DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED PROVINCIAL ROAD K77: ELIZABETH ROAD TO K154, MIDVAAL LOCAL MUNICIPALITY, GAUTENG

GAUT: 002/14-15/0188

SUBMITTED TO:

Gauteng Department of Agriculture and Rural Development:
Sustainable Utilisation of the Environment Branch
P.O. Box 8769
Johannesburg
2000

APPLICANT:

GAUTENG PROVINCE
ROADS AND TRANSPORT
REPUBLIC OF SOUTH AFRICA

spoor environmental services

SPOOR Environmental Services (PTY) Ltd.

t: +27 (0)12 480 0612 f: +27 (0)86 763 5635 e: info@spoorenvironmental.co.za
p: Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040, Pretoria, South Africa
w: www.spoorenvironmental.co.za

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DOCUMENT DETAIL

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CLIENT:	Knight Piésold Consulting Engineers (PTY) Ltd.
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APPLICANT

APPLICANT:	Gauteng Province Department of Transport and Roads
CONTACT PERSON:	Mr. Kumen Govender
PHYSICAL ADDRESS:	41 Simmonds Street, Sage Life Building, Marshalltown, Johannesburg 2007
POSTAL ADDRESS:	Private Bag X83, Marshalltown, 2017
TELEPHONE:	011 355 7050
FAX:	011 355 7235
EMAIL:	kumen.govender@gauteng.gov.za

ENVIRONMENTAL ASSESSMENT PRACTITIONER

CONSULTANT:	SPOOR Environmental Services (Pty) Ltd
CONTACT PERSON:	Mr. JC van Rooyen
POSTAL ADDRESS:	Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040
TELEPHONE:	012 480 0612
FAX:	086 763 5635
EMAIL:	jcvr@spoorenvironmental.co.za

DECLARATION OF INDEPENDENCE

I, JC van Rooyen as authorised representative of SPOOR Environmental Services (Pty) Ltd, hereby confirm my independence as an Environmental Assessment Practitioner and declare that neither I nor SPOOR Environmental Services (Pty) Ltd have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which SPOOR Environmental Services (Pty) Ltd was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Proposed Road K77: Elizabeth Road to the K154, Midvaal Local Municipality, Gauteng Province.

Signed: _____ Date: _____

DISTRIBUTION OF ENVIRONMENTAL IMPACT ASSESSMENT

PUBLIC			
Area	**Venue**	**Location**	**Contact Person**
Drumblade, Midvaal Local Municipality	The Old "Touch of Green Nursery" 19 Elizabeth Road, Drumblade AH, Midvaal	19 Elizabeth Road, Cnr Elizabeth Road and Joan Avenue Drumblade AH, Midvaal	Mrs V Geffen 084 526 9195

INSTITUTIONS	
Name	**Institution**
Mrs. B. Belot Mrs. F. Mlambo	Gauteng Department of Agriculture and Rural Development: Sustainable Utilization of the Environment Branch
Mr. K. Govender	Gauteng Provincial Department of Roads and Transport
Mr. J. Viljoen	Knight Piésold Consulting
Mr. L. Mabona	Department of Water and Sanitation
Mr. S. Manele	Sedibeng District Municipality Transport Infrastructure and Environment (Executive Director)
Mr. H. Human	Midvaal Local Municipality Department Development and Planning (Executive Director) Division Environmental Management
Mr. S. Coetzee	Midvaal Local Municipality Department Engineering Services (Executive Director)
Mr. B. Welchman	Midvaal Local Municipality Department Engineering Services
Mr. N. Mashele	Midvaal Local Municipality Department Engineering Services Civil Engineering Services (Director)
Mr. R. Maswime	Midvaal Local Municipality Department Engineering Services Division Roads (Assistant Director)
Mr. G. Botha	Provincial Heritage Resources Agency Gauteng (PHRAG)
Mr. A. Solomon	South African Heritage Resources Agency

EXECUTIVE SUMMARY

Introduction

SPOOR Environmental Services (Pty) Ltd was appointed to conduct a Scoping and Environmental Impact Assessment for the proposed Road 77 between Elizabeth Road and the K154, Midvaal Municipality. The Scoping and EIA Process is being undertaken in terms of the National Environmental Management Act (Act no. 107 of 1998) read with the Environmental Impact Assessment Regulations, 2010 (GNR 543 of 2 August 2010).

Locality

The proposed road falls within the Sedibeng District Municipality which is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the Midvaal Local Municipality, between the areas of the Drumblade Agricultural Holdings and Eikenhof. The proposed road K77 alignment is planned to extend between Elizabeth Road and the R550 (Klipriver Road) or the K154.

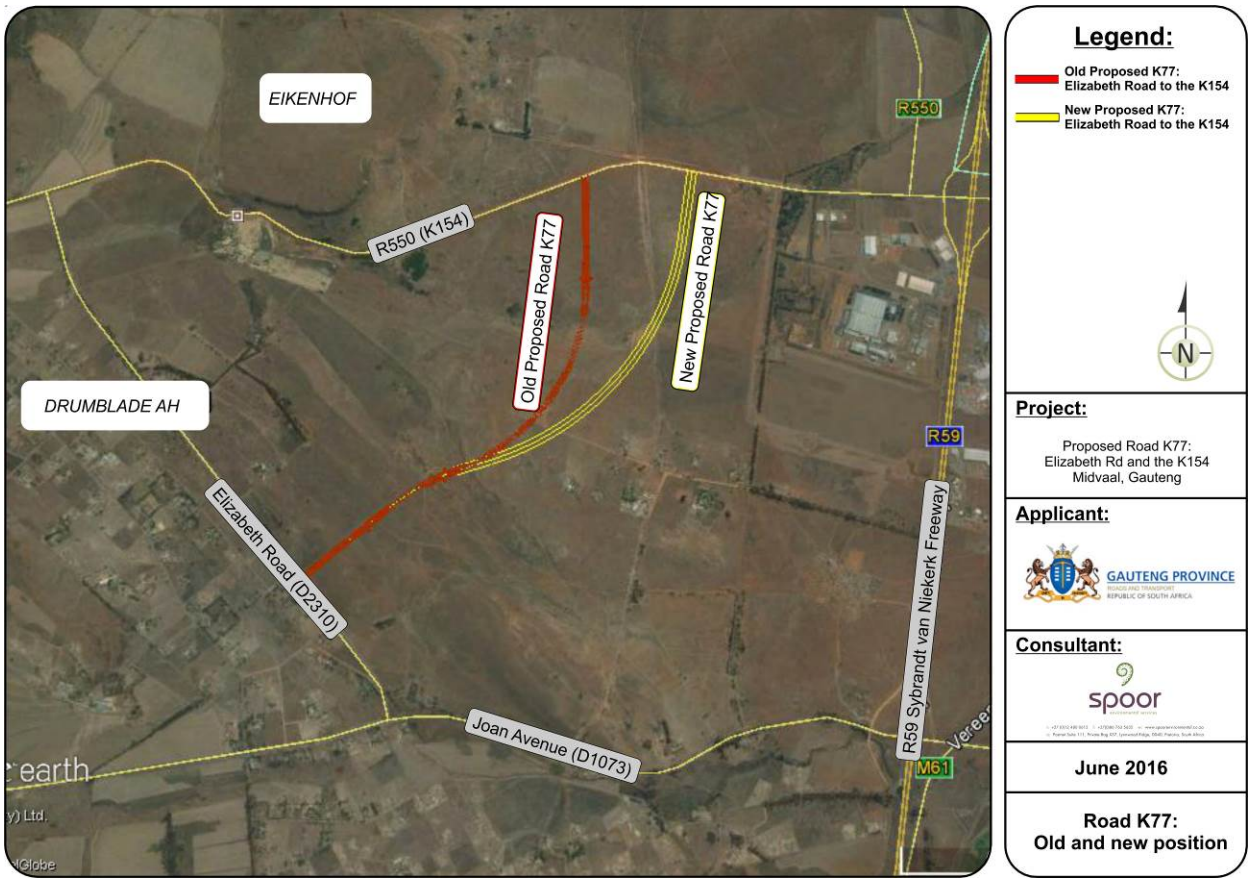
Project Description

The proposed provincial Road K77 will extend over a distance of approximately 4.3 kilometres and stretch from Elizabeth Road (D2310) to the R550 (K154). The proposed road will be designed and constructed as a tar surfaced dual carriageway (three lanes in each direction) within a road reserve of 62 metres. The first phase of this proposed project will however only include a single carriage way of one lane (3.7m wide) in each direction. A typical section of the completed road will consist of a 3 metre shoulder, three lanes of 3,7 metre each, an eight metre middle median and three lanes in the opposite direction and the final shoulder.

Background

Road K77 has a planning history that dates back to the early 1970's. An Interim Report deliberating the aspects of the planning of the then PWV road network were compiled and presented to the public in 1974. This network was planned to serve the area with a system of major transportation corridors. A separate report dealing with environmental aspects of the road network was developed at the same time. Details regarding the network were released to the public for a second time in August, 1975. Based on this network a considerable number of township applications have since been developed.

During the Specialist site biodiversity assessments, it came to the Environmental Assessment Practitioner's attention that the proposed alignment would cross a Class 1 ridge as well as the broader part of a wetland system which would highly impact the environment. According to Gauteng Department of Agriculture and Rural Development's Ridges Policy crossing a Class 1 ridge is a no-go option. In addition, this rocky ridge area has also been identified as being good quality habitat for sensitive faunal species. Discussions were held amongst the Environmental Assessment Practitioner's, the Gauteng Provincial Department of Roads and Transport, the Design Engineers and other stakeholders to find the best environmental solution for the alignment which was also acceptable to property developers in the area. A decision was made in April 2015 to realign Road K77 from Elizabeth Road northwards to reduce the impact on the receiving environment by avoiding the rocky ridge are and to cross the wetland at a position where this feature is already impacted by a service road. See the figure below.



On a more local scale the proposed road K77 is included in the planning frameworks included in the Sedibeng Integrated Development Plan, the Midvaal Integrated Development Plan, the Midvaal Spatial Development Framework as well as the Midvaal Western Regional Spatial Development Framework. These planning frameworks allow for the development of the proposed road within the auspices of the local development guidelines. In terms of development in the area of the proposed road K77, the primary development driver comes in the form of the Highlands Mixed Use Development. This development consists of a host of smaller residential, commercial and industrial developments which spans an area of more than 3500ha and which is in various stages of application, authorization and implementation.

Methodology

The approach adopted in compiling the EIA Report for the proposed project was to discuss the development in terms of its bio-physical components by means of reconnaissance site surveys as well as desktop studies. Interested and affected parties were notified of the intended development along with the relevant authorities. The Gauteng Department of Agriculture and Rural Development was consulted in the initial stages of the application and during the assessment phases in order to obtain their comments and recommendations. Alternatives for this phase of the project were compared and evaluated and key environmental issues were identified by superimposing the proposed activities on the existing environment.

Environmental Impacts Identified

Anticipated impacts have been identified and described as a result of the abovementioned processes and the pertinent impacts are summarized in the table below.

Proposed Road K77 Impact Summary

Potential Impacts	Impact Significance
Climate	
Large volumes of rain in short time	Medium
Lightning strikes	High
Impact of frost on piped services	Medium
Incidence of fog	Medium
Geology and Soils	
Topsoil clearance	Medium
Alteration of the existing geomorphology	Medium
Vegetation clearance	High
Surface and sub-soils contamination	High
Dolomitic sub surface material	Medium
Hydrology	
Erosion and siltation of surface water features	Medium
Ground and surface water pollution due to storage of chemicals and building material	High
Oil, grease and diesel spillages from construction vehicles	High
Pollution of ground water due to sanitation facilities	High
Pollution of water course as a result of polluted runoff	High
Construction within water course	High
Subsurface geological stability	High
Storm Water Management	
Scouring, erosion and sedimentation due to vegetation clearance	Medium
Contamination of storm water runoff	Medium
Increased volumes of storm water runoff due to lacking site specific storm water management	Medium
Flooding	High
Vegetation and Animal Life	
Terrestrial Areas	

Potential Impacts	Impact Significance
Loss of Ecological Sensitive & important vegetation units	High
Loss of flora species diversity	Medium
Introduction and proliferation declared weeds & invaders	High
Loss of Faunal habitat	High
Loss or displacement of threatened or protected fauna	High
Loss of Ecosystem function	Medium
Potential Impacts on the Drainage Line and Wetland Systems	
Loss of watercourse & wetland habitat	High
Loss of watercourse & wetland function	High
Loss of watercourse & wetland services	High
Social Impacts	
Socio-economic benefits as a result of development and growth in the area	High (Positive)
Employment creation	High (Positive)
Changes in crime patterns	High
Visual	
Change of Visual Character	Medium
Negative Impact on local visual receptors	Medium
Maintenance	Medium
Noise	
Operation of construction vehicles, equipment and the construction teams.	Medium
Noise generated from vehicles	Medium
Air Quality	
Dust generated during the construction phase.	Medium
Operational phase air quality	Medium
Traffic	
Reduced access	Medium
Unsafe conditions during the construction phase	High

Potential Impacts	Impact Significance
Allowance for public transport	Medium
Essential Services	
Services disruptions during construction	High
Improper waste management	High
Cultural Heritage Resources	
Possible sensitive cultural heritage materials on site	Low

The Environmental Assessment Practitioner with the aid of all the relevant government departments, specialists and interested and affected parties assessed the impacts which may occur as a result of the proposed development and proposed associated mitigation and rehabilitation measures that would mitigate these impacts.

Conclusion

In the light of the environmental data described, issues investigated and discussions with interested and affected parties, it is believed that the Environmental Impact Management Process is completed for this the Draft EIA Report Phase of the proposed road development. As the proposed road development is part of a long term planning exercise aimed at facilitating responsible development and alleviating traffic congestion and furthermore could also have a positive socio-economic impact it is recommended that the proposed road development be approved. However, it will be imperative to implement the mitigation measures and recommendations stipulated by this EIA Report and the various specialist studies. These mitigation measures and recommendations are included and refined in the Environmental Management Programme of which adherence must form part of the contractual agreement with the construction phase Managers and Contractors appointed and the Gauteng Provincial Department of Roads and Transport as the operational stage management body. A copy of the draft Environmental Management Programme is included in this EIA Report and changes will be made to the document once feedback have been received from Gauteng Department of Agriculture and Rural Development.

DETAILS AND EXPERTISE OF SPOOR ENVIRONMENTAL SERVICES

Name: JC van Rooyen
Company: SPOOR Environmental Services (Pty) Ltd
Qualifications: Pr LA Techno B.L. M. Sc (Env Soc)
Professional Registration: SACLAP

In accordance with Section 31 (2) (a) (ii) of Government Notice No. R. 543 of June 2010, this section provides an overview of SPOOR Environmental Service's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team. SPOOR Environmental Services (Pty) Ltd. has been in operation since 2011. The Director, Mr. JC van Rooyen, has been involved in an array of environmental consultation and planning projects in various spheres of the landscape design, development and environmental management disciplines over the past 15 years. SPOOR Environmental Service's approach towards projects is to strive for sustainable environments that not only reflect artistic and aesthetic quality but also hold diverse ecological and cultural value. The Company is capable of conducting environmental applications and landscape development planning and design for various projects including:

- Scoping & Environmental Impact Assessment Reports,
- Visual Impact Assessments,
- Environmental Management Systems/ Plans,
- Environmental Management Programmes (EMPr),
- Environmental Audits & Monitoring,
- Waste Management Licence Applications,
- Air Emission Licences (AEL's)
- Water Use Licence Applications (WULA)
- Integrated Environmental Management (IEM),
- Environmental Rehabilitation,
- Conservation Planning / Eco-tourism Developments,
- Landscape Design and Development,
- Landscape/ Environmental Project Management.

To date JC van Rooyen of SPOOR Environmental Services has been involved in similar projects which indicate that the EAP is capable to conduct the environmental assessment for the proposed project:

- **Route K72 including the new Pinehaven Interchange, Mogale City Gauteng**
  Client: Development and Engineering Consultants (Pty) Ltd.
  Applicant: Gauteng Provincial Department of Roads and Transport
  Responsibility: Scoping & EIA Application, Environmental Management Programme, Visual Impact Assessment and Water Use Licence Application.

- **Upgrade of Road K46 Phase II between the PWV5 and the N14 Intersection**
  Client: Knight Piésold Consulting Engineers (PTY) Ltd.
  Applicant: Gauteng Provincial Department of Roads and Transport

Responsibility: BA Application, Environmental Management Programme, Storm Water Management Guidelines, Water Use Licence Application.

- **Serapeng Road Extensions, Mamelodi, Gauteng Province**
  Client: Development & Engineering Consultants
  Applicant: City of Tshwane Metro Municipality
  Responsibility: BA Application, Environmental Management Programme.

- **Middelburg Eastern Bypass, Middelburg, Mpumalanga**
  Client: Bapela Cave Klapwijk Land Planning & Design
  Applicant: Steve Tshwete Local Municipality
  Responsibility: Finalization of Scoping and EIA process, Environmental Management Programme.

- **Brooklyn Circle Upgrade, Pretoria**
  Client: Bapela Cave Klapwijk Land Planning & Design
  Applicant: City of Tshwane Dept. Roads and Stormwater
  Responsibility: Finalization of BA Application & Environmental Management Programme.

PROJECT TEAM

The project team working on the proposed project consists of the following practitioners:

- **Mr. J.C. Van Rooyen** (*BL., M. Sc (Env. Soc*) (SACLAP) (Principle EAP)
  Landscape Technologist and Environmental Assessment Practitioner

- **Mrs. A. Le Roux** *(B. Sc L Arch, B.L Hons)*
  Candidate Landscape Technologist and Junior Environmental Assessment Practitioner

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ABBREVIATIONS

AH	-	Agricultural Holding
BA	-	Basic Assessment Report
BID	-	Background Information Document
CPF	-	Community Policing Forum
CLO	-	Community Liaison Officer
DEA	-	Department of Environmental Affairs
DEAT	-	Department of Environmental Affairs and Tourism
DWS	-	Department of Water and Sanitation
EAP	-	Environmental Assessment Practitioner
ECA	-	Environment Conservation Act
EIA	-	Environmental Impact Assessment
EIAR	-	Environmental Impact Assessment Report
EMPr	-	Environmental Management Programme
GDARD	-	Gauteng Department of Agriculture and Rural Development
GPDRT	-	Gauteng Provincial Department of Roads and Transport
GVA	-	Gross Value Added
IEM	-	Integrated Environmental Management
IDP	-	Integrated Development Plan
I&AP	-	Interested and Affected Parties
ISDF	-	Integrated Spatial Development Framework
MAMSL	-	Metres Above Mean Sea Level
MLM	-	Midvaal Local Municipality
ML/D	-	Mega Litre per Day
NEMA	-	National Environmental Management Act
NEMBA	-	National Environmental Management Biodiversity Act
NEMWA	-	National Environmental Management Waste Act
NFEPA	-	National Freshwater Ecosystems Priority Areas
NHRA	-	National Heritage Resources Act
NMD	-	Notified Maximum Demand
OHS	-	Occupational Health and Safety
PHRAG	-	Provincial Heritage Resources Authority of Gauteng
PVW	-	Pretoria Vereeniging Witwatersrand
QDSG	-	Quarter Degree Square Grid
SABS	-	South African Bureau of Standards
SAHRA -	-	South African Heritage Resources Agency
SDM	-	Sedibeng District Municipality
SDF	-	Spatial Development Framework
S&EIR	-	Scoping and Environmental Impact Report

1. INTRODUCTION

1.1 Project Overview

SPOOR Environmental Services (Pty) Ltd was appointed as the independent environmental assessment practitioner (EAP) to manage the Scoping and Environmental Impact Assessment application for the proposed detailed design and construction of a section of road K77. The section of road under this application stretches over a distance of roughly 4.3 kilometres and lies between Elizabeth road (D2310) and the K154 (R550) in the area of the Drumblade Agricultural Holdings and Eikenhof, Midvaal Local Municipality (MLM), Gauteng. The proposed road development will ultimately connect this area of the MLM to northern and southern development nodes via a network of other planned and existing roads. The primary motivation for the development of the road stems from the need to create sufficient traffic infrastructure to provide in the local area's future development requirements. See Appendix 1 & 2.

1.2 Locality

On a regional scale the proposed road falls within the Sedibeng District Municipality which is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the MLM, between the areas of the Drumblade AH and Eikenhof. See Figure 1. A list of the coordinates of the proposed road alignment is included in Table 1 below.

Table 1: Route positioning

ROUTE POSITIONING INFORMATION	
Distance (Kilometre)	**Decimal Coordinates**
From Elizabeth Road	
0m (Start)	26.44234° S 28.02887° E
500m	26.43951° S 28.03276° E
1000m	26.43669° S 28.03682° E
1500m	26.43497° S 28.04141° E
2000m	26.43326° S 28.04601° E
2167m (Middle)	26.43244° S 28.04745° E
2500m	26.43057° S 28.05002° E
3000m	26.42709° S 28.05316° E
3500m	26.42302° S 28.05525° E
4000m	26.41862° S 28.05626° E
4335m (End)	26.41554° S 28.05676° E
To R550 Heidelberg Road (K154)	

1.3 Background and Motivation

Road infrastructure provision lies at the core of the mandate of the Gauteng Provincial Department of Roads and Transport (GPDRT). According to their vision and mission the Department aims to provide "world class road and transport infrastructure networks and systems that facilitate seamless mobility of goods and people with Gauteng". The GPDRT aims to achieve this via the provision of "environmental sustainable road infrastructure and integrated transport systems and services which is reliable, accessible, safe and affordable and which promoted socio-economic development within Gauteng" (GPDRT, 2015).

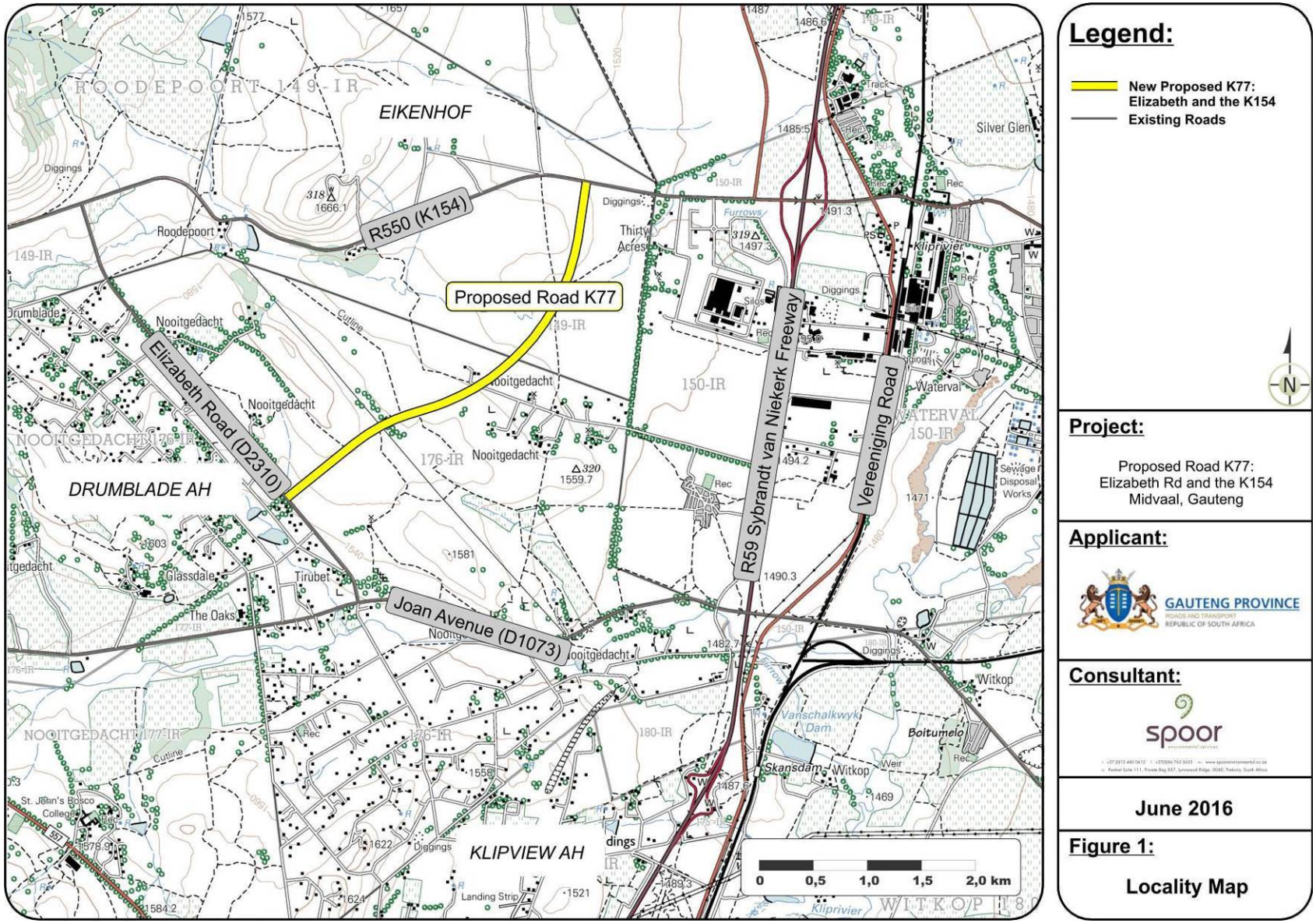

Figure 1: Locality Map

Road K77 has a long planning history that dates back to the 1970's. The predecessor to the GPDRT also known as the PWV Consortium developed and Interim Report deliberating the aspects of the planning of the then (Pretoria, Witwatersrand and Vereeniging) PWV road network. The report was compiled and presented to the public in 1974. This network was planned to serve the area with a system of major transportation corridors. A separate report dealing with environmental aspects of the road network was developed at the same time. Details regarding the network were released to the public for a second time in August, 1975. Based on this network a considerable number of township applications have since been developed. In line with the above, the GPDRT continued on the work that was done on the PWV network and developed the Gautrans Strategic Road Network Plan to outline future road network requirements for the Province.

