6 BIOPHYSICAL BASELINE

6.1 PHYSICAL BASELINE

6.1.1 Landscape and Site Setting

The proposed site is located in the area of Daleside, which according to the Midvaal Spatial Development Framework (2013/2014) is an area identified to be a part of the R59 industrial and commercial corridor. The R59 highway is located 600m to the west of the proposed site which is bordered by residential, commercial and industrial properties including Pendale Agricultural Holdings which is situated to the west of the R59.

The M61 (Springbok Road) and Metro railway line are located to the east of the proposed site. The residential areas of Witkop and Henley-on-Klip are also located approximately 1km to the northeast and 3km to the southeast of the proposed site respectively. There are additional pockets of residences surrounding the proposed site. Residences are located just off Graniet Road, Kalksteen Road and Lawa Road and are located at varying distances away from the boundaries of the proposed site (i.e. between 150m to 200m).

Current land uses surrounding the proposed site have been presented in *Table 6.1* and *Figure 6.5*.

Table 6.1 Surrounding Land Uses

Direction	Current Land Use
Study Site	Vacant land zoned for Industrial 3 use Google Earth Imagery for the site indicates that no development had occurred on Portion 89 until approximately 2006, when a house was developed on the property. There was some minor disturbance on Portion 88. Both properties were considered agricultural land, prior to being zoned for industrial use.
East	The site is bordered by Tilliet Road to the east with warehousing and trucking businesses across Tilliet Road. Further east, the M61 (Springbok Road) and the Metro railway line run north south with the Glen Douglas Mine located beyond the railway line. The Glen Douglas Mine is an open pit-mine (two pits) producing products comprising metallurgical dolomite, aggregate and agricultural lime. Exploration and development of the mine dates back to 1954, with mining operations having commenced in 1957.
South	Storage and maintenance facility for construction equipment (Earthman)
West	The majority of this area is open grassland with some disturbance such as trenches, soil dumping and alien bush clumps.

Direction	Current Land Use
North	Small businesses (ie brick manufacturing and carpentry facilities)

6.1.2 *Climate*

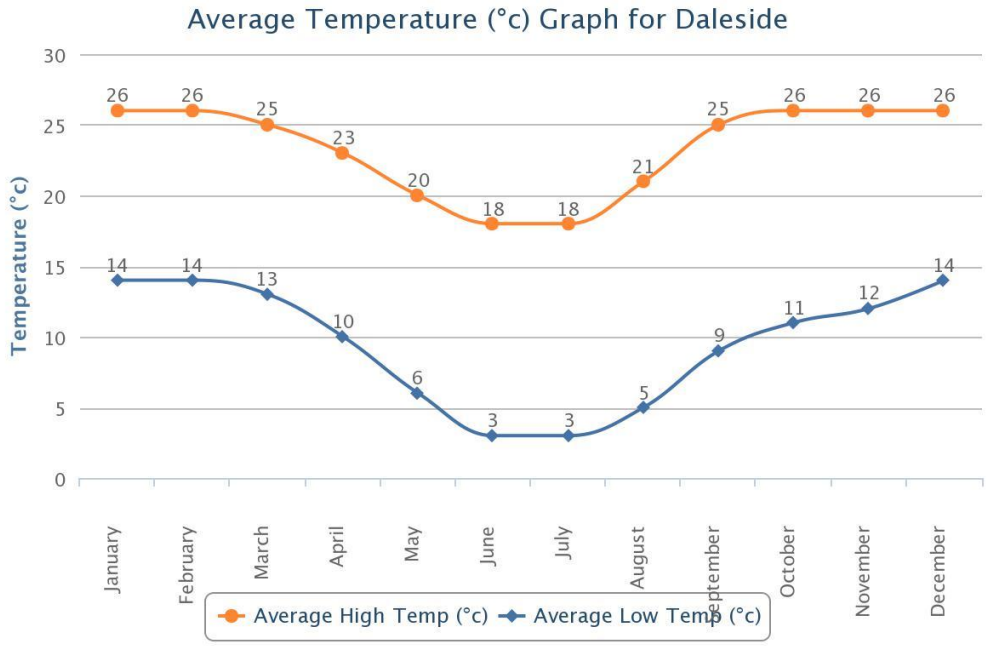
The Gauteng region has a mild climate, characterised by warm, moist summers and cool dry winters(1).

Temperature

It is noted that there is a large variation between summer and winter temperatures, within the Gauteng region due the continental nature of the climate. The daily mean temperature in January is 21.2°C and in July, 9.8°C. The mean annual temperature is approximately 16°C in the southern region of Gauteng.

The hottest time of year in the Daleside area occurs between October and February(2) and reaches temperatures of up to 30°C. The monthly average daily maximum temperatures in the area range from 17°C in June to 27.6°C in January (*Figure 6.1*). The region is the coldest during June when the temperature drops to 0°C on average during the night(3).

Figure 6.1 Average Temperature for Daleside



Source: www.worldweatheronline.com accessed 27 May 2014

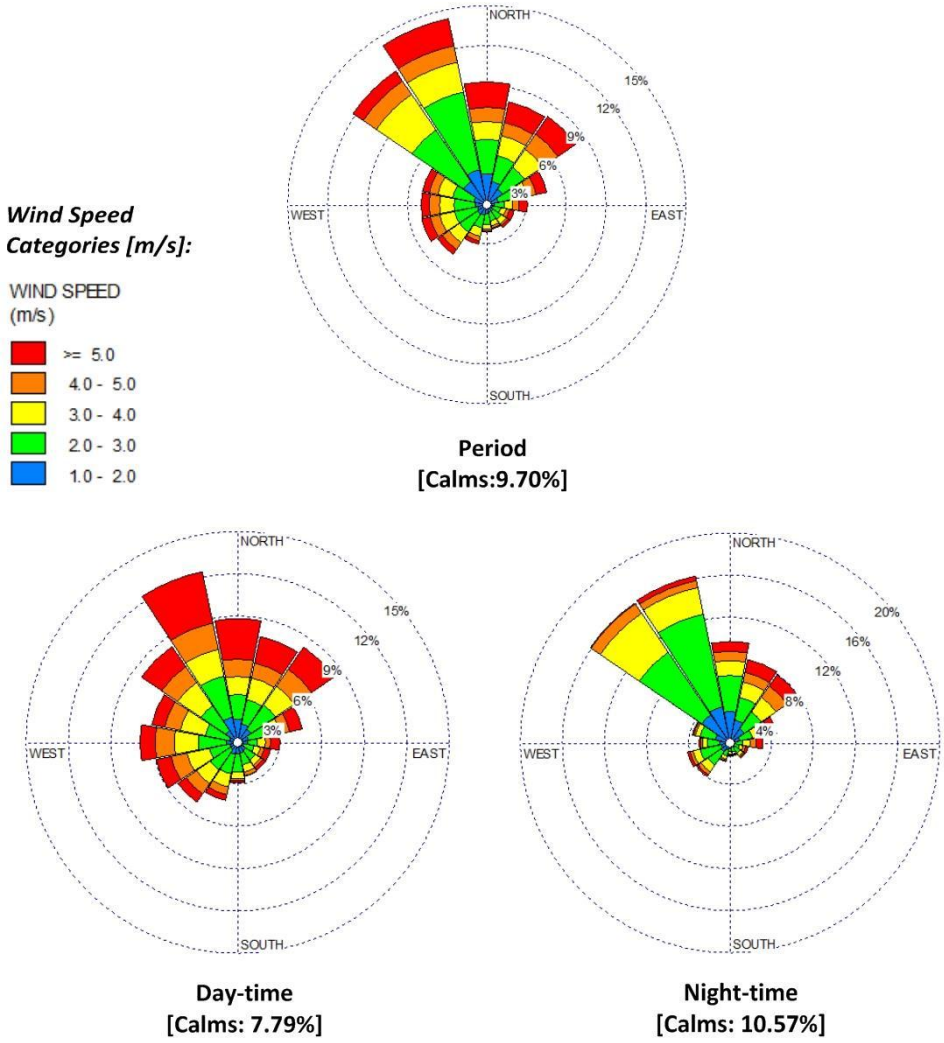
(1)Gauteng Department of Agriculture, Conservation and Environment. 2004. Gauteng State of Environment Report. Gauteng Provincial Government.
(2) www.weatherspark.com
(3) www.saexplorer.co.za

Wind

The wind direction in the area is primarily north-westerly, northerly and north-easterly with southerly winds predominating when cold fronts extend into the Gauteng province during the winter months.

Annual average, day time and night time wind roses from the South African Weather Services station at the Vereeniging airfield (13.5km from the Project site were obtained for the period 2010-2012 (*Figure 6.2*). Wind roses offer a graphic representation of the frequency with which the wind was blowing from a specific direction (the direction of the "spokes") while the wind speeds for each direction are represented by the colour and the width of the "spokes".

Figure 6.2 Average Wind Roses for Vereeniging (2010 to 2012)

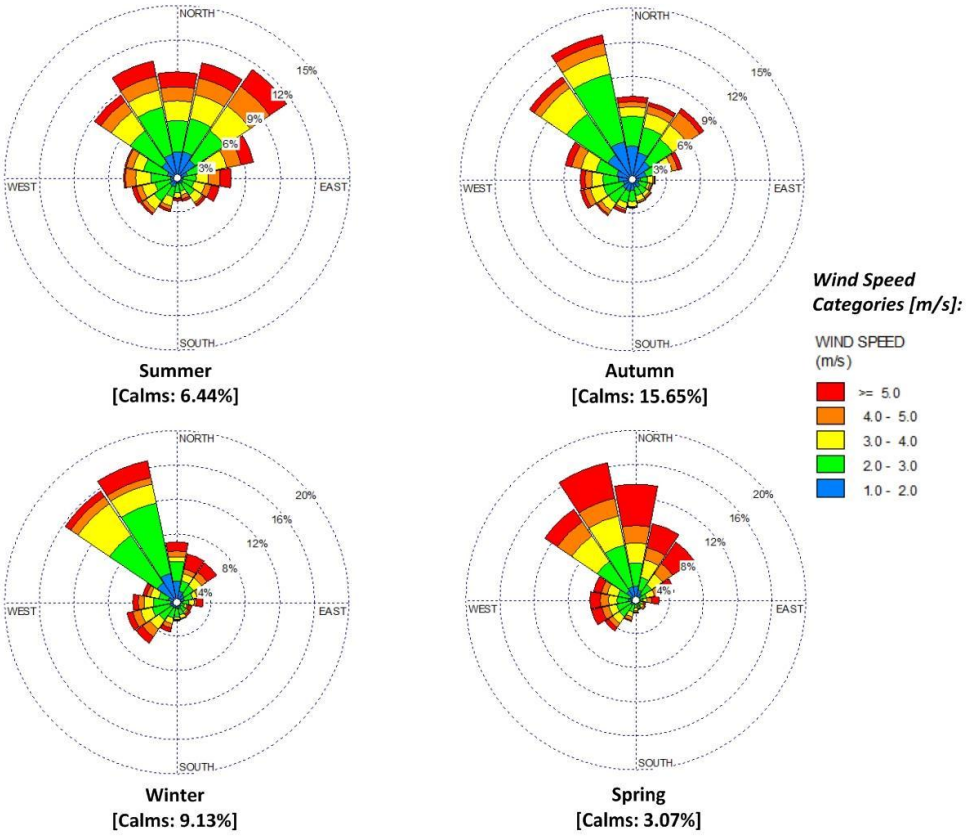


Source: South African Weather Service

It is evident that the wind in the region is dominated by north-westerly to north-easterly winds, while day time conditions are characterised by strong winds, with speeds generally decreasing during night-time.

