, Ashy Tit, Acacia Pied Barbet, Black-collared Barbet, Crested Barbet, Marico Flycatcher, Coqui Francolin, Natal Francolin, Marico Sunbird, Barred Wren-Warbler and Crimson-breasted Shrike are all common here.

The open grassland areas to the south support Northern Black Korhaan, a resident pair of Secretarybird, Short-clawed Lark and Rufous-naped Lark, Anteating Chat, Lilac-breasted Roller as well as Desert Cisticola and Zitting Cisticola.

The acacia woodland is good for the various cuckoos in summer, Burnt-necked Eremomela, Long-billed Crombec, Magpie Shrike, Brubru, Red-backed Shrike, various barbet species, Golden-tailed Woodpecker, Cardinal Woodpecker, Violet-eared Waxbill and Black-faced Waxbill. The picnic site is excellent for White-browed Sparrow-Weaver, Red-throated Wryneck, Lesser Honeyguide, Scaly-feathered Finch, Black-headed Oriole, Arrow-marked Babbler and Kalahari Scrub-Robin.

Raptors and Accipiters are well represented with Verreaux's Eagle (near the picnic site), Black-chested Snake-Eagle, Booted Eagle, Wahlberg's Eagle, Shikra and Cape Vulture are all frequently reported.

A recent newcomer to the reserve is the Red-billed Oxpecker. This species has avoided the Pietersburg Plateau in the past and only occurred there as a vagrant. However, they appear to be doing well and all game, particularly giraffe and zebra, should be scanned for this species.

The following list of red data species can potentially occur in the area as listed in the table below.

**Table 1. List of red data birds that could occur in the study area**

Bird Species	Status	Probability of occurrence in general area
BALD IBIS	Vulnerable	Low
SECRETARYBIRD	Near threatened	Low
CAPE VULTURE	Vulnerable	Low
MARTIAL EAGLE	Vulnerable	Medium
LESSER KESTREL	Vulnerable	Low
WHITEBELLIED KORHAAN	Vulnerable	Medium
SHORTCLAWED LARK	Near threatened	Medium

A total of 7 bird species are listed in the red data book of South African Birds. The following is proposed considering the conservation management of bird species, their habitat and feeding grounds:

The probability that any of the red data bird species occur in the area is very low as a result of the following:

- Marginal habitat requirements observed on site
- Degraded state of the vegetation in general
- Human disturbances in the general area of the proposed development area

## **Mammals**

The following list of rare species can occur according to Friedman & Daly (2004), in the study area.

**Table 2. List of red data mammals that could occur in the study area**

Scientific name	Vernacular name	Probability of occurrence	Status
<i>Atelerix frontalis</i>	South African Hedgehog	Low	Near threatened
<i>Hyaena brunnea</i>	Brown hyena	Low	Near threatened
<i>Leptailurus serval</i>	Serval	Low	Near threatened
<i>Mellivora capensis</i>	Honey badger	Low	Near threatened
<i>Myotis tricolor</i>	Temminck's Hairy bat	Low	Near threatened

- Although species might occur in the area according to their distribution range as indicated in the Red Data Book of the Mammals of South Africa (Friedman & Daly, 2004), species were only included if observed; or if the habitat was considered suitable according to the species' habitat preference
- Mammal species classified as being 'near threatened' have a low to very low probability of occurring in the area due to the close proximity to rural areas and anthropogenic influences in the area. The species classified as 'least concern' have a wide distribution range and monitoring over the long term is needed to prevent habitat fragmentation.

## **Herpetofauna**

The only species listed in the IUCN red data categories is the South African python and giant bullfrog, while the black file snake and cape file snake is listed as protected species under the Limpopo Environmental Act. The close proximity to the residential areas makes the probability of the snake species occurring in the area low. The structure of this vegetation type is between open woodland and true grassveld. A low diversity of amphibians could occur on the site as a result of little or no breeding habitat occurring. However, the conservation of bullfrog habitat should receive high priority.