In addition to the above the MLM also recognises the importance of the establishment and protection of the Municipal road network in order to "*ensure that Midvaal is functionally linked to the surrounding urban fabric and performs its function, both economically and socially, in the broader regional and provincial context*" (Midvaal SDF, 2011). The K77 forms part of proposed road infrastructure developments within the MLM and also as a proposed Class 2 roads as contained in the Sedibeng Integrated Transport Plan.

On a more local scale the area surrounding the Eikenhof, Drumblade AH and Klipview AH areas is included in an area that is set to be part of significant residential, commercial and industrial developments in the future. In studies obtained from the project Design Engineers and other sources, the development site of the proposed road K77 is partly included in the Gauteng Highlands development which comprises a host of other developments. The Gauteng Highlands Development is developed by the Blue Rose Development Group and is reported to be in various stages of applications, authorizations and development. See Figure 2. A list of these developments includes the;

- Eye of Africa Golf Estate (680 ha);
- Graceview Industrial Park (147 ha) including the planned 300 000m² Pick 'n Pay Distribution Campus;
- Heineken / Diageo Sedibeng Brewery (83 ha);
- The Grace Multi-Use Development including Graceland housing development and
- Gracewood (Joziwood) studios (708 ha);
- Mountainview Residential Estate (293 ha); and the
- Woodacres Residential Estate (197 ha).

In addition, developments administered by other Developers includes the;

- Klipriver Business Park (150 ha);
- Central Developments (1,250 ha);
- Savanna City (Basil Read / Old Mutual) integrated housing development;
- BSI Steel (adjacent to the R59);
- Developments on Rand Water Land (adjacent to the R550/D766 and R59); and
- Tambo Springs Inland Port (along K154 near the N3).

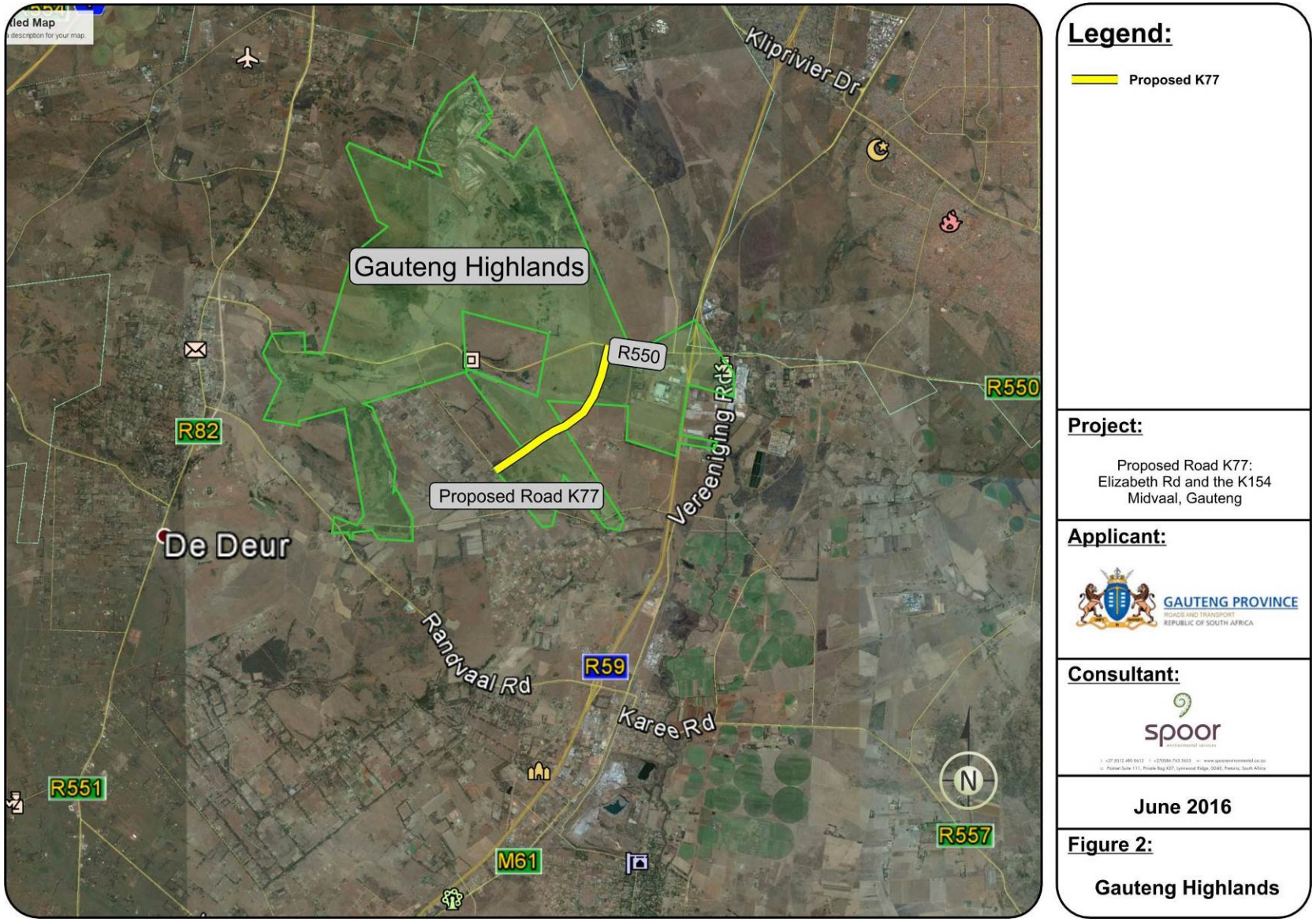

Figure 2: Extent of Gauteng Highlands

In summary the need for the development of the K77 therefore seem to originate firstly out of the stance to maintain and improve the current road infrastructure from the provincial to the local municipal level and secondly to ensure the requisite traffic infrastructure is developed to support the future residential, commercial and industrial developments. Specialist Traffic Impact Assessments studied for the purposes of the current application have identified the need for the upgrade of the existing traffic infrastructure and in the light of this, the environmental impact assessment for the upgrade of the R550 (from the existing gravel road to a surfaced road) has also been finalized and environmental authorization granted.

1.4 Methodology

The principles of NEMA (Act No. 107 of 1998) stress the importance of the conservation of the world's and our country's natural and cultural heritage. It also stresses the fact that environmental management must place people and their needs at the forefront and serve their physical, psychological, developmental, cultural and social interests equitably. This introduces an anthropocentric approach to environmental management and establishes the importance of a balanced view towards development and conservation.

The principles of Integrated Environmental Management (IEM) also include:

- the promotion of sustainable development;
- protecting natural environments;
- maintaining of an environment which is not harmful to people's health or well-being;
- an open participatory approach to impact assessment;
- the timeous consideration of environmental impacts before decisions on proposed developments are taken and;
- accountability for the potential impacts and the management of these impacts.

An application for authorisation to undertake the scoping and environmental impact assessment process for the proposed development was submitted to the Gauteng Department of Agriculture Rural Development (GDARD) on the 12th of November 2014. The acknowledgement of receipt of the application was received from the Department on the 28th of November 2014. The GDARD afforded the project with the following reference number: **GAUT:002/14-15/0188.**

In short, the Environmental Impact Assessment Report will describe the following:

- The background to the project;
- The relevant legislation and guidelines that were considered in preparation of the Scoping Report;
- a description of the property on which the proposed activity is to be located;
- a detailed description of the proposed scope of work;
- a description of the environment that may be affected by the project which will include all current physical, biological, social, economic and cultural aspects of the receiving environment;
- details of the public participation process conducted;
- a description of all feasible and reasonable alternatives;
- identification of all physical, biological, social, economic and cultural environmental impacts of the proposed development on the properties, and
- a detailed analysis and evaluation of the potential impacts associated with the construction and operational phase on the environment and subsequent conclusions, recommendations and mitigation measures to be implemented.

1.4.1 Phases in the EIA Process

The first phase of the public participation process ran concurrently with the scoping phase when interested and affected parties in the vicinity of the proposed development were notified by advertisements of the environmental evaluation process in a local newspaper, the Citizen of the 13th of January 2015, (as recommended by the ward Councillor) as well as site notices placed on the site boundary and adjacent to main routes running past the site. Interested and Affected Parties (I&APs) adjacent to the proposed road development received Background Information Documents (BID's) which provided them with details on the proposed development, all the contact details of the EAP and where they could obtain additional information regarding the proposed road development.

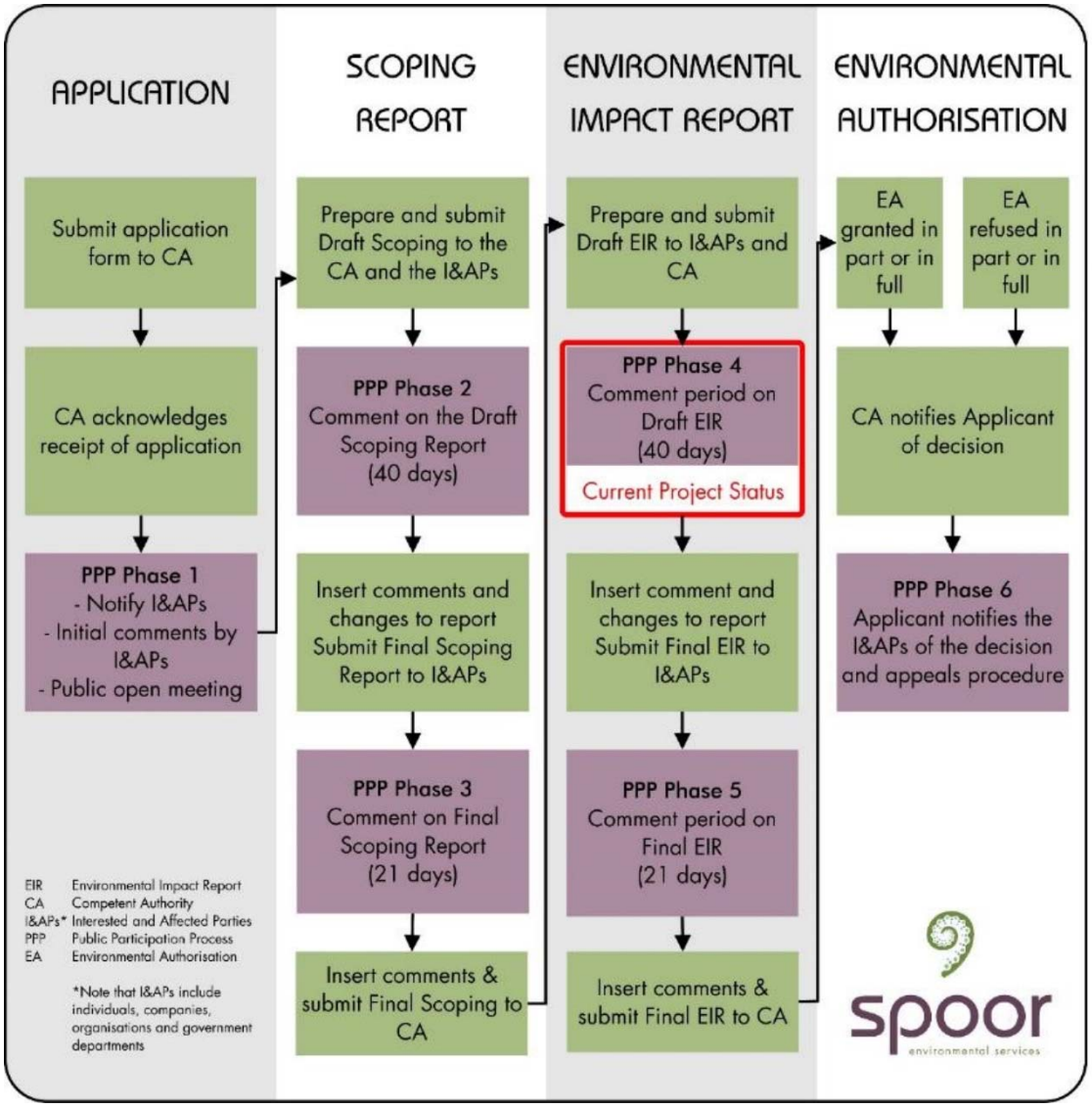

Figure 3: EIA phases

The project EIA is currently in the notification stage of the Draft Environmental Impact Assessment Report (PPP Phase 4). The remainder of the EIA process is depicted in Figure 3.

The GDARD was consulted in the initial stages of the formulation of the Draft and Final Scoping Report to obtain their recommendations as to the remainder of the assessment. Additionally, relevant authorities of other sections of local and provincial government were also informed of the proposed development in

order to allow these authorities to include their comments and recommendations. All this information has been included in this Draft Environmental Impact Assessment Report, which will be submitted to the public and the GDARD for review.

2. DESCRIPTION OF THE PROPOSED PROJECT

2.1 Road Design Considerations

SPOOR was informed by the GPDRT that the existing road K77 alignment detail was developed over the preceding two-year period. This alignment was based on the planning performed during the 1970's in addition to the more recent requirements of the overarching traffic planning strategies including the GPDRT Strategic Road Network Plan and the Sedibeng Integrated Transport Plan as well as the traffic infrastructure directives included in the Midvaal Local Municipality Integrated Development Plan (IDP) and Strategic Development Framework (SDF). Traffic Impact Assessments performed for adjacent developments were furthermore also taken into account during the design of this section of the proposed K77. The section of the proposed road K77 under this application constitutes the middle section of an alignment that will stretch further to the north and the south.

The average daily traffic on the road is estimated to be to 2938 vehicles. The estimated heavy vehicle traffic according to the SANRAL Traffic Count Information Yearbook of 2012 compiled by Mikros Traffic Monitoring, is approximately 70%. Thus, the estimated average daily truck traffic is estimated at 2,507 heavy vehicles per day for year 2019 for the section of the K77. The estimated traffic growth in the area is expected to be between 2% and 4% per annum. This is in line with the GDP growth in the country, as is expected to be the case. Predictions for future traffic loading are based on recommended values provided in Draft TRH 4 (1996), published by the Department of Transport for COLTO (Committee of Land and Transport Officials). Due to the medium level of service it is recommended that the road be designed as a Class C road. (Knight Piésold, 2016). Assumptions made by the road design Engineers for the purpose of the analysis are as follows:

- Structural design period of 15 years;
- Initial design (base) year taken as 2019 when construction is expected to be Completed;
- Traffic growth rates of 2%, 3% and 4% per year up to 2034 in the sensitivity analysis calculations;
- Heavy vehicle characteristics (i.e. number of axles, axle configuration and spacing as well as loading) remain constant over the forecast period. (Knight Piésold, 2016).

The full extent of new developments (Section 1.3), the anticipated 2030 Regional Road Network and the Gauteng Province Planning Department were also taken into account in terms of the proposed road and interchange designs.

2.2 Road Design

2.2.1 Carriage Way

In terms of the proposed road construction, the road will extend over a distance of approximately 4.3 kilometres and will stretch from Elizabeth Road (D2310) to the R550 (K154). The Design Engineer also reports that the proposed K77 will serve as an urban collector road providing North-South connections in the area between Elizabeth Road and the K154.

The proposed road will be designed and constructed as an asphalt surfaced (Pavement Class V) dual carriageway (three lanes in each direction) within a road reserve of 62 metres. (Knight Piésold, 2016). A Class V standard allows for an ES3-10 pavement class. (Knight Piésold, 2016). The first phase of this

proposed project will however only include the construction of a single carriage way (eastern section) of one lane (3.7m wide) in each direction. Additional lanes will be constructed as required by the growth in the traffic load which the road need to carry. A typical section of road will consist of a 3 metre shoulder, three lanes of 3,7m each, an eight metre middle median, three lanes in the opposite direction and the final shoulder. Once completed the roadway will also have bus lanes along the middle of the carriageway. Storm water infrastructure will be added on the outer boundaries of the proposed road. See Figure 4 and Appendixes 1 & 2.

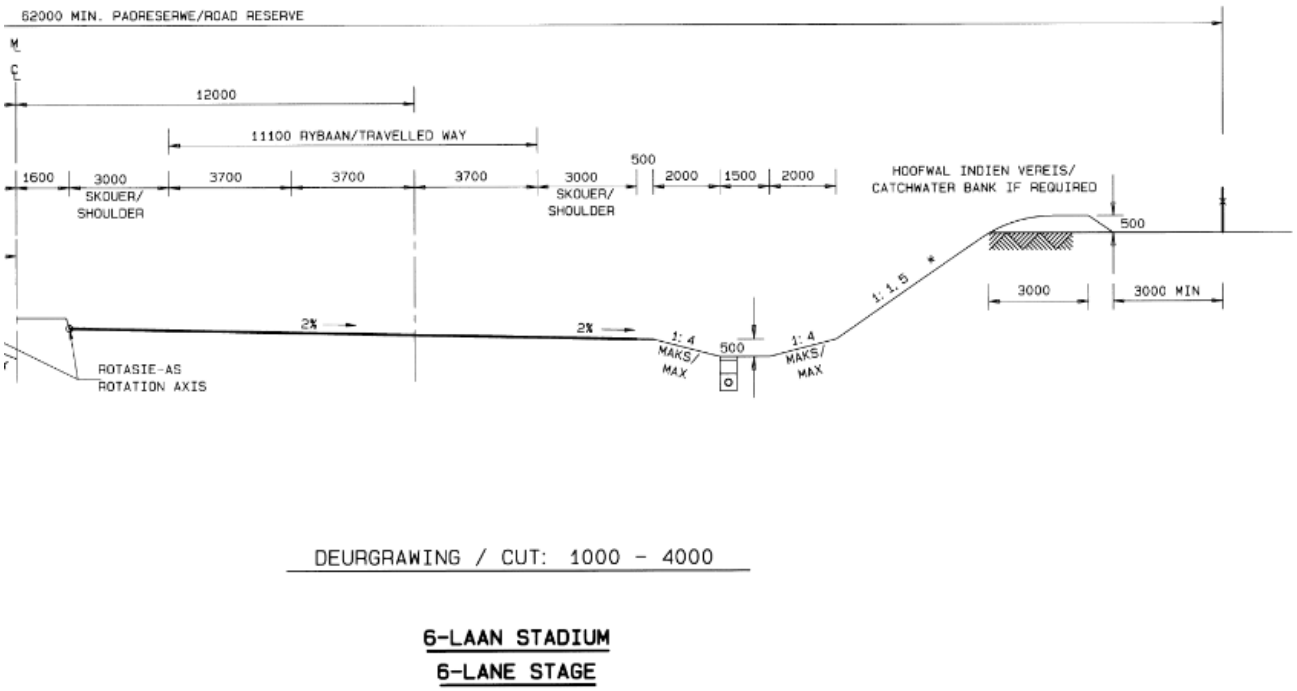

Figure 4: Typical Road Section (One Direction) (Knight Piésold, 2016)

2.2.2 Access and Intersections

Route K77 proposed between Elizabeth road and the K154 will start at Elizabeth Road at Km 0.00. Elizabeth Road is a single carriageway road with no median. The following accesses and intersections are located on the proposed route K77:

Km 0.600	30m access road at 90°
Km 1.254	40m access road at 90°
Km 1.987	40m access road at 90°
Km 3.108	30m access road at 90°

The end of route K77 intersects with route K154 at Km 4.343. Route K154 is a dual carriageway similar to Route K77. No other future accesses are planned for this section of route K77 and all accesses are spaced more than 600m apart. Bus and Taxi infrastructure will be accommodated at all the intersections.

Access to adjacent properties will happen via specific signalized intersections as described above. Mitigation measures will be included in the K77 specific Environmental Management Programme (EMPr)

that will guide the applicant and associated contractors regarding access and fences during the construction and operational phases of the proposed development. (Knight Piésold, 2016).

2.2.3 Supporting Infrastructure

Additional road infrastructure will consist of;

- the relevant street furniture e.g. street lighting, litter bins, traffic signage and safety barriers in the required areas;
- bus and taxi pick–up areas in the designated areas with associated structures;
- traffic signalling and related infrastructure;
- storm water infrastructure including discharge structures;
- a bridging structure to cross the non-perennial upper tributary of the Klip River. (See Appendixes 1 & 2.)

2.2.4 Construction Phase

The construction activities associated with the proposed construction of the K77 will include the required construction camp including site offices and facilities, temporary sanitation facilities, construction vehicle parking, material holding and laydown areas, etc. Detailed mitigation specifications will be included in the K77 EMPr to guide the placing and management of this aspect of the proposed project.

2.3 Essential Services

All civil service related requirements for the proposed project are being managed by Knight Piésold Engineering Consultants (PTY) Ltd., who serves as the appointed Civil Engineering and Project Management Consultation firm on the Project. The Engineer has conducted in depth assessments of all the services that would be impacted on (Telkom, Eskom, Sasol, Rand Water) by the proposed alignment and reported that apart from a Rand Water Pipeline no services will be impacted. SPOOR contacted Rand Water as part of the standard public participation process and Rand Water confirmed that the road alignment will cross their B7 pipeline. They furthermore stated the recommended mitigation measures which is included in the project EMPr. Constant communication will be upheld by the Engineer and the various service providers throughout the pre-construction planning and construction phases.

The phasing of the construction will be discussed with all the service providers to ensure that services are moved well ahead of actual construction. This will be done in order to inform members of the local communities well before any disruptions in services will occur in order for them to prepare and also to keep services disruptions minimal. In addition, these services will also be incorporated into the design and construction of the new road in a way that assures its effective functioning into the future.

Availability of infrastructural resources (e.g. water and electricity) will be negotiated with the relevant service provider (Eskom, Rand Water or the Midvaal Local Municipality - MLM) with specific reference to the construction and operational phases of the proposed road. In terms of water required for the construction phase the most probable scenario would be that the appointed construction contractor would link onto one of the nearest Rand Water or municipal water supply pipeline, which would be metered and the account paid. The electricity requirements of the development consist of the connection needed for the traffic signalling infrastructure, the lighting of the interchanges and lighting along a specified distance the K77 during the operational phase of this road. The appointed contractor will connect onto the existing Eskom or MLM electricity connection for this purpose.

2.3.1 Storm Water Management

A detailed storm water management plan was developed for the proposed road K77. See Appendix 2. The main purpose of the storm water management plan was to determine the flow of the storm water from the relevant catchments and to design storm water infrastructure to manage these flows efficiently. The master plan incorporates a minor drainage system for frequent storm events and a major drainage system for the less frequent storm events (CSIR, 2005). The major drainage system consists of the Klip River tributary and the minor drainage system consists of side drains, kerbs, discharge points, grid inlets and cross drains. (Knight Piésold, 2016).

2.3.1.1. Flood Peak Estimation

Flood peak estimation was conducted in order to determine the type and sizes of the storm water drainage infrastructure require for the proposed section of the K77. The Engineer reported that the catchment areas of the drainage structures range from 0.003km² – 36.39km² and can be categorized as small. The following deterministic methods were used to estimate the flood peaks: The Rational Method (RM), Standard Design Flood (SDF) Method and the Empirical (Kovacs) Method. (Knight Piésold, 2016).

The RM is usually recommended for small catchments with an area of up to 15km² and therefore was the only method used for computing flood peaks for sizing the minor drainage system. The SDF method has no catchment limitation, however according to SANRAL (2002), it is recommended for catchment areas greater than 20km². Empirical methods are based mainly on flow measurements at measuring stations covering catchments that are seldom smaller than 10km² and usually larger than 100km². Consequently, the SDF and Kovacs method were only used for flood estimation for sizing the major drainage infrastructure. The flood peaks computed for various return intervals using the methods discussed above are summarized in the Detailed Design Report. (Knight Piésold, 2016). See Appendix 2.

In addition, the Engineer reported that Manning's equation was used to determine the sizes of the minor storm water drainage infrastructure (side drains and cross drains). Sizing of the minor drainage systems entails assessing the capacities of different sizes of drains against the estimated design peak discharge. The proposed K77 would require Type F side drains and Trapezoidal (earth and stone pitched) channels as well as storm water pipes and pipe culverts at various sizes to carry storm water to the specified discharge points below the proposed road and underneath intersections. The specific storm water drainage systems used at the specific chainages along the K77 road alignment is specified in Appendix 2.