The seasonal variation in wind flows for Vereeniging is illustrated in *Figure 6.3*. During winter months (July to August), the northward shift of the anti-cyclonic circulation and the enhanced influence of cold fronts give rise to a south-westerly wind. Summer months are characterised by tropical easterly flow.

Figure 6.3 Seasonal Variation in Wind Patterns in Vereeniging (2010 to 2012)



Source: South African Weather Service

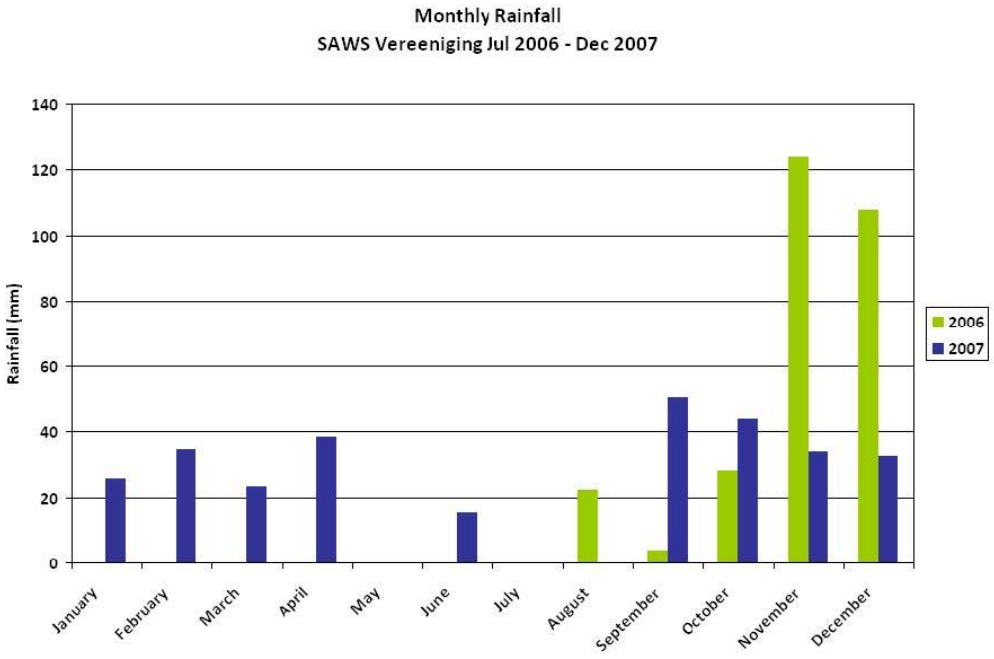
Rainfall

Rainfall occurs from October to March, with a mean annual precipitation of 668mm[1]. In the southern areas of the Gauteng province, mean rainfall is 556mm. Rainfall in the region occurs almost exclusively in showers and thunderstorms with the maximum rainfall occurring between November and January, while winter months are normally dry.

Monthly rainfall recorded at Vereeniging for the period July 2006 to December 2007 is presented in *Figure 6.4*. The wettest months recorded was November and December 2006 (i.e. both months recorded > 100 mm)[2].

(1)Gauteng Department of Agriculture, Conservation and Environment. 2004. Gauteng State of Environment Report. Gauteng Provincial Government.
(2) www.weathersa.co.za

Figure 6.4 Rainfall for July 2006 to December 2007 in Vereeniging Region



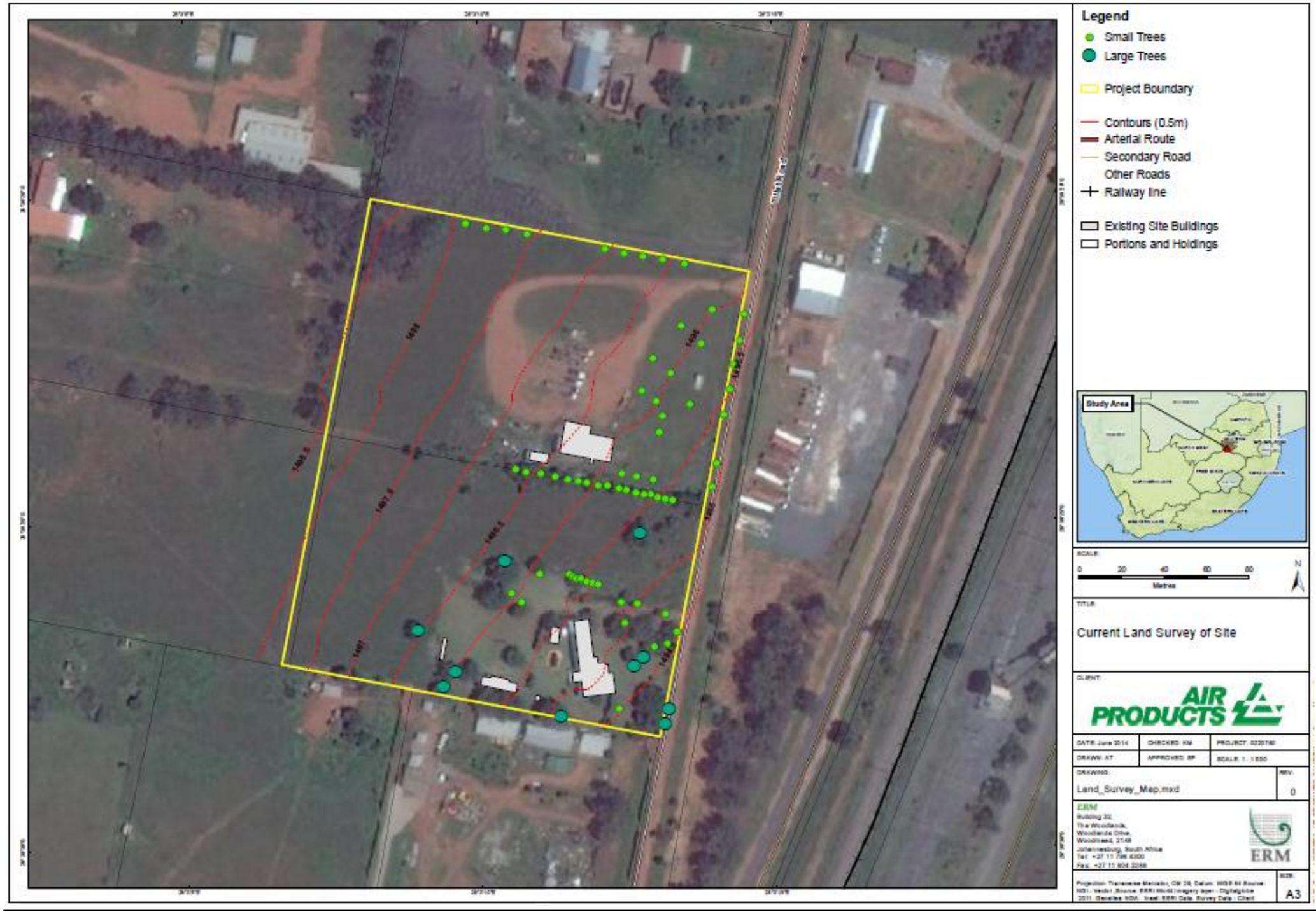
Source: www.weathersa.co.za

6.1.3 *Topography*

According to Mucina & Rutherford (2006) the greater study area is characterised as having slightly undulating plains, dissected by prominent rocky chert ridges. The area around the site is undulating and generally flat.

Air Products undertook a land survey for the proposed site, which indicates that the site is generally flat, however there is a natural gradient which slopes to the south east (*Figure 6.5*). The elevation of the proposed site is approximately 1502 m above mean sea level (msl).

Figure 6.5 Land Survey of Proposed Site



6.1.4 Geology

According to the 1:250 000 geological map sheet [2628] of East Rand, the study area is underlain by sandstone and shale with coal beds near the bottom of the succession of the Vryheid Formation which belongs to the Karoo Sequence. Pockets of dolomite and chert with their associated residual and transported soils of the Malmani Subgroup, Chuniespoort Group, are present within this study area. The dolomites are characterised by fossils of algae formations and contain high levels of calcium carbonate. Over a period of time, groundwater erodes away the calcium carbonate found within the dolomite layers, resulting in the occurrence of sinkholes. As the site might be underlain by dolomite or dolomite might be present in close proximity of the site, a detailed dolomite stability investigation will be undertaken prior to construction to understand the inherent risk class.

6.1.5 Soils

The soils of the proposed site are considered well-drained, red, apedal soils of the Hutton form (Hu) overlying weathered and hard rock and various other unconsolidated materials. The Hutton form - Hu13R (Gauteng Agricultural Potential Atlas – GAPA) is specifically found on site and is limited in depth. This is dystrophic to mesotrophic loam (i.e. low to moderate inherent fertility and strongly to moderately weathered profile) of variable depth in complex association with rock outcrops. This was evident on site with areas showing exposed rock (*Figure 6.6*).

Figure 6.6 Exposed Rock on Site

Source: NSS Ecological Scan report, January 2014

6.1.6 *Surface and Groundwater*

Surface Water

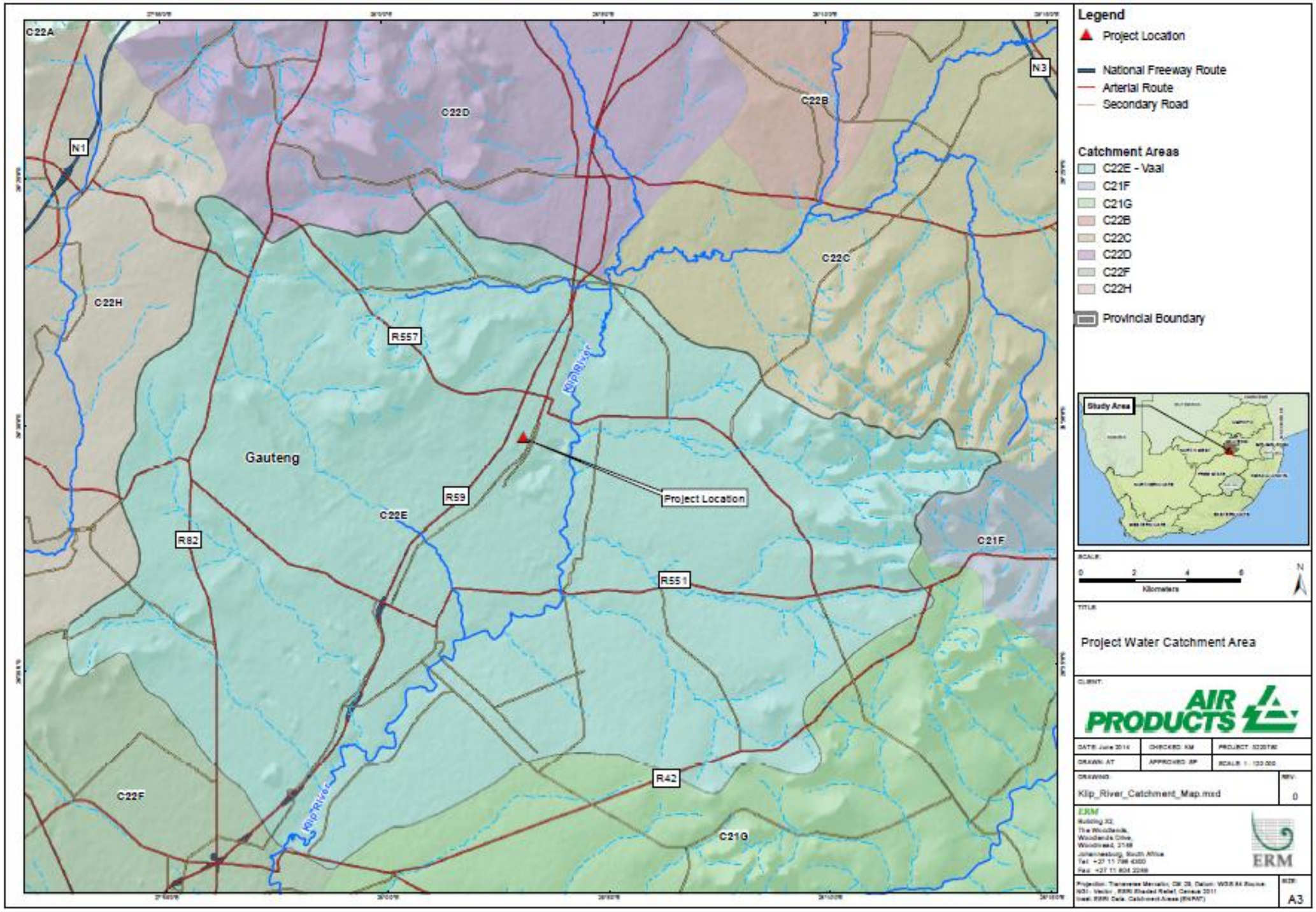
The Klip River catchment covers an area of approximately 3000km^2 (1).The river's headwaters lie in the range of hills and ridges which run across the Witwatersrand urban complex and is comprised of three sub-catchments namely the Upper Klip, the Rietspruit and the Lower Klip.