## **SENSITIVE AREAS**

"Ecological sensitivity" refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. Any area for which a sensitivity analysis is performed can be divided into two main zones namely:

- Natural habitats
- Modified habitats

Natural habitats are still in its natural state, and the degree of influence either by humans or animals are minimal. Modified habitats are habitats that have been significantly altered either by humans or animals. The natural or modified state is evaluated by a quick analysis of the following:

- Previous land use (old cultivated fields or ploughed lands)
- State of habitat (vegetation; water resources; soil surface; disturbance)

Ecological importance and sensitivity assessment of a development is done thereafter using the following criteria for each specific vegetation type identified in the previous section:

- plant species
  - Rare and endangered species
  - Protected species
  - Indigenous species contributing to the immediate aesthetic value of sites
- Soil and geology
  - erodability
  - rockiness
  - sensitive rock types (e.g. chist etc)
  - agricultural potential of soils
- Topography
  - Slope
  - Potential visual impact to neighboring properties
- Water resources (Wetlands, drainage channels, seepings, floodplains and river systems)
  - Floodlines
  - Sensitive habitats

Each of the criteria is analyzed according to the development type and the potential impact the development will have on the specific vegetation type over the longer term.

- High sensitivity areas (High Impact Zone) - Conservation priority areas are identified according to the following criteria and no development can be supported in these areas
  - 50 ó 100 year floodlines and sensitive catchment areas
  - Rare and endangered species habitats
  - Rocky slopes
- Moderate sensitivity (High impact zone) ó Specific mitigation measures needed for development as follows:

- Erosion prevention during road construction or construction of residences/ other buildings
  - Large trees / protected species should be preserved as part of the development. This includes the natural woodland areas.
  - Many exotic species should be eradicated
  - Use of a professional landscape designer to show the areas where the development will have the least impact
- Low Sensitivity (Low impact zone). The development won't have any significant impact on the natural environment. These areas are not as sensitive and can be divided into two specific areas according to the following:
    - Disturbed areas which have been significantly modified for example old cultivated fields, encroached areas. No limitations exist in these areas and the development can be supported

## **High sensitivity environmental areas**

High sensitivity areas are NOT necessarily 'no-go' development zones due to a combination of factors that were identified during the analysis and mapping of the specific classes. Subsequently areas other than the red data species habitat will be available for development but only after the actions described in the matrix are strictly followed for the specific environmental sensitivity class.

Areas with a high sensitivity inside development nodes where a definite policy regarding development zones have been adapted can be developed provided that the actions stipulated inside the matrix are followed. Areas included in Polokwane SDA 3 include the outcrop areas, drainage channels (including potential breeding habitats for the giant bullfrog)

## **Moderate sensitivity environmental areas**

Moderate sensitivity should be preferred areas for development compared to high sensitivity areas inside nodes. The actions described in the matrix should however be strictly followed. High density developments can be supported in moderately sensitive areas, although provision should be made for the following:

- Public open spaces or parks should be created to enhance the aesthetical value of areas. Such areas include natural indigenous woodland, drainage areas, wetlands or outcrops
- Indigenous tree species in the area should be preserved as part of the gardens of the residences, and indigenous trees and plants should be used for landscaping.

## **Low sensitivity environmental areas**

These areas should be considered as preferred development areas inside the SDA3 area compared to moderate / high sensitivity classes. Unlimited development can be supported in the area. These areas have often been extensively degraded by dumping of building rubble, garden refuse and litter. These areas need to be identified and rehabilitated.

## **Matrix for sensitivity classes**

The different sensitivity classes referred to above plays an important role in determining whether specific areas will be more or less suitable for sustainable development. A matrix was therefore created to act as a facilitator in the development process. Specific reference was made for developers, consultants and other role-players in the development process to follow specific guidelines. Furthermore, management principles also need to be implemented to ensure that the development is sustainable in terms of the natural environment. These guidelines and management principles are presented in the matrix below:

**Table: Matrix of guidelines indicating the environmental sensitivity classes**

Sensitivity Classes	Management Principles for Development in different Sensitivity Classes	Guidelines for Sensitivity Classes
<p><b>High Sensitivity</b></p>	<ul style="list-style-type: none"> <li>• Perennial rivers and main non-perennial streams               <ul style="list-style-type: none"> <li>○ No clearance of riparian vegetation should be allowed within the demarcated 40 m each side of the river or stream or existing riparian vegetation line.</li> <li>○ No development should be allowed within the 1:100 year flood line.</li> <li>○ An impact assessment needs to be conducted prior to the construction of any new weirs or dams.</li> <li>○ No exotic vegetation should be planted and the encroachment of exotic vegetation must be prevented and existing exotic plants should be eradicated.</li> <li>○ Erosion should be prevented and existing erosion should be monitored and controlled.</li> </ul> </li>   <li>• Hills and koppies               <ul style="list-style-type: none"> <li>○ Development within the demarcated areas should be minimized and restricted to environmentally friendly development. The impacts of any proposed development should be assessed prior to construction and mitigation measures must be adopted.</li> <li>○ Occurrence of sensitive, rare and endangered plant and animal species should be determined and alternatives or mitigation measures to prevent any damage to them adopted.</li> <li>○ No exotic vegetation should be planted and the encroachment of exotic vegetation must be prevented.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Detailed ecological surveys (including a flora and fauna survey and river health analysis by a specialist) by a registered qualified specialist on all aspects of the natural environment. The survey should preferably be conducted under summer survey conditions, although it depends on the general state of the site. Any red data species observed on site should be mapped and buffer zones should be provided to mitigate deleterious edge effects. Protected tree species should be preserved. Long-Term Monitoring programme should be implemented on site in such a case.</li> <li>• An independent, suitably qualified individual must act as environmental control officer and do a site visit.</li> <li>• Maps to be included in the report should be as follows:               <ul style="list-style-type: none"> <li>• Vegetation Map</li> <li>• Sensitivity Map (including a description of sensitivity mapping rules)</li> <li>• Buffer zone map for red data species</li> <li>• Photographic guide of the site and vegetation characteristics</li> </ul> </li> </ul>

Sensitivity Classes	Management Principles for Development in different Sensitivity Classes	Guidelines for Sensitivity Classes
<b>Moderate Sensitivity</b>	<ul style="list-style-type: none"> <li>• Areas with natural vegetation and minimum modification               <ul style="list-style-type: none"> <li>○ Development within the demarcated areas should be restricted to environmentally compatible development. The impacts of any proposed development should be assessed prior to construction and mitigation measures must be adopted.</li> <li>○ The clearing of these areas for large-scale residential development, monoculture crops, mining or commercial developments should be prevented.</li> <li>○ No exotic vegetation should be planted and the encroachment of exotic vegetation must be prevented.</li> </ul> </li> <li>• Areas sensitive for erosion               <ul style="list-style-type: none"> <li>○ These soils are sensitive for erosion and mitigation measures to prevent erosion are need for any new development. Rehabilitation and stabilization of existing erosion also need to be addressed.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• A <b>site visit</b> by a qualified botanist (at least BSc (hons) in plant ecology or botany) and preferably a qualified environmental officer which would indicate the following:               <ul style="list-style-type: none"> <li>• Photographs of the site and its related vegetation communities</li> <li>• A plant species list indicating the degraded state of the vegetation (indicator species)</li> <li>• A vegetation map of the site, if any natural vegetation is found on the site, a full survey of the area should be conducted. Such an area should receive high priority as a public open space.</li> <li>• Rehabilitation plan for the site, would it be deemed necessary, after site inspection.</li> <li>• If any protected plant species occur on site, such as marula, they should be preserved, while all exotics should be eradicated.</li> <li>• Floodline determination of drainage areas, with mitigation measures</li> </ul> </li> </ul>
<b>Low Sensitivity</b>	<ul style="list-style-type: none"> <li>• Areas that have been completely modified or modified to such an extent that it would probably never return to its original state. Areas include encroached areas, old cultivated fields, quarries etc.</li> </ul>	Unlimited development can be supported provided that an officer from Department of environmental affairs does a site visit with the consultant.

## **SENSITIVE AREAS OF PARTICULAR IMPORTANCE IN POLOKWANE SDA 3 AREA**

Specific areas of importance occur within the area as a result of specific value these features bring to the general area. Ecological aspects, uniqueness, recreational and aesthetical value are all factors contributing to the specific features being of recreational value to the area. To promote such areas would not only benefit and promote Polokwane within the Limpopo Province as a tourist attraction, but will most definitely create conservation areas of benefit to the fauna and flora of the area. Such areas in the Polokwane SDA3 area include the rocky outcrops, major drainage areas and natural Polokwane Plateau Bushveld areas.