2.3.1.2. Drainage Feature Crossings

The proposed road K77 development intercepts two drainage features. One at the start of the proposed road (between chainage 0.000 and 0.100) and the other at a distance of 1 100m south of the K154 (between chainages 3 100 & 3 300). See Figure 5. The drainage feature at the intercept of the proposed K77 and Elizabeth road classifies as a minor drainage system of which the storm water drainage will be managed via a grassed trapezoidal channel and a pipe culvert cross drain as described above. The crossing of the upper tributary of the Klipriver (between chainages 3 100 & 3 300) is however described as a major drainage system and would require a reinforced cellular concrete box culvert structure to transport storm water runoff along this natural channel underneath the alignment. A Water Use Licence Application will be submitted to the Department of Water Affairs in terms of Section 21(c) and (i) of the National Water Act, 1998, (Act 36 of 1998) for the crossing of the said drainage courses.

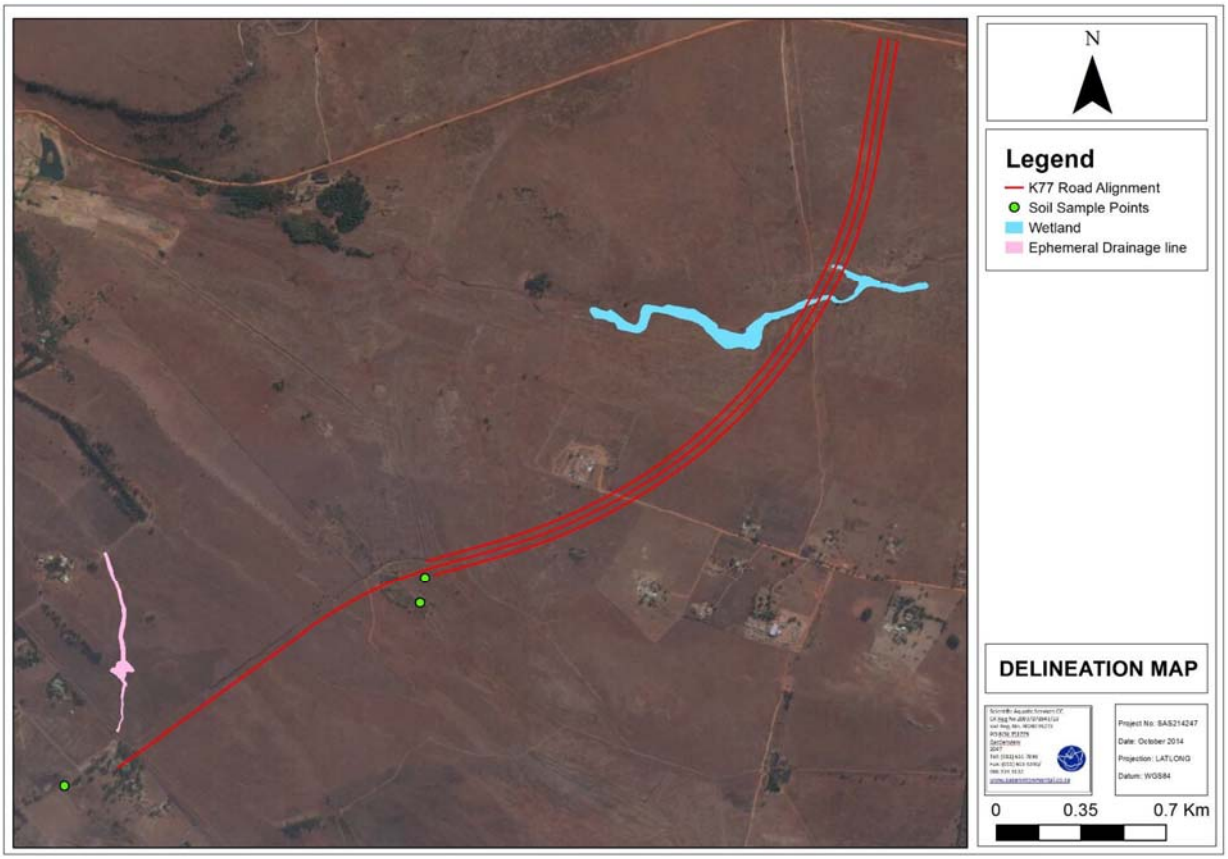

Figure 5: Drainage Features Along the K77 Route

2.3.1.3. Culvert Design (Chainage 3 100 & 3 300)

The Engineer reported that the aim of culvert design was to maintain equilibrium between flow and the erosion processes of the natural watercourse. The hydraulic assessment of the Klip River tributary in its present state as well as with the culvert structure installed was carried out using the US Army Corps of Engineers River Analysis System – HEC – RAS version 4.1.0. This system enables the computation of one dimensional steady and unsteady flow river hydraulics, sediment transportation and water temperature analysis. Only the steady flow system was executed for this study however. The steady flow system is used to evaluate flood encroachments, assess the impacts on the water surface profiles due to the channel modifications and assist in the design of various obstructions. In addition, the 1:20 year recommended design flood peaks referred to as the "indicator flood" (Drainage Manual, 2013), was used in conjunction with the class of the road (Class 3) to determine the design flood frequency. (Knight Piésold, 2016).

The results of the hydraulic assessments indicated that a culvert structure of 10 portal cells of 3.0 x 2.4m would be sufficient to manage the 1:20 year recommended flood design peaks. The barrels were modelled as 70m long with a longitudinal slope of 1%. The impact that this structure will have on the existing flood characteristics is summarised in Table 2.

Table 2: Impact of Proposed Klipriver Tributary Culvert (Knight Piésold, 2016)

Structure	Q_D (m^3/s)	Downstream velocity ratio	Change in the upstream water level (m)	Freeboard (m)
Culvert	110	2.41	-0.07	0.59

The Engineer reported that the downstream velocity ratio is greater than 1.67. Consequently, erosion protection measures should be adopted at the Culvert outlet to mitigate against erosion. An illustration of the inundation expected during the culvert design flood event and the 1 in 100-year flood event is available in Appendix 2. From the maps it can be seen that the culvert has an impact on the existing flood lines in the area. However, this influence is limited to a short distance upstream of the culvert. (Knight Piésold, 2016).

2.3.1.4. Protection Against Scouring and Erosion

Determination of the anticipated scour depth is an important consideration in culvert design, as it determines the founding level of the structure and whether there is need for energy dissipaters at the outlet. The scour depth and rate depend on the stream flow conditions, erosive power of the flow, bed material properties and the balance between sediment transported into and out of the hydraulic structure. (Knight Piésold, 2016).

- **Inlet**

Flow through the culvert is expected to accelerate over a very short distance (usually assumed to be equal to the height of the structure) before entering the barrel of the structure. These high velocities may induce scour affecting the stability of the wing walls. Therefore, a concrete apron extending at least the height of the structure is recommended on the upstream side. (Knight Piésold, 2016).

- **Outlet**

In terms of the outlet, the primary aim of erosion protection downstream of the culvert is to reduce the exit velocities to be no greater than the natural stream flow velocities. Past experiences indicate that the 1:100-year flood event results in the most severe scour conditions. At the culvert site, exit velocities during this event can reach 5,09m/s. The Engineer furthermore reported that an undular jump is expected at the culvert outlet. These jumps have no distinct wave front and are not associated with a lot of energy loss. Flow changes from supercritical to subcritical through a series of unbroken waves propagating downstream. Revetment extending at least 10m downstream of the culvert structure is therefore necessary to protect the embankments against scour. This can be in the form of a concrete apron with baffles extending at least the height of the structures with a combination of gabion boxes and reno mattresses over the remaining length. The gabion boxes need only to be 1,5m high. (Knight Piésold, 2016). Additional storm water management guidelines will be discussed in Section 7 and the project EMPr.

3. LEGISLATIVE FRAMEWORK

The following section includes the primary list of legislation which is deemed relevant to the proposed development on all levels of government, including the constitutional, national, provincial and local level. Although the aim was to be as comprehensive as possible the list does not represent a complete legal review and the responsibility remains with the Applicant to ensure compliance with the required relevant legislation.

3.1 The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)

The Constitution of the Republic of South Africa is the principal legal source of the Republics' legislative framework, including its environmental law. The Bill of Rights is fundamental to the Constitution of South Africa and in, section 24 of the Act, it is stated that:

Everyone has the right (a) to an environment that is not harmful to their health or well-being; and (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.

Given that environmental management is founded partly on the principles of public participation, Section 195 of the Constitution is of primary relevance. This section states that:

> *(1) Public administration must be governed by the democratic values and principles enshrined in the constitution, including the following principles: (a) (b) (c) (d) (e) People's needs must be responded to, and the public must be encouraged to participate in policy making. (f) Public administration must be accountable. (g) Transparency must be fostered by providing the public with timely, accessible and accurate information (Government Gazette, 1996).*

3.2 Environment Conservation Act, 1989 (ECA) (Act 73 of 1989)

The primary objective of the ECA is to provide for the effective protection and control of the environment. Subsequent to the promulgation of the Act in 1989, a number of key regulations governing EIA's and identified activities that may be detrimental to the environment have also been promulgated. Section 8 of the Regulations regarding activities identified under section 21(1) of the Environmental Conservation Act (73 of 1989) – General EIA Regulations states that:

> *After a plan of study for the environmental impact assessment has been accepted, the applicant must submit an environmental impact report to the relevant authority, which must contain; (a) A description of each alternative including particulars on (i) The extent and significance of each identified environmental impact; and (ii) The possibility for mitigation of each identified impact. (b) A comparative assessment of all the alternatives; and (c) Appendices containing descriptions of (i) The environment concerned; (ii) The activities to be undertaken; (iii) The public participation process followed, including a list of interested parties and their comments; (iv) Any media coverage given to the proposed activity; and (v) Any other information included in the accepted plan of study.*

3.3 National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)

The purpose of the Environmental Impact Assessment Amendment Regulations of 2010 is to:

> *"regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment, or where it cannot be avoided, ensure mitigation and management of impacts to acceptable levels, and to optimise positive environmental impacts, and for matters pertaining thereto."*

The Act provides for the right to an environment that is not harmful to the health and well-being of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks (Government Gazette, 1998). Section 30 (1, 3 and 4) of NEMA states that:

> *Additionally, in terms of the regulations for certain activities, as identified in terms of Section 24(2)(a) and (d) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), the applicant must follow the Environmental Impact Assessment Process (also known as the EIA process) as described in the National Environmental Management Act, 1998 (Act No. 107 1998). This process must be performed with the aid of the appointed independent Environmental Assessment Practitioner (EAP) which must perform the necessary assessments and then submit the results of these assessments in the form of a scoping report and an environmental impact assessment report thereafter. These reports will be submitted to the Gauteng Department for Agriculture and Rural Development (GDARD) for authorisation.*

The proposed project is listed in terms of the listed activities under the NEMA (Act 107 of 1998), June 2010 regulations. This document constitutes the Scoping Report and was compiled as part of an application for environmental authorization in terms of section 24 of the NEMA and as contemplated in regulation 28(f) and 29 of the EIA Regulations.

3.3.1 Listed Activities Applicable to the Proposed Design and Construction of Road K77 between Elizabeth Road and R550 (K154).

The table below provides a summary of the listed activities specified in the EIA Regulations of June 2010 and which is applicable to the proposed development.

Table 3: Listed Activities in terms of the June 2010 NEMA Regulations

GNR and Activity No	Activity Description	Discussion
GNR.544 Activity 11	*The construction of:* *(i) canals* *(ii) channels* *(iii) bridges;* *(xi) infrastructure or structures covering 50m² or more*	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of a bridging structure covering 50m² or more within 32m of a watercourse.

GNR and Activity No	Activity Description	Discussion
	where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	
GNR 544 Activity 18	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from:* *(i) a watercourse.*	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of a bridging structure. More than 5 cubic metres of soil will be excavated/ moved with the construction of the bridge or culvert.
GNR 544 Activity 22	*The construction of a road, outside urban areas,* *(i) with a road reserve wider than 13,5 meters, or* *(ii) where no reserve exists where the road is wider than 8 meters,*	The new proposed road will be constructed outside of the urban edge with a road reserve of 62 meters.
GNR 545 Activity 18	*The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, where this road:* *(ii) is a road administered by a provincial authority;* *(iii) road reserve is wider than 30 metres; or* *(iv) will cater for more than one lane of traffic in both directions.*	The proposed K77 was presented to the public with the first publication of a network of transportation corridors in November, 1974. The constructed road will be administered by the Gauteng Province Department of Roads and Transport, will have a 62m road reserve and will cater for 3 lanes of traffic in both directions.
GNR 546 Activity 13	*The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,* *(d) In Gauteng;* *v Sites identified as irreplaceable or important in the Gauteng Conservation Plan.*	The site will require the clearance of approximately 24 ha of area identified as important by the Gauteng Conservation Plan.
GNR 546 Activity 16	*The construction of:* *(iv) infrastructure covering 10 square metres or more,* *where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.* *(b) In Gauteng;* *v Sites identified as irreplaceable or important in the Gauteng Conservation Plan.*	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of bridging infrastructure covering more than 10 square metres. This construction will take place within 32m of the watercourse.

SPOOR Environmental Services Environmental Consultants has subsequently been appointed by the applicant, Gauteng Province Department of Roads and Transport (GPDRT), as the independent Environmental Assessment Practitioners (EAPs) to undertake this Environmental Impact Assessment process and to ensure compliance with all the relevant Environmental Legislation, Regulations and Guidelines.

3.4 National Environmental Management: Biodiversity Act, 2004 (NEM:BA) (Act 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed. In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations),
- Application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity,
- Limit further loss of biodiversity and conserve endangered ecosystems.

3.5 National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)

In regulating air quality in South Africa, The NEM:AQA was introduced to protect the environment by introducing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development whilst promoting justifiable economic and social development. In addition, the act aims to provide national norms and standards for regulating air quality monitoring as well as air quality management and control. The list of activities included in General Notice 248 must be considered for any activities that produces emissions. The following passages of the act bare relevance;

Section 22: No person may without a provisional atmospheric emissions licence conduct an activity;
(a) listed on the national list anywhere in the Republic; or
(b) listed on the list applicable in a province anywhere in the province.

3.6 National Environmental Management: Waste Act, 2008 (Act 59 of 2008)

Act no 59 of 2008 provides for the control of waste management activities which have or is likely to have a detrimental effect on the environment. The act aims to;

- Reform the law regulating waste management in order to protect health and the environment by providing reasonable measures to prevent pollution and ecological degradation and for securing ecologically sustainable development,
- To provide for institutional arrangements and planning matters,
- To provide for national norms and standards for regulating the management of waste by all spheres of government,
- To provide for specific waste management measures,
- To provide for the licensing and control of waste management activities,

- To provide for the remediation of contaminated land,
- To provide for a national waste information system,
- To provide for compliance and enforcement, and
- To provide for all matters related to the above aspect.

Importantly the act furthermore includes requirements that stipulate that no person may commence, undertake or conduct a waste management activity listed in the act unless a licence is issued in respect of that activity.

3.7 National Water Act, 1998 (NWA) (Act 36 of 1998)

The National Water Act (NWA) identifies 11 consumptive and non-consumptive water uses in terms of section 21 of the act which must be authorized. The authorization system includes scheduled uses, general authorizations and licences. It allows for the reserve of the specific water resource to be determined and also includes a public involvement process in the establishment of strategies and decision-making and guarantees the right to appeal against such decisions. The reserve is defined by the quality and quantity of the water resource in order to meet basic human needs as well the ecological requirements.

Section 27 of the NWA specifies that the following factors regarding water use authorization be taken in consideration:

- The efficient and beneficial use of water in the public interest,
- the socio-economic impact of the decision on whether or not water use is authorized,
- alignment with the catchment management strategy,
- the impact of the water use and possible resource directed measures,
- investments made by the applicant in relation with the water resource in question.

The proposed development will require a Water Use Licence in terms of Section 21 (c & i) of the National Water Act (Act 36 of 1998).

3.8 National Heritage Resources Act, 1999 (NHRA) (Act 25 of 1999)

Section 38(1) of the South African Heritage Resources Act (25 of 1999) requires that a heritage study be undertaken for:

(a) construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
(b) construction of a bridge or similar structure exceeding 50 m in length; and
(c) any development, or other activity which will change the character of an area of land, or water –
(1) exceeding 10 000 m^2 in extent;
(2) involving three or more existing erven or subdivisions thereof; or
(3) involving three or more erven, or subdivisions thereof, which have been consolidated within the past five years; or
(d) the costs of which will exceed a sum set in terms of regulations; or
(e) any other category of development provided for in regulations.

3.9 Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)

The main aim of this act is to provide a legal vehicle for the protection of productive agricultural resources. The act provides for the control and protection of wetlands, soil conservation matters, control and prevention of veld fires, control of weeds and invader plants, and the control of pollution via agricultural practices. The act therefore focusses on fighting of soil erosion, the protection of water resources, and combatting the degradation of indigenous vegetation conducive to agricultural practices through the control of invasive alien vegetation.

3.10 Municipal Systems Act, 2000 (Act 32 of 2000)

The Municipal Systems Act form part of a string of other legislation which aims at empowering local government to fulfil its constitutional obligations. As part of this objective the SA government published the Local Government White Paper in 1998, which outline the policy framework for local government structures. In addition, government furthermore published the Municipal Demarcation Act, 1998 (Act 27 of 1998) which allowed for the demarcation of new municipal boundaries, the Municipal Structures Act, 2000 (Act 33 of 2000) which outlines the required structures of a local authority and the Municipal Financial Management Act, 2003 (Act 56 of 2003) which must secure sound and sustainable management of the fiscal and financial affairs of municipalities and municipal entities by establishing norms and standards and other requirements for the lawful financial management of these entities.

The Municipal Systems Act work in unison with these sets of legislation by regulating key municipal organizational, planning, participatory and service delivery systems. In combination these sets of legislation provide a framework for the democratic, accountable and developmental local government system as envisaged by the Constitution.

3.11 Integrated Environmental Management

The term Integrated Environmental Management (IEM) has been used in South Africa since the 1980's. Documentation on how IEM would assist the EIA process was originally produced in 1992 by the then National Environmental Management Competent Authority. The need has since arisen for more comprehensive inputs in the EIA process and this paved the way for the development of the Integrated Environmental Management Series in 2002 which consisted of a set of booklets providing more detailed insights in the approach and methodologies associated with EIA. In brief the IEM seeks to achieve the following;

> *"Integration of environmental considerations across the full lifecycle of the activity: for example, for a project this implies consideration of environmental issues through pre-feasibility, feasibility, planning and design, construction, operation and decommissioning" (DEAT 2002).*

3.12 National Land Transport Act, 2009 (Act 5 of 2009)

The National Land Transport Act (Act 5 of 2009) provides appropriate structuring of land transport planning on national and provincial level and should guide the local municipality's Integrated Transport Plans (ITPs)**.**

3.13 Occupational Health and Safety Act, 1993 (Act 85 of 1993)

The Occupational Health and Safety Act, 1993 (Act 85 of 1993) provides for the health and safety of individuals in the workplace as well as for the health and safety of individuals working near or with of plant and machinery. The Act also protects people, other than persons at work, against hazards to health and safety due to the activities of people at work.

3.14 Gauteng Policies

3.14.1 Gauteng Infrastructure Act, 2001 (Act 8 of 2001)

The Gauteng Transport Infrastructure Act (Act 8 of 2001) relates to the laws relating to roads and other types of transport infrastructure in Gauteng and provides guidance to the planning, design, development, construction, financing, management, control, maintenance, protection and rehabilitation of such infrastructure.

3.14.2 Gauteng 25-Year Integrated Transport Master Plan (ITMP 25)

The Gauteng 25-Year Integration Transport Master Plan is a medium-term transport plan recommending eight significant transport interventions which will be implemented over the next 25 years from November 2013. The report takes into account the National Development Plan and the Strategic Investment Projects (SIPs), the Gauteng Vision 2055 and the various Integrated Transport Plans (ITPs) developed by local government. The report also describes the current reality of transport in Gauteng, the expected population and economy growth over the next 25 years, funding and expected outcomes of the implementation.

3.14.3 Gauteng 5-Year Implementation Transport Plan (GITP 5)

The aim of the 5-Year Gauteng Transport Implementation Plan is to “fast-track” the implementation of certain urgent initiatives and projects that are already being implemented by the Gauteng Department of Roads and Transport (GPDRT) for completion during the next five years as a precursor to achieving the ITMP25 goals and objectives.

The K77 is one of the initiatives listed in the GPDRT Current Priority Road List in the 5-Year Gauteng Transport Implementation Plan.

3.15 Regional Policies

The following Regional strategies were considered with the assembling of the Scoping and Environmental Impact Report:

- Sedibeng Spatial Development Framework
- Midvaal Spatial Development Framework 2013 – 2014
- Midvaal Western Region Spatial Development Framework
- Sedibeng Integrated Development Plan
- Midvaal Integrated Development Plan
- Midvaal Strategic Environmental Management Plan (SEMP)
- Midvaal Density Policy

4. DESCRIPTION OF THE ENVIRONMENT

BIO-PHYSICAL ENVIRONMENT

4.1 Climate

The study area is located in the summer rainfall zone of the Republic of South Africa, with an expected mean annual precipitation (MAP) of approximately 670 mm. 1992 was the driest recorded year with a MAP of 399 mm. Summer rains are typically of localized short duration thunderstorms with most of the precipitation occurring between October and February. The dry season coincides with the winter months between May and August. The highest annual rainfall occurs during the December – January period with an average of 115 mm. Summers are warm to hot and winters cool to cold with temperatures dropping to below 0° during cold spells. Maximum average summer temperatures vary between 28°C and 33°C, while the minimum winter temperatures vary between 0°C and 4°C. Frost occurs regularly during winter and especially along the low lying areas and around water bodies.

4.2 Topography

The proposed alignment stretches over an area of undulating hills and gentle slopes with rocky outcrops and a localised drainage channel which drains along a shallow valley towards the east. The highest point is north east of Elizabeth road at an elevation of approximately 1 585 MAMSL, with the lowest point along the drainage line at an elevation of 1 5 MAMSL. The steepest slope over the length of the alignment is located in the northern section of the alignment just to the south of road K154 (Heidelberg Road). The route alignment is representative of the local topography with the rocky ridges and the drainage channel presenting the only prominent topographical features along the route. The area of the alignment slopes in an easterly to south easterly direction. See Appendix 3.

4.3 Geology and Soils

A baseline geotechnical assessment was performed for the purposes of assessing the underlying geology with regard to the construction of the proposed road. The Geotechnical Specialist reported that a total number of 24x test holes were dug along the route of the original alignment. Test holes were dug by means of a TLB to an approximate depth of 1.0m or prior refusal. Samples were taken randomly from the different existing layer works encountered in the test holes for the required foundation indicator purposes. In terms of the new alignment, the Specialist reported that the geological conditions of the original and the new road alignment are expected to be similar as they occur on similar underlying geology. No additional testing was therefore required for the new alignment. (Roadlab, 2016) See Figure 6.