Characteristic features of the landscape of the catchment include mine dumps and urban development: the city of Johannesburg and neighbouring satellite towns lie at the head of the catchment, whilst the industrial town of Vereeniging is located at the confluence of the Klip River and the Vaal Barrage. A large area of the Klip River catchment between these urban centres is presently characterised by agricultural and market gardening activities while stands of alien invasive plant species found adjacent to the river. In addition, water flow in the Klip River is also characterised by runoff from both urban areas and discharges from wastewater treatment works (WWTWs). These water sources contribute to poor water quality in the river system, but at the same time they result in the Klip River flowing on a permanent basis. According to the Midvaal Spatial Development Framework (2011), water from the Klip River is used primarily for agricultural irrigation, with industries being supplied with potable water directly from Rand Water(2).

The Klip River is approximately 2km to the east of the proposed site and drains into the Vaal River to the south. Whilst the proposed site is situated within the Klip River catchment, there are no freshwater systems (tributaries) on or near the proposed site (*Figure 6.7*).

(1)Department of Water Affairs (DWA). 2009. *Adopt-a-River Programme Phase II: Development of an Implementation Plan. Water Resource Quality Situation Assessment*.
(2) Midvaal Spatial Development Framework (2011)

Figure 6.7 Klip River Catchment Area



Groundwater

According to the 1: 500,000 Hydrogeological Map Series of South Africa, the aquifer type in the region is intergranular and fractured. Borehole yields (volume of water that can be abstracted from a borehole) are between 0.5 and 2.0 l/s. Groundwater in the region is primarily used for irrigation for agricultural purposes.

The Aquifer Classification Map of South Africa(1) classifies the regional aquifer as a minor aquifer, which indicates that it is a moderately-yielding aquifer system of variable water quality. Furthermore, the regional aquifer is considered to have a moderate vulnerability rating, which indicates the tendency or likelihood for hydrocarbon impact to reach a specified position in the groundwater system.

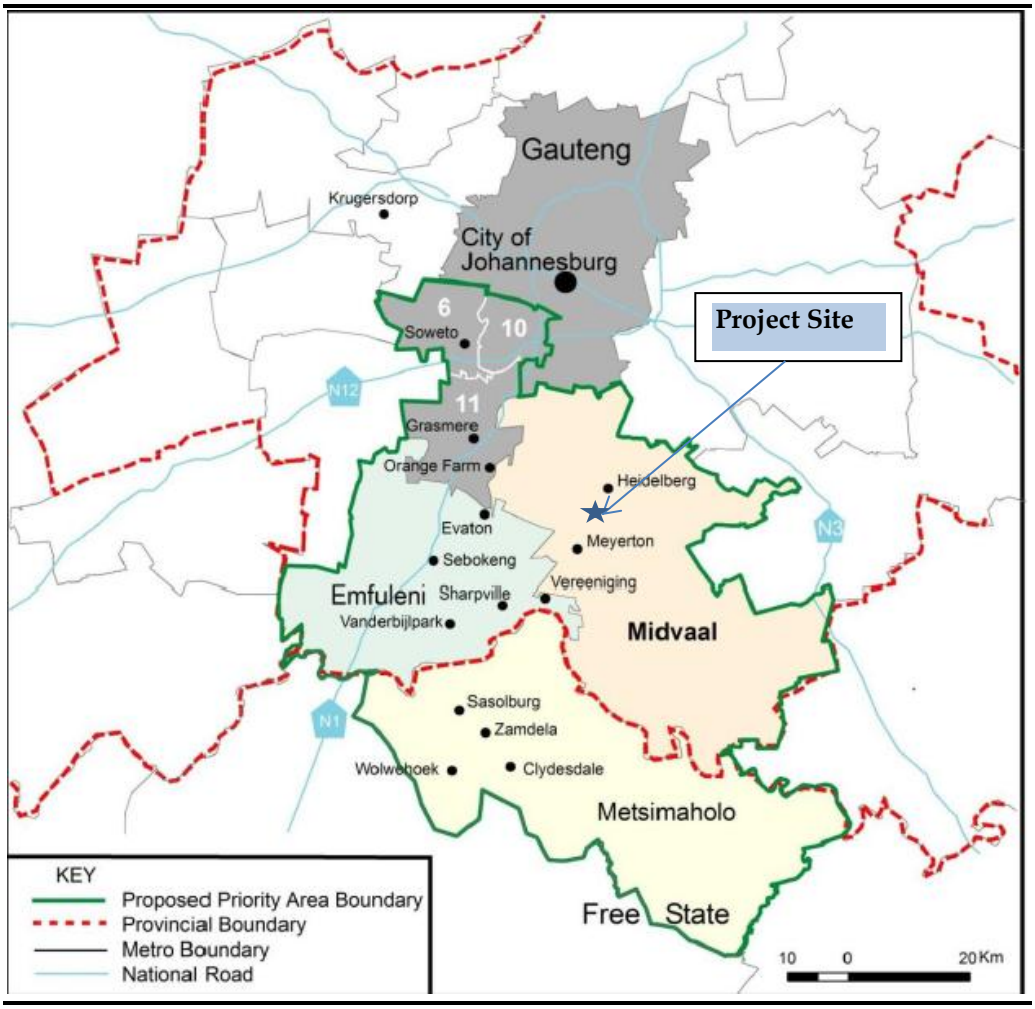
The classification of the aquifer (minor) in combination with its vulnerability rating (moderate) can be used to determine its susceptibility rating using the matrix provided in the Aquifer Classification of South Africa(2). The susceptibility rating of the aquifer is medium and is the qualitative measure of the relative ease with which a groundwater body can be potentially impacted by anthropogenic activities. According to the Midvaal Local Municipality Spatial Development Framework (2011), the greater area is underlain by dolomite, which is generally characterised by large quantities of groundwater which is at significant risk of pollution due to the existing mining, commercial and agricultural activities in the surrounding area.

6.1.7 Air Quality

The Vaal Triangle Airshed was declared the first priority area on 21 April 2006 (*Figure 6.8*). With the Project being located within the Vaal Triangle Priority Area, there are several important implications for the Project. New developments which are associated with atmospheric emissions and hence the potential for contributing to air pollutant concentrations are subject to intense scrutiny by national air pollution control officers. Emphasis is being placed on ensuring that best practice control measures are being adhered to and that the development will not substantially add to the existing air pollution burden in the region.

(1) Council for Scientific and Industrial Research. 1999. *Aquifer classification of South Africa*
(2)Council for Scientific and Industrial Research. 1999. *Aquifer classification of South Africa*

Figure 6.8 Boundary of the Vaal Airshed Priority Area (Green)



Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

The Department of Environmental Affairs (DEA) operates six ambient monitoring stations within the Vaal Airshed Priority Area. The monitoring stations from which the baseline air quality information was obtained are described in *Table 6.2* with an indication of its distance from the proposed site and its associated advantages and disadvantages as it relates to this assessment.

Table 6.2 Ambient Monitoring Stations

Station	Approximate Distance and Direction from Site	Advantages	Disadvantages
Kliprivier	10km north-northeast	• Situated a similar distance from the R59 highway as the project site	• Reflect higher ambient pollution concentrations due to localized sources.

Station	Approximate Distance and Direction from Site	Advantages	Disadvantages
Sharpeville	27km southwest		• Reflect higher ambient pollution concentrations due to localized sources (domestic burning). • Expected to reflect industrial emissions from Vereeniging and Vanderbijlpark.
Sebokeng	23km west-southwest		• Reflect higher ambient pollution concentrations due to localized sources (domestic burning).
Three Rivers	17km south-southwest	• Most representatives of ambient air quality in the project area with respect to background air pollution sources and ambient air quality.	• Reflect the industrial impacts from Meyerton.

Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

Measured and modelled concentrations were assessed against the National Ambient Air Quality Standards (NAAQS) (*Table 6.3*). Sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and respirable particulates (PM_{10}) are the pollutants of concern for this Project.