### ***Outcrops***

The outcrops unit should be considered the most sensitive ecological unit in the Polokwane SDA3 area. The northern slopes of the outcrop areas is the habitat of the red data species *Euphorbia clivicola* and should be incorporated as part of a proposed Botanical Reserve (discussed under Management & recommendations). The dominance of the mountain aloes in the area contribute to the uniqueness and conservation priority of this vegetation unit. The vegetation is typical of the outcrops in the area, although unique in terms of vegetation. The outcrops also form part of the major corridors for fauna and flora discussed earlier. However, even though the area is sensitive, several areas occur where littering and rubble dumping still occurs. The area is further a refuge for criminals, while the activity of quad bikes, motorbikes and 4-wheel drive vehicles on the terrain over weekends have caused substantial degradation of the area in certain areas. This emphasizes the importance to conserve the area and allow only controlled access for tourists and local residents.

### **Management recommendations regarding Botanical Reserve Area**

As stated earlier it is proposed that the outcrop areas be proclaimed as a botanical reserve to ensure that the red data species *Euphorbia clivicola* are conserved. The following conservation management principles should be followed:

- The proposed area of the botanical reserve should be fenced off to prevent any peripheral impacts during construction in the surrounding areas on the sensitive outcrops. The area for the proposed reserve and buffer zone from the base of the outcrops are indicated in figure below.
- The proposed area should be fenced all along the current roads as indicated on the figure below. Only isolated areas occur where the fence will impact on natural veld. A firebreak should be made on the inside of the fence where roads are absent to ensure that fires are kept out of the area.
- A long-term monitoring programme for the red data species, aloes and other aspects on and around the outcrops should be implemented to ensure the area stays in a natural state.

- Rehabilitation of the area should be done in the following ways:
  - Clearing up of areas where littering, rubble and garden refuse dumping occur at present.
  - Roads on the fence periphery should serve as firebreaks and should be properly scraped to prevent fires.
  - The exotic species like prickly pear should be eradicated.
  - Encroachers should be cleared.
  - No access to the site should be allowed for a period of time to allow for proper management principles and monitoring programmes to be established. Thereafter controlled access to the area can be allowed.
  - The populations of the following species should be documented to ensure their survival:
    - *Euphorbia clivicola* (red data species)
    - *Aloe marlothii* (unique population)
    - *Eleadendron transvaalense* (protected tree species)

### **Corridors – Natural Drainage Channels and vegetation**

In the development of a large town planning scheme where future residential and town development will destroy or modify most of the natural habitat for plants and animals it is important to link the conservation and sensitive areas with natural corridors to ensure a network of natural vegetation to provide for the movement of animals between these areas. Proposed corridors are indicated on the sensitivity and corridor map to link the existing Polokwane Game Reserve with most of the other identified sensitive areas to provide for the movement of birds, small mammals and herpetofauna. Other conservation areas of importance in the general area include the bird sanctuary and Kuschke Nature Reserve.