In terms of soils the Specialist reported that the top layer consisted mostly of transported silty, fine to coarse sands with quartzite & chert pebbles present in some of the holes opened. The underlying layers consisted mostly, in a matrix of silty sands and clayey sands, to gravels varying from fine to coarse. The sands varied from silty sands to clayey sands with grass roots visible in all of the holes and shrub and tree roots visible in only some of the holes. The consistency of the transported soils was loose to medium dense. The gravels were mostly sandstone and chert (Dolomitic) which were the more competent materials sampled and tested in the investigation. (Roadlab, 2016)

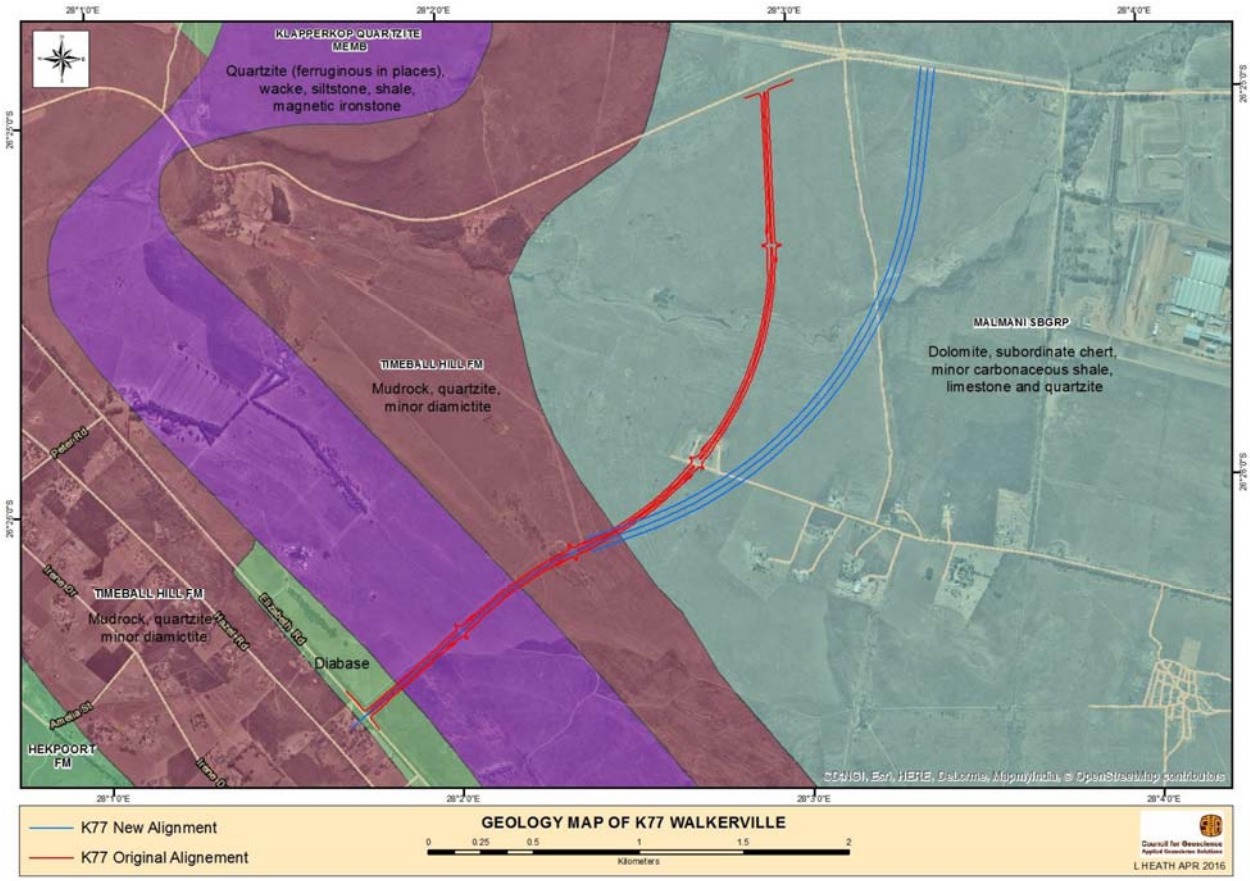

Figure 6: Geology Along the K77 Alignment

According to the assessment the proposed alignment is furthermore underlain by geology of three primary groups Proceeding from south to north, these include the Klapperkop Quartzite formation, Timeballhill formation and the Malmani Subgroup. Sequentially, the Klapperkop Quartzite formation consists of quartzite, wacke, siltstone, shale and magnetic ironstone whereas the Timeball Hill formation consists of quartzite, mudrock and minor incidences of diamictitie and the Malmani subgroup, of dolomite, subordinate chert, minor carbonaceous shale, limestone and quartzite. (Roadlab, 2016)

Finally, it was understood from the geotechnical investigation that the underlying geology and soils can support the proposed road K77 infrastructure. The Specialist however recommended that the transported top layer will have to be excavated and cut to spoil. The underlying materials can be re used from some of the excavations and uniform sections. Sandstone and chert gravels must be identified and re used (cut to stockpile) for construction of selected and stabilized sub base layers. Additionally, allowance must be made for importing G6/G5 materials for sub base layers as well as for importing G2/G1 for the construction of a crushed stone base if this falls within the design of the engineer. (Roadlab, 2016) See Appendix 4 for the detailed report.

4.4 Surface Level Drainage

4.4.1 Introduction

The study area is drained by means of a non-perennial drainage line which is also an upper tributary of the Klipriver. Storm water flows via surface flow over the site in an easterly direction to ultimately collect in the drainage line which sequentially flows into the in the Klip River that drains in a southerly direction

approximately 3,5km to the north east of the proposed road. A channelled valley-bottom wetland was also found on the edges of the drainage line and in the section where the proposed alignment crosses this feature. Finally, the project area is located in the C22D and C22E quaternary drainage regions which is included in the Upper Vaal Water Management Area.

4.4.2 Anticipated Stormwater Related Impacts

Storm water management related to the proposed alignment is discussed in detail in section 2.3.1 and Appendix 2. In terms of the geotechnical investigations it is evident that the soils in the area are prone to erosion and with the increase in development and related infrastructure in the area, stormwater flows are expected to increase. This aspect will have a negative impact on the surrounding environment and the proposed infrastructure if the anticipated impact of development is not quantified on a catchment and sub catchment level and most importantly, managed on a local site level. Whereas the Detailed Design Report primarily describes measures to manage stormwater for the continued safe operation of the proposed road infrastructure, specific management guidelines have been developed to address the interface of the proposed road and its stormwater infrastructure with the natural drainage features and the associated natural environment. Specific anticipated impacts include the following;

- Erosion occurring as a result of sheet flow over exposed construction areas and barren soils areas and cuttings alongside the proposed alignment,
- Erosion occurring at the discharge ends of storm water infrastructure, and
- Erosion occurring at sites of construction through wetland areas.

4.4.3 Proposed Stormwater Management Guidelines

Stormwater management guidelines will concentrate on managing the anticipated impacts at the local site locations. Principle management guidelines in terms of the three anticipated impacts identified above include

- In terms of road verges, cuttings and fill areas storm water management will focus on the reshaping of the associated land form to resemble a scenario as close to the natural landscape as possible with gentle slopes. These slopes will be covered with quality topsoil and seeded with a grass seed mix that resembles the grasses of the area. Steeper slopes will be treated in the same manner and stabilized with netting to protect the topsoils;
- Environmentally sensitive stormwater discharge structures has been developed to discharge stormwater flowing from roadside channels, pipes and smaller culverts into the receiving environment. The principle here is to reduce the discharge velocities and to disperse the stormwater flows in order to restrict concentrated flows causing erosion at these locations;
- Stormwater management at the wetland crossing includes ensuring that the wetland maintains the same functioning at pre-and post-construction timeframes. Management measures here include ensuring sustained groundwater base flow up and downstream of the culvert, managing stream flow velocities and managing head cut erosion to ensure that the wetland is not drained over time and to maintain its ecological integrity.

In all of the above measures, sustained monitoring and maintenance of stormwater infrastructure will be critical to ensure that the receiving environment of the road is managed optimally in terms of erosion control and the sequential upkeep of the receiving natural environment. See Appendix 2

4.5 Groundwater

Information provided in the site specific geotechnical report show that the site is underlain by porous unconsolidated and consolidated sedimentary strata as well as dolomite and limestone. Groundwater occurrences are usually limited to fractured zones within the bedrock, and the static groundwater level occurring within the weathered zones. Although no shallow groundwater table were reported by the Specialist, the geotechnical assessment performed for the proposed road focussed on the geological integrity of the proposed road alignment with the view of accommodating this road. Test pits were also shallow and would not necessarily reveal geohydrological information. Notwithstanding this detail, dolomitic areas are synonymous with groundwater quality related sensitivity and mitigation measures will be developed accordingly.

Pertinent anticipated impacts related to the development of the road relates to events of possible groundwater pollution occurring during the construction or operational phases of the proposed road. Impacts related to the construction phase includes spillages of hydrocarbon contaminants at the construction site and laydown areas. These includes oil and fuel spillages related to site accidents as well as hydraulic oil spillages. Although groundwater contamination via site sewage is also a possibility, this is very small and also easily managed. Spillages during the operational phase of the proposed road includes hydrocarbon or sewage contaminations as a result of spillages occurring after major road accidents. Mitigation measures for these incidents will be discussed in section 7 of this report as well as in the project EMPr and will focus on planning for possible contaminations and putting measures in place to restrict anticipated impacts in the light of groundwater conservation.

4.6 Vegetation and Animal Life

4.6.1 Introduction

Site specific biodiversity assessments was performed by an ecological specialist (Scientific Aquatic Services) on the route alignment and adjacent environs. The assessments concentrated on the terrestrial and wetland ecological aspects of the site. Specific outcomes in terms of this Specialist assessment includes:

Terrestrial Ecological Assessment:

- To define the Present Ecological State (PES) of the ecological resources in the vicinity of the proposed development route;
- To conduct a Species of Conservational Concern (SCC) assessment, including potential for such species to occur on the K77 Route Alignment;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features; and
- To determine the environmental impacts of the proposed development on the terrestrial ecology within the K77 Route Alignment and to development mitigation and management measures.

Wetland Assessment:

- To define the PES and Ecological Importance and Sensitivity EIS of each wetland system within the K77 Route Alignment;

- To determine the functioning of each system and the environmental and socio-cultural services that the system provide;
- To advocate a Recommended Ecological Category (REC) for each wetland feature;
- To delineate all wetlands zones occurring within the K77 Route Alignment; and
- To determine the environmental impacts of the proposed activity on the wetland areas within the K77 Route Alignment with the eye on developing effective impact mitigation measures which can be implemented to reduce the identified impacts. (SAS, 2015)

The following section elaborates on the findings of the ecological assessments conducted.

4.6.2 Flora (Vegetation)

The area of the proposed route features valley slopes to undulating hills with woodland occurring in sheltered areas along rocky ridges and drainage lines. The application site consists predominantly of grass covered hills with a prominent patch of *Acacia caffra* or Common Hook Thorn in the centre of the alignment. Small sections of exotic ornamental trees also exist along the alignment with a patch of *Populus nigra* or White Poplar infestation along the tributary.

According to Mucina & Rutherford (2006) the study site falls predominantly in the Soweto Highveld Grassland vegetation unit with the smaller northern section falling in the Carletonville Dolomite Grassland unit. In terms of the bioregion the majority of the proposed alignment falls in the Mesic Highveld Grassland bioregion with a smaller part included in the Dry Highveld Grassland bioregion. The whole of the proposed alignment is included in the Grassland biome which is listed as being endangered. In addition, the GDARD Conservation Plan version 3.3 (C-Plan v3.3; 2011), indicated that the majority of the proposed route alignment falls within a Critical Biodiversity Area (CBA), with a smaller portion in the middle section of the route located within an Ecological Support Area (ESA).

CBAs are areas containing Irreplaceable, Important and Protected Areas and are defined as areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (SANBI; BGIS, 2013). ESAs are landscape features that are essential for the maintenance and generation of biodiversity in sensitive areas that require careful management. (SAS, 2015)

In terms of terrestrial sensitivity, the National List of Threatened Terrestrial Ecosystems (2011) also indicated that the proposed alignment for route K77 falls within the remaining extent of the vulnerable Soweto Highveld Grassland vegetation type. (SANBI; BGIS, 2013). However current and historic anthropogenic activities and associated edge effects have transformed the vegetation within the K77 Route Alignment to a point where it is no longer representative of this vegetation type. Additionally, the route also does not fall within an area forming part of the National Protected Area Expansion Strategy (NPAES) or any other formally or informally protected area. (SAS, 2015).

4.6.3 Results of Site Specific Flora Scan (See Figure 7)

The biodiversity Specialist identified three primary vegetation units at the study site. These include;

- Wetland habitat;

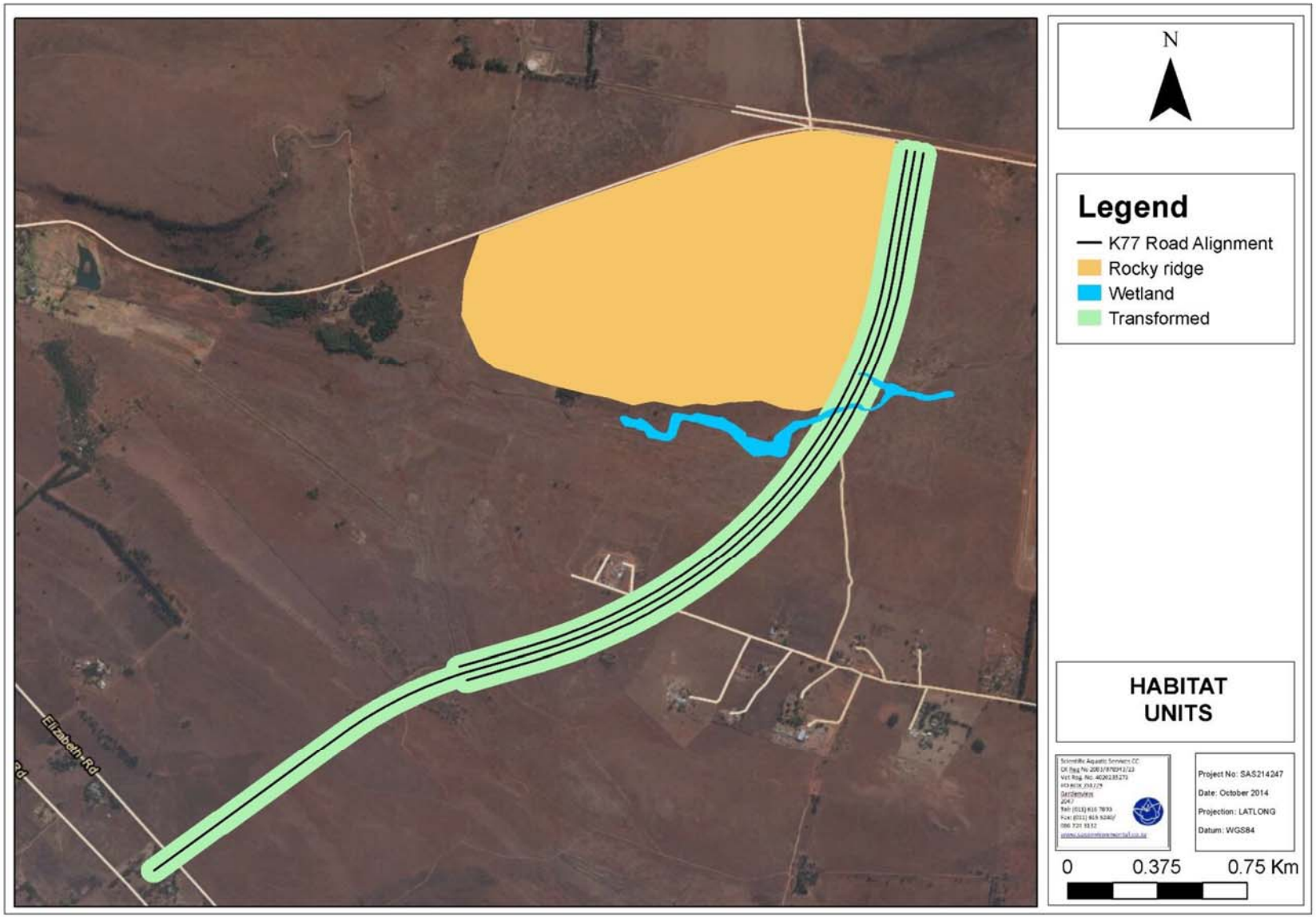

Figure 7: K77 Habitat Units (SAS, 2015)

- Transformed habitat; and the
- Rocky ridge habitat.

4.6.3.1 Wetland Habitat (See Figure 9)

The Specialist reported that one wetland feature was encountered within the K77 Route Alignment. See Figure 7 & 8. The wetland feature was categorized as a channelled valley bottom wetland. Severe transformation is evident within the wetland area which is most probably associated with historical anthropogenic activities such as agricultural activities and the construction of infrastructure and associated service roads within the wetland area. This has resulted in topographic, geomorphological and water quality alterations. Vegetation transformation in this vegetation unit has also occurred as a result of alien floral invasion. (SAS. 2015).

In terms of the wetland characteristics, the Specialist reported the following. The wetland occurring in close proximity to the proposed K77 Route Alignment has been classed according to the classification system compiled by SANBI (Ollis et al., 2013). The wetland was classified as Inland System falling within the Highveld Ecoregion and within the Mesic Highveld Grassland Group 3 WetVeg group that falls within a valley floor landscape unit and classified as a channelled valley bottom wetland. Wetland functionality was calculated as being 1.0 placing this feature within a moderately low category. The wetland feature is thus considered to have moderately low levels of service provision and ecological functioning.

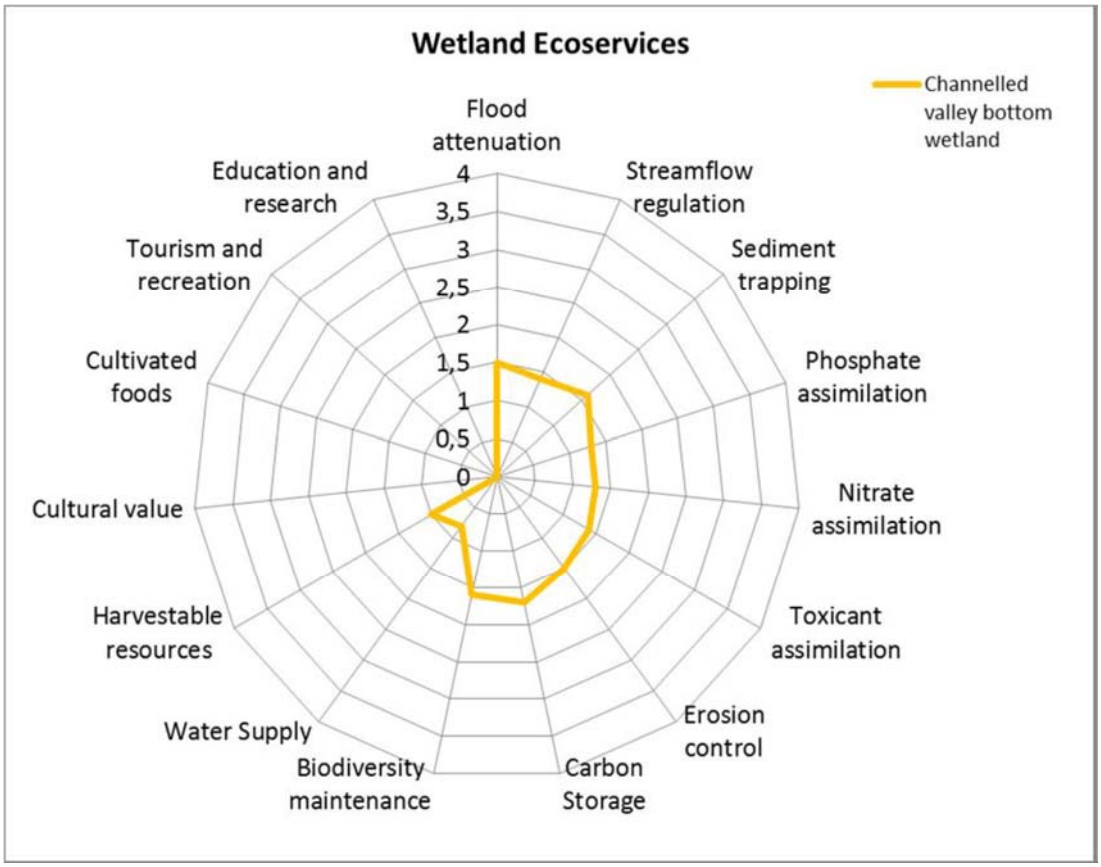

Figure 8: Wetland Eco Services (SAS, 2015)

Vegetation cover within the wetland was low and this resulted in reduced ability of the wetland to provide habitat to faunal species. In addition, water quality enhancement services (sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation and erosion control) was provided at intermediate

levels due to low vegetation cover. The wetland obtained an intermediate score for flood attenuation and streamflow regulation, mainly as a result of the channelled nature of the wetland which enables water to spread and slow down during flood peaks. The areas in close proximity to the wetland might have been utilised for crop cultivation historically. In addition, it plays no role in terms of socio-cultural service provision. (SAS, 2015) See Appendix 5 for more detail.

Dominant alien floral species were *Populus alba, Tithonia diversifolia, Verbena bonariensis, Bidens pilosa,* and *Pennisetum clandestinum*. *Populus alba, Tithonia diversifolia* and *Verbena bonariensis* are classified as alien and invader species according to the Conservation of Agricultural Resources Act (CARA, 1983) and National Environmental Management Biodiversity Act (Act no 10 of 2004) (NEMBA). During construction and maintenance activities, these species must be removed and managed to prevent an increase in alien floral invasion within the wetland.

With regard to the Present Ecological State (PES) of the wetland, it obtained a score placing the wetland within category C (moderately modified). This indicated that loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. Furthermore, the results of the wetland function assessment and PES assessment were used to obtain the Ecological Importance and Sensitivity (EIS) value. The various categories considered are included in Table 3 below.

Table 4: Wetland Importance and Sensitivity (EIS) (SAS, 2015)

Feature	**Wetland**	
Primary Determinants	**Score**	**Confidence**
1. Rare & Endangered Species	0	3
2. Populations of Unique Species	0	2
3. Species/taxon Richness	2	2
4. Diversity of Habitat Types or Features	2	3
5. Migration route/breeding and feeding site for wetland species	1	3
6. PES as determined by IHI assessment	1	3
7. Importance in terms of function and service provision	2	4
MODIFYING DETERMINANTS		
1. Protected Status according to NFEPA Wetveg	3	3
2. Ecological Integrity	2	4
TOTAL	**13**	
MEAN	**3.2**	
OVERALL EIS	**C**	

As can be seen from these results, the EIS for the wetland feature falls within Category C (Moderately modified), which indicates that the feature is ecologically important and sensitive on a local and possibly a provincial scale. The biodiversity of wetlands falling within this category is usually not considered to be sensitive to flow and habitat modifications. (SAS, 2015).

4.6.3.1.1 Recommended Ecological Category (REC)

The REC for the wetland features associated with the proposed K77 Route Alignment was determined, taking into consideration the results of the wetland functions, IHI and EIS assessments. A REC Category C was assigned to the wetland in order to ensure that the present levels of ecological services and functioning of the wetland is maintained, and to possibly enhance the PES.

In terms of the on-site wetland habitat, the Specialist stated that although transformed, wetland habitat performs an important function in terms of habitat provision for avifauna and other faunal species. The wetland should not be permitted to deteriorate any further and it is recommended that rehabilitation is undertaken as part of the proposed development activities in such a way as to meet this management target. Disturbances within this habitat unit must be avoided. However, if construction within the wetland areas is absolutely unavoidable, the duration and footprint of disturbance must be minimised and rehabilitated as soon as possible. Connectivity of the wetland features need to be maintained in order to ensure linear protection of water quality within these systems as well as ensuring the continuity of the habitats and resources. Any activities occurring within the wetland boundary, including rehabilitation, must be authorised by the DWS in terms of Section 21 (c) & (i) of the National Water Act (Act 36 of 1998). (SAS, 2015)

4.6.3.2 Transformed Habitat

The transformed habitat unit identified by the Specialist comprised the majority of the area of the K77 Route Alignment. This unit is associated with previous low density residential areas (agricultural plots), roads, agricultural fields and grazing areas and the related disturbed veld. The vegetation structure and ecological integrity in these areas were severely transformed, and floral species associated with this habitat unit were alien and invasive species and common garden ornamentals of mostly alien origin. No floral sensitivities were encountered nor are any expected to occur in this habitat unit. Due to the extent of vegetation transformation within the habitat unit, the proposed K77 Route Alignment development is highly unlikely to have a significant impact on the general faunal and floral ecology of the area. (SAS, 2015).

4.6.3.3 Rocky Ridges

Rocky outcrops are distributed at various sections along the route but the highest concentrations of outcrops and with the steepest slopes occurs along the northern most section of the proposed K77 route. Species found within this habitat unit included *Diospyros lycioides, Elephantorrhiza elephantina, Searsia pyroides, Senegalia caffra* and *Parinari capensis.* The Specialist reported that in terms of conservation value, this area provided the most intact floral habitat along the alignment.

Although no species of conservation concern or protected species were encountered during the assessment, *Boophone disticha* (Bushman Poison Bulb) and *Hypoxis hemerocallidea* (Star flower) were found, which are listed as declining as a result of intensive harvesting for medicinal purposes. A practical mitigation measure proposed by the Specialist includes the route to be optimised in such a way as to cross the rocky ridge areas at a ninety degree or another acute angle and use the existing gravel road on the rocky ridge area, which will reduce impacts to acceptable levels. If it is unavoidable that these species will be disturbed, the species should be rescued and relocated to suitable areas outside of the footprint, with the process overseen by a suitably qualified specialist. (SAS, 2015). For additional lists of species of special concern see the Specialist Biodiversity Assessment Report in Appendix 5. See Figure 7.