Table 6.3 National Ambient Air Quality Standards

Pollutant	Averaging Period	Concentration (µg/m³)	Frequency of Exceedance	Compliance Date
Benzene (C_6H_6)	1 year	10	0	Immediate till 31 December 2014
	1 year	5	0	01 January 2015
Nitrogen Dioxide (NO_2)	1 hour	200	88	Immediate
	1 year	40	0	Immediate
Particulate Matter (PM_{10})	24 hour	120	4	Immediate till 31 December 2014
	24 hour	75	4	01 January 2015
	1 year	50	0	Immediate till 31 December 2014
	1 year	40	0	01 January 2015
Sulphur Dioxide (SO_2)	10 minutes	500	526	Immediate
	1 hour	350	88	Immediate
	24 hour	125	4	Immediate
	1 year	50	0	Immediate

Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

The health effect screening levels used in this assessment for non-criteria pollutants are presented in *Table 6.4.*

Table 6.4 Health Screening Levels for Non-Criteria Pollutants

Pollutant	Averaging Period	Concentration (µg/m³)	Source
Acetone $(CH_3)_2CO$	1 hour	30 900	US ATSDR Acute RfC
Phosphine (PH_3) (Acetylene Impurity)	1 day	3	US EPA HEAST
	1 year	0.3	US EPA IRIS Chronic RfC

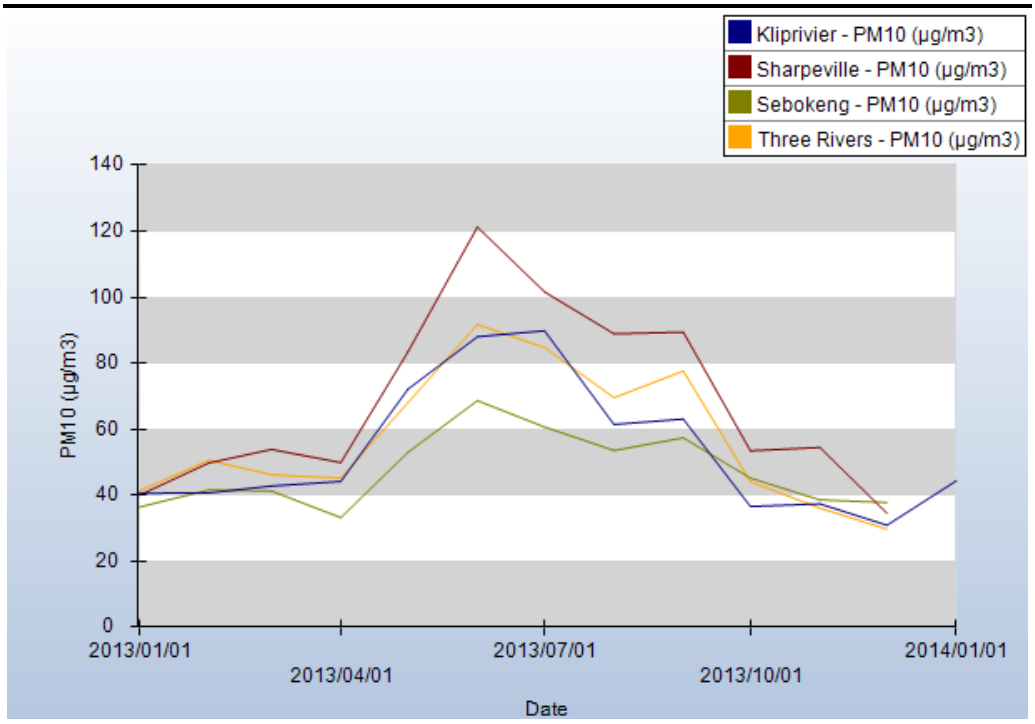
Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

PM_{10}

The measured annual average PM_{10} concentrations range from 50µg/m³ at Three Rivers to 73µg/m³ at Sharpeville monitoring stations. These concentrations exceed the 1 year average for PM_{10} stipulated in the NAAQS, which is 50µg/m³. PM_{10} concentrations measured at all four stations therefore exceed both the current and future NAAQS PM_{10} concentrations (ie 40µg/m³ effective 01 January 2015).

Monthly PM_{10} concentrations show a peak in winter months, due to increased domestic fuel burning and reduced washout due to rainfall (*Figure 6.9*).

Figure 6.9 Measured Monthly Average PM_{10} Concentrations

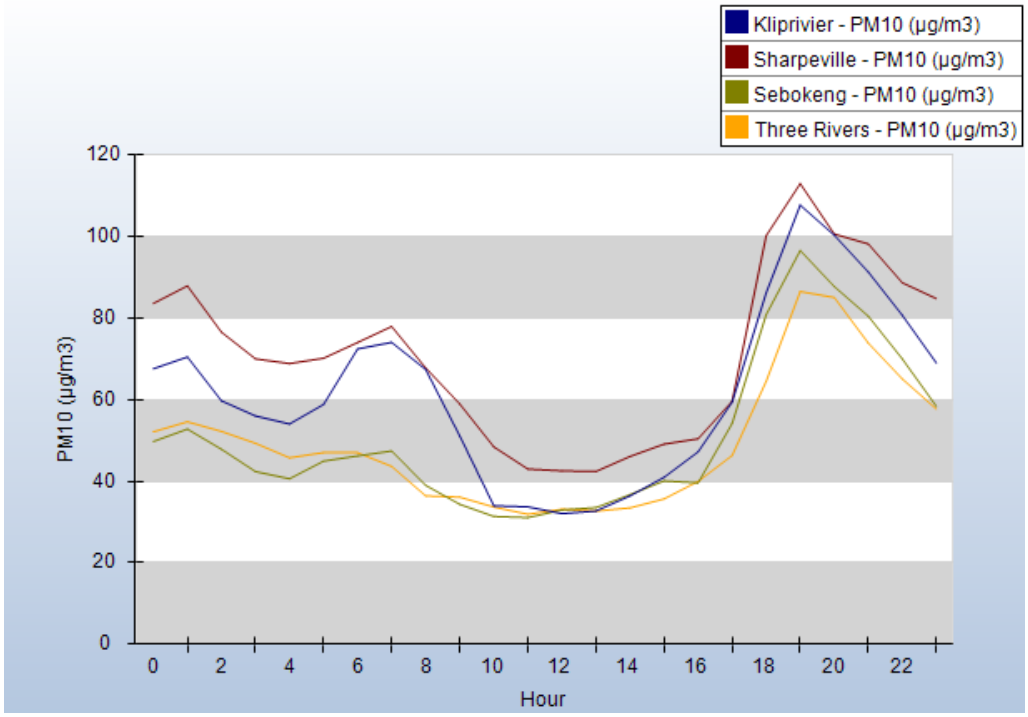


Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

As evident in *Figure 6.10*, diurnal PM_{10} concentrations indicate two peaks at all four monitoring stations (ie at 7am and 7pm). This is the result of domestic

fuel burning and to a lesser extent vehicle emissions. The Kliprivier and Sharpeville monitoring stations indicate higher PM_{10} concentrations during the morning peak hours than the other two stations due to its proximity to major roads. All four monitoring stations indicate high average PM_{10} concentrations during the pm peak hours due to a combination of domestic fuel burning and traffic emissions.

Figure 6.10 Measured Diurnal Average PM_{10} Concentrations

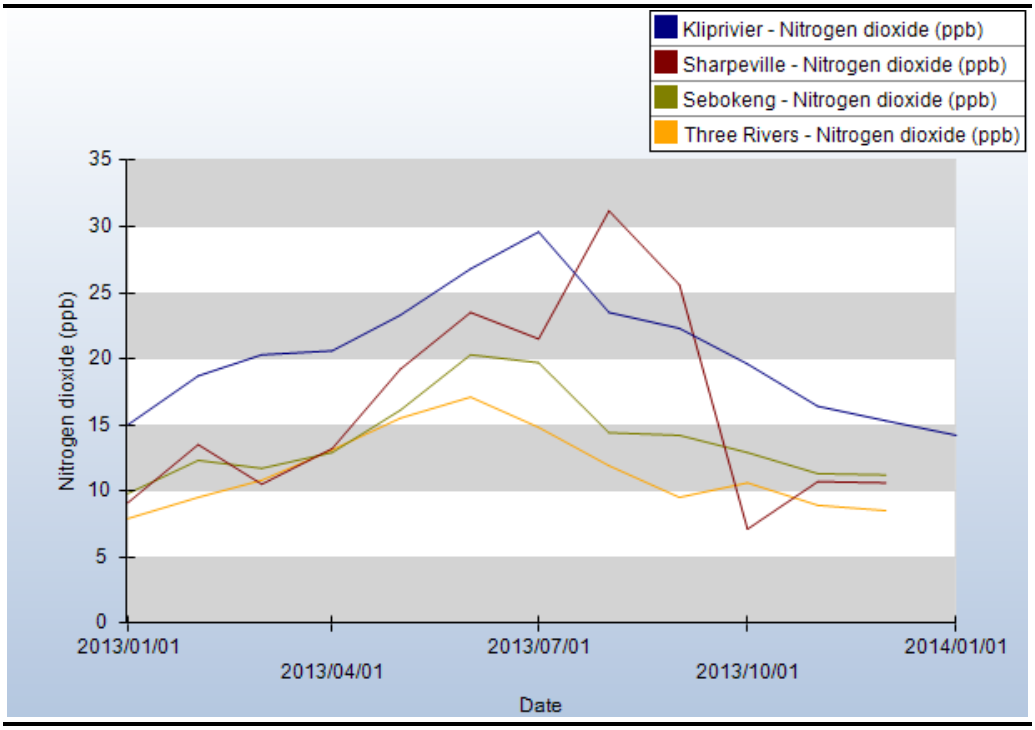


Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

NO_2

The annual average NO_2 concentrations range from 23µg/m³ at Sharpeville to 34µg/m³ at the Kliprivier monitoring station. The 1 year NO_2 average concentration stipulated in the NAAQS is 40µg/m³. The measured annual average NO_2 concentrations at all four stations are therefore below and in compliance with the NAAQS. Monthly NO_2 concentrations show a peak in winter months, due to increased domestic fuel burning as well as reduced washout due to rainfall (*Figure 6.11*).

Figure 6.11 Measured Monthly Average NO_2 Concentrations

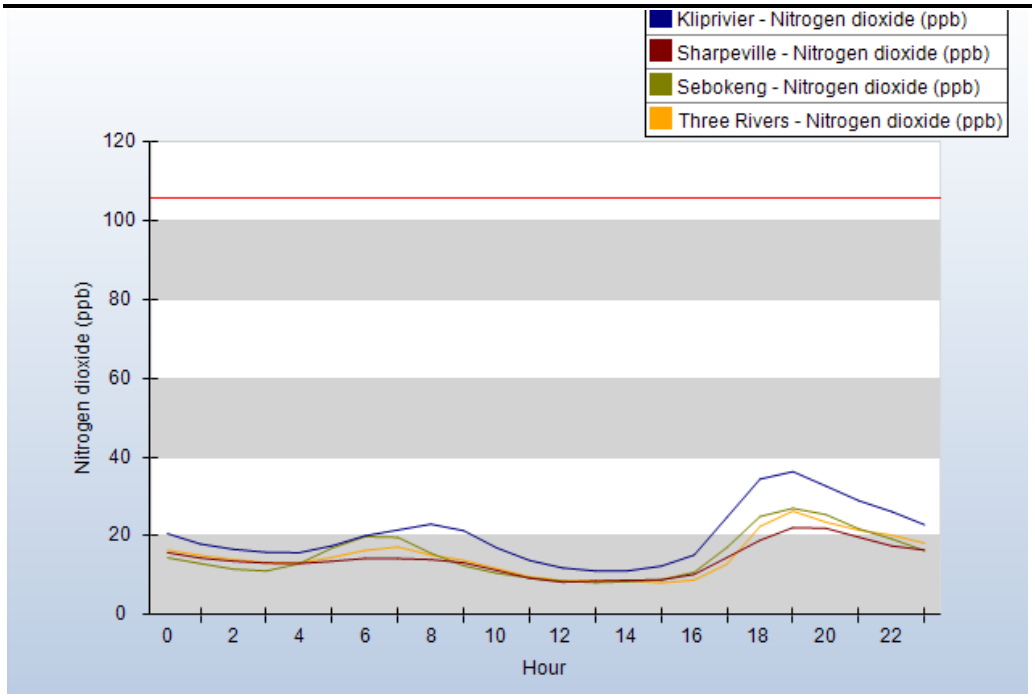


Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

The Kliprivier monitoring station situated next to the R59 highway recorded the highest NO_2 concentrations during the morning and evening peak hours (*Figure 6.12*). Vehicle tailpipe emissions as well as power generation sources were identified as the main NO_2 sources in the Vaal Triangle Priority Area, according to the Vaal Triangle Airshed Priority Area Air Quality Management Plan(1).