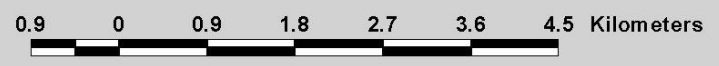
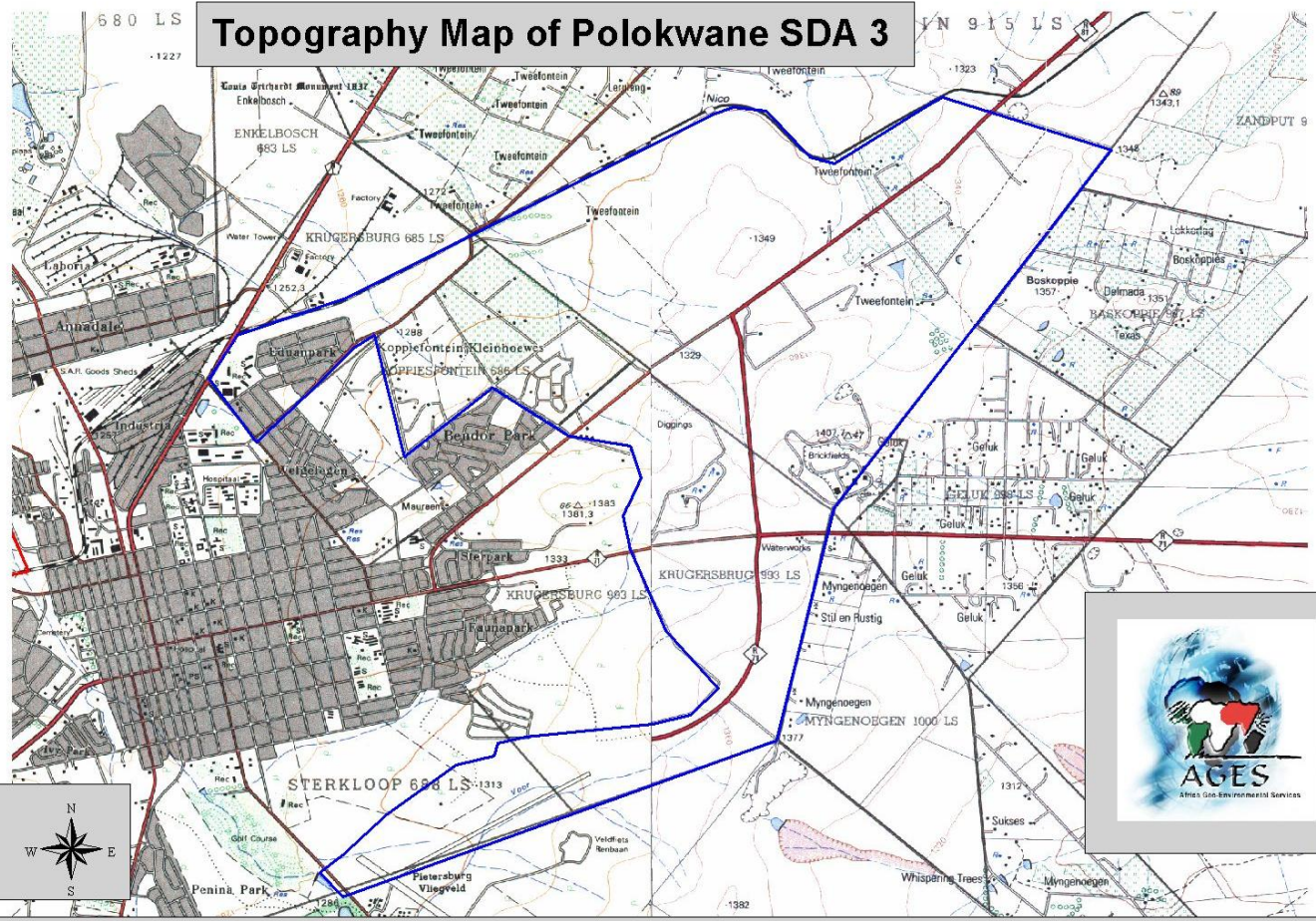
These corridors will traverse fences, roads and existing developments. Most of the corridors are proposed as part of rivers or drainage lines that should be protected to maintain the drainage system and ecological integrity of the area. The idea is not to preserve these areas as no-go areas for development but certain compatible developments can be allowed outside the river and drainage line buffers in these corridors as long as corridors of natural vegetation remains to provide food and shelter and barriers for smaller animals are minimized. The width of the corridors will vary but should be  $\pm 300$  m.

Areas in the Polokwane SDA3 area of particular importance as corridors include the following:

- Sensitive wetland and drainage areas where the rare and endangered giant bullfrog occur (see corridor map)
- Natural woodland areas considered to be pristine Polokwane Plateau Bushveld. The importance to conserve these areas as corridors cannot be underestimated, especially considering the degraded and modified state of this unique vegetation type. Areas of particular importance are indicated on the aerial photograph.

These corridors can also be exploited as tourism hiking trails as indicated on the map photograph below. No development should occur in the zone of the corridors and surroundings, especially in limited development zones such as the area around the airfield in the southern section of the site.

# Topography Map of Polokwane SDA 3



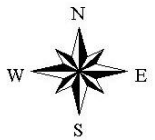
 Polokwane SDA 1  
 SDA 3



## Vegetation Map of Polokwane SDA3



1 0 1 2 Kilometers



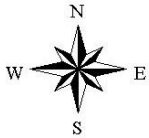
### Vegetation

-  Drainage Channels - Floodlines
-  Indigenous Woodland / False plateau Grassveld
-  Modified Land / Brick Factory
-  Old Fields / Degraded Bushveld
-  Outcrops - Broadleaf woodland

# Sensitivity Map of Polokwane SDA3



1 0 1 2 Kilometers



- Sensitivity**
- High Sensitivity - Corridors / Green belts
  - Low Sensitivity - Modified / Degraded Land
  - Moderate Sensitivity - Mititgation Measures Needed