Figure 9: Wetland Area (SAS, 2015)

4.6.4 Summary of Floral Sensitivity

The Vegetation Index Score (VIS) was designed to determine the ecological state of each habitat unit defined within an assessment site. This enables an accurate and consistent description of the Present Ecological State (PES) concerning the proposed alignment in question. The information gathered during these assessments also significantly contributes to sensitivity mapping, leading to a more truthful representation of ecological value and sensitive habitats. In terms of this index, the three habitat types that were identified in the study area were rated in the following manner;

- **Rocky Ridge Unit**: **Class C (Moderately modified**) – Transformation of this habitat unit has occurred, although it still provides habitat for possible SCC floral species.
- **Transformed Unit: Class E (Loss of natural habitat - = extensive)** The ecological functionality and habitat integrity of the transformed habitat unit is regarded as being low. The diversity of alien plant species and severe vegetation transformation result in this habitat unit having a low ecological sensitivity and little conservation value from a floral biodiversity perspective.
- **Wetland Unit: Class D (Largely modified**) - The wetlands have been significantly disturbed by historical earthworks and vegetation clearing. The wetlands are significantly augmented by urban runoff. (See Appendix 5)

4.6.5 Mammals

A reconnaissance 'drive around' followed by a thorough 'walk through' on foot was undertaken by the biodiversity Specialists to determine the general faunal habitat types found throughout the K77 Route alignment and, following this, the areas where the proposed K77 Route Alignment are to be situated were investigated. Special emphasis was placed on areas that may potentially support faunal Species of Conservation Concern (SCC). Sites were investigated on foot in order to identify the occurrence of the dominant faunal communities, species and habitat diversities. The presence of any faunal inhabitants of the K77 Route Alignment was also assessed through direct visual observation or identifying such species through calls, tracks, scats and burrows. (SAS, 2015)

The Specialist reported that observations during the site assessment, only yielded *Cynictis penicillata* (Yellow Mongoose) along with dung of *Lepus saxatilis* (Scrub Hare). This was expected due to the transformed nature of the K77 Route Alignment and high levels of anthropogenic activity, thus in its present ecological state the K77 Route Alignment does not offer suitable habitat for a high diversity of larger mammal species. Mammals likely to be observed will invariably be those of smaller mammal species, which more easily adapt to transformed environments, especially species of the *Muridae* and *Soricidae* families, most notably *Rattus* (Black Rat) and *Mus musculus* (House mouse). It is highly unlikely that any mammal SCC will occur within the K77 Route Alignment. Species listed as occurring in the 2628AC quarter degree square grid (QDSG) consist of the *Damaliscus pygargus phillipsi* (Blesbok); *Elephantulus*

myurus (Rock Elephant Shrew); and the *Leptailurus serval* (Serval). Sightings of individuals of these species or proof of their habitation in the area were however not reported.

As presented in the Environmental Scoping comment from I&AP's in the area has also indicated that the area still boasts a healthy population of animal life. Although not necessarily encountered during the Specialist assessment it is accepted that the local Community will boast well informed experiential knowledge of the fauna still in the area and mitigation measures to limit the possible impacts of the proposed new road will therefore be included in the EMPr.

4.6.6 Birds (Avifauna)

The South African National Biodiversity Institute (SANBI) provides detail on Important Bird Areas (IBA) across South Africa. Information are presented in the form of spatial data which can be plotted. The Specialist also consulted Birdlife South Africa to verify if the K77 Route Alignment falls inside or close to any listed IBAs. The closest IBA to the project site is the Suikerbosrand Nature Reserve IBA (SA number 022) which is situated 13km east of the K77 Route Alignment. The Suikerbosrand Nature Reserve is situated between Meyerton and Heidelberg and in the industrialised highveld area of Gauteng. This IBA is extremely valuable in terms of IBA key species, for example, *Tyto capensis* (Africa Grass Owl) which occurs in this area in considerable numbers. *Sagittarius serpentarius* (Secretary bird) also breeds on the reserve and two pairs have been recorded here in recent years. *Mirafra cheniana* (Melodious Lark) was added as a key species because it was regularly recorded since 2007. It is highly likely that these birds can migrate to the K77 Route Alignment. (SAS, 2015)

The Specialist reported that although no avifaunal SCC were directly observed on site, data provided by the South African Bird Atlas Project (SABAP) shows that *Tyto capensis* (Grass owl) have been recorded in the area. Furthermore, there is also sufficient suitable habitat available for *Mirafra cheniana* (Melodious Lark) on the rocky ridge area. Therefore, due to the habitat suitability for these two SCC, it is recommended that the rocky ridge and wetland habitat units be excluded for development. (SAS, 2015). Specie lists of the avifaunal component of the biodiversity at the site can be viewed in Appendix 5

4.6.7 Reptiles, Amphibians and other Invertebrates

The Specialist reported no occurrences of reptile or amphibian species at the site. In addition, no specialist studies for any species of amphibian or reptile are required for consideration in the review of a development applications under the GDARD (2014) C-Plan version 3.3. (SAS, 2015)

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the K77 Route Alignment. As such, the Specialist indicates that the invertebrate assessment is not an indication of the complete invertebrate diversity potential of the proposed development site and surrounding area. The rocky ridge areas were specifically investigated, as this is the most intact invertebrate habitat within the K77 Route Alignment. Representatives of commonly encountered families in the Insecta class were observed during the assessment. It is highly unlikely that diverse invertebrate populations are present due to the disturbed nature of the K77 Route Alignment. (SAS, 2015) See Appendix 5.

4.6.7.1 Arthropoda

The Specialist identified no invertebrate SCC during the site assessment. The rocky ridge areas of the site are ideal habitat for *Chrysoritis aureus* (Heidelberg Copper butterfly) and *Lepidochrysops praeterita* (Highveld Blue Butterfly) however and they are also naturally found in the Suikerbosrand Nature Reserve. The road alignment was therefore optimised to avoid the area identified as sensitive to these species. This will reduce impacts to acceptable levels. Habitat for these species will be preserved and the proposed road development is unlikely to contribute to a loss of insecta diversity in the region. SAS, 2015. See Figure 7.

4.6.7.2 Arachnida (Spiders)

In terms of the occurrence of sensitive spider species the Specialist reported that these species are notoriously difficult to observe in the field due to their behavioural habits. Additionally, due to the size and nocturnal or crepuscular nature of many spider species it is not practical to identify all possibly occurring species during a limited field assessment. Therefore, an inference of possible species occurrences has to be made by evaluating habitat suitability, prey sources and the location of the K77 Route Alignment. SAS, 2015.

Trapdoor and Baboon spiders are listed as threatened throughout South Africa (Dippenaar-Schoeman, 2002). All baboon spider species form the genus; *Ceratgyrus, Harpactira* and *Pterinochilus* are protected under the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA). All scorpion species from the genus *Hadogenes, Opisthacanthus and Opistophthalmus* are also protected under NEMBA for South Africa. Where necessary, permit applications should be obtained from the relevant authorities if species needs to be relocated. SAS, 2015.

Special emphasis was placed by the Specialist on locating any SCC Trapdoor spiders, but none was found. Furthermore, the rocky ridge section within the study area was extensively searched for any signs of scorpions and spiders, *Opistophthalmus pugnax* (Burrowing scorpion) was found, and only signs of the *Theraphosidae* family (Baboon Spiders) were encountered. The likelihood of members of the Baboon Spider family utilising the area is high. Should the rocky ridge be excluded from the proposed development, habitat for these species will be conserved and is unlikely to contribute to a loss of arachnid diversity in the region. SAS, 2015. Special measures will however be included in the EMPr to be enable construction workers and staff to identify these species and to handle any occurrences in terms of the Specialist's recommendations.

SOCIO-ECONOMIC ENVIRONMENT

4.7 Social Impact Assessment

4.7.1 Introduction

A Social Impact Assessment (SIA) was performed in order to measure the anticipated social impacts that may result as a consequence of the construction and operation of the proposed K77. The Specialist used asset od definitions to describe the nature of social impact assessment and what this aim to achieve. One definition describes SIA as: "*the process of analysing (predicting, evaluating and reflecting) and managing the intended and unintended consequences on the human environment of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions so as to bring about a more sustainable and equitable biophysical and human environment*". Vanclay (2002).

The Specialist describes the basic SIA methodology as an assessment of the social determinants of the area measured against the perceived impacts which the proposed development will inflict on this social fabric. Information gathered from the NEMA EIA process as well as selected interviews with surrounding landowners and other parties were used to determine impacts and to measure these against a set impact rating tool. In terms of the above the Specialist utilized the Assessment criteria as developed by the Department of Environmental Affairs and Tourism 2002. For more detail on this process, See Appendix 6.

4.7.2 Provincial and Municipal Context

Midvaal Local Municipality (MLM) is located within the Sedibeng District Municipality, the most southern district municipality in Gauteng and stretches from Tedderfield AH to the Vaal River in the south. The MLM has been subdivided into three management regions, i.e. the Eastern-, Central- and Western Region. The K77 Road between Elizabeth Road and R550 (K154) falls within the Western Region – the far north-western part of the Municipality. The Western Region is bordered by the Emfuleni-, Ekurhuleni- and the City of Johannesburg Municipalities as well as the Midvaal CBD together with the R59 Corridor in the east. The Western Region's predominant land uses include, but are not limited to, undeveloped land, extensive agricultural farming, agricultural holdings, industrial and commercial industries, rural- to high-density residential areas and environmental conservation areas.

The MLM is also home to an estimated 95 301 people, accounting for nearly 0.8% of Gauteng's population. The population constitutes of 58,3% Black-, 38,6% White-, 1,6% Coloured- and 0,8% Indian residents. The Sedibeng District Municipality's average annual population growth since 2001 has been approximately 1,4% in relation to a population growth of 3,9% in the MLM between 2001 and 2011 (Census 2011 Municipal Report, Gauteng).

MLM had an employment rate of 18,6% in 2011 compared to the official unemployment rate of 26,3% in South Africa. The Census results of 2011 also revealed that only 2,4% of municipal residents are illiterate.

4.7.3 Existing Land Use

Properties which falls under the proposed alignment consist of those included in Table 3. Of these portions 32, 8, & 10 of the Farm Nooitgedacht 176-IR is included in The Grace Mixed Land Use Residential Development. The remainder of the land under the alignment consists of vacant land and the EAP

understands from the Blue Rose and the CBR Developments Group that they are also in discussions with the owners of this land in order to obtain it for additional future development. Properties adjacent to the alignment and its respective ownership are included in Table 5.

Table 5: Road K77 Land and Ownership

Property	Owner
Properties and owners from south to north	
Portion 32 of the Farm Nooitgedacht 176-IR	Blue Rose Developments CC – The Grace
Portion 8 of the Farm Nooitgedacht 176-IR	Blue Rose Developments CC – The Grace
Portion 10 of the Farm Nooitgedacht 176-IR	Blue Rose Developments CC – The Grace
Portion 23 of the Farm Nooitgedacht 176-IR	CBR Developments (Pty) Ltd.
Portion 17 of the Farm Nooitgedacht 176-IR	Hans Rudolph Benecke Trust
Remainder of the Farm Roodepoort 149-IR	Botha Familie Trust (Blue Rose Sale in Process)

Table 6: Properties adjacent to road K77

Property	Owner
Plot 44 of Drumblade AH	MR & D Dare
Portion 1 of Plot 45 of Drumblade AH	T Keegan
Remainder of Plot 45 of Drumblade AH	T Keegan
Portion 1 of Plot 46 of Drumblade AH	Bonkie Family Trust
Portion 31 of the Farm Nooitgedacht 176-IR	L P C De Villiers
Portion 15 of the Farm Nooitgedacht 176-IR	Blue Rose Developments CC
Portion 16 of the Farm Nooitgedacht 176-IR	J Dauvellier Estate (CBR Developments (Pty) Ltd sale in Process)

Settlements in the immediate vicinity of the proposed road consist of the Drumblade AH and the Klipview AH (Blue Saddle Ranches) to the south west and south of the proposed road, the Kliprivier informal settlement to the south east and the Kliprivier & Heineken Commercial and Business areas to the east and forming part of the R59 Corridor Developments alongside the R59. Areas further afield consist of the De Deur (Homestead Apple Orchards AH) and Walkerville AH to the south west and west, Eikenhof to the North and Garthfield AH to the east of the R59. Finally, the Greenfields, Katlehong and Thokoza residential areas lies between 10 and 15km to the north west and the town of Meyerton lies the same distance to the direct south.

4.7.4 Summary of Anticipated Social Impacts

The Specialist reported that the primary impacts are associated with change the character of the area from an aesthetically pleasing tranquil area with a rural feel to it to a developed area with heavy traffic volumes. Apart from the impacts related to the changing character of the area, the other impacts will mainly be present during the construction phase and/or can fairly easily be avoided or mitigated. Few or none employment opportunities will be created and this should be communicated clearly to the community during public participation processes so that not expectations in this regard are created. (Bezuidenhout, 2015).

Additionally, the Specialist stated that it is not foreseen that identified social impacts can be prevented or even mitigated, as the refusal of authorisation for one development will not lead to the refusal of authorisation for the other projects. Should the proposed construction of Road K77 not proceed, it will have even more negative impacts for the greater area, most notable severe traffic congestion. (Bezuidenhout, 2015). A detailed list of impacts and the proposed Specialist mitigation measures are discussed in section 6.

4.8 Agricultural Potential

In the light of the proposed urban development planned for the area and the available desktop data on agricultural potential the impact on agricultural resources were not deemed severe enough to permit a Specialist assessment of this environmental aspect. According to the GDARD Agricultural Potential Atlas the portions of land under the proposed alignment contains potential ratings from “High” to “Low to None”. The majority of the alignment is situated on rock shallow soils and thus the “Moderate” – “Low to None” agricultural potential ratings. The section of the alignment which contains a “High” potential rating occurs along the drainage channel and includes a section of wetland. Therefore, although the remaining portion of land situated on high potential arable may be farmed successfully from a subsistence point of view it is not deemed viable from a commercial farming point of view.

4.9 Visual Environment

Aesthetically the area of the proposed development is rather pleasing. The receiving visual environment of the proposed K77 alignment consists of a rural atmosphere characterized by grass covered rolling hills with intermittent rocky outcrops. The hilly aspect of this landscape will obscure sections of the proposed alignment. Other similar linear structures such as Elizabeth road and the R550 Heidelberg road as well as the R59 itself also transects the local area which will by association lessen the severity of visual obtrusion of the proposed road to an extent. High laying areas such as hillsides and hill tops where the proposed road will cross the landscape will be visually more obtrusive.

Although the existing and future developments in the area are deemed to lessen the visual impact of the proposed alignment it is anticipated that the proposed road will be a significant structural addition to the existing landscape. The construction of the proposed road in the absence of the future urban developments will cause the visual impact to be quite severe in the short term. It will be important for the proposed development to take the future urban developments the surrounding visual character into consideration in order for the development not to be overly intrusive. See proposed mitigation measures in section 6.

4.10 Noise

4.10.1 Introduction

A Specialist Noise Impact Assessment was performed in order to determine the possible impacts of the proposed new road on the noise related environmental receptors in the area. See Figure 10. The Specialist reported that ambient noise measurements were carried out according to (South African National Standard (SANS) Code of Practice 10103:2008 (Ref. 1) and also at three locations along the proposed alignment. Two main types of noise climate were assessed for the area. Additionally, measurements were carried out in accordance with SANS- Code of practice, SANS 10103:2008 - The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication as well as that required by the regulations of the DEAT - NO. R. 154. Noise Control Regulations in Terms of Section 25 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989). Govt. Gaz. No. 13717, 10 January 1992, i.e. Gauteng province, Department of Agriculture, Conservation and Environment, Notice 5479 of 1999. Noise control regulations, 1999, Provincial gazette extraordinary, 20 august 1999. (Hassall, 2015).

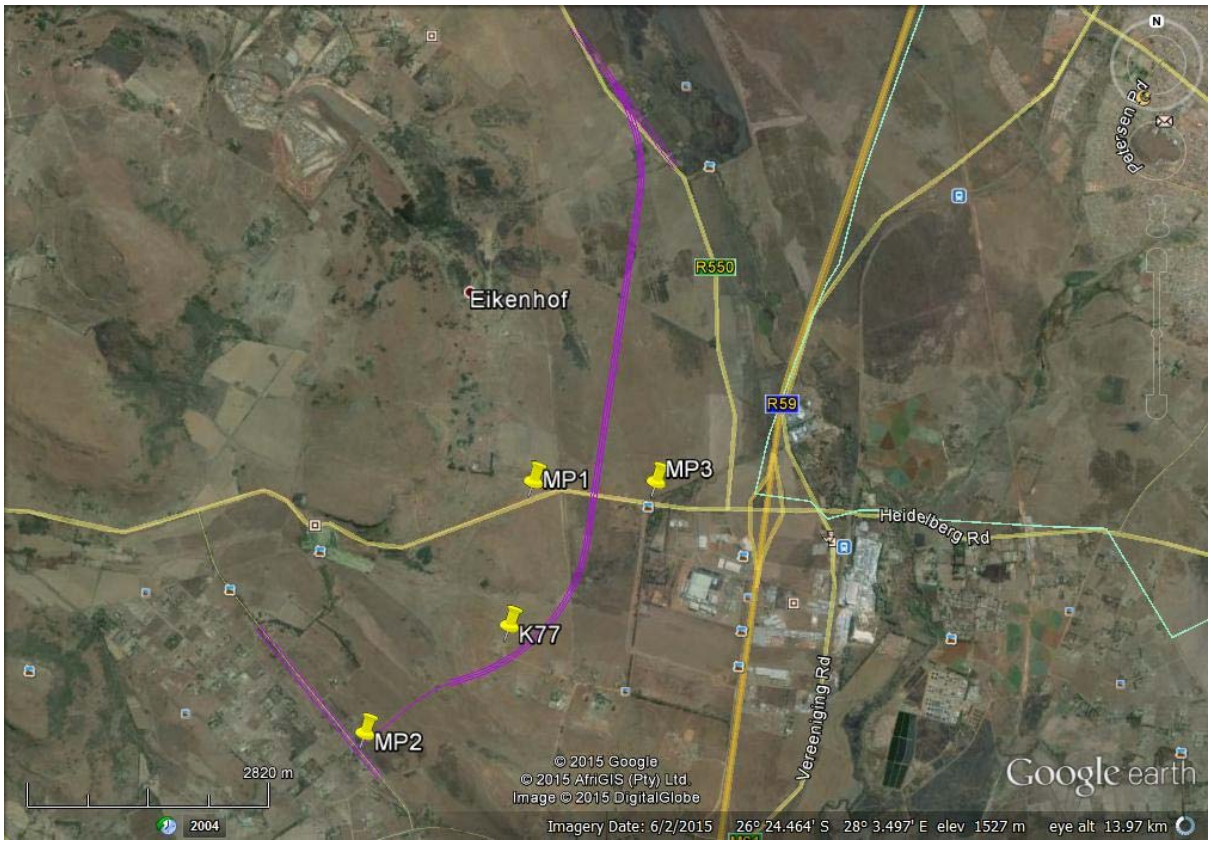

Figure 10: Noise Measurement Stations Along the Proposed K77 Alignment (Hassall, 2016)

4.10.2 Methodology

The noise impact on the proposed development was assessed by measuring the existing baseline noise levels in the area and comparing these and the recommended zone levels with the calculated and predicted road noise levels generated from current and predicted peak hour traffic flows for 2019 presented in the supplied traffic assessments. All calculations and predictions were carried out in accordance with the relevant SANS codes and regulations as described above. (Hassall, 2015)

The expected response of the community to the noise impact, i.e. the change in ambient noise of the area, is based on the relevant SANS document and expressed in terms of the effects of impact, on a scale of 'None' to 'Very. High". This report is an overall assessment designed to predict the collective response of a noise-exposed population and therefore the impact the change in ambient noise is likely to have on this population. It is furthermore based on measured and/or predicted equivalent continuous noise levels according to the relevant SANS code of practice. (Hassall, 2015)

4.10.3 Findings

4.10.3.1 Measuring Point (MP) 1

These values are typical of an agricultural area without settlements. The noise climate is extremely consistent. The values are typical of a rural area with sparse and irregular road traffic, which is dependent on the presence or absence of a noise event such as a vehicle pass-by or aircraft flyover. Note also that the L90 (the sound level exceeded for 90% of the time, and usually taken as the background noise without intruding events) is also constant, 31/32 dB(A) during the day, dominated by natural sounds such as bird song and insects. These are generally in agreement with the SANS recommendations for a rural area. (Hassall, 2015)

4.10.3.2 Measuring Point (MP) 2

The proposed K77 intersects the existing (D2310) Elizabeth Road close to this measurement position. The values at this position resembles that of MP1. are typical of a rural area with sparse and irregular road traffic dominating the LAeq,I value, which is highly variable being dependent on the presence or absence of a noise event such as a vehicle pass-by or aircraft flyover. The sound level here is very repeatable at 34 dB(A) during the day. This background noise is primarily from remote domestic activities and natural sound from birds, animals, etc. These road noise measurements are used as the baseline values in the assessment of the noise changes to be expected from the traffic on the proposed K77 which intersects the D2310 at this position. (Hassall, 2015)

4.10.3.3 Measuring Point (MP) 3

Measurements at this MP was taken at a position 90m from the centreline of the D2313 Perdekop road, north the industrial area, and 700m from the proposed alignment of the new K77. Noise level values here are typical of a rural area with occasional intrusive noise from remote aircraft and local traffic and significant low level natural sound from birds, etc., forming the background noise. The R59 highway is still audible from this position and it should be noted that it is the western boundary of the current development area. (Hassall, 2015)

4.10.4 Noise Prediction Assumptions

The Specialist reported that the predicted traffic counts are in accordance with the peak traffic flow predictions reported in the traffic impact assessment. It should be noted that the reference traffic study was carried out for a somewhat different road layout than that adopted more recently. However, the peak traffic flow through The Grace development area is likely to be similar, whatever the detailed layout of the road system, so the traffic impact assessment figures have been used in this noise prediction procedure. The following assumptions were made:

1. Peak hour total traffic flow for 2019 is predicted to be 4000 v/h, which is very close to the maximum capacity of a two-lane carriageway
2. A total of two lanes in either direction
3. An average speed of 80km/hr (the likely speed limit).
4. A 5% percentage of Heavy Goods Vehicles.
5. A maximum gradient of 2%.
6. Standard road surface and carriageway height.
7. A road reserve of 20m either side of the nominal road centre-line.

The predicted noise level for the entire section through the development is therefore estimated to be 72.0 dB(A) at 20m from the road centre-line. (Hassall, 2015)

4.10.5 Noise Impact Assessment

The Specialist states that the noise impact on the areas affected by the proposed K77 will be concentrated entirely in the immediate vicinity of the alignment. Other industrial and transportation noise sources of low significance could be found in the area such as remote factories, road haulage, and occasional aircraft flyovers. The change in noise levels caused by the operation of the new road is considered high enough to warrant specific noise mitigation measures. (Hassall, 2015) This will be discussed in Section 6.

Impacts associated with the construction phase are unlikely to be higher than for the post-construction phase and is generally classed as LOW to MODERATE in the short term. This will to a degree depend on the equipment noise profiles of the actual equipment used and placement of temporary access roads, if any. Impacts related to the operational phase of the development will in the worst case cause the increase in noise level in excess of 10dB in the area within 120m of the new alignment. Although most of the zoning along the alignment is designated as commercial, there are some dwellings indicated within this distance, and therefore the impact is classed as HIGH. In general, dwellings beyond this distance will significantly benefit from the noise shielding effect of the intervening buildings and/or boundary walls (recommended) and impacts in this zone is designated as LOW to NONE. (Hassall, 2015) For more detail see Appendix 7.

4.11 Air Quality

An initial degradation of air quality will occur as a result of the construction activities during the construction phase of the proposed road development. The increase in traffic load will furthermore also lead to an increase of vehicle emissions considering that development pressure in the area will lead to increased traffic. Although air quality will most probably decline from current levels, a proper road constructed to carry the surrounding traffic efficiently should decrease traffic which will reduce the vehicle emissions from congestion as it will reduce the time vehicles spend on the road. Additional mitigation measures such as seasonally adapted watering of roads and construction sites during construction as well as retaining as much as possible of the existing natural vegetation can significantly reduce the effects of this. Air quality will increase dramatically upon the conclusion of the construction phase and the implementation of suitable landscape development plans in the public and private spaces.

4.12 Cultural-Historic Environment

4.12.1 Introduction

A Phase 1 Cultural Heritage Resources Impact Assessment was conducted along the original and the amended alignment in order to determine if any sensitive or important culturally historic material are present in the area of the proposed new road. The Specialist reported that the site area was visited twice and inspected on foot and by vehicle. Visibility of the site was good as the grass had burned shortly before the site assessment and was also grazed well by cattle.

Information on possible incidences of archaeologically significant resources in the area was also provided by local I&AP's and this information was forwarded to the Specialist by the EAP. (See Appendix 8). The Specialist subsequently studied the information and included it in his investigations.

4.12.2 Background

The Specialist reported that early industrial and mining activities and associated infrastructural development impacted negatively on the heritage resources of the study area. These activities include coal collieries for the gold mines of the Witwatersrand, the Vereeniging Power station and the Vaal Water Scheme (PGS 2010, 2011; Digby Wells 2013 in Küsel, 2015).