(1)Department of Environmental Affairs and Tourism. 2009. *Vaal Triangle Airshed Priority Area: Air Quality Management Plan*

Figure 6.12 Measured Diurnal Average NO_2 Concentrations

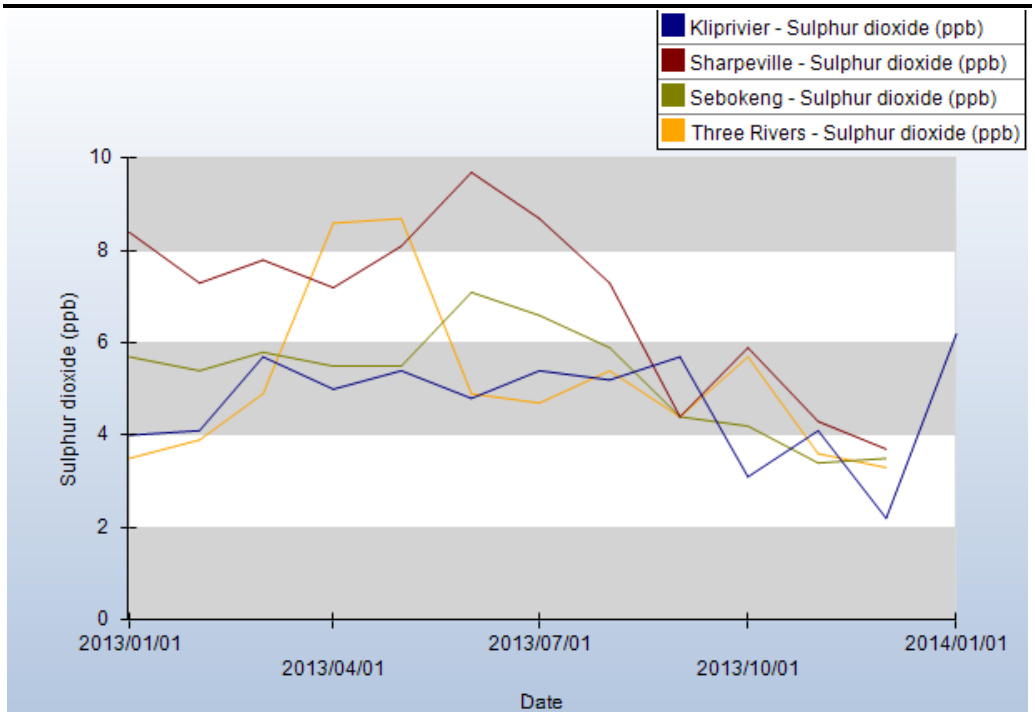


Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

SO_2

The measured annual average SO_2 concentrations range from 11µg/m³ at Kliprivier to 18µg/m³ at the Sharpeville monitoring station. The 1 year SO_2 average concentration stipulated in the NAAQS is 50µg/m³. The annual average SO_2 concentrations measured at all four stations are therefore below and in compliance with the NAAQS. Similar to NO_2 and PM_{10}, monthly SO_2 concentrations show a peak in winter months, due to increased domestic fuel burning as well as reduced washout due to rainfall (*Figure 6.13*).

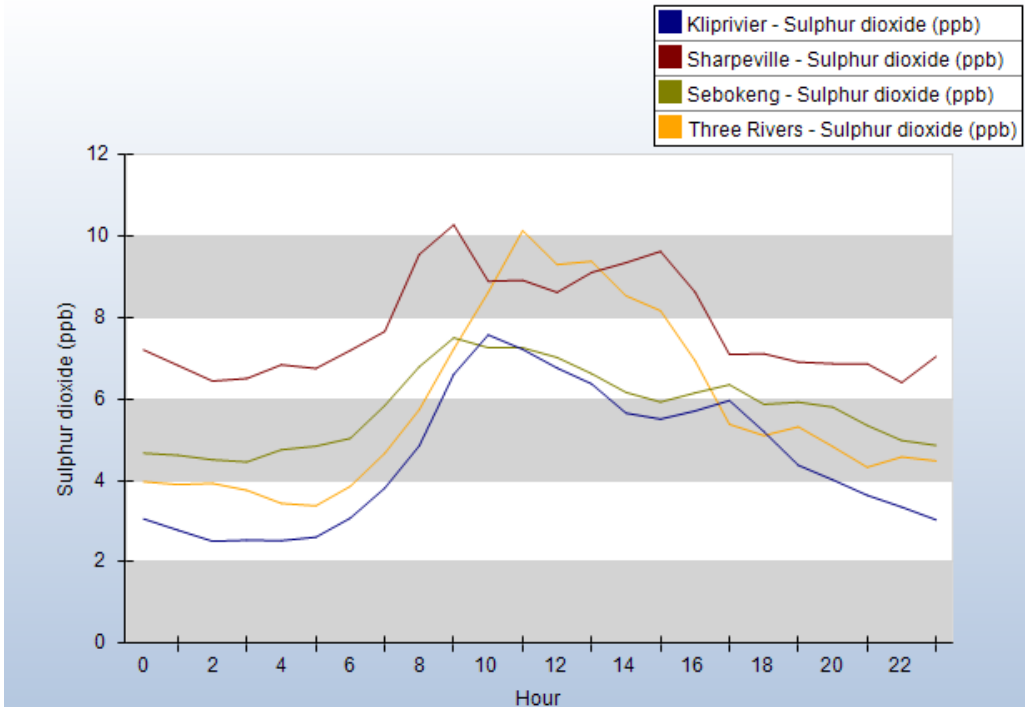
Figure 6.13 Measured Monthly Average SO_2 Concentrations



Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

Diurnal SO_2 concentrations increased during the day to reach a maximum at around 2pm, indicative of industrial and power generation sources. The Sharpeville monitoring station, situated between the Vereeniging and Vanderbijlpark industrial areas recorded the highest average SO_2 concentrations during 2013, with the Kliprivier monitoring station recording the lowest average SO_2 concentrations (*Figure 6.14*).

Figure 6.14 Measured Diurnal Average SO_2 Concentrations



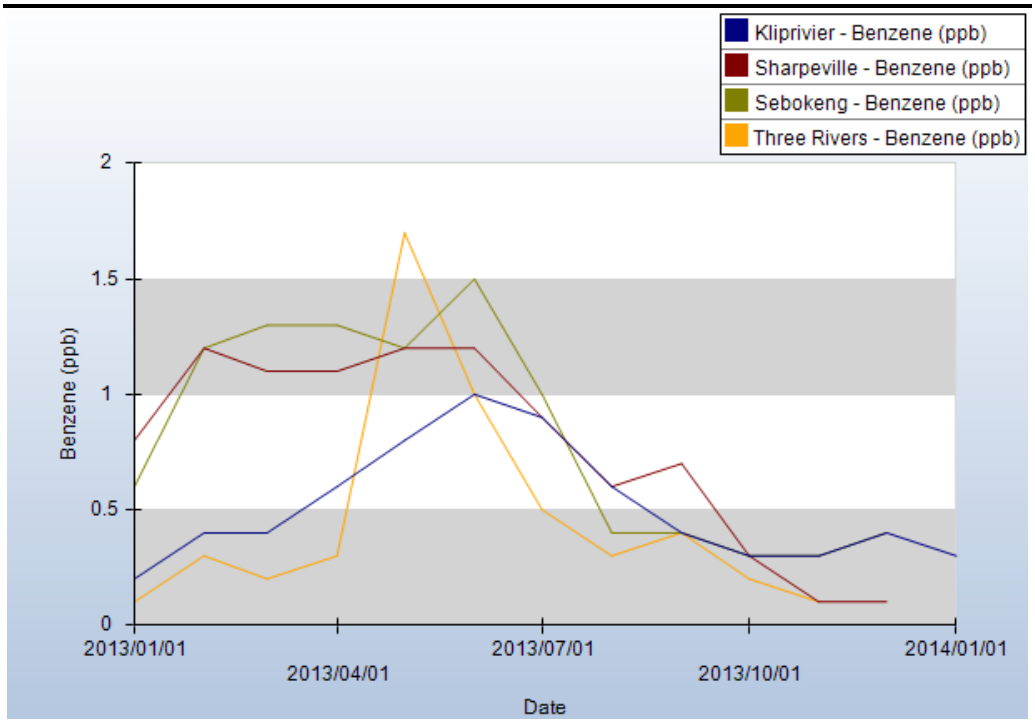
Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

Benzene

The four closest monitoring stations do not measure Volatile Organic Compounds (VOC) concentrations and a NAAQS is not presently in place for VOCs. Therefore cumulative VOC impacts have been calculated using benzene concentrations which are measured at the four monitoring stations. The cumulative concentrations have been measured against the 1 year average for benzene, which is 5µg/m³, as stipulated in the NAAQS (effective from 01 January 2015). The measured annual average benzene concentrations range from 1.5µg/m³ at Kliprivier to 2.5µg/m³ at the Sebokeng monitoring station. Annual average benzene concentrations at all four monitoring stations are therefore below and in compliance with the NAAQS.

Similar to PM_{10} and NO_2 concentrations, monthly benzene concentrations show a peak in winter months (*Figure 6.15*).

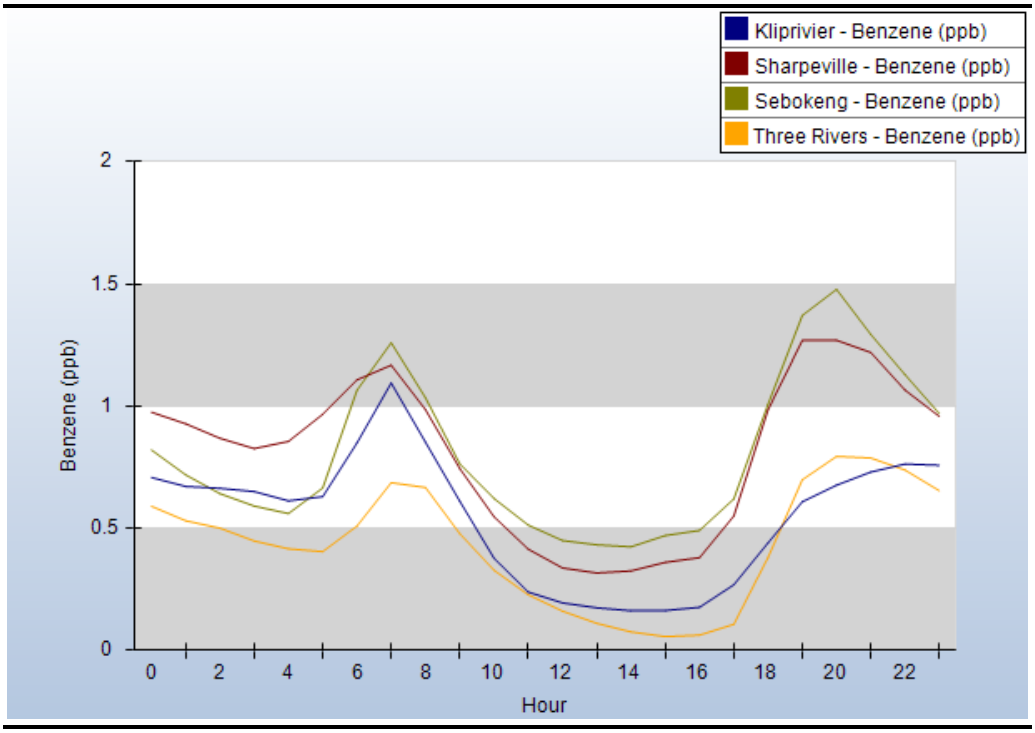
Figure 6.15 Measured Monthly Average Benzene Concentrations



Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

The diurnal benzene concentrations also indicate two peaks at all four monitoring stations (ie at 7am and at 7pm (*Figure 6.16*). The main contributing source of benzene emissions is vehicle tailpipe emissions. The highest concentrations of benzene were measured at the Sebokeng and Sharpeville monitoring stations.