The area is perhaps best known for activities and heritage remains relating to the second Anglo-Boer War (1899-1902). Battle sites, cemeteries, memorials, former farm localities and historic structures, that have been mostly destroyed, constitute some of the data sets from this period (Pakenham 1933; Digby Wells 2013; Van der Walt 2013). The town of Vereeniging, established in 1882 and proclaimed in 1889, was the scene of many important events during the war. Important military luminaries represented the British and Boers during the signing of the Peace Treaty, at a locality currently near the Vereeniging Refractories Recreation Hall (Digby Wells 2013)

The region also has a rich Stone Age history. The Vaal River gravels are particularly well-known for vast numbers of lithics from the Earlier Stone Age (ESA). Well-known sites along the Vaal and Klip rivers include Klipplaatdrif, the Klip River Quarry site and the Duncanville Archaeological Reserve (Söhnge et al. 1937; Le Roux 1951; Mason 1968; Digby Wells 2013). Characteristic Large Cutting Tools (LCTs) of the ESA in the form of hand axes, cleavers and picks are iconic lithics. These tool types occur in large numbers in association with scraper forms and flakes. During this period landscape use by the early hominins shows a focus on water sources (Hallinan 2013). Deacon & Deacon (1999) argue that such a specialist, or stenotopic, pattern of landscape use was tied to both ecological and behavioural aspects. MacKay et al. (2014) argue that activities that relate to the acquisition of water, food and tool production, and perhaps also social activities, were mostly undertaken in open landscape settings. Open sites consequently constitute a major source of data on in particular the earlier periods when rock shelters were rarely used. (Küsel, 2015)

Secure water sources in the study region also offered other subsistence resources such as raw materials for the production of stone tools, and an abundance of plant and animal foods. It is therefore not surprising that there is an abundance of sites along the Vaal and Klip rivers and huge numbers of the ESA Oldowan, and in particular the Acheulean, stone tools are present in river gravels (Digby Wells 2013; Van Schalkwyk 2013). Localities in the study area that date to the ESA constitute exceptionally important

heritage resources and all developments should take the possible presence of sub-surface lithics into account. (Küsel, 2015)

Middle Stone Age (MSA) localities in the region are not as well-known (Thackeray 1992). Some MSA occurrences of low significance have been recorded. Nevertheless, as the MSA occur extensively in most regions of southern Africa, this should be borne in mind when developments are undertaken in the study area. (Küsel, 2015)

A remarkable locality near Redan contains numerous and mainly geographic rock engravings from the Later Stone Age (LSA) (Van Riet Lowe 1952; Mason 1962; Prins 2007). This fenced Provincial Heritage Site is spread over more than 4000 square metres on the remainder of Portion 29 of the farm Kookfontein 545 IQ. Digby Wells (2007) commented on a report by Matakoma by W Fourie (2007) who documented LSA scatters at Bankfontein in secondary contexts. Digby Wells (2007) recommend that site MHC003 had to be re-evaluated when the then dense vegetation cover would allow further investigations. (Küsel, 2015)

A detail Heritage Impact Assessment was done by Prof Tom Huffman in 2009 on the farms Roodepoort 159 IR and Driefontein 146 IR. These farms lie west of Nooitgedacht 176 IR on the quartzite ridge. Here he found scatted occurrence of Early Middle and Later Stone Age sites as well as some stonewalling possible of Khai origin. He also recorded some farm settlements and graves (Huffman T.N. 2009 Heritage Assessment for the Roodepoort – Driefontein project Gauteng in Küsel, 2015))

African farmer stone-walled sites represent another major heritage resource as the Highveld region was settled by later African communities, in particular near Heidelberg and in the Suikerbosrand area, and in particularly in the Suikerbosrand Nature Reserve (Mason 1962, 1968; National Cultural History Museum 1999). Mason (1968) recorded numerous sites with aerial photography. Wits archaeology has subsequently undertaken research at Suikerbosrand (Huffman et al. 2006/2007; McQuilkan 2009). Coetzee (2013) in an HIA recorded an absence of Iron Age settlements on the Farm Vischgat 467 LR in the Midvaal Local Municipality. (Küsel, 2015) (Also See Appendix 8)

4.12.3 Results

Though the area was surveyed well, the Specialist reports that no important cultural heritage resources or graves were found along the proposed route. Notwithstanding the fact that the site has no significant heritage value, any cultural heritage resources or graves that are unearthed during construction should cause all work to stop until the site has been inspected and mitigated by a cultural heritage Practitioner. See Appendix 8)

5. THE PUBLIC PARTICIPATION PROCESS

5.1 Introduction

The objective of the public involvement process is to provide interested and affected parties (I&AP's) e.g. all local and provincial authorities, adjacent land-owners, community leaders, service providers and other stakeholders, with the relevant information regarding the proposed road development to enable them to engage effectively in the EIA process. The participation process also assists in the identification of ways in which concerns can be addressed and alternatives considered. The prescribed process entailed the process as set forth in Chapter 6 of the EIA Regulations R543 of the NEMA (Act No. 107 of 1998).

The basic elements of the public participation process consist of the advertisement of the project in the press, as well as on site whereby the intent of the proposed project is described. These advertisements also disclose the environmental assessment practitioners' contact details to enable I&APs to register and to express any interest or concern which they may harbour. I&APs are also invited to a public meeting where information regarding the proposed road can be discussed. A Background Information Document (BID) is drafted and distributed to all of the I&APs via registered mail, e-mail, facsimile or other communication method. This document again explains the intent of the applicant as well as what the full extent of the project will include. Contact details are again provided in order to assist I&APs in forwarding their comments. Any and all of the positive and negative comments are thereby obtained and dealt with on a case by case basis.

5.2 Identification of Interested and Affected Parties

On site advertisements were placed on the site, as well as alongside major access routes running along the boundaries of the application site. (See Appendix 9_1). The advertisement regarding the Environmental Assessment Process was published in the Citizen Newspaper on the 13th of January 2015. (See Appendix 9_2).

All of the implicated Local, Provincial and National Government Departments and their relevant sub sections were approached and their contact details obtained. Other non-government organizations and institutions in the area were also informed. The BID regarding the project was drafted in English and distributed via, e-mail and facsimile to all of the abovementioned parties. Door to door consultations were also performed on the 13th of January 2015 where the BID was distributed to all the surrounding land owners and the proposed development discussed. (See Appendix 9_3). The identified Interested and Affected Parties received the opportunity to comment on the Draft and Final Scoping Reports.

A Public Open day was held on the 18th of May 2016 at the old "A Touch of Green" venue which is close to the site location. Information regarding the proposed road alignment and other design detail were presented at this open day event as well as the findings of the EIA process and all of the Specialist Assessment to date. I&AP's who attended this event had the opportunity to obtain information specific to their requirements and the EAP provided the relevant feedback where this was required.

5.3 Summary of the Issues Raised by the I&AP's and the Responses from the EAP

I&APs provided comment to express general interest, issues and concerns and to request information and learn more on how they can become involved as a stakeholder during the initial notification stage

and the Scoping Report comment phase (Appendix 9_5 & 9_6). Responses from I&AP's are included in the discussion below. No comments were received from any state or local departments to date.

A landowner adjacent to the proposed road informed the EAP that he would require surety from GPDRT that no physical damage will be done to his property during construction as the proposed road runs just outside of his eastern erf boundary. The EAP responded that his request will be discussed with the design engineer and that he would revert back to him as soon as new information became available. A landowner within 100m of the new road commented that the new development would create a disturbance to the area's tranquillity. The EAP noted the comment.

KlipSA (Klipriviersberg Sustainability Association) enquired whether a six lane road was necessary and if a possibility exists to avoid construction by upgrading existing roads. The EAP replied that the section of K77 under the SPOOR application will be connected to alignments to the north and the south of that to serve future development in the area. In addition, although the application is for six lanes within a 62 meter reserve, a two lane single carriageway will be constructed at present. The rest of the lanes will follow as development and the subsequent traffic demand for this area is realized. The EAP would however put the I&AP in contact with the design engineers in terms of your request to understand the planned road network for the larger area. The chairman of KlipSA asked whether an alternative alignment can be discussed to avoid cutting through farm land and the ecological unit. The EAP replied that a number of other alignments were considered for this section of the K77 but that this clashed with existing development proposals for the area. The existing route was presented as the one developed over a space of the last two years and one that fits into the GPDRT's road planning as well as that of the Midvaal Municipality and private property developers. The EAP ensured the I&AP that his comment regarding cutting through an ecological unit will also be forwarded to the design engineers for their consideration. Lastly, the Conservancy made a suggestion that under- or over passes should be constructed accommodating safe movement for faunal species. The EAP agreed to bring the matter under the attention of the Biodiversity Specialist and request them to comment on the matter.

I&APs not directly affected by the development also asked clarification to why a six lane road was necessary in an area with almost no development and expressed concern of the environmental consequences of the road. The EAP response to another I&AP can be read in the above paragraph. In reply to the anticipated construction time frame for the development, the EAP replied that it was not yet known as the EIA process could influence the anticipated construction timeline a great deal. The EAP stated that he will inform the I&AP if new information became available. Another I&AP was concerned with the influx of labourers to the area of which the EAP took note. A request was made to how the stakeholders will be involved in the EIA process to which the EAP explained that the project was in the initial stages of the Environmental Impact Assessment (EIA) and would provide more detail on the project and related meetings during the remainder of the EIA process.

The service providers, Telkom, Sasol, Rand Water and Eskom, were contacted for comment to which Rand Water and Eskom replied stating that they were not affected by the project. During the amendment of the route Rand water indicated that the new alignment would cross their B7 pipeline. Rand water also provided the EAP with their wayleave procedure. This information was forwarded to the design engineer for their attention and in order for them to come into contact with Rand Water to discuss the way forward. Telkom replied with their wayleave procedure which was also forwarded to the Design Engineer.

Comments received during the Public Open Day were minuted and are included in Appendix 9_7. The main comments included the following. Many of the respondents were residents from the Blue Saddle AH and had concerns regarding the alignment of the road in this area. The EAP illustrated the extent of the K77 under the present application and indicated that although SPOOR is aware of applications for the K77 alignment to the north of the K154 and to the south of Elizabeth road, the EAP does not have detailed knowledge of these applications. The EAP furthermore assisted I&AP's with details of the EAPs involved with the northern and southern alignments.

Several attendees mentioned that the proposed road K77 would increase ease of access onto the R59 significantly. One party however believed that the proposed K77 alignment was a waste of money and also for the following reasons. The I&AP believed that a simple solution was to construct on and off ramps onto the R59 at the intersect of Joan Road and the R59. The party elaborated that the road parallel to the R59 north were always used to travel to the Heidelberg/R59 on ramp but that this was closed during the development of the Sedibeng Brewery Development which lies on the south western corner of the Heidelberg Road and The R59. The Councillor stated that this was discussed at several meetings but that the relevant authorities did not support an on and off ramp at the Joan Road and R59 intersect.

Another respondent, (Mrs D Kruger) also requested verification of where the section of proposed K77 south of Elizabeth road would cross the Drumblade – Blue Saddle area. In addition, the respondent also elaborated on the wealth of heritage and faunal occurrences in the area especially the hill to the direct west of the Drumblade AH. The EAP discussed the alignment of the proposed K77 between Elizabeth and The K154 and indicated that the section of proposed road K77 under this application would not cross to the south of Elizabeth road or the Blue Saddle area. In addition, the EAP also briefly discussed the findings of the Heritage and Ecological Specialist assessments as well as the realignment that was undertaken as a result of the sensitivities found along the original route.

Two respondents (Mrs. J Self and Mrs. and Mr. Visser) from the north western section of the Drumblade AH expressed the concern regarding the upgrade of the K154 (Heidelberg Road). They however had no concerns regarding the K77 route. The main concerns were the increase of traffic from the direction of the western areas of Orange Farm, Evaton and Daveton as result of the better road quality of the K154 and the quicker connection to the R59. Their concerns included the rise of traffic noise in the present tranquil area of the Drumblade AH as well as the impact which the increased traffic volumes would have of the existing fauna (Jackal, small buck and birds). The EAP again illustrated the proposed alignment of the K77 route under this application. The EAP responded in agreement and indicated that the incidence of increased fauna fatalities as a result of the new road infrastructure in the area is an identified impact in terms of the K77 route alignment as well and that specific mitigation measures are being developed in the K77 EIA process to attempt to mitigate this impact. (See Appendix 9_6)

No other responses have been received from other service providers and all utilities are updated with the progress of the EIA at the relevant stages. To view the complete register of all comments and responses, please refer to Appendix 9_8.

5.4 Way Forward

The EIA is at the Draft stage and the Draft EIA report will next be provided to I&AP's for their perusal and comment. As with the Draft and Final Scoping Reports, any comment will be formally responded to and included in the Final EIA report.

5.5 Conclusion

It is believed that I&APs were given sufficient opportunity to participate in the environmental process to date. I&APs that registered as a result of the advertisements and subsequent notices were logged on the registry (Appendix 9_8) and provided with additional information where this was requested.

The EAP will continue to notify I&APs during the remainder of the process in order to obtain all of the issues, concerns and positive or negative comments regarding the proposed road development. All responses (to and from the EAP) will be included in the evaluation process in order to guide the studies and to attempt reaching the most productive solutions for the proposed project and its neighbours. This documentation will ultimately be included in the relevant EIA reporting for evaluation purposes.

6. DESCRIPTION OF ALTERNATIVES

The concept of the weighing of different alternatives in a proposed development is defined in the Department of Environmental Affairs and Tourism's (DEAT) 2004 Integrated Environmental Management (IEM) Information Series as: "*a possible course of action, in place of another, that would meet the same purpose and need*". Additionally, the role of alternatives is explained to be: "*to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts."* (DEAT, 2004).

The following alternatives will be considered for the development of the proposed route K77 alignment.

6.1 Scheduling Alternatives

- The principle alternative that will be investigated in terms of the scheduling of the proposed development concerns the time of year that the construction will commence, should the proposed development be authorized. It will be recommended that major earthworks will be scheduled to commence during the autumn and winter months as far as this is possible. This will limit the level of erosion and consequent siltation of downstream water bodies that will result because of storm water runoff over the site during heavy downpours. Appropriate wetting procedures by water tanker will also be recommended to take place during winter months to minimize the effect of air pollution generated by dust from construction vehicles;
- Clearance of the site can also be phased to reduce the area of bare soils susceptible to erosion until construction activities commence in a specific section of the site;
- It will be recommended that construction be scheduled to occur only on weekdays between 07:00 and 17:00 and not during weekends and other public holidays. Special arrangements will need to be made by the construction management team should this schedule be altered to finish the project in time.

6.2 Design Alternatives

- The proposed road alignment travels through an open grassland area as well as over a drainage channel and ridge system. Information received from the Specialist assessments indicated that the specific section of ridge crossed by the alignment was very sensitive. Additionally, the section of wetland crossed by the alignment in this location was also quite broad.
- In terms of the above alternative placement of structures was considered in order to lessen the anticipated impacts. These included the moving of the crossing structure to an existing channel crossing along the drainage way where an existing Rand Water service road crosses the drainage channel and associated wetland;
- The crossing of the wetland area of the alignment will be constructed via alternative construction methods. This will include the specifications in terms of the COLTO Standard Specifications for Road and Bridge Works for State Authorities as well as the SANRAL Drainage Manual be implemented in the design of the road crossing in the wetland area
- Standard sub base layering works consisting of non-permeable compacted filling will be replaced by rock fill at the wetland crossing to ensure that the wetland base flow from the upstream position is not cut off from the downstream areas. This will ensure that the area downstream of the wetland crossing does not dry up and seize to function as wetland;

- The road crossing structure will consist of a ten cell concrete culvert structure that will also function as a wildlife underpass to allow for continual faunal movement up and down the drainage way keeping this connectivity in order.

6.3 The "NO-GO" Alternative

This alternative involves maintaining the status quo by not developing this section of the proposed road K77. Primary reasons for the proposed detailed and construction of road K77 to commence consist of the following;

- the proposed road development has been in planning since the early 1970's with the main purpose of providing a transportation network that will serve the region (district and local scale) local with a quality network which connects to adjacent networks to provide effective traffic movement throughout;
- the proposed road is included in the Gauteng 5 Year Implementation Transport Plan and the Gauteng 25 Year Integrated Transport Master Plan. In addition, the proposed road alignment is also encompassed in the planning detail included in the Sedibeng District Municipality IDP as well as the Midvaal Local Municipality IDP and SDF and the Midvaal Western Regions SDF;
- The planning frameworks mentioned above identifies the need for the road in the light of residential, commercial and industrial development which is anticipated in the local area and which will require sufficient traffic infrastructure to facilitate the associated traffic volumes;
- When implemented in an environmentally responsible manner the proposed road will provide in direct (to a lesser degree) and indirect socio-economic benefits in terms of development (residential, commercial and industrial) facilitation and associated employment.

6.4 Routing Alternatives

Routing alternatives were assessed for the whole of the K77 alignment as part of a larger long term road planning and assessment study of the area that were performed since the early 1970's. The section of the K77 alignment under this EIA appointment was a result of the larger study. Detailed assessments were performed for the relevant section of K77 alignment and certain environmental sensitivities were discovered. These included the rocky outcrop supplementary to the class 1 ridge in the northern section of the alignment and the associated sensitive habitat. The original alignment also crossed the drainage channel and valley bottom wetland feature at a location where the impacts on these features would be more than in other less sensitive locations. The project ecological Specialist developed sensitivity mapping and discussions were held with the relevant stakeholders to develop an alternative route over these sensitive features. See Figure 7.

An alternative alignment was developed that moved this section of the road 600m to the east. This route avoids the sensitive habitat and the class 1 ridge and it furthermore also crossed the drainage channel and associated wetland feature at a location where these aspects are both thinner in extent and also not as sensitive as a result of the existence of a current Rand Water service road crossing. The new alternative was adopted by the Stakeholders and the proposed alignment are now situated on the amended route proposal.

7. POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Introduction

Environmental Issues Identified in the impact assessment section of the report were identified in accordance with the guidelines as set forth by Section 21(1) of the Environment Conservation Act, (Act No. 73 of 1989), as well as the regulations described in the Department of Environmental Affairs and Tourism's (DEAT) Integrated Environmental Management Information Series (DEAT, 2004).

7.2 Key Environmental Issues

Anticipated environmental issues were determined by superimposing the various elements of the proposed activity over the existing environment. This information was screened and used to inform the specialist studies. Detailed information from the specialists was used to develop a site sensitivity analysis. Further planning and design decisions and recommendations were made based on this site sensitivity analysis. Impacts will be discussed in terms of the criteria mentioned in the following section.

7.3 Impact Significance Criteria and Rating Scales

In accordance with the requirements of the NEMA, 1998 (Act 107 of 1998) the potential and anticipated impacts were assessed in terms of the criteria and rating scales listed below. Specialists were requested to assess the potential and anticipated impacts relating to their specialist fields in the same order to ensure that the impacts were interpreted correctly. Table 7 provides a summary of the impact criteria and rating scales used to determine the significance of potential impacts.

Table 7: Impact Criteria and Rating Scales

Criteria	Rating Scales	Notes
Nature	❖ Positive	This is an evaluation of the type of effect the construction, operation and management of the proposed development would have on the affected environment.
	❖ Negative	
	❖ Neutral	
Extent	❖ Low	Site-specific, affects only the development footprint.
	❖ Medium	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius).
	❖ High	Regional (beyond a 10 km radius) to national.
Duration	❖ Low	0-4 years (i.e. duration of construction phase).
	❖ Medium	5-10 years.
	❖ High	More than 10 years to permanent.

Criteria	Rating Scales	Notes
Intensity	❖ Low	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected.
	❖ Medium	Where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected.
	❖ High	Where natural, cultural or social functions and processes are altered to the extent that the impact will temporarily or permanently cease these functions and processes; and valued, important, sensitive or vulnerable systems or communities are substantially affected.
Frequency of occurrence	❖ Continuous	Where Impact will occur without interruption
	❖ Intermittent	Impact occurring from time to time without any periodicity
	❖ Periodic	Impact occurring at more or less regular intervals
	❖ Time-linked	Impact occurring only or mostly at specific times e.g. at night or during office hours
Probability (the likelihood of the impact occurring)	❖ Low	It is highly unlikely or less than 50 % likely that an impact will occur.
	❖ Medium	It is between 50 and 70 % certain that the impact will occur.
	❖ High	It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.
Reversibility	❖ Low	Low ability of environment to be reverted to pre-impact state if cause of impact is removed
	❖ Medium	Medium ability of environment to be reverted to pre-impact state if cause of impact is removed
	❖ High	High ability of environment to be reverted to pre-impact state if cause of impact is removed
	❖ Low	No irreplaceable resources will be impacted.

Criteria	Rating Scales	Notes
Potential for impact on irreplaceable resources	❖ Medium	Resources that will be impacted can be replaced, with effort.
	❖ High	There is no potential for replacing a particular vulnerable resource that will be impacted.
Consequence (a combination of extent, duration, intensity and the potential for impact on irreplaceable resources).	❖ Low	A combination of any of the following: - Intensity, duration, extent and impact on irreplaceable resources are all rated low. - Intensity is low and up to two of the other criteria are rated medium. - Intensity is medium and all three other criteria are rated low.
	❖ Medium	Intensity is medium and at least two of the other criteria are rated medium.
	❖ High	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration. Intensity is rated high, with all of the other criteria being rated medium or higher.
Significance (all impacts including potential cumulative impacts)	❖ Low	Low consequence and low probability. Low consequence and medium probability. Low consequence and high probability.
	❖ Medium	Medium consequence and low probability. Medium consequence and medium probability. Medium consequence and high probability. High consequence and low probability.
	❖ High	High consequence and medium probability. High consequence and high probability.
Confidence (degree of confidence in the predictions, based on the availability of information and the specialist's knowledge and expertise)	❖ High	High degree of confidence in the predictions
	❖ Medium	Medium degree of confidence in the predictions
	❖ Low	Low degree of confidence in the predictions

An explanation of the above-mentioned impact criteria is provided below. Only the above-mentioned criteria were taken into account in the assessment of impact significance. In addition, the degree of confidence in the prediction of impacts, the nature of applicable mitigation measures and legal requirements applicable to the impacts will also be described.

7.3.1 Nature

This is an evaluation of the type of effect the construction, operation and management of the proposed development would have on the affected environment. Will the impact change in the environment be positive, negative or neutral? This description will include that which will be affected and the manner in which the effect will transpire. There may be a number of possible activities contributing to the same impact. Vice versa there may be a number of different impacts resulting from a single activity.

7.3.2 Extent or Scale

This refers to the spatial scale at which the impact will occur. Extent of the impact is described as: low (site-specific - affecting only the footprint of the development), medium (limited to the site and its immediate surroundings and closest towns) and high (regional and national). This refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of small extent, are of very high importance, e.g. impacts on species of very restricted range.

7.3.3 Duration

The lifespan of the impact is indicated as low (short-term: 0-4 years, typically impacts that are quickly reversible within the construction phase of the project), medium-term: (5-10 years, reversible over time) and high (long-term: greater than 10 years and continue for the operational life span).

7.3.4 Intensity or Severity

This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered? The EAP will quantify the magnitude of the impacts and outline the rationale used.

7.3.5 Probability of Occurrence

The probability of the impact actually occurring based on professional experience of the EAP with environments of a similar nature to the site and/or with similar projects. Probability is described as low (improbable), medium (distinct possibility), and high (most likely). It is important to distinguish between probability of the impact occurring and probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.

7.3.6 Impact on Irreplaceable Resources

This refers to the potential for an environmental resource to be replaced, should it be impacted. A resource could possibly be replaced by natural processes (e.g. by natural colonisation from surrounding areas), through artificial means (e.g. by re-seeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases.

In natural systems, providing substitute resources is usually not possible, but in social systems substitutes are often possible (e.g. by constructing new social facilities for those that are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable e.g. red data species that are restricted to a particular site or habitat of very limited extent.

7.3.7 Consequence

The consequence of the potential impacts is a summation of above criteria, namely the extent, duration, intensity and impact on irreplaceable resources.

7.3.8 Significance

Impact significance is defined to be a combination of the consequence (as described above) and probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact actually occurring. In simple terms, if the consequence and probability of an impact is high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.

7.3.9 Degree of Confidence in Predictions

The EAP will provide an indication of the degree of confidence (low, medium or high) that there is in the predictions made for each impact, based on the available information and their level of knowledge and expertise. Degree of confidence is not taken into account in the determination of consequence or probability.

7.4 Environmental Issues Identified

7.4.1 Climate

Impacts related to the proposed road development and as a result of climatic conditions are predominantly concerned with high volumes of precipitation. The incidence of lightning strikes, frost, and fog must also be considered. These include the following;

- Precipitation in this area tends to be in the form of thunderstorms, which may result in large volumes of rain falling in a relatively short space of time. This in turn results in high volumes of storm water runoff. Large exposed areas will result in loss of topsoil (important in terms of the habitable substrate for fauna and flora) and the subsequent siltation of the nearby water bodies such as the upper tributary of the Klip River and the Klip River downstream. This will in turn impact negatively on the flow of the river, its water quality and on the aquatic life in the river.
- Lightning, which generally accompanies these thunderstorms, could also impact negatively on the project especially as the project area is surrounded by large tracts of open grass veld which is susceptible to veld fire.;

7.4.1.1 Management and Mitigation Measures

1. Detailed storm water related mitigation measures will be discussed later on in the report.
2. The principle contractor must be made aware of the incidence of lightning. The relevant health and safety measures must be implemented strikes as per the Occupational Health and Safety Act (OHS, Act 85 of 1993) and Regulations.
3. Services (especially piped services) related to the development must adhere to the necessary building standards in terms of incidence of frost and possible impacts on piped services e.g. bursting pipes etc.
4. The incidence of fog in local low laying areas along the route must be investigated to incorporate the appropriate traffic infrastructure (warning signs) to the road design.

Table 8: Impact Rating of Potential Climate Related Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Impact of large volumes of rain in short time	Phase: Construction and operation										

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Without Mitigation	Negative	High	Low	Medium	Intermittent	High	High	Medium	Medium	Medium	High
With Mitigation	Neutral	Medium	Low	Low	Intermittent	Medium	High	Low	Low	Low	High
Lightning strikes	Phase: Construction and operation (Limited)										
Without Mitigation	Negative	Low	High	High	Intermittent	Medium	Low	High	High	High	High
With Mitigation	Neutral	Low	High	Low	Intermittent	Low	Low	Low	Low	Low	Medium
Impact of frost on piped services	Phase: Construction and operation										
Without Mitigation	Negative	Low	High	Medium	Intermittent	Medium	High	High	Medium	Medium	Medium
With Mitigation	Neutral	Low	High	Low	Intermittent	Low	High	Low	Low	Low	Low
Incidence of fog	Phase: Construction and Operation										
Without Mitigation	Negative	Low	Low	Medium	Intermittent	Medium	Low	High	Medium	Medium	Medium
With Mitigation	Neutral	Low	Low	Low	Intermittent	Low	Medium	Low	Low	Low	Low

7.4.2 Geology & Soils

The following potential impacts have been identified with regards to geology and soils:

- Topsoils removed during the construction phase may be impacted via inadequate management measures;
- Impacts that the proposed development will have on the geology and soils of the site consist of the alteration of the existing topography and geomorphology. Areas of the site will have to be levelled for construction purposes which will involve cut and fill operations. The current outlook of the site as well as the drainage patterns will therefore be altered;
- The development will also strip the site of parts of its vegetation. This may cause erosion of the top soil layer by storm water runoff across the site if not managed correctly;
- Surface and sub-soils may be contaminated during the construction phase resulting from leaks of fuels and lubricants of construction vehicles and from the operations at the construction site camp and via accidental spills during the operational phase;
- A section of the proposed road is situated on dolomite which is known for the formation of sinkholes and other unstable sub surface conditions.

7.4.2.1 Management and Mitigation Measures

Specific geology and soil related mitigation measures include:

1. Topsoil (top 300mm layer minimum) must be protected in accordance with the detailed recommendations included in the EMPr.
2. Very occasional nearly flat-lying portions will present difficulties with the provision of water-borne sanitation (bus and taxi shelters), as well as site drainage, with highly localized ponding of surface water expected after heavy precipitation events.
3. Adequate measures are necessary to prevent large-scale changes in soil moisture beneath the structures on a seasonal basis.
4. Excavation of deep service trenches, as well as some road excavations, will entail additional costs, due to the presence of bedrock at relatively shallow depth in some localized sections.
5. Proper site drainage must be implemented to prevent ponding of surface water near foundations.
6. Water-loving plants and trees should not be placed within 15m of any structure or services.
7. Care must be taken to prevent the ponding of storm water in those areas where drainage structures cross beneath roads.
8. No seepage type temporary or permanent sanitation systems may be allowed. It is recommended that sealed on-site sanitation systems that do not rely on seepage for the disposal of liquid wastes (e.g.: septic tanks that drain into “French Drain”-type soak-away) be utilized in the proposed development, mainly due to possible risk of groundwater pollution and/or the lateral spread of liquid contaminants.
9. It is recommended that a detailed footprint geotechnical investigation be conducted for each proposed structure prior to detailed foundation design.

10. It is recommended that an engineering geologist or geotechnical engineer inspect all foundation trenches prior to construction in order to identify and evaluate any surface or subsurface geological characteristics in variance with that found during this investigation. Also see detailed construction recommendations contained in the Geotechnical Investigation - Appendix 4.

Table 9: Impact Rating of Potential Geology & Soil Related Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Topsoil clearance	Phase: Construction										
Without Mitigation	Negative	Low	Low	Medium	Time-Linked	High	High	Low	Medium	Medium	High
With Mitigation	Neutral	Low	Low	Low	Time-Linked	Low	High	Low	Low	Low	High
Alteration of the existing geomorphology	Phase: Construction and operation (Limited)										
Without Mitigation	Negative	Low	High	Medium	Continuous	High	Low	Low	Medium	Medium	High
With Mitigation	Neutral	Low	High	Low	Continuous	High	Low	Low	Low	Low	Medium
Vegetation clearance	Phase: Construction										
Without Mitigation	Negative	Low	Low	Medium	Time-linked	High	High	Low	High	High	High
With Mitigation	Negative	Low	Low	Medium	Time-linked	High	High	Medium	Medium	Medium	High
Surface and sub-soils contamination	Phase: Construction and operation										

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Without Mitigation	Negative	Low	High	High	Intermittent	Medium	High	High	High	High	Medium
With Mitigation	Neutral	Low	High	Low	Intermittent	Low	High	Low	Low	Low	High
Dolomitic sub surface material	Phase: Construction and operation										
Without Mitigation	Negative	Low	High	Medium	Continuous	Medium	Medium	Medium	Medium	Medium	Medium
With Mitigation	Neutral	Low	High	Low	Continuous	Low	High	Low	Low	Low	High

7.4.3 Hydrology

7.4.3.1 Surface Water

The following potential impacts have been identified with regards to surface water:

- Inappropriate phasing of the construction phase can cause large clearings of vegetation which will result in massive erosion during severe thunderstorms. This will result in the loss of topsoils and the siltation of downstream waterbodies;
- Surface water contamination can be caused as a result of spills of chemicals and other waste from the construction camp during the construction phase;
- Accidental spills or punctures of on-site temporary diesel tanks etc. during the construction phase and spills from vehicles during the operational phase could cause large scale surface water contamination and destruction of water bodies such as the local drainage channel and wetlands as well as the Klip River downstream;
- Surface water will also be contaminated as a result of waste and other debris that will be washed from the road and road verges into the storm water system and then into the local surface water bodies;
- Construction of the road over the upper tributary of the upper tributary of the Klip River will require construction works in the actual drainage channel and the wetland itself. This will cause significant disturbance to the fauna and flora in this area as well as the functioning of the hydrological cycle in this position;
- In addition to the above it is obvious that the new K77 alignment cross the drainage channel. Water Use Applications in accordance with the Section 21 of the National Water Act 1998 (Act No. 36 of 1998) will therefore need to be applied for.
- Stormwater related impacts will be managed in Section 7.4.3.4.

7.4.3.2 Ground water

The following potential impacts have been identified with regards to ground water:

- Groundwater contamination can occur over time if sound maintenance and monitoring are not performed on construction vehicles and service areas of the construction site camp;
- Groundwater contamination can also occur via the contamination of boreholes flooded with stormwater from the proposed new roads;
- Aspects such as dewatering of the water table via boreholes or long term ponding can cause unstable subsurface geological conditions especially in the area underlain by dolomite

7.4.3.3 Management and Mitigation Measures

Specific surface and ground water mitigation measures include:

1. No long term areas cleared of vegetation may occur. A construction management plan should be implemented to specify appropriate time for the bulk of the construction activities to commence (preferably May to early September). Site clearance may not in any area be done beyond 15m on both sides of the 62m road reserve.
2. The whole of the construction site may also not be cleared of vegetation at once. Site clearance may only proceed for the next phase of construction as per the construction management plan.
3. Construction work carried out in the drainage line must be performed strictly between the months of April to August as far as this is reasonably possible. Where this is not possible the Principle Contractor must prepare a report stating the reasons and additional measures that will be taken to curb storm water related impacts as well as the degradation of water quality.
4. Detailed method statements must be submitted to the ECO by the Principle Contractor on the methodologies to be followed during construction in the water course.
5. All such materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages. Sufficient bunding of fuel storage tanks and chemical storage areas must be provided.
6. Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum.
7. Spill trays must be provided if refuelling of construction vehicles are done on site.
8. On site waste disposal and pit latrines must strictly be prohibited during the construction phase and disposal must be carried out with standard sealed chemical toilets and waste disposal containers. The Principle Contractor must make arrangements with the Midvaal Local Municipality's waste section for proper disposal at licenced waste disposal sites of all construction waste.
9. No uncontrolled discharges may be permitted from the construction camp.
10. All spillages from any potential contaminants such as lubricants and hydro-carbon based fuels must be safely and immediately removed and disposed of at an appropriate site.
11. Surface water draining of contaminated areas containing oil and petrol should be channelled towards a sump which will separate these chemicals and oils.
12. Storm water shall not be allowed to flow through the batching area. Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the Consulting Engineer.
13. Spoil sites may not be used for the disposal of hazardous or toxic waste.
14. A long term maintenance plan must be developed by the GPDRT for routine maintenance of the road verges and other related road infrastructure to decrease the volume of road related waste spilling over into the surrounding environment.
15. Special attention must be given to site drainage details and adequate drainage structures must be designed and constructed to avoid subsurface water saturation and possible structural failure of road infrastructure.

16. The use of all materials, fuels and chemicals which could potentially leach into underground water must be controlled and managed according to the relevant legislation.
17. A ground and surface water monitoring program must be designed and implemented in order to verify the impact on local resources.

Table 10: Impact Rating of Potential Surface and Groundwater Related Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Erosion and siltation of surface water features	Phase: Construction and operation										
Without Mitigation	Negative	Medium	Medium	Medium	Time-linked	High	High	Medium	Medium	Medium	High
With Mitigation	Neutral	Medium	Medium	Low	Time-linked	Low	High	Low	Low	Low	High
Ground and surface water pollution due to storage of chemicals and building material	Phase: Construction and operation										
Without Mitigation	Negative	Medium	Low	High	Intermitted	Medium	Medium	High	High	High	Medium
With Mitigation	Neutral	Medium	Low	Low	Intermitted	Low	Medium	Low	Low	Low	High

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Oil, grease and diesel spillages from construction vehicles	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	High	Intermitted	Medium	Medium	High	High	High	Medium
With Mitigation	Neutral	Medium	High	Low	Intermitted	Low	High	Low	Low	Low	High
Pollution of ground water due to sanitation facilities	Phase: Construction and operation										
Without Mitigation	Negative	Low	Low	High	Continuous	Medium	Medium	High	High	High	High
With Mitigation	Neutral	Low	Low	Low	Continuous	Low	Medium	Low	Low	Low	High
Pollution of water course as a result of polluted runoff	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	High	Periodic	High	High-Medium	High	High	High	High
With Mitigation	Neutral	Medium	High	Low	Periodic	Low	Medium	Low	Low	Low	High
Construction within water course	Phase: Construction Phase										

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Without Mitigation	Negative	Low	Low	High	Time-linked	High	High	Medium	High	High	High
With Mitigation	Negative	Low	Low	Medium	Time linked	High	High	Medium	Medium	Medium	High
Subsurface geological stability	Phase: Construction and operation										
Without Mitigation	Negative	Low	High	Low	Intermittent	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Low	High	Low	Intermittent	Low	High	Low	Low	Low	High

7.4.3.4 Storm Water Management

The following potential impacts have been identified with regards to storm water management during the construction and operational phase:

- Reduced infiltration capacity as a result of additional paved road surfaces. Additional hard surfaces will increase the volume of water entering into local storm water drainage systems. Cumulatively, this puts pressure on natural water drainage systems downstream and should therefore be managed locally as far as possible;
- Increased scouring and erosion may also result because of exposed areas during the construction phase and higher volumes and velocities of storm water during the operational phase. This could cause degradation (siltation) of the surface water quality in the downstream water bodies;
- Clearance of vegetation, stockpiling of excavated soil, contamination of storm water during construction and operation, and the activities (re-fuelling, handling of chemicals etc.) in the construction camp;
- Sudden downpours with high volumes of precipitation may cause flooding which may be dangerous for road users and pedestrians.

7.4.3.5 Management and Mitigation Measures

Specific storm water management mitigation measures include:

1. Storm water drainage structures must be designed by qualified engineers and in a way that disposes of the site storm water in a safe matter, which is not harmful to the surrounding environment in any way. Sufficient local infiltration structures to reduce overall storm water build up at the lowest point of the site and storm water energy dissipaters in major storm water channels must form part of the storm water design detail. (See EMPr Appendix 4)
2. An operational phase storm water management plan that caters for contaminated storm water must also be addressed.
3. Special attention must also be given to the design of the storm water structures at the discharge ends of the storm water system so as not to cause erosion damage where this system interfaces with the Wetland area and the upper tributary of the Klip river. (See EMPr Appendix 4)
4. Construction activities should preferably take place during the drier season to prevent soil erosion and siltation to surface water features.
5. The excavated and stockpiled soil material must be stored and piled on higher lying areas of the site outside of the 1:100-year flood line and not in any storm water channel or on steep gradients.
6. Particular attention will have to be paid to discharge points of all storm water channels, where flow of water is concentrated. If these points are not sufficiently stable for the increased flow rates anticipated, stabilization measures must be designed.
7. All surplus or unsuitable excavation materials arising from excavations must be spoiled, neatly spread and levelled so as not to interfere with future works or disrupt the natural flow of water. Rocks, trees and debris must be removed from the construction area to spoil areas designated for this purpose.
8. Locality, intended operation, maintenance and future rehabilitation methods for spoil sites must be approved by the engineer and any relevant landowner.
9. Care should be taken to avoid any accumulation of surface water near to future building sites by appropriate surface storm water drainage design
10. Constructed drainage structures should be cleared of all waste, organic and inorganic, on a regular basis.

11. The storm water system must be inspected and repairs must be done to all damaged areas where required via an operational phase road management plan.

Table 11: Impact Rating of Potential Storm Water Related Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Scouring, erosion and Sedimentation due to vegetation clearance	Phase: Construction and operation										
Without Mitigation	Negative	Medium	Low	Medium	Intermittent	High	High	Medium	Medium	Medium	High
With Mitigation	Neutral	Medium	Low	Low	Intermittent	Low	High	Low	Low	Low	High
Contamination of storm water run off	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	High	Intermittent	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Medium	High	Low	Intermittent	Low	High	Medium	Medium	Medium	High
Increased volume of storm water due to lacking site specific storm water management	Phase: Construction (Limited) and operation										
Without Mitigation	Negative	Medium	High	Medium	Intermittent	High	Medium	Medium	Medium	Medium	Medium

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
With Mitigation	Neutral	Medium	High	Low	Intermittent	Low	High	Low	Low	Low	High
Flooding	Phase: Construction and operation										
Without Mitigation	Negative	Low	Low	High	Periodic	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Low	Low	Low	Periodic	Low	High	Medium	Low	Low	High

7.4.4 Vegetation and Animal life

7.4.4.1 Vegetation

The following possible vegetation related impacts were identified:

- *Boophone disticha* (African Potato or Star Lily) and *Hypoxis hemerocallidea* (Bushman Poison Bulb) was recorded within the rocky ridge area and may be lost as a result of construction activities within this here. These species are recorded as being in decline and must be protected;
- The clearing of any remaining indigenous vegetation for construction purposes (especially the patch of *Acacia caffra* or Common Hook Thorn between chainages (1100 and 1300)), must be kept to the essential minimum (e.g. construction must remain on the alignment footprint and significant indigenous vegetation that do not affect the proposed road must be marked and retained);
- Plant collection during construction for fire wood and medicinal purposes;
- Increase of exotic invaders into the area with special mention to *Campuloclinium macrocephalum* (Pompom weed);
- Construction activities will have a negative impact on riparian vegetation along the drainage channel;
- General habitat fragmentation.

7.4.4.2 Animal Life

The following possible faunal impacts were identified:

- *Opistophthalmus pugnax* (Burrowing scorpion) and signs of *Theraphosidae* family (Baboon Spiders) in the rocky ridge area were encountered on the K77 Route Alignment. Suitable habitat also exists for the *Chrysoritis aureus* (Heidelberg Copper butterfly) and the *Lepidochrysops praeterita* (or Highveld Blue Butterfly);
- Suitable habitat furthermore exists for *Tyto capensis* (Grass Owl) as well as the Giant Bullfrog (*Pyxicephlus adspersus*), and local residents has attested to their presence locally.
- Research has shown that both the African Grass-Owl and the Marsh Owl suffer significant losses through vehicle collisions (Ansara, 2004) which can be attributed to the travelling speed of the vehicles.
- Construction in the wetland area and water course will have a negative impact on faunal habitat in these areas;
- The construction of the proposed road will also bring with it the associated animal vehicle conflicts and the decline of fauna as a result.

7.4.4.3 Water Course and Wetland Area

The following impacts related to the water course and wetland area were identified:

- ❖ The relevant design guidelines i.e. the COLTO Standard Specifications for Road and Bridge Works for State Authorities as well as the SANRAL Drainage Manual be implemented in the design of the road crossing in the wetland area;
- ❖ Site clearance and disturbance of vegetation diminishing wetland functionality;
- ❖ Construction activities (compaction of soils, spillage of waste and contaminants and topsoil stockpiling) along the water course and wetland area;
- ❖ Operational phase impacts i.e. erosion as a result of inadequate maintenance of stormwater discharge structures, spillage of waste material and contaminants into the wet areas;
- ❖ Continuous introduction and proliferation of alien invasive species into local environment.

7.4.4.4 Management and Mitigation Measures

Specific ecological mitigation measures include:

1. The GPDRT must be contractually bound to implement the Environmental Management Plan (EMPr) and Environmental Authorization (EA) during the construction and operational phases of the proposed road development.
2. No unnecessary removal of vegetation may be allowed. (See EMPr Appendix 1 for the relevant fines.) Only areas under the development footprint may be cleared of vegetation. Trees, shrubs and other vegetation naturally growing on the site should be retained as part of the landscaping.
3. Graphic presentations (posters) of *Boophone disticha* (African Potato or Star Lily) and *Hypoxis hemerocallidea* (Bushman Poison Bulb), areas where they might occur and how workers and staff must proceed when encountering these species must be placed in a central meeting area at the construction camp as part of the environmental awareness.
4. Identified specimens of the abovementioned species that cannot be conserved in situ should be transferred subject to a permit issued by the competent authority to a suitable area in the local site area. Where individual plants need to be removed, these specimens must be removed by a plant specialist.
5. All declared weeds and invaders and other alien species must be removed from the site. Special attention must be given to the spread and proliferation of especially *Campuloclinium macrocephalum* (Pompom weed). Posters can be put up in the same manner as under point 3. The appropriate agency should implement an on-going monitoring and eradication program for all invasive and weedy plant species growing within the road servitudes.
6. Graphic presentations (posters) of the *Opistophthalmus pugnax* (Burrowing scorpion), *Theraphosidae family* (Baboon Spiders), *Chrysoritis aureus* (Heidelberg Copper butterfly and *Lepidochrysops praeterita* (or Highveld Blue Butterfly) areas where they might occur and how workers and staff must proceed when encountering these species must be placed in a central meeting area at the construction camp as part of the environmental awareness.
7. Awareness of *Tyto capensis* (Grass Owl) as well as the Giant Bullfrog (*Pyxicephlus adspersus*) must be created in the same way as above.
8. High risk areas (area along the wetland) in terms of the Grass Owl, also coincide with the migratory corridors of the owls.
9. Should any of the abovementioned species be encountered by any of the construction staff during the construction phase, the ECO must be contacted and his recommendation as to the handling of the specific specie must be followed.

10. Notice boards of the occurrence of owls and frogs must be erected along the route during the operational phase. The Biodiversity Specialist also recommends a maximum travelling speed of 80km/h along this section of road.
11. Additional mitigation measures to curb owl – vehicle conflicts would be the fitment of rumble strips on the tar road placed from 100m either side of the outer edge of the wetland boundary, placed approximately every 50 m throughout the impact areas.
12. The culvert structure designed to cross the wetland and watercourse must also allow for sufficient animal under passes to allow faunal movement along the watercourse corridor.
13. Contractors must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase. The necessary penalty clauses for the disturbance of faunal species will be included in the EMPr. See Appendix 1.
14. Where possible, work should be restricted to one area at a time, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
15. The construction area included in the servitude should be fenced off prior to construction commencing (including site clearing and pegging). All construction-related impacts (including service roads, temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment/building materials/vehicles or any other activity) should be fenced. Access of vehicles should be prevented and access of people should be controlled, both during the construction and operational phases. Movement of indigenous fauna should however be allowed (i.e. no solid walls, e.g. through the erection of palisade fencing).
16. All sensitive areas as indicated in this report (See Figure 7) together with the associated buffer zones should be fenced during the construction phase to prevent any human activity from encroaching onto these areas. Monitoring of the fences is of paramount importance to ensure no infringement of the fences occurs.
17. Crossing of the natural watercourse should be minimized and constructed at the shortest possible route, perpendicular to the natural drainage system. Only one crossing of the drainage line will be allowed during construction.
18. Sealing of surfaces under a bridge or gabion construction should be avoided. Subsurface water flow in the wetland area must be maintained during the lifespan of the project. The relevant design guidelines i.e. the COLTO Standard Specifications for Road and Bridge Works for State Authorities as well as the SANRAL Drainage Manual be implemented in the design of the road crossing in the wetland area.
19. Soils removed in the wetland area and in the watercourse must be excavated and stored as close as possible to the excavation area but outside of the 1:100-year flood line area of any drainage way. After construction has been completed this area must be rehabilitated in line with the recommendations of the Wetland Delineation Report (Appendix 5). Specifically, the soils in the area must be replaced in the same order than in which it was excavated.
20. Disturbance to the wetland during construction should be minimized. A plan for the immediate rehabilitation of damage caused to wetlands should be compiled by a registered specialist. This rehabilitation plan should form part of the EMPr and a record book should be maintained on site to monitor and report on the implementation of the plan.

21. It is suggested that where work is to be done close to the drainage line, these areas be fenced off during construction, to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system.
22. Construction activity occurring within the riparian areas must commence from upstream proceeding downstream with proper sedimentation barriers in place to prevent sediments and pollution moving downstream from the site.
23. During the construction phase there will be increased surface runoff and a decreased water quality (with increased silt load and pollution). Construction in the wetland area must be completed during the winter months as far as possible.
24. Construction camps: Plant parking areas and material stockpiles must be located outside the 1:100-year flood line area and further than 100m horizontally from the watercourse.
25. A storm water cut-off drain should be constructed between the construction areas and the watercourse.
26. The overall alluvial characteristics of the drainage line (balance between sand, gravel and stone) must be similar before construction to ensure natural systems of flooding and sedimentation deportation and conveyance occur.

Table 12: Impact Rating of Potential Ecological Impacts: Terrestrial Areas

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Feature	**Potential Impacts on vegetation**										
Loss of Ecological Sensitive & important vegetation units	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	Medium	Continuous	High	High	High	High	High	High
With Mitigation	Neutral	Medium	High	Low	Continuous	Low	High	Low	Low	Low	Low

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Loss of Flora species diversity	Phase: Construction and Operational Phase										
Without Mitigation	Negative	Medium	High	Medium	Continuous	High	High	Medium	Medium	Medium	Medium
With Mitigation	Negative	Medium	High	Low	Continuous	Low	High	Low	Low	Low	Low
Introduction and proliferation declared weeds & invaders	Phase: Construction and operation										
Without Mitigation	Negative	High	High	High	Continuous	Medium	Medium	Medium	High	High	High
With Mitigation	Neutral	High	High	Low	Continuous	Medium	High	Low	Low	Low	High
Loss of Faunal habitat	Phase: Construction and operation										
Without Mitigation	Negative	High	High	High	Continuous	High	High	Medium	High	High	High
With Mitigation	Negative	High	High	Medium	Continuous	Medium	High	Medium	Medium	Medium	Medium
Loss/displacement of threatened or protected fauna	Phase: Construction and operation										
Without Mitigation	Negative	High	High	High	Continuous	High	High	Medium	High	High	High

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
With Mitigation	Neutral	High	High	Medium	Continuous	Medium	High	Medium	Medium	Medium	Medium
Loss of Ecosystem function	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	Medium	Continuous	Low	Medium	Medium	Medium	Medium	Medium
With Mitigation	Negative	Medium	High	Low	Continuous	Low	Medium	Medium	Low	Low	Medium

Table 13: Impact Rating of Potential Ecological Impacts: Wetland Area and Water Course

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Feature	**Potential Impacts on the Wetland Area and Water Course**										
Loss of watercourse & wetland habitat	Phase: Construction and operation										
Without Mitigation	Negative	Low	Medium	High	Continuous	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Low	Medium	Low	Continuous	Low	High	Low	Low	Low	High
Loss of watercourse & wetland function	Phase: Construction and operation										
Without Mitigation	Negative	Medium	High	High	Continuous	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Medium	High	Low	Continuous	Low	High	Low	Low	Low	High
Loss of watercourse & wetland services	Phase: Construction and operation										
Without Mitigation	Negative	High	High	High	Continuous	Medium	High	Medium	High	High	High
With Mitigation	Neutral	High	High	Low	Continuous	Low	High	Low	Low	Low	High

7.4.5 Social Impacts

The following potential social impacts have been identified:

- Socio-economic benefits as a result of development and growth in the area;
- Employment creation;
- Changes in crime patterns.