Figure 6.16 Measured Diurnal Average Benzene Concentrations



Source: Atmospheric Impact Report for the Proposed Acetylene Plant, Airshed Planning Professionals (May 2014)

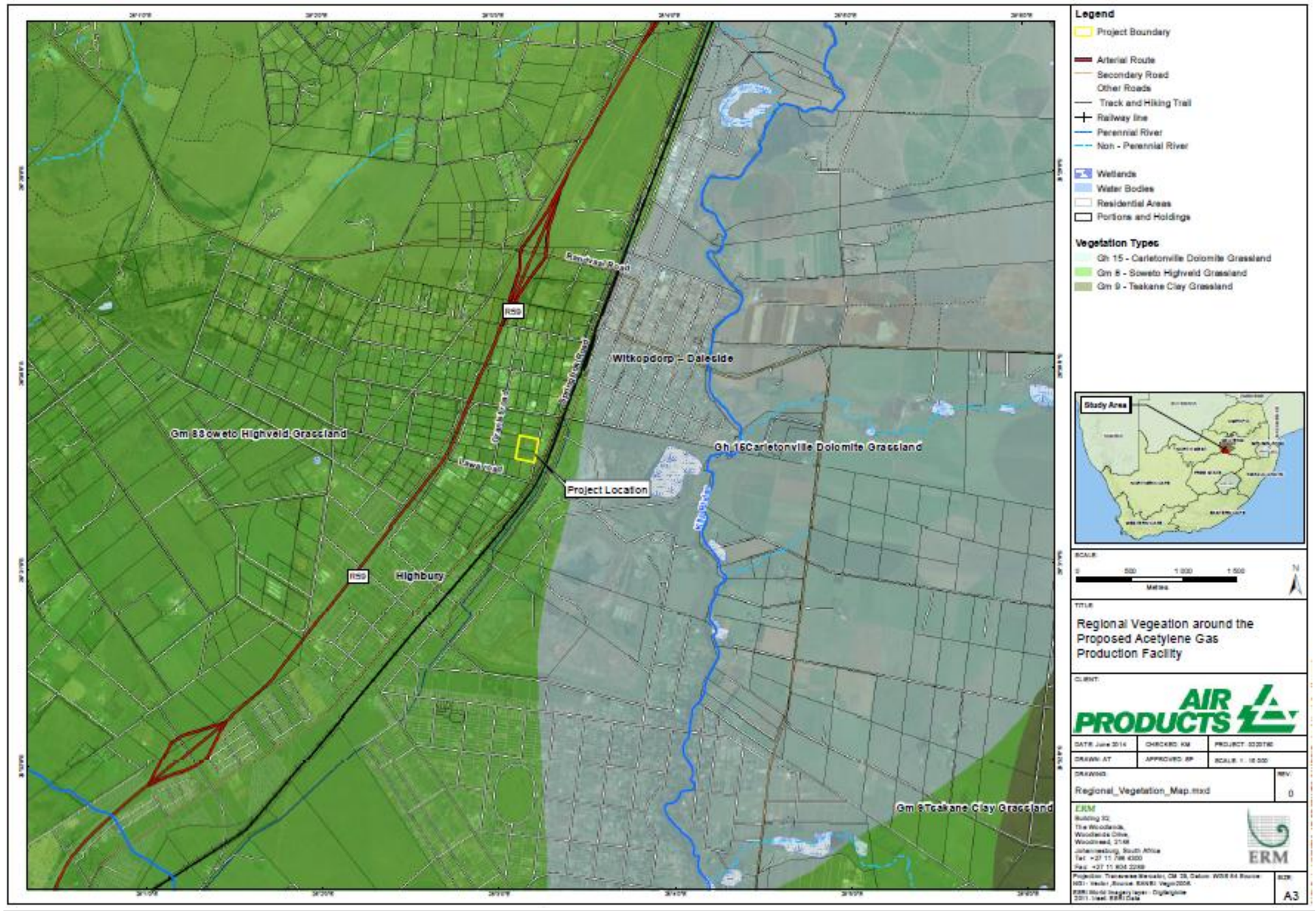
6.2 BIOLOGICAL BASELINE

6.2.1 Flora

The Project is situated within the Grassland Biome as defined by Rutherford & Westfall (1994). The Grassland Biome is dominated by non grassy herbs (forbs), many of which are perennial plants with large underground storage structures. The Grassland Biome is characterised by high biodiversity with the majority of rare and threatened plant species occurring in the summer rainfall regions of South Africa.

The Project site is located within the Endangered Soweto Highveld Grassland, according to the National Spatial Biodiversity Assessment undertaken by Mucina & Rutherford in 2006 (*Figure 6.17*). Furthermore, the Project site is also located within the South African National Biodiversity Institute's (SANBI) Priority Area, known as the Bushveld Bankenveld region.

Figure 6.17 Regional Vegetation Map



Soweto Highveld Grassland

The dominant taxa for the short to medium-high grassland vegetation type are listed in *Table 6.5* and are dominated almost entirely by *Themeda triandra* but with some other grass species such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix* also present. The grassland cover is for the most part continuous and is interrupted only by scattered wetlands; pans; narrow stream alluvia and the occasional rocky outcrops.

Table 6.5 Dominant Floral Species of the Soweto Highveld Grassland

Vegetation Type	Soweto Highveld Grassland	Recorded on Site and Surrounds
Low Shrubs	Anthospermum hispidulum	
	Anthospermum rigidum subsp. pumilum	
	Berkheya annectens	
	Felicia muricata	✓
	Ziziphus zeyheriana	✓
Herbaceous Climber	Rhynchosia totta	
Graminoids	Andropogon appendiculatus	
	Brachiaria serrata	✓
	Cymbopogon pospischilii	
	Cynodon dactylon	✓
	Elionurus muticus	✓
	Eragrostis capensis	
	Eragrostis chloromelas	
	Eragrostis curvula	✓
	Eragrostis plana	
	Eragrostis planiculmis	
	Eragrostis racemosa	✓
	Heteropogon contortus	✓
	Hyparrhenia hirta	✓
	Setaria nigrirostis	
	Setaria sphacelata	✓
	Themeda triandra	✓
	Tristachya leucothrix	
Herbs	Hermannia depressa	✓
	Acalypha angustata	✓
	Berkheya setifera	✓
	Dicoma anomala	
	Euryops gilfillani	
	Geigeria aspera var. aspera,	
	Graderia subintegra	
	Haplocarpha scaposa	
	Helichrysum micronifolium	
	Helichrysum nudifolium var. nudifolium	✓
	Helichrysum rugulosum	✓
	Hibiscus pusillus	
	Justicia anagalloides	
	Lippia scaberrima	
	Rhynchosia effusa	
	Schistostephium crataegifolium	
	Selago densiflora	
	Senecio coronatus	
	Hillardia oligocephala	✓
	Wahlenbergia undulata	✓
Geophytic Herbs	Haemanthus humilis subsp. hirsutus	

Vegetation Type	Soweto Highveld Grassland	Recorded on Site and Surrounds
	Haemanthus montanus	

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Site Survey Results

The Project site has been transformed by infrastructure development (ie farmhouse, outbuilding, pool, paved driveway and landscaped gardens) on the southern portion of the site. Furthermore, vegetation clearing and dumping characterises the northern and western portions of the site. Approximately 42 percent of the site has been transformed with the remaining area comprising a diverse array of Highveld grassland species.

In terms of species diversity, 93 plant species were recorded within the site. As mentioned above, the Grassland Biome has an extremely high biodiversity, reaching over 80 species per 1000m^2 (1).

Table 6.6 shows that the majority of the indigenous species were typical Highveld herbaceous grassland species containing a diverse number of forbs and a number of grasses, succulents and geophytic species. Approximately, 11 percent consisted of a woody component (i.e. shrubs to trees), however, these were associated with the landscaped garden areas. Approximately 22.5 percent of the species recorded within the site were also listed as alien species (both woody and herbaceous).

Table 6.6 Percentage of Species Growth Forms on and around the Site

Growth Forms	Percentage of Species Recorded
Forbs/Herbs	42.88
Shrubs to trees	10.99
Dwarf shrub	9.89
Graminoid	9.89
Succulent	8.79
Shrubs	7.69
Climbers	3.3
Sedges	3.3
Geophyte	2.2
Parasites	1.1

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Three vegetation communities were observed on the Project site during the site survey. These were recorded as:

- Disturbed *Seriphium-Eragrostis* Grassland Patch (associated with the *Melia* tree storey);

(1)Cowling R.M., Richardson D.M. & Pierces. M. 1997. Vegetation of Southern Africa. Cambridge, Cambridge University Press;
Van Wyk B.E., Van Oudtshoorn B. & Gericke N. 2000. Medicinal Plants of South Africa. Pretoria, Briza.

- *Elephanthorizza-Heteropogon* Grassland Patch (*Figure 6.18*); and
- *Ziziphus-Hillardia (Vernonia)* Grassland Patch (*Figure 6.18*).

Figure 6.18 Vegetation Structure On and Around the Site

Emerging *Elephanthorizza-Heteropogon* Grassland

Emerging *Ziziphus-Hillardia (Vernonia)* Grassland patch

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Vegetation wetland indicators were not found during the site fieldwork. The habitat/vegetation communities observed are described below in *Table 6.7* and *Figure 6.19*.