7.4.5.1 Management and Mitigation Measures

Specific mitigation measures with regards to the site's social impacts include:

1. Planning of the development must include measures to maximise socio-economic benefits of the proposed road to the area. It will be beneficial if a broad spectrum of stakeholders is involved in the process.
2. The maximum number of employment opportunities must be created by making use of labour intensive methods as far as possible. Opportunities for unskilled/ low-skilled workers should be maximised.
3. Skills development must form part of employment creation. Skills development initiatives focus on the skills that will be required for the proposed road and commence as soon as possible. The GPDRT should liaise with national departments such as Public Works and Environmental Affairs about using the Expanded Public Works Programme to create opportunities and provide services as part of the development.
4. Local labour must be employed as far as possible. A percentage of local labour must be included as a condition in all contracts. The local community must assist with defining the term "local" in terms of the skills available in the area. The percentage and definition must be determined with input from the business chamber and local communities.
5. The GPDRT through the project manager must create a labour desk and ensure information about the number and nature of jobs are advertised in the local communities. The process of applying for jobs must be communicated clearly and appropriately – via existing communication channels and others such as local radio stations.
6. The members of the neighbouring community and owners of property in the area must be kept informed on the development and must be granted the opportunity to comment on issues that may affect them.
7. Ward councillors representing residents must be actively involved in all decision-making.
8. The municipality must establish a culturally appropriate grievance mechanism where people can lodge issues and complaints relating to development on the site so that these issues can be dealt with timeously.
9. Measures must be taken to prevent crime during construction of the development, should it be approved. This includes:

- Access control
- Fencing the site
- Increased patrolling of the site
- Construction workers to wear visible identification.

Table 14: Impact Rating of Potential Social Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Socio-economic benefits as a result of development in the area	Phase: Construction and Operational Phase										
Without Mitigation	Positive	High	High	High	Continuous	High	Low	Low	High	High	High
With Mitigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Employment creation	Phase: Construction and Operational Phase										
Without Mitigation	Positive	High	High	High	Continuous	High	Low	Low	High	High	High
With Mitigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Changes in crime patterns	Phase: Construction and Operational										
Without Mitigation	Negative	Medium	Medium	High	Intermittent	Medium	Medium	High	High	High	Medium
With Mitigation	Neutral	Medium	Medium	Medium	Intermittent	Medium	High	Low	Medium	Medium	Medium

7.4.6 Visual Environment

The following potential impacts have been identified with regards to visual impact:

- Primary visual impacts present themselves in the form of the change of the visual character of the area as a result of the proposed road development. Initial visual impacts will be the most severe as a result of the site clearance for construction, should the development be authorized;
- Negative visual impact on local visual receptors;
- When established, the visual impact of the proposed development will diminish as the proposed road development integrates into the other developments envisaged for the area. However, the proposed development site holds significant aesthetic attributes in terms of the landscape and vegetation. These aspects will need to be considered in terms of the layout and the design of the proposed activities and facilities.

7.4.6.1 Management and Mitigation Measures

Proposed mitigation measures include:

1. Existing vegetation should be retained as far as possible at the construction site and the temporary construction camp structures to act as visual screens/absorbers and dust collectors.
2. Construction camp to be positioned so as to reduce its visual intrusion. The construction camp and laydown areas must furthermore be screened with netting to reduce its visual impact during the construction phase
3. No painting or marking of natural features shall be allowed. Marking for surveying and other purposes shall only be with pegs and beacons.
4. Additional locally indigenous landscaping should also be implemented in key areas to screen negative visual aspects.
5. Topographic shaping should be implemented - final profile of rehabilitated areas is formed to emulate natural contours of the area. Road cuttings and fill areas to be rehabilitated to emulate occurrence of natural rocky outcrops in the area both in colour and shape.
6. Rehabilitate/restore exposed areas as soon as possible after construction activities are complete.
7. Dust suppression techniques should be in place at all times during the construction and operational phases.
8. No construction rubble, construction material, refuse, litter or any other material not found naturally in the surroundings should be allowed at any time to be lying around on the construction site.
9. Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the road development.
10. Routine maintenance should be part of the operational phase management plan of the proposed road in order for it to be kept neat and in good order.

Table 15: Impact Rating of Potential Visual Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Change of Visual Character	Phase: Construction and operation										
Without Mitigation	Negative	Low	High	Medium	Continuous	High	Low	Low	Medium	Medium	High
With Mitigation	Negative	Low	High	Medium	Continuous	Medium	Low	Low	Low	Low	High
Negative Impact on local visual receptors	Phase: Operation										
Without Mitigation	Negative	Low	High	Medium	Continuous	High	Low	Low	Medium	Medium	High
With Mitigation	Negative	Low	High	Medium	Continuous	Medium	Low	Low	Medium	Medium	High
Maintenance	Phase: Operation										
Without Mitigation	Negative	Low	High	Medium	Continuous	Medium	High	Medium	Medium	Medium	High
With Mitigation	Neutral	Low	High	Low	Continuous	Low	High	Low	Low	Low	High

7.4.7 Noise

The following potential impacts have been identified with regards to noise:

- Elevated noise levels are expected as a result of the traffic associated with the development of the proposed new road;
- Ambient noise levels are expected to increase with increased development in the area. The initial increase in road related noise is expected to be noteworthy as a result of the existing rural nature of the receiving environment;
- Significant noise impacts will also occur during the construction phase and also as a result of construction vehicles and equipment;
- Environmental noise will be assessed via a specialist noise impact assessment and anticipated impacts will be managed via the EMPr to ensure that acceptable noise levels are maintained.

7.4.7.1 Management and Mitigation Measures

Specific mitigation measures with regards to the site's noise impact include:

1. Schedule road traffic movements to normal working hours (08H00 –18H00) during the construction phase.
2. All equipment and vehicles on the site should be equipped with noise suppressing measures and kept in proper working order.
3. Appropriate silencing measures to be taken if noise levels exceed levels of nuisance.
4. Should an extension of the upgrading hours be required, the adjacent property owners are to be informed in writing two days in advance of any overtime activities.
5. Noise barriers such as solid walls near must be erected near sensitive receptors such as schools, old age homes and residences.
6. As a general rule noise levels during construction should not exceed 85 dB as required by the occupational health and safety standards.
7. Operational Phase noise levels will need to comply with the relevant National, Provincial and Municipal Noise regulations and bylaws.

Table 16: Impact Rating of Possible Noise Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Operation of construction vehicles, equipment and the	Phase: Construction										

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
construction teams.											
Without Mitigation	Negative	Low	Low	High	Time-linked	High	High	Low	Medium	Medium	High
With Mitigation	Neutral	Low	Low	Low	Time-linked	Medium	High	Low	Low	Low	High
Noise generated from vehicles	Phase: Operational										
Without Mitigation	Negative	Low	High	Medium	Time-linked	High	High	Low	Medium	Medium	High
With Mitigation	Neutral	Low	High	Low	Time-linked	Medium	High	Low	Low	Low	High

7.4.8 Air Quality

The following potential impacts have been identified with regards to air quality:

- Dust generated during the construction phase will be the chief contributor to the reduced air quality during this phase but can be successfully mitigated via seasonally adapted wetting by water tanker vehicles;
- General air quality is expected to decrease slightly as a result of higher volumes of traffic travelling through the area;

7.4.8.1 Management and Mitigation Measures

Specific mitigation measures with regards to the site's air quality impact include:

1. Damping down of access roads, stockpiles and cleared areas should take place to minimize dust pollution.
2. Hard surface the site roads at the earliest appropriate time in the construction phase.
3. Servicing construction vehicles on a regular basis will ensure that the minimum amount of fumes are realized during construction activities.
4. The burning of rubble will not be allowed on site.
5. Local vegetation must be retained during the construction phase as far as possible. No unnecessary vegetation clearance must be allowed. Re vegetation of the road development area must be performed as soon as possible after completion of the construction phase.
6. Operational Phase air quality will need to comply with the relevant National, Provincial and Municipal Air quality regulations and bylaws.

Table 17: Impact Rating of Potential Air Quality Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Dust generated during the construction phase.	Phase: Construction										
Without Mitigation	Negative	Medium	Low	Medium	Time-linked	High	Medium	Medium	Medium	Medium	High
With Mitigation	Neutral	Medium	Low	Low	Time-linked	Medium	High	Low	Low	Low	High
Operational Phase Air Quality	Phase: Operational										
Without Mitigation	Negative	Medium	High	Medium	Continuous	High	Low	Low	Medium	Medium	Medium
With Mitigation	Negative	Medium	High	Medium	Continuous	Low	Low	Low	Low	Low	High

7.4.9 Traffic

The following potential impacts have been identified with regards to road traffic related services:

- ❖ It is expected that the proposed road K77 development will have a positive impact on the existing traffic flow in the area.

7.4.9.1 Management and Mitigation Measures

Specific mitigation measures with regards to the site's traffic impact include:

1. Provision is to be made within each development site for the accommodation of public transport based on the requirements by the authorities involved with the provision of these facilities.
2. Sufficient pedestrian infrastructure needs to be installed along the road to ensure that pedestrians will be able to access the area safely.
3. The provision of public transport facilities in the region must comply with the requirements of the Local Authority must ensure that their planning is done with regard to the implementation of a public transport system in the region as required.
4. The construction phase of the project needs to be advertised in the local media, on site and in the municipal, structures well in advance of the construction phase in order to ensure that the local communicates and visitors to the area are aware of the construction site and the related dangers in terms of heavy vehicle movement, dust etc.
5. Traffic warning signalling needs to be installed around the project site for the entire construction phase and must carry the necessary warnings in terms of the dangers of the construction site.
6. The necessary arrangements need to be made for alternative access to all properties and residential areas that may be cut off as a result of construction activities.
7. The relevant road traffic related upgrades and services need to be constructed in alignment with the recommendations of the Specialist Traffic Impact Assessment in order to ensure that additional traffic flow caused by the proposed new road is sufficiently integrated into the existing flow without causing congestion or traffic delays.

Table 18: Impact Rating of Potential Traffic Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Reduced access	Phase: Construction										
Without Mitigation	Negative	Medium	Medium	Medium	Time-Linked	High	High	Medium	Medium	Medium	High
With Mitigation	Neutral	Medium	N/A	Low	Time-Linked	Low	High	Low	Low	Low	High
Unsafe conditions during construction phase	Phase: Construction and Operational										
Without Mitigation	Negative	Medium	Low	High	Time-Linked	High	High	High	High	High	High
With Mitigation	Neutral	Medium	N/A	Medium	Time-Linked	Medium	High	Medium	Medium	Medium	High
Allowance for public transport	Phase: Construction and Operational										
Without Mitigation	Negative	Low	High	Medium	Continuous	High	High	Medium	Medium	Medium	High
With Mitigation	Positive	Low	High	Low	Continuous	Low	High	Low	Low	Low	High

7.4.10 Essential Services

The following potential impacts have been identified with regards to civil services resources:

- Rand Water indicated that a major pipeline will be crossed by the proposed road. Appropriate measures will be required to ensure that this pipeline is not compromised during the construction and operational phases of the proposed road;
- Disruptions in civil and electrical services supply during the construction phase;
- Waste management must be handled in a responsible manner during the construction and operational phases.

7.4.10.1 Management and Mitigation Measures

1. The project engineers will need to consider in detail the safe crossing of the proposed road of the rand water pipeline to the degree that the proper functioning of the pipeline is ensured dung the construction and operational phases of the proposed road.
2. The crossing or moving of any services will need to follow the necessary wayleave application process. The project engineers will need to engage with the relevant service providers well in advance of the actual construction of the road to ensure that the process is managed timeously.
3. The local communities in the area and region around the project are and which might be impacted by disruption in civil and electrical services must be notified well in advance of the proposed construction phase of the project. A line of communication must be created through the community liaison Officer to communicate possible disruptions in services well in advance of these disruptions.
4. Temporary services connections must be established before existing services are severed.
5. In terms of waste management, the following aspects must be considered:
    i. During the construction phase, solid waste must be placed in skips and stored in a designated space for collection where in will not cause any pollution or cause a health hazard. All solid waste must also be stored under cover and surrounded by walls or bunds to prevent contamination spread into the environment.
    ii. Hazardous waste must be stored in sealed containers in a suitable waterproof and bunded area.
    iii. Storage areas must be further that 100m away from the wetland and drainage line and out of the 1:100-year flood line.
    iv. Contaminated and hazardous waste must be disposed of at a permitted landfill site that is authorized to accept such waste. The collection of hazardous waste must be carried out in a manner that will prevent spills or leaks that may cause environmental contamination.
    v. The recycling of suitable materials (glass, paper, plastics etc.) is encouraged and must be managed in an environmentally responsible manner.
    vi. The responsibility rests with the Applicant to identify any sources or potential sources of pollution related to the proposed development and must take appropriate measures to prevent any pollution to the environment. Failure to comply with the requirements of the NWA Act 36 of 1998 could lead to legal action being instituted against the Applicant.

Table 19: Impact Rating of Potential Civil Services Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Services disruptions during construction	Phase: Construction										
Without Mitigation	Negative	Low-High	Low	High	Intermittent	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Low-High	Low	Low	Intermittent	Medium	High	Low	Low	Low	High
Improper waste management	Phase: Construction and Operation										
Without Mitigation	Negative	Low	High	High	Continuous	Medium	High	Medium	High	High	High
With Mitigation	Neutral	Low	High	Medium	Continuous	Medium	High	Low	Low	Low	High

7.4.11 Cultural Heritage Resources

The following potential impacts have been identified with regards to cultural resources:

- Occurrence of objects and artefacts with heritage value not detected during the Specialist assessment.

7.4.11.1 Management and Mitigation Measures

Specific mitigation measures with regards to the site's heritage impact include:

10. Should any archaeological artefacts or skeletal material be revealed in the area during construction activities, such activities should be halted, and the archaeological Specialist be notified in order for an investigation and evaluation of the find(s) to take place.

Table 20: Impact Rating of Potential Heritage Impacts

Activity/Impact	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Potential for Impact on Irreplaceable Resources	Consequence	Significance	Confidence
Possible sensitive cultural heritage artefacts	Phase: Construction										
Without Mitigation	Negative	Low	Low	Medium	Time-Linked	Low	Medium	Low	Low	Low	Medium
With Mitigation	Positive	Low	Low	Low	Time-Linked	Low	Medium	Low	Low	Low	High

7.5 Impact Summary

The following table serves as a summary of the identified impacts associated with the proposed Road 77 between Elizabeth Road and the K154. The significance of the impacts discussed in Table 21 is of that without any mitigation measures added. To view the significance of the possible impacts with mitigation added see Section 7.4.1 – 7.4.11.

Table 21: Proposed Road K77 Impact Summary

Potential Impacts	Impact Significance
Climate	
Large volumes of rain in short time	Medium
Lightning strikes	High
Impact of frost on piped services	Medium
Incidence of fog	Medium
Geology and Soils	
Topsoil clearance	Medium
Alteration of the existing geomorphology	Medium
Vegetation clearance	High
Surface and sub-soils contamination	High
Dolomitic sub surface material	Medium
Hydrology	
Erosion and siltation of surface water features	Medium
Ground and surface water pollution due to storage of chemicals and building material	High
Oil, grease and diesel spillages from construction vehicles	High
Pollution of ground water due to sanitation facilities	High
Pollution of water course as a result of polluted runoff	High
Construction within water course	High
Subsurface geological stability	High
Storm Water Management	
Scouring, erosion and sedimentation due to vegetation clearance	Medium
Contamination of storm water runoff	Medium

Potential Impacts	Impact Significance
Increased volumes of storm water runoff due to lacking site specific storm water management	Medium
Flooding	High
Vegetation and Animal Life	
Terrestrial Areas	
Loss of Ecological Sensitive & important vegetation units	High
Loss of flora species diversity	Medium
Introduction and proliferation declared weeds & invaders	High
Loss of Faunal habitat	High
Loss or displacement of threatened or protected fauna	High
Loss of Ecosystem function	Medium
Potential Impacts on the Drainage Line and Wetland Systems	
Loss of watercourse & wetland habitat	High
Loss of watercourse & wetland function	High
Loss of watercourse & wetland services	High
Social Impacts	
Socio-economic benefits as a result of development and growth in the area	High (Positive)
Employment creation	High (Positive)
Changes in crime patterns	High
Visual	
Change of Visual Character	Medium
Negative Impact on local visual receptors	Medium
Maintenance	Medium
Noise	
Operation of construction vehicles, equipment and the construction teams.	Medium
Noise generated from vehicles	Medium
Air Quality	

Potential Impacts	Impact Significance
Dust generated during the construction phase.	Medium
Operational phase air quality	Medium
Traffic	
Reduced access	Medium
Unsafe conditions during the construction phase	High
Allowance for public transport	Medium
Essential Services	
Services disruptions during construction	High
Improper waste management	High
Cultural Heritage Resources	
Possible sensitive cultural heritage materials on site	Low

8. CUMULATIVE AND REGIONAL IMPACTS

A cumulative impact may result from changes to the environment caused by an action/impact in combination with other past, present and future actions or impacts. Cumulative impacts can arise from one or more activities. The assessment of cumulative impacts on a study area is difficult; as many of the impacts occur on a much wider scale than the site being assessed and evaluated. It is often difficult to determine at which point the accumulation of many small impacts reaches the point of an undesired or unintended cumulative impact that should be avoided or mitigated. There are often factors which are uncertain when potential cumulative impacts are identified.

The following cumulative impacts have been identified for the proposed road K77 development and due care should be taken in order to address these impacts in terms of the recommended mitigation and management measures described under section 7 of this report.

8.1 Terrestrial Habitat loss

The proposed road development will enter into an area of natural habitat which was previously open grassland forming part of the endangered Soweto Highveld Grassland and the Carletonville Dolomite Grassland which is listed as vulnerable. The area consisted of open veld that was sparsely inhabited and underutilized from a pasture or other agricultural use point of view. Although anthropogenic influences are noticeable, the low to no use of the local environment made the area accessible for a variety of fauna and flora species for habitat. Habitat loss and fragmentation and not impacts on singular species itself is the primary agent in the loss of biodiversity. Although this impact cannot be mitigation fully and a loss of habitat is inevitable it is important to incorporate the mitigation measures described in section 7 of this report as well as in the various specialist reports in order to minimise the impact of habitat loss as far as it is possible.

It is furthermore critical that any development must be sustainable from a social, economic and ecological point of view to ensure that natural habitats are not sterilized for any reason. Focus must be placed on the most optimal use of every development area and aspects such as responsible storm water management, indigenous landscaping during rehabilitation and site maintenance for the remainder of the life of the road must be stringently enforced to assist in the reduction of habitat loss where ever possible.

8.2 Habitat loss- Wetland and Riverine areas

The proposed road will cross the upper tributary of the Klip river and the associated wetland at this crossing. See Section 2.3.1.2, 4.6.1.3 and Figure 5 and 8. It is believed that the related impact will not be significant because of the fact that the water course and wetland crossing has been moved to an area already impacted by a pipeline and related service road. In addition, impact specific mitigation measures in the project EIAR and EMPr have also been developed and must be implemented to minimize the impacts here. Riverine and wetland areas are critically important for their ecological (e.g. habitat, water storage) and social (storm water management, open space, water quality) services. Wetlands in the Gauteng Province are under severe pressure from development activity and are in decline. It is for this reason that it is also of critical importance that the prescribed mitigation and rehabilitation measures be implemented and their success be monitored over the lifetime of the project.

8.3 Increased Volumes of Storm Water Run-off

The proposed development will increase the total area of paved surfaces in the area which will reduce surface area available for the infiltration of storm water and will increase the volume of storm water that flows over the site into the local drainage ways. The increased volumes of storm water can cause erosion of the local top soils as well as associated siltation of the Klip river and the associated riverine areas and wetlands if not managed appropriately. Detailed mitigation and site rehabilitation measures have been developed to curb these impacts and it is believed that the prescribed measures will reduce any noteworthy related impacts when implemented.

8.4 Social and Economic Impacts

Aspects such as the creation of employment, ease of access and appropriate infrastructure are possible positive socio economic cumulative impacts that could result from the proposed road development. For this to happen it is imperative that the project is designed, constructed and maintained to the highest standards. Should the proposed road development not be implemented in the abovementioned fashion it will prove to be a massive expense as well as a services and maintenance burden on the MLM.

9. CONCLUSION AND RECOMMENDATIONS

It is believed that the most noteworthy anticipated impacts have been identified at the conclusion of this, the Draft EIA phase of the Proposed Road K77 development. The receiving environment of the proposed development have been scrutinized in terms of the anticipated significant impacts revealed by Specialist assessments, desktop assessment and other literature as well as discussions with representatives of local authorities and interested and affected parties.

Impacts deemed to occur during the construction and operational phase were identified and their significance rated accordingly. Pertinent impacts identified include:

- Sensitive environments related to the upper tributary of the Klip river riverine area and associated wetland areas as well the drainage lines on site;
- The occurrence of two plant species that is considered to be in decline and of conservation concern - *Boophone disticha* (African Potato or Star Lily) and *Hypoxis hemerocallidea* (Bushman Poison Bulb);
- The occurrence of *Opistophthalmus pugnax* (Burrowing scorpion) and signs of *Theraphosidae* family (Baboon Spiders) in the rocky ridge area as well as suitable habitat for the *Chrysoritis aureus* (Heidelberg Copper butterfly) and the *Lepidochrysops praeterita* (or Highveld Blue Butterfly);
- Suitable habitat furthermore exists for *Tyto capensis* (Grass Owl) as well as (*Pyxicephlus adspersus*) the Giant Bullfrog and local residents has attested to their presence locally.
- Possible negative impact related to insufficient storm water management;
- Possible disruption in important services infrastructure;
- Positive socio-economic benefits such as economic growth and employment creation.

A thorough Public Participation Process has also been conducted to date. Responses received from local I&APs and other stakeholders, as well as proof of the newspaper adverts have been included. The final issues and response report serving as a summary of the comments and responses received from I&APs is also included in this report and the EAP is of the opinion that the issues raised were addressed accordingly.

In the light of the environmental data described, issues investigated and discussions with interested and affected parties, it is believed that the Environmental Impact Management Process is completed for this the Draft EIA Report Phase of the proposed road development. As the proposed road development is part of a long term planning exercise aimed at facilitating responsible development and alleviating traffic congestion and furthermore could also have a positive socio-economic impact it is recommended that the proposed road development be approved. However, it will be imperative to implement the mitigation measures and recommendations stipulated by this EIAR and the various specialist studies. These mitigation measures and recommendations are included and refined in the EMPr of which adherence must form part of the contractual agreement with the construction phase Contractors appointed and the GPDRT as the operational stage management body. A copy of the draft EMPr is included in Appendix 10 and changes will be made to the document once feedback have been received from GDARD.

9.1 Environmental Management Programme (EMPr)

In accordance with the Integrated Environmental Management Guidelines published by the Department of Environmental Affairs and Tourism in 2004, Guideline document 12, the purpose of the EMPr is to

"*describe how negative environmental impacts will be managed, rehabilitated and monitored and how positive impacts will be maximized"* It is a detailed plan of action prepared to organise and coordinate environmental mitigation, rehabilitation and monitoring. A Draft EMPr is included in this EIAR and when authorized must be adopted in conjunction with the mitigation measures and recommendations as included in the EIAR. As such the EMPr must be viewed as a dynamic document that may require updating and revision where necessary.

10. WAY FORWARD

This Draft EIA Report have been drafted as per the plan of study for EIA which was included in the Final Scoping Report approved by the GDARD on the 26th of June 2015. The Draft EIA Report includes the Specialist studies that has been used to analyse and assess the receiving environment and to identify possible impacts the development can have on the environment. Sensitive environments have been identified (See Figure 7) as a result which has caused the proposed road alignment to move in order to avoid these sensitivities.

This report will be made available to all registered and affected parties as well as the relevant state departments, the local authorities and the GDARD for a period of 40 days. All comments received will be analysed, addressed and summarised in the Final EIA Report. The final EIA report will then be made available to Interested and Affected Parties for a further 21 day review period for comment.

Any further comment will be inserted into the updated Final EIA Report which will then be submitted to GDARD for their reviews upon which they will make the final decision whether or not to authorize the proposed road Also see Figure 3.

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