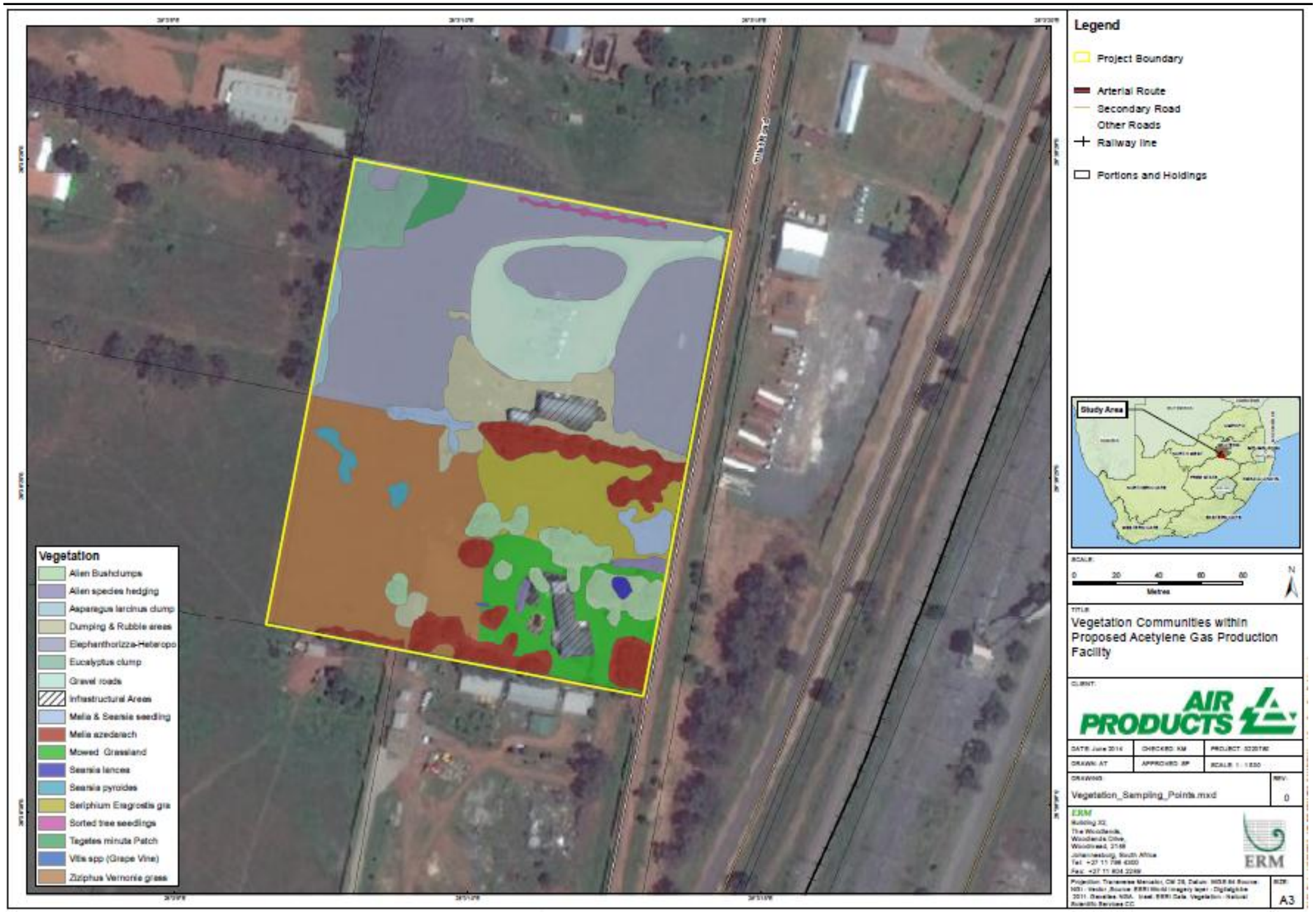
Table 6.7 Percentage of Habitat/Vegetation Units Sampled On and Around the Site

Habitat/Vegetation Unit	Description	Local Significance	Area (%)
Grassland			
Elephanthorizza-Heteropogon Grassland	Both these vegetation units contain signs of a typical Highveld Grassland indicative in the species recorded. The units are considered semi-natural with some (minimal) disturbance through dumping and clearing.	Medium	28.97
Ziziphus-Hillardia (Vernonia) Grassland patch		Medium	20.66

Habitat/Vegetation Unit	Description	Local Significance	Area (%)
Disturbed *Seriphium-Eragrostis* Grassland patch	Species diversity and richness within this habitat is minimal. There is some disturbance through dumping and clearing, as well as alien encroachment.	Medium	6.59
Indigenous Bush Clumps			
Asparagus laricinus clumps	Species diversity and richness within these habitats are minimal.	Medium – Low	0.67
Searsia Clumps	This is assisted by the creation of a shady environment and species such as the pioneer Asparagus laricinus showing signs of bush encroachment. Disturbances included dumping and alien species encroachment	Medium - Low	0.9
Transformed Area			
Gravel roads, Dumping and Rubble areas	These are transformed areas with limited species diversity dominated by pioneer and alien species.	Low	15.44
Alien Bush clumps		Low	15.12
Mowed Grassland		Low	5.59
Infrastructural Areas		Low	2.97
Mixed Tree Seedling Clumps		Low	2.01
Tagetes minuta Patch (alien species)		Low	1.07

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Figure 6.19 Vegetation Communities within the Project Site



Conservation Important Flora

There are over 44 Endangered, Vulnerable or Near Threatened species in Gauteng according to the International Union for the Conservation of Nature (IUCN) Threatened Plant Species Programme (TSP). However, the majority of these species are unlikely to occur on the site or adjacent area, based on habitat availability on site. During the site survey, *Boophone disticha*, a Conservation Important (CI) species was detected and scattered across the site. This species is Declining according to the TSP. A possibly planted *Cussonia paniculata* was also detected (*Figure 6.20*). This species is protected under the Gauteng Nature Conservation Ordinance (1993) and requires approved permits prior to removal or translocation.

Figure 6.20 Photos of CI Floral Species On Site

Boophone disticha. [Dec] *Cussonia paniculata*

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Alien Invasive Species

South Africa became a signatory to the Convention of Biological Diversity in 1998, and the enactment of recent national legislation has affirmed South Africa's commitment to biodiversity and conservation. To assist in the control and prevention of these species, the DEA has compiled draft regulations under the under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), which contain management categories for alien invasive plant species, these are listed below.

- Category 1a: Remove and destroy - Invasive species requiring compulsory control.

- Category 1b: Remove and destroy - Invasive species controlled as part of an invasive species control programme.

- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept plants as a gift. No permits for plants to exist in riparian zones.

- Category 3: Invasive species regulated by activity. An individual plant permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift. No permits for plants to exist in riparian zones.

In terms of the site and surrounds, approximately 30 percent of the species recorded are alien species. Species classified as Category 1, 2 and 3 are presented in *Table 6.8*. The majority of the alien species were located around the dumping area, the alien woody bush clumps and the building areas (*Figure 6.21*). Category 1 species such as *Datura* and *Solanum* were emerging in the heavily disturbed areas.

Table 6.8 Category 1, 2 and 3 Alien Invasive Species Located on Site

Family	Scientific Name	Lifecycle	Growth Form	Category
Convolvulaceae	*Ipomoea purpurea (L.) Roth*	Annual	Climber, herb	3
Fabaceae	*Acacia baileyana F.Muell.*	Perennial	Shrub, tree	3
Meliaceae	*Melia azedarach L.*	Perennial	Tree	3
Myrtaceae	*Eucalyptus sideroxylon A.Cunn. subsp. sideroxylon*	Perennial	Tree	2
Onagraceae	*Oenothera rosea L'Hér. ex Aiton*	Perennial	Herb	3
Solanaceae	*Datura seedlings*	Annual	Herb, shrub	1
Solanaceae	*Solanum sisymbriifolium Lam.*	Perennial	Herb, shrub	1

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Figure 6.21 Examples of Alien and Invasive Species Observed oand around the Site

Eucalyptus and *Pennisetum clandestinum*

Melia azedarach and *Tagetes minuta*

Solanum sisymbriifolium (Category 1b) *Schinus molle*

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Ecological Sensitivity of the Site

The ecological sensitivity of the site is defined as the renewability and success for rehabilitation of the species. The ecological sensitivity has been used to determine areas of local conservation significance within the study area. Further defining characteristics include:

- conservation value (based on a regional / national and local scale);
- presence of CI species (identified at the vegetation unit/habitat level); and
- level/extent of disturbance.

Identified vegetation units within the Project site were ranked into *High, Medium-high, Medium, Medium-low* or *Low* classes in terms of significance. This was undertaken according to a sensitivity-value analysis (*Table 6.9*) and included input based on knowledge of the area, on the ground investigations and experience when dealing with ecological systems and processes.

Table 6.9 Scoring Range for the Areas of Significance

Category	Scoring Range	
	Upper	Lower
High	15	11
Medium-High	10.9	7
Medium	6.9	3
Medium-Low	2.9	-1
Low	-1.1	-5

A summary overview of scoring the areas of local conservation significance is presented in *Table 6.10* and *Figure 6.22*.

Table 6.10 Summary of Local Areas of Conservation Significance

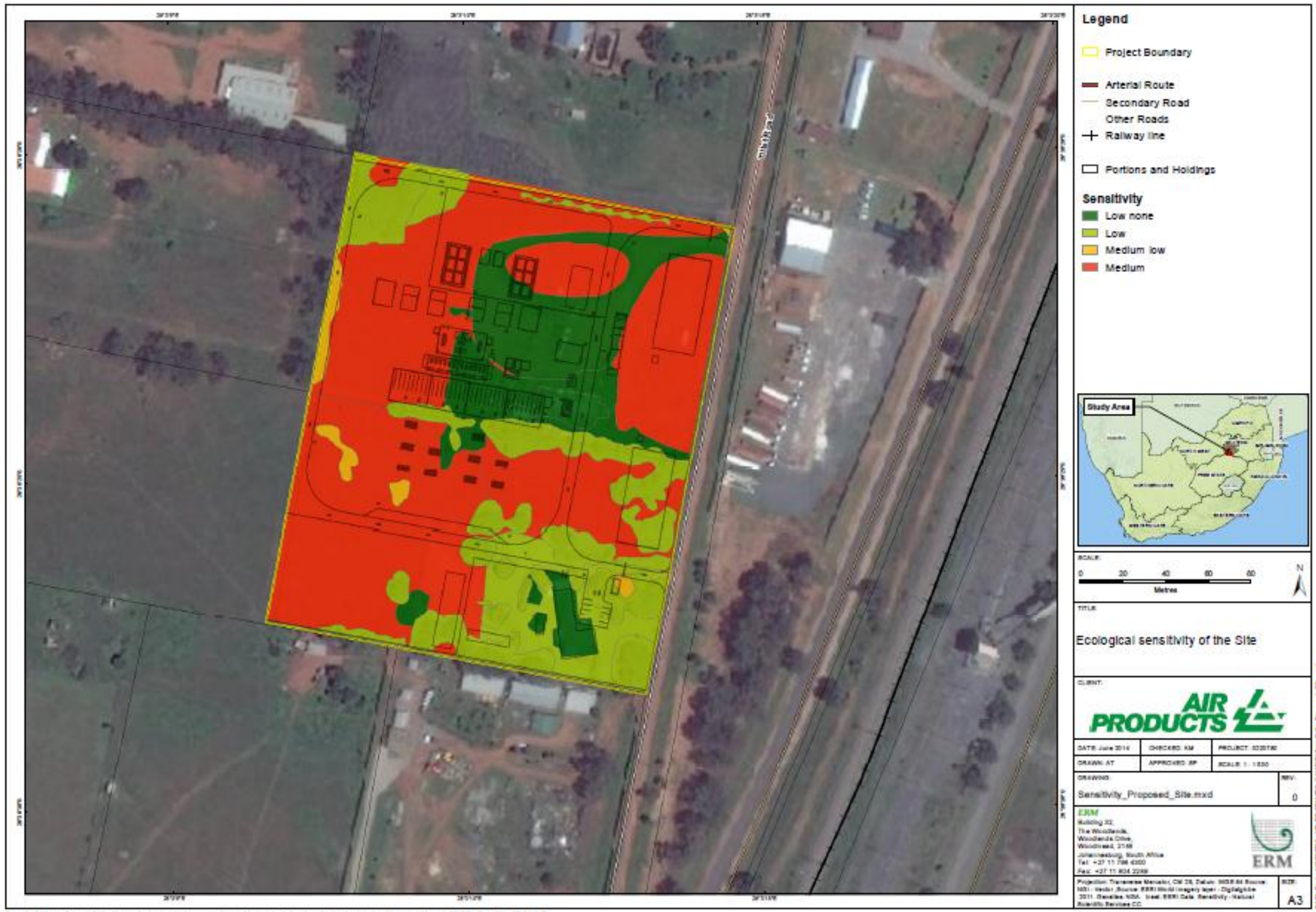
Vegetation Type	Ecological Sensitivity (Rating 1-5)	Conservation Value (Rating 1-5)	Presence of CI Species* (Rating 1-5)	Level/Extent of Disturbance (Rating 1-5)	Total Score

Vegetation Type	Ecological Sensitivity (Rating 1-5)	Conservation Value (Rating 1-5)	Presence of CI Species* (Rating 1-5)	Level/Extent of Disturbance (Rating 1-5)	Total Score
Grassland Communities					
Elephanthorizza-Heteropogon Grassland	Med-Low (2)	Signs of a typical Highveld Grassland indicative in the species recorded. Within the Threatened SHG (GM8) (3)	Yes (2) – lower ranked species	Some disturbance through dumping and clearing – but minimal (-1)	Medium (6)
Ziziphus-Hillardia (Vernonia) Grassland patch	Med-Low (2)	Signs of a typical Highveld Grassland indicative in the species recorded. Within the Threatened SHG (GM8) (3)	Yes (2) – lower ranked species	Some disturbance through dumping and clearing – but minimal (-1)	Medium (6)
Disturbed *Seriphium-Eragrostis* Grassland patch	Low (2)	Species diversity and richness minimal. Within the Threatened SHG (GM8) (2)	Yes (2) – lower ranked species	Some disturbance through dumping and clearing – but minimal (-1)	Medium (5)
Indigenous Tree Clumps	Low (1)	Species diversity and richness minimal (2)	Possible (1) under the trees	Creation of shade, some disturbance through dumping and alien encroachment (-1.5)	Medium-Low (2.5)
Completely Transformed					
Alien bush clumps Cleared Areas Dumping etc	Low-None (0)	There are limited indigenous species and representation of a grassland community within these areas. Conservation value is considered very limited and may house temporary habitat for some faunal taxa (1)	Unlikely (1)	Extensive disturbance and change. Limited natural indigenous species remaining / vegetation structure and dynamics severely altered (-4)	Low (-2)

*Note: Includes faunal species

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Figure 6.22 Site Sensitivity Map



6.2.2 *Protected and Conservation Areas*

Protected and conservations areas have been identified on a national and provincial scale and are described in the sections below. The Project site falls within two National Priority Areas (NPAs), a description and status of these areas has been provided below.

- SANBI National Priority Area (NPA) **– Bushveld Bankenveld** ; and
- **Soweto Highveld Grassland** is on the national list of threatened terrestrial ecosystems gazetted under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

National Priority Areas

The Bushveld Bankenveld NPA is one of nine spatial priority areas that represent areas with the greatest biodiversity. The moist grasslands, which include the Bushveld Bankenveld, face the highest overall pressures(1). It should be noted that areas identified as NPA are done so at a national level, ie the data used is of a course scale. It is recommended by Rouget et al. (2004) that the boundaries of these areas should not be identified at the level of property boundaries and should therefore not be used in isolation for decision-making at the local scale.

The Soweto Highveld Grassland has an ecosystem threat status of Vulnerable (VU). This system is listed under criterion: *A1: Irreversible loss of natural habitat* indicating that the ecosystem has undergone a loss of natural habitat in turn impacting on their structure, function and composition. Loss of natural habitat includes outright loss, for example the removal of natural habitat for building of infrastructure, mining etc., as well as severe degradation. For this purpose, habitat is considered severely degraded if it was unable to recover to a natural or near-natural state following the removal of the cause of the degradation (eg invasive aliens, over-grazing}, even after very long time periods.

Provincial Irreplaceable and Important Sites

The GDARD guides conservation and land-use decisions in support of sustainable development through the C-Plan 3 database(2). The C-Plan 3 maps the distribution of the Province's known biodiversity into categories according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature. There are no categories found in and within the immediate surrounds of the site. The Klip River to the east is highlighted as an Important site ie a sensitive area that is important for the conservation of biodiversity in Gauteng.

(1)National Biodiversity Institute. 2004. National spatial biodiversity assessment, Strelizia 17, NBI, Kirstenbosch.
(2) Unpublished, 2011

6.2.3 *Fauna*

The Project site is predisposed to a low diversity of faunal species that are likely to occur given the small area and high degree of land transformation. A total of three mammal, 22 bird, two reptile, three frog and 12 terrestrial macro-invertebrate species were detected during the site survey. Although the abundance of terrestrial macro-invertebrates on site is high the overall species richness is low.

The highly transformed and fragmented habitat on site in addition to the lack of any natural rocky ridges, wetlands or open water habitats means that the likelihood of the presence of CI faunal species is low. Furthermore, only two alien invasive faunal species were detected on site namely the Rock Dove (*Columba livia*) and Common Myna (*Acridotheres tristis*). A stray dog was also observed on site, which belonged to the previous landowners. Air Products is currently taking care of the dog on the site, however the dog will be taken off the site to a dog shelter, prior to construction.

The faunal species observed on site are recorded in *Table 6.11* and *Figure 6.23*.

Table 6.11 Faunal Species Observed on Site

Species	Common Name	Status	
		Global[1]	National[2]
Mammals			
Lepus saxatilis	Scrub Hare	LC (D)	LC
Cryptomys hottentotus	Common Mole-rat	LC (S)	LC
Galerella sanguinea	Slender Mongoose	LC (S)	LC
Birds			
Bostrychia hagedash	Hadeda Ibis	LC (I)	LC
Elanus caeruleus	Black-shouldered	LC (S)	LC
Vanellus coronatus	Crowned Lapwing	LC (I)	LC
Vanellus armatus	Blacksmith Lapwing	LC (I)	LC
Columba guinea	Speckled Pigeon	LC (S)	LC
Streptopelia capicola	Cape Turtle Dove	LC (I)	LC
Streptopelia senegalensis	Laughing Dove	LC (S)	LC
Chrysococcyx caprius	Dideric Cuckoo	LC (S))	LC (B)
Trachyphonus vaillantii	Crested Barbet	LC (D)	LC
Mirafra africana	Rufous-naped Lark	LC (D)	LC
Hirundo rustica	Barn Swallow	LC (D)	LC (NB)
Pycnonotus tricolor	Dark-capped Bulbul	-	LC
Cisticola fulvicapilla	Neddicky	LC (S)	LC
Lanius collaris	Common Fiscal	LC (I)	LC
Acridotheres tristis	Common Myna	LC (I)	AL
Passer melanurus	Cape Sparrow	LC (S)	LC
Ploceus velatus	Southern Masked-weaver	LC (S)	LC
Euplectes orix	Southern Red Bishop	LC (S)	LC

[1] International Union for Conservation of Nature (IUCN). 2013. The IUCN Red List of Threatened Species.
[2] Friedmann, Y., & Daly, B. 2004. Red Data Book of the Mammals of South Africa: a conservation assessment.
SABAP 2 (Second Southern African Bird Atlas Project). 2013.
Minter, L. et al. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland.

Species	Common Name	Status	
		Global[1]	National[2]
Euplectes afer	Yellow-crowned Bishop	LC (S)	LC
Crithagra atrogularis	Black-throated Canary	LC (S)	LC
Columba livia	Rock Dove	LC (D)	AL
Zosterops capensis	Cape White-eye -	-	LC (N-End)
Reptiles			
Trachylepis capensis	Cape Skink	-	-
Trachylepis punctatissima	Montane Speckled Skink	LC (S)	-
Frogs			
Amietophrynus gutturalis	Guttural Toad	LC (I)	LC
Tomopterna cryptotis	Tremolo Sand Frog	LC (S)	LC
Tomopterna natalensis	Natal Sand Frog	LC (U)	LC
Invertebrates			
Graphipterus limbatus	Velvet Ground Beetle		
Ectrichodia crux	Millipede Assasin		
Junonia orithya madagascariensis	Eyed Pansy		
Tarucus sybaris Sybaris	Dotted Blue	LC	LC
Patrician Blue	Patrician Blue	LC	LC
Cupidopsis cissus cissus	Common Meadow Blue		
Belenois aurota aurota	Brown-veined White	LC	LC
Eretis umbra umbra	Small Marbled Elf	LC	LC
Spialia diomus ferax	Common Sandman		
(Family: Shingidae)	Hawk moths		
Anoplolepis custodiens	Pugnacious Ant		
(Order: Diplopoda)	Millipede		
(Order: Chilopoda)	Centipede		

Key: AL = Alien; D = Decreasing; I = Increasing; LC = Least Concern; N-end = Near-Endemic; S = Stable; U = Unknown

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Figure 6.23 Examples of Fauna Observed On Site

Slender Mongoose (*Galerella sanguinea*)

Montane Speckled Skink (*Trachylepis punctatissima*)

Guttural Toad (*Amietophrynus gutturalis*)

Eyed Pansy (*Junonia orithya madagascariensis*)

Dotted Blue (*Tarucus sybaris Sybaris*)

Marbled Elf (*Eretis umbra umbra*)

Source: Ecological Scan and Impact Assessment for Air Products Proposed Acetylene Gas Production Facility, Natural Scientific Services (January 2014)

Mammals

Mammal species confirmed on site includes the Scrub Hare (*Lepus saxatilis*), Common Mole-rat (*Cryptomys hottentotus*) and Slender Mongoose (*Galerella sanguinea*). During consultation with the local community, four additional species on site were described which include Single-Striped Mouse (*Lemniscomys rosalia*), Striped Mouse (*Rhabdomys pumilio*), Suricate (*Suricata suricatta*) and Yellow Mongoose (*Cynictis penicillata*).

Birds

The open areas were found to support a number of common grassland species such as Rufous-naped Lark (*Mirafra africana*) while several typical garden species which included, amongst others, nesting Southern Masked-weaver (*Ploceus velatus*), Cape Sparrow (*Passer melanurus*) and Common Fiscal (*Lanius collaris*) were observed by the house and associated outbuildings on the

southern portion of the site. The lack of natural free-standing water bodies or wetland habitat explains the absence of water bird species.

Reptiles

Two reptile species were confirmed on site following active searching (*Table 6.11*). These included a Cape Skink (*Trachylepis capensis*) from beneath a mat and several Montane Speckled Skinks (*Trachylepis punctatissima*) from piles of old building material. Rinkhals (*Hemachatus haemachatus*) is said to be a commonly encountered snake in the area while Brown House Snakes (*Lamprophis capensis*) are apparently seen less frequently.

Frogs

According to Minter et al. (2004) a total of 15 frog species have the potential to occur in the greater area, however the lack of open water bodies and wetlands on or near the site exclude the presence of at least seven of these species. Three species which are less strictly tied to permanent water bodies and often found some distance from water were removed from an old swimming pool on site. These included Guttural Toad (*Amietophrynus gutturalis*) Tremolo Sand Frog (*Tomopterna cryptotis*) Natal Sand Frog (*Tomopterna natalensis*).

Invertebrates

Five butterfly species were detected on site despite a distribution map(1) which shows that a total of 77 species of butterflies should have been likely to occur in the study area.

(1)Henning, G.A., Terblanche, R.F., & Ball, J.B., (eds). 2009. South African Red Data Book: Butterflies. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria.