Mc CORMICK PROPERTY DEVELOPMENT

DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED ESTABLISHMENT OF A FILLING STATION AT MAAKE PLAZA SHOPPING CENTRE ON PART OF THE REMAINDER OF THE FARM RITA 668-LT, TZANEEN AREA, LIMPOPO PROVINCE

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ACRONYMS	
BCT	Bakgaga Community Trust
BID	Background Information Document
BNHSZ	Broad Natural Homogeneous Soil Zone
BTL	Biomass to Liquid Diesel
DLA	Department of Land Affairs
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
ESR	Environmental Scoping Report
GPS	Global Positioning System
GTL	Gas to Liquid Diesel
GTM	Greater Tzaneen Municipality
Ha	Hectare
HIA	Heritage Impact Assessment
HOD	Head of Department
I&AP	Interested and/or Affected Party
IDP	Integrated Development Plan
ISCW	Institute for Soil, Climate and Water
LDEDET	Limpopo Department of Economic Development, Environment and Tourism
LRP	Lead Replacement Petrol
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
MPD	Mc Cormick Property Development
TEL	Tetraethyl Lead
RAL	Roads Agency Limpopo
RoD	Record of Decision
RSA	Republic of South Africa
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SANS	South African National Standard
ULP	Unleaded Petrol
ULSD	Ultra-low sulphur diesel
TIA	Traffic Impact Assessment
WMA	Water Management Area
WRC	Water Research Commission

EXECUTIVE SUMMARY

1. Introduction

Polygon Environmental Planning CC, as independent Environmental Assessment Practitioner (EAP), has been appointed by Mc Cormick Property Development (Pty) Ltd (MPD) to conduct an Environmental Impact Assessment (EIA) for the proposed establishment of a filling station and associated convenience shop on the premises of the Maake Plaza shopping centre, on part of the Remainder of the farm Rita 668-LT in the Greater Tzaneen Municipality (GTM).

An application for environmental authorisation has been submitted to the Limpopo Department of Economic Development, Environment and Tourism (LDEDET), the decision-making authority in this regard, and both the scoping and impact assessment phases of the EIA have been concluded. The results of the EIA are hereby submitted in the form of this EIR, whilst measures for the prevention, minimisation and/or mitigation of potential impacts of the proposed filling station are included in the accompanying Environmental Management Programme (EMP).

2. Site and Project Description

2.1. Site Description

The filling station is proposed to be developed on a section of land in the north-western corner of the premises of Maake Plaza shopping centre, which in turn is situated on the south-eastern corner of the junction of the R36 (Tzaneen - Lydenburg road) and the D4075 road which leads from the R36 into Rita and Maake. The proposed filling station site is approximately 1 700m^2 (0,17 ha) in extent and currently consists of landscaped gardens.

The land belongs to the Republic of South Africa (RSA) and is managed by its Department of Rural Development and Land Reform (DRDLR, previously the Department of Land Affairs – DLA). The Bakgaga ba Maake tribe, represented by the Bakgaga Community Trust (BCT), are the custodians of this land and the applicant, MPD, is leasing the proposed site from the Bakgaga ba Maake Traditional Authority.

The site is zoned as Business 2, which makes provision for *inter alia* a filling station. No re-zoning will therefore be required for establishment of the proposed filling station. Surrounding land use is a mixture of mainly commercial and residential uses which are partly informal and partly formalised

2.2. Project Description

It is proposed that a filling station with an underground fuel storage capacity of 115m^3 for lead replacement petrol (LRP), unleaded petrol (ULP) and diesel, and an associated convenience shop be developed on the premises of Maake Plaza shopping centre to serve visitors to the centre, members of the local community and passing traffic. The forecourt is to contain customer parking bays and four pump islands. The filling station will not be fenced off from the rest of the shopping centre and is proposed to share the shopping centre's main entrance. Please refer to the proposed layout map in Appendix B of this report.

Water to the proposed facility is to be obtained from an existing borehole situated approximately 400m from the site, which also serves Maake Plaza shopping centre. Ablutions at the facility are to be connected to the sewerage system which has been established on the site of Maake Plaza shopping centre, and which consists of a septic tank and oxidation ponds. Electricity is available at the site and will be provided by the GTM on behalf of Eskom.

Solid waste generated at the proposed facility is proposed enter the municipal waste stream. Waste will be sorted into recyclable and non-recyclable materials, with non-recyclable waste to be collected by the GTM and disposed of at the municipal landfill site, and recyclable waste collected by a recycling contractor on a regular basis, as is currently done with the shopping centre's waste. The recycling contractor will distribute the different types of recyclable waste to relevant recycling facilities. Solid waste will be temporarily stored in a refuse cage in the yard behind the convenience store, to await collection by the GTM.

Access to the proposed filling station site is to be from the main entrance to the shopping centre and taxi rank, which is from the D4075 road. This is required in terms of the BB2 standards (*Guidelines for Accesses to Filling Stations)* published by the Gauteng Department of Public Transport, Roads and Works (Gautrans).

According to Mr Awie van Zyl, traffic engineer with Avzcons who conducted the traffic impact assessment as part of the Basic Assessment for the Maake Plaza shopping centre, filling stations are not trip generators, i.e. no additional vehicle trips are loaded onto the surrounding road system and intersections as a result of the establishment of a filling station. Rather, filling stations **intercept** trips on the road system. It was therefore not necessary to conduct a traffic impact assessment with specific reference to the proposed filling station.

3. Project Motivation and Feasibility

The proposed filling station is proposed to form part of the existing Maake Plaza shopping complex, and would be a complementary use to this regional shopping complex. It is anticipated that the shopping centre with the proposed filling station would provide an integrated shopping experience to customers and increase the level of convenience in obtaining products and services. The proposed filling station would furthermore be ideally suited to serve the taxi rank which forms part of the shopping complex development.

3.1. Motivation and feasibility

A feasibility study was undertaken in December 2008 by Petrorex (and amended in 2009) to gauge the financial feasibility of a filling station at this site and to investigate the potential financial impacts of such a filling station on existing nearby filling stations. The feasibility study concluded that although a reduction in fuel sales can be expected at nearby filling stations, the impact is not anticipated to significantly affect those filling stations' viability and it is not foreseen that this proposed filling station, if approved, would lead to the demise of these pre-existing filling stations.

Situated at the junction of the R36 (the main road connecting Tzaneen with Lydenburg and Hoedspruit) and the D4075, which leads from the main road into the villages comprising Maake, the proposed filling

station on this site would furthermore be in an ideal position to serve passers-by on these roads. Though there are other existing filling stations in the vicinity, it is anticipated that this proposed filling station would fill a niche that is not filled by the existing filling stations. Being a well-known national brand, the proposed Total filling station is anticipated to draw customers who might otherwise have been wary (whether correctly or not) of the currently existing filling stations, particularly the non-branded ones, as the Total chain is known to provide certain facilities, services, products, conveniences and ablutions to a certain standard, as well as a wide range of products in their convenience store. Particularly passersby such as tourists are expected to fall in this category.

Therefore the site, due to its location and ancillary regional retail facility, satisfies the needs and requirements of the commuter and transient trade, as well as the traffic generated from the adjacent shopping centre to ensure a concurrent and full time support of the service station facility. The taxi rank would also benefit from this development (Petrorex, 2009).

From a safety and convenience point of view, the site satisfies the following requirements for service stations (Petrorex, 2009):

- Strategic location
- Visibility
- Accessibility
- Access gradient
- Sight distance
- Stopping sight distance
- Access spacing

Along with complying with the basic requirements the application site, certain other specific advantages are applicable to the site (Petrorex, 2009):

- The site is strategically positioned along the R36 / P17–3 road, after a main intersection / downstream with accesses according to sound road planning principles, via the entrance roads towards the adjacent Maake Plaza shopping centre. This is highly desirable since right turn movements are prevented on the adjacent main road.
- The convenience and safety factors of vehicles travelling on the D4075 at lower speed differentials are highly advantageous and desirable.
- The proposed site offers the highest convenience for drivers when filling up with fuel as the proposed layout and the availability of the access points do not encourage motorist travelling towards surrounding towns to make special trips to the service station itself.
- The stop sight distances are ideal, and the proposed service station site size is furthermore adequate to accommodate a modern type of service station. It is convenient and safe and will not cause inconvenient diversions, creating additional conflicting turning movements and thus negatively affecting road safety.
- The fact that the canopy and pump island layout is directly behind the ingress point will not cause traffic conflict points and will allow for proper and safe circulation between motorists and heavy vehicles, inclusive of the fuel delivery vehicle, on the forecourt itself as well as entering and exiting the site.
- A newly designed, modern facility with sufficient product type distribution on the forecourt as well as in the shop will complement the services offered by the newly developed shopping centre.

- All requirements of the proposed service station focused on the convenience and safety of the motoring public are met by the proposed service station development.

Discussions with a number of local residents indicate a need for a filling station providing a higher level of service than is currently available at the existing nearby filling stations. The major issues raised with regards to the nearby stations are inconsistent fuel availability and a lack of certain conveniences such as shade and protection from rain for customers.

3.2. Trading area / market

Taking into consideration the accessibility, visibility and location of the site, the trading area in which the service station is proposed to operate, could be broken down into:

- The **primary market** from where the customers are expected consists out of transient and commuter trade on road R36 / P17 -3 and road D4075. These commuters originate from the primary catchment area that includes the towns of Tzaneen / Letsitele / Lydenburg. The secondary catchment area includes the towns of Nkowankowa / Lenyenye / Ka-Mohlaba / Ka-Xipala / Ka-Xikwambana and Rita Village / Maake.
- The **secondary market**, consisting of traffic (primary trips) generated by the adjacent retail centre. These are referred to as *new trips*, or trips generated by the retail and commercial centre. The visit to the centre or development is the primary reason for the trip.

4. Investigation of Alternatives

4.1 Activity Alternatives

No activity alternatives (alternative uses of the site) – were investigated, due to the following:

- The proposed site to be used for this proposed filling station is relatively small (approximately 0,17 ha) and therefore prohibitively small to be used viably for many other activities. ;
- The Bakgaga ba Maake Traditional Authority, the custodians of the land on behalf of the Republic of South Africa, have approved the proposed filling station on this site;
- There are no sensitive surface water resources on, or in close proximity to, the site;
- The geo-hydrological investigation indicated that, with proper, medium-level groundwater protection, the impact on groundwater resources of a filling station on this site is anticipated to be minimal;
- The site has already been transformed, and currently consists of landscaped gardens. Impacts in terms of fauna and flora would therefore be negligible;
- The feasibility report indicated that proposed development site satisfies all the conditions required of a filling station site in terms of convenience and safety to the motoring public as well as a number of other advantages (please refer to Section 3.1 above);
- The feasibility study indicated that a new filling station on this site carries no significant threat to the economical sustainability of the competitor service station sites in the identified local trading area;
- Though there are other existing filling stations nearby, it is anticipated that this proposed filling station would fill a niche that is not filled by the existing filling stations, through provision of a wider range of products and services as well as a consistent level of service.

4.2. Site Alternatives

No site alternatives were investigated, due to the following:

- The feasibility report indicated that proposed development site is the ideal site for a filling station, as it satisfies all the conditions required of a filling station site in terms of convenience and safety to the motoring public.
- The Bakgaga ba Maake Tribal Authority, the custodians of the land, have approved the proposed filling station on this particular site;
- No sensitive ecological features were found to occur on this site, and the site has already been transformed through landscaping during development of the Maake Plaza shopping centre on the same premises; impacts in terms of fauna and flora are therefore anticipated to be negligible;
- No heritage sites or features were found onsite;
- There are no sensitive surface water resources on, or in close proximity to, the site;
- The geo-hydrological investigation indicated that, with proper, medium-level groundwater protection, the impact on groundwater resources of a filling station on this site is anticipated to be minimal;
- Civil services (water, electricity and sewerage) are already available at the site;
- Safe access is already in place (constructed as part of the Maake Plaza shopping centre development);
- The site has already been transformed, and development of the property would not bring about any loss in habitat, nor would it require any relocation of plant or animal species, people or businesses. It would furthermore not necessitate cessation of any current activities on the site;
- The proposed filling station would be a complementary use to the shopping complex of which it is proposed to form part;
- The proposed filling station would be ideally suited to serve the taxi rank which forms part of the shopping complex development.

4.3. Layout Alternatives

The proposed layout was dictated by the shape and size of site as well as the position of the roads bordering the site (the R36 and the D4075). No layout alternatives were investigated, as the proposed layout is felt to be the most efficient one possible, given the irregular shape of the site and its small size, and furthermore a change in the layout of this particular proposed facility would have no significant effect on the type or significance of bio-physical or socio-economic impacts.

4.4. Design / Technology Alternatives

No design / technology alternatives were investigated, as the design specifications to which the facilities are proposed to be constructed make use of the best available.

4.5. No-go Alternative

The 'no-go' alternative refers to the scenario in which the proposed activity does not take place. In this case, the conditions and trends on site would remain as they currently are. If the no-go alternative is

taken, the proposed filling station would not be established and the impacts that are anticipated to be associated with the proposed activity would not come to pass. Chapter 4 of this report contains an assessment of the impacts that can be expected in case of the no-go option.

5. Applicable Legislation

5.1 National and provincial legislation

In terms of Regulation No. R. 387 of the EIA Regulations (2006), published in terms of section 24(5) read with section 44 of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), environmental authorization is required for this proposed project. To this end, an EIA is required to be conducted. The following listed activities are applicable to this proposed project:

Table 5.1: Applicable controlled activities in terms of the EIA regulations

R. 387 ACTIVITY NR	ACTIVITY DESCRIPTION
3	The construction of filling stations, including associated structures and infrastructure, or any other facility for the underground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin.

Table 5.2: Applicable national and provincial legislation

LEGISLATION	RELEVANT SECTIONS	PERTAINS TO
Constitution Act (No 108 of 1996)	Chapter 2, Section 24	Bill of Rights: Environmental rights
Conservation of Agricultural Resources Act (Act No 43 of 1983), as amended	Part 5	Prohibition of the spreading of weeds
	Part 6	Control measures
Development Facilitation Act (No 67 of 1995)	Chapter 1	General principles for land development and conflict resolution.
Limpopo Environmental Management Act, 2003 (No 7 of 2003)	Schedule 2, 3, 11 and 12	Lists of protected animals and plants
National Environmental Management Act (No 107 of 1998) and regulations	R. 386 and 387	Environmental Impact Assessment
	Section 2	Guiding principles
	Section 23	General objectives
National Environmental Management: Air Quality Act (No 39 of 2004)	Section 32	Control of dust
	Section 34	Control of noise
	Section 35	Control of offensive odours
National Environmental Management: Biodiversity Act (No 10 of 2004)	Section 57	Restricted activities involving listed threatened or protected species
	Sections 65–69	Regulation of activities involving alien species
	Sections 71, 73 and 75	Regulation of activities involving invasive species
National Environmental	Chapter 3	Reduction, re-use, recycling and recovery of waste

Management: Waste Act (No 59 of 2008)	Chapter 5	Storage, collection and transportation of waste
	Chapter 6	Treatment, processing and disposal of waste
National Heritage Resources Act (No 25 of 1999)	Section 34	Protection of structures older than 60 years
	Section 35	Protection of archaeological and palaeontological sites and material as well as meteorites
	Section 36	Conservation of burial grounds and graves
	Part IV	Control of environmental pollution, including waste management and prohibition of littering)
National Water Act (No 36 of 1998)	Section 19	Prevention and remedying effects of pollution, particularly where pollution of a water resource occurs or might occur as a result of activities on land
	Section 20	Control of pollution of water resources following an emergency incident
	Chapter 4 (Sections 21-55)	Governs water use
Occupational Health and Safety Act (No 85 of 1993)	All	Provides for the health and safety of persons at work and in connection with the use of plant and machinery, and protection against health and safety hazards.
State Land Disposal Act (No 48 of 1961)	Section 2	Disposal of state land by the president.
Petroleum Products Act (No 120 of 1977)		Licensing for operation of a filling station.
Promotion of Administrative Justice Act (No 3 of 2000)	The whole	The right to administrative action that is lawful, reasonable and procedurally fair, and to the right to written reasons for administrative action as contemplated in section 33 of the Constitution; and to provide for matters incidental thereto.

5.2. Municipal by-laws

The following by-laws of the Greater Tzaneen Municipality (GTM) are applicable to the proposed development.

Table 5.3: Applicable municipal by-laws

BY-LAW	PERTAINS TO
Greater Tzaneen Municipality (GTM) Flammable Liquids By-Law (2004)	Control of flammable liquids.
GTM Refuse By-Law (2004)	Handling and disposal of refuse.
GTM Drainage By-Law (2004)	Matters pertaining to drainage, including drains & manholes, sewerage, storm water, wastewater fittings & fixtures, and other related matters.
GTM Waste Management Plan (2006/07)	Strategies and programmes for waste minimization; collection, transportation, disposal and treatment of waste; pollution control.

GTM Corporate Disaster and Emergency Plan (date of compilation unknown)	To outline policy and procedures for the both the proactive disaster prevention and the reactive disaster response and mitigation phases of Disaster Management. It is intended to facilitate multi sectoral coordination in both pro-active and reactive programmes.

5.3. SABS standards

The following SABS standards are applicable and will be adhered to in the establishment of this proposed facility:

Standard:	Pertains to:
SANS 10400	Fire fighting equipment
SANS 1123	Piping
SANS10062	
SANS 10142	Electrical installation
SANS 1012	
SANS 10108	
SANS 10089-2	
SANS 1109	
SANS 1535: 2005	Tank standards
SANS 1830: 2006	Piping standards
SANS 10131 part 2	Pumps and underground tanks
SANS 1186	
SANS 10089	
SANS 10089-3	Stop switch
SANS 1186-1	Symbolic safety signs: “No Smoking” and “No Open Flame”

In addition to design standards to which the proposed facilities must adhere, certain safety standards are also required to be adhered to during transport of fuel to the proposed filling station:

Table 5.5: SANS standards applicable to transport of fuel

Standard:	Pertains to:
SANS 1518	Transport of dangerous goods – design, construction, testing, approval and maintenance of road vehicles and portable tanks
SANS 10228	The identification and classification of dangerous goods for transport
SANS 10229-1	Transport of dangerous goods – packaging and large packaging for road and rail transport Part 1: Packaging
SANS 10231	Transport of dangerous goods – operational requirements for road vehicles
SANS 10232-1	Transport of dangerous goods – emergency information systems Part 1: Emergency information system for road transport
SANS 10233	Transport of dangerous goods – intermediate bulk containers for road and rail transport
SANS 10263	The warehousing of dangerous goods – enclosed storage areas and covered and uncovered outdoor storage yards

5.4. Provincial Guidelines

Guideline:	Issued by:	Pertains to:
EIA Administrative Guideline: Guideline for the Construction and Upgrade of Filling Stations and Associated Tank Installations (2002)*	Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACEL)	Specifies minimum requirements for the establishment of filling stations.
BB2 standards: Guidelines for Accesses to Filling Stations	Gauteng Department of Public Transport, Roads and Works (Gautrans)	Access to Filling Stations

* The then Gauteng Department of Agriculture, Conservation, Environment and Land Affairs' (GDACEL's) (now GDACE - Gauteng Department of Agriculture, Conservation and Environment) EIA Administrative Guideline for the construction and upgrade of filling stations and associated tank installations (2002) has been adopted by LDEDET, as there is no equivalent guideline or legislation relating particularly to the Limpopo province. The guidelines and requirements contained in this guideline are therefore also considered to be applicable to the Limpopo province.

6. Impact Identification and Assessment

Potential impacts which may be associated with the proposed development were identified based on the results of specialist studies that have been conducted, as well as on the EAP's professional judgement and on feedback received from Interested and/or Affected Parties (I&APs).

Identified potential impacts were assessed in terms of the following:

- **Status:**
  - *Positive* – the proposed activity is anticipated to have a positive impact in terms of the particular parameter;
  - *Negative* – the proposed activity is anticipated to have a negative impact in terms of the particular parameter;
  - *Neutral* – the proposed activity is anticipated to have neither a positive nor a negative impact in terms of the particular parameter.

- **Extent:**
  - *Site-bound* – the impact is not expected to be felt outside the boundaries of the site;
  - *Local* – the impact is to be felt on the site and in its immediate surroundings, up to a radius of 50km from the site);
  - *Sub-regional* – the impact is to be felt at a distance of up to 100km from the site;
  - *Regional* – the impact is to be felt in the Limpopo Province;
  - *National* – the impact is to be felt across provincial boundaries.

- **Duration:**
  Refers to the period of time over which impacts can be expected to be experienced.
  - *Short term* – 0 to 5 years;
  - *Medium term* – more than 5 years, up to 15 years;

- *Long term* – more than 15 years;
- *Permanent* – the impact is irreversible.

- **Magnitude:**
  Refers to the intensity of the potential impact.
  - *Negligible* – the impact will barely be felt, if at all. No mitigation required;
  - *Low* – the parameter will only be affected to a small extent by the proposed project. No mitigation required, but monitoring is recommended;
  - *Medium* – the parameter will be affected by the proposed project, but functions in terms of the parameter can still continue. Mitigation and monitoring required;
  - *High* – functioning in terms of the parameter will be significantly affected by the impact. Extensive mitigation and long-term monitoring required.

- **Probability:**
  - *Improbable* – it is unlikely that the impact will be experienced;
  - *Possible* – the impact may be experienced. Monitoring required; mitigation may also be required based on the type of impact and its significance;
  - *Highly probable* – the impact will most likely be experienced. Monitoring and mitigation required based on the type of impact and its significance in order to reduce the probability of the impact occurring and/or to reduce the magnitude of the impact;
  - *Definite* – the impact will be experienced. Monitoring and mitigation required based on the type of impact and its significance in order to reduce the probability of the impact occurring and/or to reduce the magnitude of the impact.

- **Significance:**
  The significance is based on a consolidation of the anticipated extent, duration, magnitude and likelihood of the potential impact.

  - *Negligible* – The impact will barely be felt, if at all. No mitigation required;
  - *Low* – The parameter will only be affected to a small extent by the proposed project. No mitigation required, but monitoring is recommended;
  - *Medium* – The parameter will be affected by the proposed project, but functions in terms of the parameter can still continue. Mitigation and monitoring required;
  - *High* – Functioning in terms of the parameter will be significantly affected by the impact. Extensive mitigation and long-term monitoring required.

7. Bio-Physical Investigations

Certain specialist bio-physical investigations were undertaken onsite in 2007 during the Basic Assessment for the then-proposed Maake Plaza shopping centre. The site which is now proposed to house the filling station, was initially planned to form part of the shopping centre, and was therefore included in the investigations during the Basic Assessment for the shopping centre. Certain other specialist investigations were undertaken only as part of this EIA, specifically with a view to the proposed filling station.

Bio-physical investigations consisted of the following:

7.1. Climate

Climatic investigations consisted of a desktop overview of available information.

Very low impacts of climate upon the proposed project may be expected in terms of potential acceleration of soil erosion in case of rain during the *construction phase*. Potential accelerated soil erosion is anticipated to have a very low significance, due to the relatively flat topography of the proposed development site, the relatively small development area and the relatively short construction period. There are furthermore no nearby watercourses or wetlands that could be impacted on negatively by potential siltation due to soil erosion.

It is not expected that increased erosion rates will be experienced during the *operational phase*, as open areas will be paved. There will be no areas of exposed soil. As the study area is not particularly windy, it is not expected that the small amount of odours that may be generated would be dispersed to surrounding areas.

The proposed project is not anticipated to have any impact on the local climate.

7.2. Topography

The site is relatively flat and slopes slightly downward to the north-east. The general topography in the area is that of a plain marked at intervals by hills, such as the nearby Ritakop. The site is located at approximately 500m above mean sea level and no drainage features were found on or in the direct vicinity of the site. No impacts are anticipated in terms of topography as very little, if any, levelling or shaping of the landscape is anticipated to be required during construction.

7.3. Geotechnical investigation

Geo 3 Consulting Engineering, Hydro and Environmental Geologists undertook a geotechnical investigation during the planning processes for the then-proposed Maake Plaza shopping centre. The assessment included the portion of the site which is now proposed to be developed as a filling station.

The exposed soils were inspected and profiled according to standard procedures by a professionally registered engineering geologist. To classify the soils, evaluate their moisture-density relationships, consolidation properties and collapse potential, representative samples of the regolith were recovered from the sidewalls of the pits and submitted to the laboratories of EngeoLab in Nelspruit and Civilab in Johannesburg for testing. The full report is attached.

7.4. Geo-hydrological investigation and risk assessment

The geo-hydrological assessment, undertaken by In-Situ Groundwater Consulting, consisted of the following:

- Detailed desk study gathering existing information from topographical maps, ortho-photos, geological maps, hydrological information, published and unpublished reports etc;
- Request all borehole data in the catchment area from GPM Consultants in Limpopo Province;

- Verify all received borehole data and identify additional water users through a hydro-census at and around the proposed development to assess the groundwater utilization in the area;
- Commission two groundwater monitoring boreholes according to the prescribed specifications of the Department of Water Affairs (DWA).
- Based on all the above-mentioned regional and site specific data, a specialist report was compiled on the groundwater depths, quality, flow directions and velocity. From this information, potential impact zones were identified, including a first order risk assessment to determine the potential for groundwater contamination.

The study concluded that considering the available information, the proposed filling station might have some impact on the environment, but as long as proper management procedures are in place, the effect is anticipated to be minimal.

7.5. Ecological investigation

A specialist ecological assessment was conducted by Dr Buks Henning of Africa Geo-Environmental Services (AGES) during the BA for the then-proposed Maake Plaza shopping centre. The following was documented during the investigation:

- State of vegetation and time of survey
- Plant species of importance
- Average cover and height of floristic components
- General ecological information such as soil type, geology, location of drainage channels etc
- Plant communities were identified on site and a classification of vegetation data was done to identify, describe and map vegetation units, which will include a sensitivity map.

With the natural vegetation already having mostly been cleared and the site having been landscaped as part of the construction of the Maake Plaza shopping centre, faunal and vegetation impacts of the proposed establishment of the filling station are anticipated to be negligible.

7.6. Air Quality

Petrol and diesel fumes may have potentially negative impacts on human health and may contribute to photochemical smog. However, the proposed facility has been designed to limit the potential for fugitive emissions as far as possible.

A related potential impact is the potential generation of exhaust fumes from vehicles visiting the filling station and waiting to be assisted. The idling vehicles will, however, be in the open, where fumes can dissipate; still, drivers will, through appropriate signage, be advised to switch off vehicles while waiting to be assisted. These impacts are anticipated to be mostly site-bound.

7.7. Services and Waste Management

Water and electricity consumption, as well as generation of sewage, is expected to increase as a result of activities at the proposed facility. This would place added pressure on the nearby borehole which is to supply water to the proposed facility, as well as on the municipal electricity supply infrastructure and the

sewerage treatment facility on the premises of Maake Plaza shopping complex. Generation of solid waste is anticipated to increase, along with littering.

Recyclable waste (paper / cardboard; glass; aluminium cans; and spent printer cartridges) will be separated from non-recyclable waste at source, and will be collected by a recycling contractor on a regular basis for delivery to relevant recycling facilities. Non-recyclable waste will be collected by the municipal solid waste management division for disposal at the municipal landfill site.

8. Socio-Economic Investigations

8.1. Heritage Resources

No sites of heritage importance were identified within the study area; no negative impacts on heritage resources are therefore anticipated. However, should sub-surface artefacts be unearthed during construction, all activities should be ceased and the South African Heritage Resources Association (SAHRA) as well as a heritage specialist should be contacted.

8.2. Social Aspects

Direct social impacts are expected to have low significance. *Construction phase* impacts are expected to relate mainly to job creation, whilst *operational phase* impacts are expected to relate to job creation, reduction in income and possible job losses at nearby existing filling stations, increased convenience and access to fuel for local vehicle owners, potential safety risk because of the highly flammable nature of the types of fuel to be stored onsite, and potential health risk related to the chemicals in fuel vapours during filling of fuel tanks and pumping of fuel. Health and safety issues are elaborated upon in the following section.

8.3. Health and Safety

Though there is a risk of injury during the construction phase, potential health and safety impacts are expected to relate mostly to the operational phase and to be associated with the flammable and potentially hazardous nature of the chemicals which make up petrol and diesel. These substances pose a risk of fire or explosion, as well as health risks in case of exposure.

8.4. Economic Aspects

A feasibility study was conducted by Petrorex in December 2008 (and amended in 2009). As part of this study, the potential impact of the proposed filling station on existing nearby filling stations was gauged. In considering the possible impact on the environment of the proliferation of a filling station as well as the possible impact on existing filling stations, the following must be taken under consideration:

- Fulfilling the needs of the targeted community / market;
- Economical impact on the sustainability of existing filling stations.

The volume of fuel sales projection based on the commuter and transient trade passing the proposed site on road R36 / P17-3 and road D4075, as well as the volume of fuel sales generated by the Maake Plaza

Shopping centre, can be seen as the volume likely to have an influence on the competitor sites in the trading area of the GTM area.

In this scenario the influence of the volume loss of each competitor service station's performance was allocated proportionally according to the percentage market share of the particular service station. The Ofcolaco BP is anticipated to experience the highest negative influence at an expected volume loss of 61 kilolitres in the first year, followed by the Engen site in Ka-Mohlaba at 38 kilolitres, Total Lenyene at 37 kilolitres, the non-branded site (Poo ke Nna Filling Station) at 35 kilolitres and Tepco Mohlaba Crossing at 24 kilolitres. The identified competitor sites will not suffer a significant fuel sales volume loss and will still be viable and sustainable if the proposed Maake Plaza filling station development becomes operational. The proposed service / filling station carries no significant threat to the economical sustainability of the competitor service station sites in the identified local trading area.

8.5. Visual Aspects

The site is situated in a built-up area and is bound on all sides by commercial and residential development (mostly commercial), as described in Chapter 2. Although the shopping complex of which the filling station is proposed to form part, is surrounded by majestic mountains, the level at which the filling station is to be situated has already been transformed by development, and the proposed filling station would be in line with the type and scale of developments already found in the area.

Construction-phase impacts are related to construction activities such as earthworks and actual construction activities. They are anticipated to have a low significance, as these activities will be very short term in duration and would extend over a small area only.

Operational phase impacts relate to the visual impact of the established filling station and any associated signage and lighting. The operational phase visual impact of the proposed development is anticipated to have low significance, as the proposed development is visually compatible with the type of activities on surrounding properties. The affected area will also be relatively small in size and, as the filling station is to form part of a commercial development (Maake Plaza), it is not expected to visually intrude on the landscape but rather is expected to visually form a part of the rest of the development on the site.

Night-time operational phase visual impacts are expected to be of low-medium significance: the proposed filling station is anticipated to have 24-hour lighting for security purposes as well as lit signage, but the lighting is anticipated to be compatible with that of the Maake Plaza shopping centre of which the filling station is proposed to form part, as the centre also has 24-hour lighting in the parking area, shopfronts and back of house. It is therefore anticipated that the filling station would visually form a whole with the shopping centre.

8.6. Noise

The proposed development site is situated in a thriving commercial hub, which is host to a variety of formal and informal commercial activities. The chatter of large volumes of pedestrians on the roads, at Maake Plaza and at the onsite taxi rank, blends with the constant buzz of traffic on the busy adjacent road and music from shops in Maake Plaza shopping centre.

Construction-phase impacts are anticipated to be mainly associated with construction activities themselves, including earthworks, off-loading of material from trucks, etc. A small amount of noise can be expected to be generated by the engines of heavy trucks delivering materials to the site. Noise impacts during the construction phase will be short-term in duration, occurring only whilst construction is underway. Construction activities will, as far as possible, be limited to the daytime, when ambient noise levels are higher than at night and the impact of noise associated with the construction / establishment activities is therefore lower. Construction-related noise is anticipated to have a low significance in the context of the ambient noise levels.

Noise impacts expected to be introduced into the receiving environment by the proposed new filling station during the *operational phase* are anticipated to be similar to the types and levels of noise currently experienced. Current noise levels are associated mostly with vehicular traffic (engines) and pedestrian traffic (voices), and operational-phase noise impacts associated with the proposed filling station are similarly anticipated to relate to vehicles visiting the filling station and the chatter of drivers, pedestrians and pump attendants. Noise impacts are anticipated to be felt mostly during the daytime, when the filling station would be most active, and during this time the ambient noise levels are also elevated. Very little noise is expected to be generated during the relatively quiet night time, and impacts are therefore anticipated to be negligible.

Due to the compatibility of the anticipated new noise impacts with the existing ambient noise sources and levels, potential noise impacts are anticipated to be of low significance.

8.7. Traffic

According to Mr Awie van Zyl, traffic engineer with Avzcons, filling stations are not trip generators, i.e. no additional vehicle trips are loaded onto the surrounding road system and intersections. Rather, filling stations intercept trips on the road system. It was therefore not necessary to conduct an additional traffic impact assessment over and above the one which was conducted as part of the Basic Assessment for the Maake Plaza shopping centre.

Impacts with regards to traffic load and congestion associated with the proposed filling station are anticipated to be insignificant, due to the fact that no new trips are anticipated to be generated, and the fact that the entrance to the filling station is proposed to be via the existing access to Maake Plaza shopping centre, off the secondary road D4075 (and not the busier R36), which carries a lighter traffic load – little disruption to traffic flow is therefore expected.

8.8. Cumulative / indirect impacts

As is the case for any activity, impacts are not limited to those directly associated with the proposed activity – potential cumulative impacts need to be considered as well, so that activities can be seen not just as stand-alone entities but as part of the larger picture of development in the area. Please refer to Chapter 8 for an assessment of anticipated cumulative and/or indirect impacts.

9. Public Participation

The purpose of the public participation process was to inform I&APs of the proposed project and to obtain their input into the process.

9.1. Background Information Document and Comment and Registration Form

A Background Information Document (BID) was compiled in English (also containing a SePedi summary) in order to provide a background and description of the proposed project and the EIA process being followed. The BID was distributed to stakeholders and adjacent landowners along with the locality map and comment and registration form. The comment and registration form provided I&APs and stakeholders with a convenient method of submitting their contact details to the consultants in order to register on the project database, as well as to raise any issues, comments or concerns that they had in terms of the proposed project.

9.2. Advertisement of First Public Meeting and Commencement of EIA Process

The commencement of the EIA process was advertised for a period of 30 days (29 August – 28 September 2008) by means of newspaper advertisements, site notices and direct notification of stakeholders by fax, e-mail, post or personal delivery of notices.

9.3. Stakeholder Meetings

Two **public meetings** have been held thus far – one during the scoping phase (13 September 2008) and one during the impact assessment phase (12 September 2009) – with the purpose of providing information to stakeholders and the general public regarding the proposed project and to provide a forum for discussion of any queries, comments or concerns that stakeholders might have. A third **public meeting** has been arranged for Saturday, 24 July 2010 (during the public review period of this report) in order to discuss the content of this EIR and the associated EMP, particularly for the benefit of illiterate or semi-literate community members.

A **Focus Group Meeting** (FGM) has also been conducted with representatives of existing filling stations in the local trading area to discuss the feasibility study which has been conducted with regards to the proposed new filling station, as well as the potential financial impacts of the proposed filling station on existing nearby filling stations.

9.4. Issues Raised

Comments and issues raised during the Public Participation Process thus far have been incorporated into the Issues Trail (Appendix R). The main issue raised during public participation was the concern that there may not be sufficient **demand** for another filling station in the area, and the fear of the owners of two nearby filling stations that their **income** might be reduced if customers prefer the new filling station to their existing facilities.

9.5. Availability of Draft ESR for Public Review

The draft ESR was **originally** available for public review and comment for a period of 30 days, from 3 October to 3 November 2008. The availability of the report was advertised by means of newspaper advertisements, site notices and direct notification of stakeholders by fax, e-mail, post or personal

delivery of notices. Copies of the draft ESR were also submitted directly to the certain key stakeholders for their review and comment.

Following input from I&APs with regards to the original draft ESR, the report was subsequently amended, and a significant amount of information added. The **revised draft ESR** was made available for public review and comment for a period of 30 days, from 14 May to 13 June 2009. The availability was advertised in the same way as that of the original draft ESR, and copies of the report were submitted directly to an expanded list of key stakeholders.

9.6. Availability of Draft EIR and EMP for Public Review

The draft EIR and EMP are currently available for public review and comment for a period of 62 days (from 3 June to 6 August 2010). The usual 30-day comment period has had to be extended due to the June school holidays partially overlapping with the comment period. The extended comment period provides for 30 days outside of school holidays. Copies are also being submitted to a number of key stakeholders for their review and comment.

9.7. Authorization

Following review of the final EIR and EMP, LDEDET will either authorise, reject or conditionally authorise the proposed filling station development. Polygon will directly notify all registered I&APs of the outcome of LDEDET's decision within 10 days of issuing of the authorization; they will also be informed regarding the appeal process which can be followed if any parties wish to appeal LDEDET's decision.

10. Conclusions and Recommendations

The EIA process has identified no fatal flaw issues associated with the proposed development and has found that the proposed development can be supported on the proposed site, provided that the recommended management and mitigation measures are implemented in order to limit potentially negative impacts and reinforce potential positive impacts that may be associated with the proposed project. These measures are stipulated in the accompanying EMP.

1. INTRODUCTION

Polygon Environmental Planning CC, as independent Environmental Assessment Practitioners (EAP), has been appointed by Mc Cormick Property Development (Pty) Ltd (MPD) to conduct an Environmental Impact Assessment (EIA) for the proposed establishment of a filling station and associated convenience shop on the premises of the Maake Plaza shopping centre, on part of the Remainder of the farm Rita 668-LT in the Greater Tzaneen Municipality (GTM). The site falls within the Mopani District of the Limpopo Province (please refer to the locality map in Appendix A).

The proposed filling station triggered a full EIA, as it entails an activity listed in terms of Regulation 387 of the EIA Regulations (2006), published in terms of section 24(5) read with section 44 of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998). The following listed activity applies to the proposed project:

R. 387, Activity 3 – *The construction of filling stations, including associated structures and infrastructure, or any other facility for the underground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin.*

An application for environmental authorisation has been submitted to the Limpopo Department of Economic Development, Environment and Tourism (LDEDET), the decision-making authority in this regard, and both the scoping and impact assessment phases of the EIA have been concluded. The results of the EIA are hereby submitted in the form of this EIR, whilst measures for the prevention, minimisation and/or mitigation of potential impacts of the proposed filling station are included in the accompanying Environmental Management Programme (EMP).

2. SITE AND PROJECT DESCRIPTION

2.1 Site description

2.1.1. Location

The site on which the filling station is proposed to be developed is approximately 1 700m^2 (0,17 ha) in extent and is situated on the south-eastern corner of the junction of the R36 (Tzaneen - Lydenburg road) and the D4075 road which leads from the R36 into Rita and Maake. The site forms part of the premises of the existing Maake Plaza regional shopping centre.

2.1.2. Ownership

The land belongs to the Republic of South Africa (RSA) and is managed by its Department of Rural Development and Land Reform (DRDLR, previously the Department of Land Affairs – DLA). The Bakgaga ba Maake tribe, represented by the Bakgaga Community Trust (BCT), are the custodians of this land and the applicant, MPD, is leasing the proposed site from the Bakgaga ba Maake Traditional Authority. A copy of the lease agreement, signed by MPD, the Bakgaga ba Maake Traditional Authority and a representative of the DRDLR, is attached under Appendix D of this report as part of the application form which was submitted to L DEDET at the outset of this EIA process.

2.1.3. Current land use and zoning on and around the site

The site currently consists of landscaping and was cleared of indigenous vegetation during the construction, in 2008, of the Maake Plaza shopping centre, as the site was initially to form part of the shopping complex. Re-zoning of the site from Agricultural to Business 2 was approved on 3 July 2007; this zoning makes provision for *inter alia* a filling station. No re-zoning will therefore be required for establishment of the proposed filling station.

Surrounding land use is a mixture of commercial and residential uses. Surrounding commercial land use is partly informal and partly formalised, and consists of *inter alia* the following:

- **To the south:** Maake Plaza shopping centre and taxi rank;
- **To the west:** Informal traders; driving school; security training; informal barber shop; residential land use;
- **To the north:** Informal traders; Poo ke Nna Filling Station;
- **To the east:** Medical centre; maize depot; general dealer; other commercial activities.

2.2. Project description

It is proposed that a filling station with associated convenience shop be developed on the premises of Maake Plaza shopping centre to serve visitors to the centre, members of the local community and passing traffic.

A **tank farm** with a total underground fuel storage capacity of 115m^3 is proposed to be installed, consisting of the following:

- 1 x 23m^3-capacity tank: Diesel
- 2 x 23m^3-capacity tanks: Unleaded petrol
- 2 x 23m^3-capacity tanks: Lead replacement petrol

Forming part of the proposed **convenience shop** are the following:

- Convenience shop
- “Cafe Bonjour” minimart
- Small internet cafe
- Food preparation area and scullery
- Refrigerators and freezers
- Public ablution facilities (male, female and disabled)
- Storage facilities (cold and dry storage)
- ATM (Automatic Teller Machine)
- Pay points
- Attendants’ change rooms (male and female)
- Offices

The **forecourt**, to be covered by a 150mm-thick concrete slab, is to contain the following:

- Customer parking bays;
- Four pump islands; eight vehicles would therefore be able to be helped simultaneously (one on either side of each pump island).

The forecourt will be covered by a canopy.

Other facilities:

- Oil separator
- Catch pits for potentially contaminated storm water
- Walled yard area behind convenience shop, containing:
    - Refuse cage
    - Fire wood & charcoal cage
    - Compressor room

Please refer to Appendix B for detail drawings, sections, plans, etc of the proposed tanks and associated infrastructure.

The filling station will not be fenced off from the rest of the shopping centre and is proposed to share the shopping centre's main entrance.

2.3. Civil Services

Water to the proposed facility is to be obtained from an existing borehole situated approximately 400m from the site. Water pumped from the borehole is purified with ultra-violet light before being reticulated to the taps.

Ablutions at the facility are to be connected to the sewerage system which has been established on the site of Maake Plaza shopping centre, and which consists of a septic tank and oxidation ponds.

Electricity is available at the site and will be provided by the GTM on behalf of Eskom.

2.4. Solid waste management

Solid waste generated at the proposed facility is proposed enter the municipal waste stream. Waste will be sorted into recyclable (paper/cardboard, aluminium cans, glass) and non-recyclable materials. Non-recyclable waste will be collected by the GTM and disposed of at the municipal landfill site, whereas recyclable waste will be collected by a recycling contractor on a regular basis, as is currently done with the shopping centre's waste. The recycling contractor will distribute the different types of recyclable waste to relevant recycling facilities.

Solid waste will be temporarily stored in a refuse cage in the yard behind the convenience shop while it awaits collection by the GTM.

2.5. Access and Traffic (Petrorex, 2009)

The two major roads the R36 / P17-3 and the D4075 facilitate the distribution of traffic within the rural district area and between rural towns, Tzaneen, Hoedspruit and Lydenburg. They also fulfil the function of serving a variety of land uses in the immediate business node area.

Access to the proposed filling station site is to be from the main entrance to the shopping centre and taxi rank, which is from the D4075 road. Access to provincial roads is governed by the BB2 standards (*Guidelines for Accesses to Filling Stations)* published by the Gauteng Department of Public Transport, Roads and Works (Gautrans). Due to the classification of the R36 provincial road, and taking into consideration the shopping centre traffic generating factor as well as the permissible design speed of the adjacent road, the access point to the shopping centre and proposed filling station has been positioned far from the intersection for safe sight and stopping distances.

The site is strategically positioned along the R36 / P17–3 road, after a main intersection / downstream with accesses according to sound road planning principles, via the entrance roads towards the adjacent Maake Plaza shopping centre. This is highly desirable, since right turn movements are prevented on the adjacent main road. The convenience and safety factors of vehicles travelling on the D4075 at lower speed differentials are furthermore highly advantageous and desirable. The stop sight distances are (furthermore) ideal.

The proposed layout and the availability of the access points do not encourage motorists travelling towards surrounding towns to make special trips to the service station itself, i.e. generation of new trips, and the concomitant traffic impacts, is discouraged.

The size of the proposed service station site is adequate to accommodate a modern type of service station conveniently and safely, and without causing inconvenient diversions or creating additional conflicting turning movements, which would negatively affect road safety. The fact that the canopy and pump island layout is proposed directly behind the ingress point will not cause traffic conflict points and will allow for proper and safe circulation between motorists and heavy vehicles, inclusive of the fuel delivery vehicle, on the forecourt itself as well as entering and exiting the site.

According to Mr Awie van Zyl, traffic engineer with Avzcons who conducted the traffic impact assessment as part of the Basic Assessment for the Maake Plaza shopping centre, filling stations are not trip generators, i.e. no additional vehicle trips are loaded onto the surrounding road system and intersections as a result of the establishment of a filling station. Rather, filling stations **intercept** trips on the road system. It was therefore not necessary to conduct a traffic impact assessment with specific reference to the proposed filling station.

2.6. Design specifications *(Total SA)*

- Underground fuel tanks to be installed within a containment sump consisting of HDPE sheeting (minimum thickness: 40 micron) filled with compacted river sand to prevent fuel coming into direct contact with soil or groundwater in case of leakage.
- Clay layer can be incorporated in earthworks if necessary, to prevent groundwater seepage and contamination.
- Filler manhole to have minimum 35 litre capacity to intercept potential spillages during filling of tanks.

- Pumps to be installed within sumps to intercept any leakage.
- Submersible pump motor to be flame and explosion proof.
- Diesel vent pipes to be taken up to 3.8m height to that fugitive gases are vented at a safe height, reducing health risk to employees and customers.
- Diesel vent pipes to terminate in flame proof caps with gauze to reduce fire hazard.
- Automatic tank gauging to be installed.
- Emergency stop switch to be installed to reduce risk of spillage.
- Petrol dispensing units to be fitted with a safety shut-off valve.
- Any electrical switches, plugs or motors within 3m of any pump to be flame and explosion proof.
- 200mm reinforced concrete apron over tanks; this will extend 1m beyond tanks.
- Brick or concrete “saddles”, topped by a reinforced concrete slab, to be installed above storage tanks to prevent buoyancy / “floating” of tanks when fuel levels are low.
- Storm water runoff from the slab around the pump islands will be channelled into catch pits at the corners of this slab, from where it will flow underground in a UPVC pipe to an oil separator. Clean water flowing from the oil separator will enter the storm water drainage system.
- All relevant SANS (South African National Standard) codes and National Building Regulations to be adhered to.

3. PROJECT MOTIVATION AND FEASIBILITY

LDEDET subscribes to the *EIA Administrative Guideline for the Construction and Upgrade of Filling Stations and Associated Tank Installations* developed by the then Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACEL) in March 2002. This guideline specifies that, should a developer wish to submit an application for development of a filling station within 5km driving distance of an existing filling station in an urban/built-up/residential area, or within 25km driving distance of an existing filling station in other instances (e.g. rural areas, and along highways and national roads), a detailed motivation for the proposed new filling station is required to be included in the Environmental Scoping Report (ESR) or EIR.

3.1. Motivation and Feasibility

The proposed filling station is proposed to form part of the existing Maake Plaza shopping complex, and would be a complementary use to this regional shopping complex. It is anticipated that the shopping centre with the proposed filling station would provide an integrated shopping experience to customers and increase the level of convenience in obtaining products and services. The proposed filling station would furthermore be ideally suited to serve the taxi rank which forms part of the shopping complex development.

A feasibility study was undertaken in 2009 by Petrorex to gauge the financial feasibility of a filling station at this site and to investigate the potential financial impacts of such a filling station on existing nearby filling stations. The feasibility study concluded that although a reduction in fuel sales can be expected at nearby filling stations, the impact is not anticipated to significantly affect those filling stations’ viability and it is not foreseen that this proposed filling station, if approved, would lead to the demise of these pre-existing filling stations.

Situated at the junction of the R36 (the main road connecting Tzaneen with Lydenburg and Hoedspruit) and the D4075, which leads from the main road into the villages comprising Maake, the proposed filling station on this site would furthermore be in an ideal position to serve passers-by on these roads. Though there are other existing filling stations in the vicinity, it is anticipated that this proposed filling station would fill a niche that is not filled by the existing filling stations. Being a well-known national brand, the proposed Total filling station is anticipated to draw customers who might otherwise have been wary (whether correctly or not) of the currently existing filling stations, particularly the non-branded ones, as the Total chain is known to provide certain facilities, services, products, conveniences and ablutions to a certain standard, as well as a wide range of products in their convenience store. Particularly passersby such as tourists are expected to fall in this category.

Therefore the site, due to its location and ancillary regional retail facility, satisfies the needs and requirements of the commuter and transient trade, as well as the traffic generated from the adjacent shopping centre to ensure a concurrent and full time support of the service station facility. The taxi rank would also benefit from this development (Petrorex, 2009).

From a safety and convenience point of view, the site satisfies the following requirements for service stations (Petrorex, 2009):

- Strategic location
- Visibility
- Accessibility
- Access gradient
- Sight distance
- Stopping sight distance
- Access spacing

Along with complying with the basic requirements the application site, certain other specific advantages are applicable to the site (Petrorex, 2009):

- The site is strategically positioned along the R36 / P17–3 road, after a main intersection / downstream with accesses according to sound road planning principles, via the entrance roads towards the adjacent Maake Plaza shopping centre. This is highly desirable since right turn movements are prevented on the adjacent main road.
- The convenience and safety factors of vehicles travelling on the D4075 at lower speed differentials are highly advantageous and desirable.
- The proposed site offers the highest convenience for drivers when filling up with fuel as the proposed layout and the availability of the access points do not encourage motorist travelling towards surrounding towns to make special trips to the service station itself.
- The stop sight distances are ideal, and the proposed service station site size is furthermore adequate to accommodate a modern type of service station. It is convenient and safe and will not cause inconvenient diversions, creating additional conflicting turning movements and thus negatively affecting road safety.
- The fact that the canopy and pump island layout is directly behind the ingress point will not cause traffic conflict points and will allow for proper and safe circulation between motorists and heavy vehicles, inclusive of the fuel delivery vehicle, on the forecourt itself as well as entering and exiting the site.

- A newly designed, modern facility with sufficient product type distribution on the forecourt as well as in the shop will complement the services offered by the newly developed shopping centre.
- All requirements of the proposed service station focused on the convenience and safety of the motoring public are met by the proposed service station development.

Discussions with a number of local residents indicate a need for a filling station providing a higher level of service than is currently available at the existing nearby filling stations. The major issues raised with regards to the nearby stations are inconsistent fuel availability and a lack of certain conveniences such as shade and protection from rain for customers.

3.2. Trading area / market

Taking into consideration the accessibility, visibility and location of the site, the trading area in which the service station is proposed to operate, could be broken down into:

- The **primary market** from where the customers are expected consists out of transient and commuter trade on road R36 / P17 -3 and road D4075. These commuters originate from the primary catchment area that includes the towns of Tzaneen / Letsitele / Lydenburg. The secondary catchment area includes the towns of Nkowankowa / Lenyenye / Ka-Mohlaba / Ka-Xipala / Ka-Xikwambana and Rita Village / Maake.
- The **secondary market**, consisting of traffic (primary trips) generated by the adjacent retail centre. These are referred to as *new trips*, or trips generated by the retail and commercial centre. The visit to the centre or development is the primary reason for the trip.

4. INVESTIGATION OF ALTERNATIVES

4.1 Activity Alternatives

No activity alternatives (alternative uses of the site) – were investigated, due to the following:

- The proposed site to be used for this proposed filling station is relatively small (approximately 0,17 ha) and therefore prohibitively small to be used viably for many other activities. The site is too small for community service infrastructure such as school, health or church facilities; not suitable for agriculture, due to its small size and location on the premises of a shopping complex; not suitable for residential use due to its position as part of a shopping complex. The site could potentially be used for additional parking bays to serve the Maake Plaza shopping centre; however, this is not an income-generating activity and was therefore not considered a viable development alternative for detailed investigation during this EIA. Use for commercial activities other than a filling station was not considered, due to the small size of the site;
- The Bakgaga ba Maake Traditional Authority, the custodians of the land on behalf of the Republic of South Africa, have approved the proposed filling station on this site;
- There are no sensitive surface water resources on, or in close proximity to, the site;
- The geo-hydrological investigation indicated that, with proper, medium-level groundwater protection, the impact on groundwater resources of a filling station on this site is anticipated to be minimal;
- The site has already been transformed, and currently consists of landscaped gardens. Impacts in terms of fauna and flora would therefore be negligible;

- The feasibility report indicated that proposed development site satisfies all the conditions required of a filling station site in terms of convenience and safety to the motoring public as well as a number of other advantages (please refer to Section 3.1 above);
- The feasibility study indicated that a new filling station on this site carries no significant threat to the economical sustainability of the competitor service station sites in the identified local trading area;
- Though there are other existing filling stations nearby, it is anticipated that this proposed filling station would fill a niche that is not filled by the existing filling stations, through provision of a wider range of products and services as well as a consistent level of service. Being a well-known national brand, the proposed Total filling station is anticipated to draw customers (for instance tourists) who might otherwise (whether rightly so or not) have been wary of making use of un-branded filling stations in particular.

4.2. Site Alternatives

No site alternatives were investigated, due to the following:

- The feasibility report indicated that proposed development site is the ideal site for a filling station, as it satisfies all the conditions required of a filling station site in terms of convenience and safety to the motoring public, *viz*. strategic location, visibility, accessibility, access gradient, sight distance, stopping sight distance, access spacing, as well as a number of other advantages (please refer to Section 3.1 above).
- The Bakgaga ba Maake Tribal Authority, the custodians of the land, have approved the proposed filling station on this particular site;
- No sensitive ecological features were found to occur on this site, and the site has already been transformed through landscaping during development of the Maake Plaza shopping centre on the same premises; impacts in terms of fauna and flora are therefore anticipated to be negligible;
- No heritage sites or features were found onsite;
- There are no sensitive surface water resources on, or in close proximity to, the site;
- The geo-hydrological investigation indicated that, with proper, medium-level groundwater protection, the impact on groundwater resources of a filling station on this site is anticipated to be minimal;
- Civil services (water, electricity and sewerage) are already available at the site;
- Safe access is already in place (constructed as part of the Maake Plaza shopping centre development);
- The site has already been transformed, and development of the property would not bring about any loss in habitat, nor would it require any relocation of plant or animal species, people or businesses. It would furthermore not necessitate cessation of any current activities on the site;
- The proposed filling station would be a complementary use to the shopping complex of which it is proposed to form part;
- The proposed filling station would be ideally suited to serve the taxi rank which forms part of the shopping complex development.

4.3. Layout Alternatives

The proposed layout was dictated by the shape and size of site as well as the position of the roads bordering the site (the R36 and the D4075). No layout alternatives were investigated, as the proposed layout is felt to be the most efficient one possible, given the irregular shape of the site and its small size,

and furthermore a change in the layout of this particular proposed facility would have no significant effect on the type or significance of bio-physical or socio-economic impacts.

4.4. Design / Technology Alternatives

No design / technology alternatives were investigated, as the design specifications to which the facilities are proposed to be constructed make use of the best available technology and conform to all relevant standards.

4.5. No-go Alternative

The 'no-go' alternative refers to the scenario in which the proposed activity does not take place. In this case, the conditions and trends on site would remain as they currently are. If the no-go alternative is taken, the proposed filling station would not be established and the impacts that are anticipated to be associated with the proposed activity would not come to pass.

Should the proposed filling station not be developed, the following impacts can be expected:

Table 4.1: Anticipated impacts in case of the proposed filling station not being developed

BIO-PHYSICAL ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
No short-term increase in the risk of soil erosion during construction activities	Neutral	Site-bound	Short term	Very low	Definite	Very low
Long-term soil erosion rates and trends remain at current levels	Neutral	Site-bound	Long term	Negligible	Highly probable	Very low
No risk of soil or groundwater pollution by wastewater during construction	Neutral	Local	Short term	Negligible	Definite	Negligible
No risk of soil or groundwater pollution through accidental spillage, overfill or leaking tank	Neutral	Sub-regional	Long term	High	Definite	Medium – very high
Storm water attenuation (however slight) through slowing of storm water runoff by vegetation, and infiltration of precipitation into the soil	Neutral	Site-bound	Long term	Low	Highly probable	Low
No temporary loss of habitat currently provided by existing trees onsite, while replacement trees elsewhere onsite reach maturity	Neutral	Site-bound	Medium term	Negligible	Highly probable	Negligible
No airborne dust during construction	Neutral	Local	Short term	Very low	Highly probable	Very low
Levels of littering remain unchanged	Neutral	Site-bound and in the immediate vicinity of the site	Long term	Very low	Highly probable	Very low
No increased water use	Neutral	Local	Long term	Low	Definite	Low
No increased electricity use	Neutral	Local	Long term	Low	Definite	Low
No increased generation of sewage	Neutral	Local	Long	Low	Definite	Low

			term			
No increased solid waste generation	Neutral	Local	Long term	Low	Definite	Low
SOCIO-ECONOMIC ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
No elevation in levels of airborne dust	Neutral	Local	Short term	Very low	Highly probable	Very low
No health risks associated with petrol/diesel fumes and exhaust fumes	Neutral	Site-bound	Long term	Very low (fumes under normal circumstances); Unknown (accidental exposure)	Definite	Medium-High
No short-term employment creation	Neutral	Local	Short term	Low – Very low	Highly probable	Low – Very low
No elevation in levels of unruliness and/or crime during construction	Neutral	Local	Short term	Unknown	Highly probable	Low
No increase in criminal elements attracted to new filling station	Neutral	Local	Long term	Unknown	Highly probable	Medium
No job creation or job losses	Neutral	Local	Long term	Low	Highly probable	Low
Turnover of existing filling stations remains at current levels or following current trends	Neutral	Local	Long term	Medium	Highly probable	Medium
No increased risk of fire / explosion	Neutral	Local	Long-term	Unknown	Highly probable	High
No visual impact of construction activities	Neutral	Local	Short-term	Low	Definite	Low
No day-time visual impact of filling station	Neutral	Local	Long-term	Low	Definite	Low
No night-time visual impact of filling station (light pollution)	Neutral	Local	Long-term	Medium	Definite	Medium
Aesthetically pleasing landscaped area remains, instead of a built-up site	Neutral	Local	Long-term	Low	Definite	Low
No noise associated with construction activities	Neutral	Local	Short-term	Medium-low	Definite	Low
No noise associated with vehicular and pedestrian traffic to filling station	Neutral	Local	Long-term	Medium-low	Definite	Low
No disruption of traffic by construction vehicles	Neutral	Local	Short-term	Very low	Definite	Very low
No disruption of traffic flow by vehicles turning into, and exiting from, the filling station	Neutral	Local	Long-term	Very low	Definite	Very low
No disruption of traffic flow by fuel tankers turning into filling station when delivering fuel	Neutral	Local	Long-term	Very low	Definite	Low

5. APPLICABLE LEGISLATION

5.1 National and provincial legislation

In terms of Regulation No. R. 387 of the EIA Regulations (2006), published in terms of section 24(5) read with section 44 of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998),

environmental authorization is required for this proposed project. To this end, an EIA is required to be conducted. The following listed activities are applicable to this proposed project:

Table 5.1: Applicable controlled activities in terms of the EIA regulations

R. 387 ACTIVITY NR	ACTIVITY DESCRIPTION
3	The construction of filling stations, including associated structures and infrastructure, or any other facility for the underground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin.

Table 5.2: Applicable national and provincial legislation

LEGISLATION	RELEVANT SECTIONS	PERTAINS TO
Constitution Act (No 108 of 1996)	Chapter 2, Section 24	Bill of Rights: Environmental rights
Conservation of Agricultural Resources Act (Act No 43 of 1983), as amended	Part 5	Prohibition of the spreading of weeds
	Part 6	Control measures
Development Facilitation Act (No 67 of 1995)	Chapter 1	General principles for land development and conflict resolution.
Limpopo Environmental Management Act, 2003 (No 7 of 2003)	Schedule 2, 3, 11 and 12	Lists of protected animals and plants
National Environmental Management Act (No 107 of 1998) and regulations	R. 386 and 387	Environmental Impact Assessment
	Section 2	Guiding principles
	Section 23	General objectives
National Environmental Management: Air Quality Act (No 39 of 2004)	Section 32	Control of dust
	Section 34	Control of noise
	Section 35	Control of offensive odours
National Environmental Management: Biodiversity Act (No 10 of 2004)	Section 57	Restricted activities involving listed threatened or protected species
	Sections 65–69	Regulation of activities involving alien species
	Sections 71, 73 and 75	Regulation of activities involving invasive species
National Environmental Management: Waste Act (No 59 of 2008)	Chapter 3	Reduction, re-use, recycling and recovery of waste
	Chapter 5	Storage, collection and transportation of waste
	Chapter 6	Treatment, processing and disposal of waste
National Heritage Resources Act (No 25 of 1999)	Section 34	Protection of structures older than 60 years
	Section 35	Protection of archaeological and palaeontological sites and material as well as meteorites
	Section 36	Conservation of burial grounds and graves
	Part IV	Control of environmental pollution, including

		waste management and prohibition of littering)
National Water Act (No 36 of 1998)	Section 19	Prevention and remedying effects of pollution, particularly where pollution of a water resource occurs or might occur as a result of activities on land
	Section 20	Control of pollution of water resources following an emergency incident
	Chapter 4 (Sections 21-55)	Governs water use
Occupational Health and Safety Act (No 85 of 1993)	All	Provides for the health and safety of persons at work and in connection with the use of plant and machinery, and protection against health and safety hazards.
State Land Disposal Act (No 48 of 1961)	Section 2	Disposal of state land by the president.
Petroleum Products Act (No 120 of 1977)		Licensing for operation of a filling station.
Promotion of Administrative Justice Act (No 3 of 2000)	The whole	The right to administrative action that is lawful, reasonable and procedurally fair, and to the right to written reasons for administrative action as contemplated in section 33 of the Constitution; and to provide for matters incidental thereto.

5.2. Municipal by-laws

The following by-laws of the Greater Tzaneen Municipality (GTM) are applicable to the proposed development.

Table 5.3: Applicable municipal by-laws

BY-LAW	PERTAINS TO
Greater Tzaneen Municipality (GTM) Flammable Liquids By-Law (2004)	Control of flammable liquids.
GTM Refuse By-Law (2004)	Handling and disposal of refuse.
GTM Drainage By-Law (2004)	Matters pertaining to drainage, including drains & manholes, sewerage, storm water, wastewater fittings & fixtures, and other related matters.
GTM Waste Management Plan (2006/07)	Strategies and programmes for waste minimization; collection, transportation, disposal and treatment of waste; pollution control.
GTM Corporate Disaster and Emergency Plan (date of compilation unknown)	To outline policy and procedures for the both the proactive disaster prevention and the reactive disaster response and mitigation phases of Disaster Management. It is intended to facilitate multi sectoral coordination in both pro-active and reactive programmes.

5.3. SABS standards

The following SABS standards are applicable and will be adhered to in the establishment of this proposed facility:

Table 5.4: SABS standards applicable to the proposed facility

Standard:	Pertains to:
SANS 10400	Fire fighting equipment
SANS 1123	Piping
SANS10062	
SANS 10142	Electrical installation
SANS 1012	
SANS 10108	
SANS 10089-2	
SANS 1109	
SANS 1535: 2005	Tank standards
SANS 1830: 2006	Piping standards
SANS 10131 part 2	Pumps and underground tanks
SANS 1186	
SANS 10089	
SANS 10089-3	Stop switch
SANS 1186-1	Symbolic safety signs: “No Smoking” and “No Open Flame”

In addition to design standards to which the proposed facilities must adhere, certain safety standards are also required to be adhered to during transport of fuel to the proposed filling station:

Table 5.5: SANS standards applicable to transport of fuel

Standard:	Pertains to:
SANS 1518	Transport of dangerous goods – design, construction, testing, approval and maintenance of road vehicles and portable tanks
SANS 10228	The identification and classification of dangerous goods for transport
SANS 10229-1	Transport of dangerous goods – packaging and large packaging for road and rail transport Part 1: Packaging
SANS 10231	Transport of dangerous goods – operational requirements for road vehicles
SANS 10232-1	Transport of dangerous goods – emergency information systems Part 1: Emergency information system for road transport
SANS 10233	Transport of dangerous goods – intermediate bulk containers for road and rail transport
SANS 10263	The warehousing of dangerous goods – enclosed storage areas and covered and uncovered outdoor storage yards

5.4. Provincial Guidelines

Guideline:	Issued by:	Pertains to:
EIA Administrative Guideline: Guideline for the Construction and Upgrade of Filling Stations and Associated Tank Installations (2002)*	Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACEL)	Specifies minimum requirements for the establishment of filling stations.
BB2 standards: Guidelines for Accesses to Filling Stations	Gauteng Department of Public Transport, Roads and Works (Gautrans)	Access to Filling Stations

***** The then Gauteng Department of Agriculture, Conservation, Environment and Land Affairs' (GDACEL's) (now GDACE - Gauteng Department of Agriculture, Conservation and Environment) EIA Administrative Guideline for the construction and upgrade of filling stations and associated tank installations (2002) has been adopted by L DEDET, as there is no equivalent guideline or legislation relating particularly to the Limpopo province. The guidelines and requirements contained in this guideline are therefore also considered to be applicable to the Limpopo province.

6. IMPACT IDENTIFICATION AND ASSESSMENT

Potential impacts which may be associated with the proposed development were identified based on the results of specialist studies that have been conducted, as well as on the EAP's professional judgement and on feedback received from Interested and/or Affected Parties (I&APs) and stakeholders.

Identified potential impacts were assessed in terms of the following:

- **Status:**
  - *Positive* – the proposed activity is anticipated to have a positive impact in terms of the particular parameter;
  - *Negative* – the proposed activity is anticipated to have a negative impact in terms of the particular parameter;
  - *Neutral* – the proposed activity is anticipated to have neither a positive nor a negative impact in terms of the particular parameter.

- **Extent:**
  - *Site-bound* – the impact is not expected to be felt outside the boundaries of the site;
  - *Local* – the impact is to be felt on the site and in its immediate surroundings, up to a radius of 50km from the site);
  - *Sub-regional* – the impact is to be felt at a distance of up to 100km from the site;
  - *Regional* – the impact is to be felt in the Limpopo Province;
  - *National* – the impact is to be felt across provincial boundaries.

- **Duration:**
  Refers to the period of time over which impacts can be expected to be experienced.
  - *Short term* – 0 to 5 years;
  - *Medium term* – more than 5 years, up to 15 years;
  - *Long term* – more than 15 years;

- *Permanent* – the impact is irreversible.

- **Magnitude:**
  Refers to the intensity of the potential impact.
  - *Negligible* – the impact will barely be felt, if at all. No mitigation required;
  - *Low* – the parameter will only be affected to a small extent by the proposed project. No mitigation required, but monitoring is recommended;
  - *Medium* – the parameter will be affected by the proposed project, but functions in terms of the parameter can still continue. Mitigation and monitoring required;
  - *High* – functioning in terms of the parameter will be significantly affected by the impact. Extensive mitigation and long-term monitoring required.

- **Probability:**
  - *Improbable* – it is unlikely that the impact will be experienced;
  - *Possible* – the impact may be experienced. Monitoring required; mitigation may also be required based on the type of impact and its significance;
  - *Highly probable* – the impact will most likely be experienced. Monitoring and mitigation required based on the type of impact and its significance in order to reduce the probability of the impact occurring and/or to reduce the magnitude of the impact;
  - *Definite* – the impact will be experienced. Monitoring and mitigation required based on the type of impact and its significance in order to reduce the probability of the impact occurring and/or to reduce the magnitude of the impact.

- **Significance:**
  The significance is based on a consolidation of the anticipated extent, duration, magnitude and likelihood of the potential impact.

  - *Negligible* – The impact will barely be felt, if at all. No mitigation required;
  - *Low* – The parameter will only be affected to a small extent by the proposed project. No mitigation required, but monitoring is recommended;
  - *Medium* – The parameter will be affected by the proposed project, but functions in terms of the parameter can still continue. Mitigation and monitoring required;
  - *High* – Functioning in terms of the parameter will be significantly affected by the impact. Extensive mitigation and long-term monitoring required.

7. RECEIVING ENVIRONMENT: BIO-PHYSICAL

Certain specialist bio-physical investigations were undertaken onsite in 2007 during the Basic Assessment for the then-proposed Maake Plaza shopping centre. The site which is now proposed to house the filling station, was initially planned to form part of the shopping centre, and was therefore included in the investigations during the Basic Assessment for the shopping centre. Certain other specialist investigations were undertaken only as part of this EIA, specifically with a view to the proposed filling station.

Bio-physical investigations consisted of the following:

- Ecological investigation conducted by Dr Buks Henning of Africa Geo-Environmental Services (AGES);
- Geo-technical investigation by Geo 3;
- Geo-hydrological investigation and risk assessment by In-Situ Groundwater Consulting;
- Desktop overview of the local climate, topography and potential air-quality impacts.

7.1. Climate

The proposed development site is situated at Maake, in the Greater Tzaneen Municipality. This area has a sub-tropical climate, with hot summers and mild winters. Summer temperatures average 28°C, whilst winter temperatures average 15°C (www.wikitravel.co.za). Mean Annual Precipitation (MAP) in the sub-catchment area B81D, in which the site is located, is 700-800mm, mean annual evaporation 1500-1600mm and mean annual runoff 200-500mm. Rainfall station 0679508 at Lenyenye, just east of the proposed site, recorded a MAP of 756mm/year over the period 1905 to 1989; the average rainfall at the proposed development site can therefore also be considered to be approximately 756mm/year (Maake Plaza Shopping Centre Development: Geohydrological Report – In-Situ Groundwater Consulting, 2007).

7.1.1. Potential impacts

Very low impacts of climate upon the proposed project may be expected in terms of potential acceleration of **soil erosion** in case of rain during the ***construction phase***. Potential accelerated soil erosion is anticipated to have a **very low** significance, due to the relatively flat topography of the proposed development site, the relatively small development area and the relatively short construction period. There are furthermore no nearby watercourses or wetlands that could be impacted on negatively by potential siltation due to soil erosion.

It is not expected that increased erosion rates will be experienced during the ***operational phase***, as open areas will be paved. There will be no areas of exposed soil. As the study area is not particularly windy, it is not expected that the small amount of odours that may be generated would be dispersed to surrounding areas.

The proposed project is **not** anticipated to have a significant impact on the local climate.

Table 7.1: Potential impacts in terms of climate

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Accelerated erosion if construction takes place in rainy season	Negative	Site-bound	Short term	Very low	Possible	Very low
OPERATIONAL PHASE						
None anticipated	-	-	-	-	-	-

7.2. Topography

7.2.1. Status quo

The site is relatively flat and slopes slightly downward to the north-east. The general topography in the area is that of a plain marked at intervals by hills, such as the nearby Ritakop. The site is located at approximately 500m above mean sea level and no drainage features were found on or in the direct vicinity of the site.

7.2.2. Potential impacts

No impacts are anticipated in terms of topography as very little, if any, levelling is anticipated to be required during construction.

Table 7.2: Potential impacts in terms of topography

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
None expected	-	-	-	-	-	-
OPERATIONAL PHASE						
None expected	-	-	-	-	-	-

7.3. Soils, Geology and Hydrology

A **geotechnical study** was conducted by Geo 3 Consulting Engineering, Hydro and Environmental Geologists in 2007. This study included not only the site that is now proposed to be developed for a filling station, but also the rest of the site on which the Maake Plaza shopping centre is now located. This investigation did not focus on a potential filling station, but rather constituted an analysis of current conditions.

A **geo-hydrological study and risk assessment** was conducted by In-Situ Groundwater Consulting in 2009 to determine the potential risk of groundwater pollution associated with the proposed filling station and to identify potential impact zones.

7.3.1. Methodology

Geotechnical study

The investigation was conducted by Geo 3 Consulting Engineering, Hydro and Environmental Geologists on 20 April 2007, comprising the excavation of nine pits with a Bell 315 backhoe. All pits were excavated without refusal to depths of approximately 3m. The exposed soils were inspected and profiled according to standard procedures by a professionally registered engineering geologist. The resultant soil logs are attached (Appendix F – Geotechnical Report).

To classify the soils, evaluate their moisture-density relationships, consolidation properties and collapse potential, representative samples of the regolith were recovered from the sidewalls of the pits and submitted to the laboratories of Messrs EngeoLab in Nelspruit and Civilab in Johannesburg for testing according to our instructions. The test results in the format they were received from the laboratories are included with the geotechnical report (Appendix F).

Geo-hydrological study and risk assessment

The *geo-hydrological investigation* comprised the following:

- Detailed desk study gathering existing information from topographical maps, ortho-photos, geological maps, hydrological information, published and unpublished reports etc;
- Request all borehole data in the catchment area from GPM Consultants in Limpopo Province;
- Verify all received borehole data and identify additional water users through a hydro-census at and around the proposed development to assess the groundwater utilization in the area;
- Commission two groundwater monitoring boreholes according to the prescribed specifications of the Department of Water Affairs and Forestry (DWAF):
    - Optimal placement of monitoring boreholes incorporating geophysics and related infrastructure;
    - Supervision during construction;
    - Recording of all relevant geo-hydrological information such as water strike, blow yields and geology;
    - Perform pumping tests on the boreholes in order to determine the aquifer's hydraulic characteristics;
    - Take water samples for quality analyses (organic as well as inorganic).
- Based on all the abovementioned regional and site specific data, a specialist report was compiled on the groundwater depths, quality, flow directions and velocity. From this information, potential impact zones were identified, including a first order risk assessment to determine the potential for groundwater contamination.

The *Risk Assessment* was done by means of the following significance assessment methodology:

Significance is the product of probability and severity. Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Improbable - Low possibility of impact to occur either because of design or historic experience. Rating = 2
Probable - Distinct possibility that impact will occur. Rating = 3
Highly probable - Most likely that impact will occur. Rating = 4
Definite - Impact will occur regardless of any prevention measures. Rating = 5

The severity rating is calculated from the factors given to intensity and duration. Intensity and duration factors are awarded to each impact, as described below.

The Intensity factor is awarded to each impact according to the following method:

Low intensity - Nature and/or man made functions not affected (minor process damage or personnel injury may have occurred). Factor 1
Medium intensity - Environment affected but natural and/or man made functions and processes continue (Some process damage or personnel injury may have occurred). Factor 2
High intensity - Environment affected to the extent that natural and/or man made functions are altered to the extent that it will temporarily or permanently cease (Major process damage or personnel injury may have occurred). Factor 4

Duration is assessed and a factor awarded in accordance with the following:

Short term - <1 to 5 years - Factor 2
Medium term - 5 to 15 years - Factor 3
Long term - impact will only cease after the operational life of the activity, either because of natural process or by human intervention – Factor 4.
Permanent - mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient - Factor 5.

The severity rating is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. **For example:**

The Severity factor = Intensity factor x Duration factor
= 2 x 3
= 6

A Severity factor of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

RATING	FACTOR
Low Severity (Rating 2)	Calculated values 2 to 4
Medium Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High severity (Rating 5)	Calculated values 13 to 16
Severity factors below 3 indicate no impact	

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating.

The significance rating should influence the development project as described below:

- Low significance (calculated Significance Rating 4 to 6)
  - Positive impact and negative impacts of low significance should have no influence on the proposed development project.

- Medium significance (calculated Significance Rating ≥ 7 to 12)
  - Positive impact: Should weigh towards a decision to continue
  - Negative impact: Should be mitigated, before project can be approved.

- High significance (calculated Significance Rating ≥ 13 to 18)
  - Positive impact: Should weigh towards a decision to continue, should be enhanced in final design.
  - Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least low significance rating.

- Very High significance (calculated Significance Rating ≥ 19 to 25)
  - Positive impact: Continue definite.
  - Negative impact: If mitigation cannot be effectively implemented, proposal should be terminated.

7.3.2. Geology (In-Situ Groundwater Consulting)

Regional geology

The area of investigation is underlain by chlorite schists of the Weigel, La France and Mac Kop Formations and quartz-mica schists of the Rubbervale Formation of the Murchison Greenstone Belt (Figure 5 of attached Geo-hydrological report). The chlorite schists are fine to medium grained, strongly foliated and fissile rocks which range in colour from greenish grey to brownish green. They are composed predominantly of chlorite and quartz; with minor constituents that include plagioclase, orthoclase, biotite and carbonate. These schists could represent either original shales or intermediate or mafic tuffs. The light-coloured quartz-mica schists consist of quartz, sericite and a little chlorite. They are believed to have been derived largely from acid lavas.

Diabase dykes area abundant in the area and is described as medium-grained, dark-grey to blackish grey rock composed essentially of labradorite and augite. Secondary alterations like sericitization of plagioclase and uralitization of pyroxene are fairly common. The contact zone between these dykes and the country rock often contains open fractures as a result of thermal shrinkage at the time of cooling of the dyke; consequently open spaces develop between the dyke and the country rock with potentially high storage capacity. These aquifers are classified as contact secondary aquifers and are the dominant aquifer type of borehole H08-1793, the water supply borehole to the Maake Plaza Shopping Centre.

Alluvial deposits occur along the Thabina River to the west of the Maake Plaza site and borehole H08-1793.

The Thabina Fault transecting the western boundary of the investigation area roughly outlining the river course of the Thabina River displaces the Rubbervale Formation and might represent a left-lateral strike-slip fault that was probably later reactivated as a normal fault.

Local geology

The local geology, in addition to the geotechnical investigation performed for the Maake Plaza Shopping Centre, will be described at the hand of the magnetic geophysical survey which was commissioned to identify any potential preferential flow zones or geological structures, as well as the commissioned water supply and monitoring boreholes.

A map indicating the geophysical traverse lines, the localities of the newly commissioned monitoring boreholes, as well as the delineation of the interpreted dyke position to the east of the proposed filling station is presented in Figure 6.

7.3.3. Receiving environment (groundwater): regional setting (In-Situ Groundwater Consulting)

The proposed filling station site falls within quaternary sub-catchment area **B81D** (Midgley *et al.,* 1994) of the Luvuvhu and Letaba Water Management Area (WMA). Sub-catchment B81D covers an area of 1147km^2 and has a Mean Annual Precipitation (MAP) of 700-800mm, a Mean Annual Evaporation (MAE) of 1500-1600mm and a Mean Annual Run-off (MAR) of 200-500mm. Rainfall station 0679508 at Lenyenye (just east of the investigation area) recorded a MAP of 756mm/annum over the period 1905 to

1989. Therefore, 756mm/annum would be a close approximation of the average rainfall figure for the immediate catchment (study) area.

Terrain morphology (Kruger, 1983) is characterized by hills and lowlands. Differences in relief range between 130-450m. Slopes of <5% occupy more 20-50% of the area. Drainage density (after Kruger, 1983) ranges between 0.5-2km.km^{-2} and is classified as medium. Stream frequency is also classified as low to medium (0 - 6stream.km^{-2}).

The area is drained by the Thabina River which joins the Letsitele River some 10km to the northeast of the site.

The study area falls within soil mapping unit 3 of the Institute for Soil, Climate and Water (ISCW) broad natural homogeneous soil zone (BNHSZ) regions (Schulze et. al, 1997). This assigns a soil depth of 900 to 1200mm to 100% of unit 3. The soils comprising unit 3 typically support a slow drainage rate (25-30% clay content).

7.3.4. Receiving environment (groundwater): local setting (In-Situ Groundwater Consulting)

The geohydrological study area is situated between two tributaries of the Thabina River on the farms Mogoboya's Location, York 656 LT, Kingstone 657 LT and Coblentz 666 LT. It is framed by the Thabina River in the west and the quaternary sub-catchment boundary **B81D** (as defined by the Water Research Commission – WRC) in the east, encompassing Ritaskop and Mantshapeng. It is framed by lines of latitude 23° 57' and 24° 00' S and lines of longitude 30° 16'and 30° 20' E and falls on 1:50 000 toposheet 2330 CD.

Physiographically, the area of investigation constitutes rather flat terrain (elevations of between 620 and 580m amsl), gently sloping downwards towards the west and the Thabina River with two prominent topographical features in the form of Ritakop and Mantshapeng rising to altitudes of 899m amsl.

The Maake Plaza Shopping Centre's water supply borehole (H08-1793) is situated between the Thabina River and a water supply canal running parallel to the river (Figure 4). To the north and south of the borehole, small-scale rural farming is practised with water being channeled from the canal to the fields along hand-dug trenches.

7.3.5. Geotechnical evaluation – Geo 3

No outcrops were noted during the geotechnical investigation performed by Geo3 cc. and in all instances the bedrock schist of the Rubbervale formation is overlain by a thin surficial transported soil (< 0.5m) and thick residuum derived from the Insitu weathering of the schist. Nine pits were excavated to a depth of 3m without refusal. Grading and Atterberg Limit test results indicate the regolith to be fine grained (grading modulus mostly < 0.4) and classifies predominantly as *CL* in terms of the Unified Soil Classification Test. The regolith has a *medium* potential expansiveness with a predicted surface heave of up to 20mm.

Both the shallow and deeper residuum classifies as moderately and highly compressible respectively, which can possibly be attributed to leaching of the deeper residuum, while the shallow residuum has become consolidated through dessication. No groundwater seepage was encountered in any of the pits

and owing to the unconsolidated nature of the regolith, the development of a perched water table at shallow depth, i.e. with 1.5m of ground level, is unlikely.

The abbreviated soil profile is described as:

- up to 0.5m of hillwash comprising dry, grey-brown, loose, open textured, *silty SAND*, overlying;
- up to 1.5m of residuum comprising moist, orange-brown, medium dense, open textured and fissured locally, *silty clayey fine SAND*, overlying;
- greater than 2m of residuum from decomposed schist comprising, slightly moist, dark orange-brown mottled and speckled maroon, medium dense to dense, *clayey silty fine SAND* with isolated weathered schist corestones.

An average permeability value of 0.002m/day and average effective porosity value of 32.5% is indicated for the residuum soil profile which is in line with known literature values.

7.3.6. Soils

The soil was indicated by Dr Buks Henning of Africa Geo-Environmental Services (AGES) during the ecological assessment as deep red Hutton soils derived from granite / lava. Mr Henry Schurink of Geo 3 during the geotechnical evaluation classified the soils as thin (less than 0.5m) surficial transported soil with thick residuum derived from the in situ weathering of the underlying schist.

No seasonally wet soils or dispersive soils were encountered. Soils were, however, found to be susceptible to erosion. No soil with a clay content of 40% or more was encountered on the site. No unstable soil or geological features were encountered on the site. Soil was indicated by Mr Schurink to be relatively impermeable.

Please refer to the Geotechnical report (Appendix F of this report) for a breakdown of the laboratory-determined soil properties.

7.3.7. Geophysical investigation (In-Situ Groundwater Consulting)

A geophysical VLF (Very Low Frequency) electromagnetic and magnetic survey was conducted on the site of the Maake Plaza in order to site ground water supply borehole locations with the highest probability of intersecting aquifers. Although no sustainable water supply was sourced through this survey, the presence of a dolerite dyke with almost the same orientation as the R36, located between the proposed filling station and the R36 was established.

Still with the aim of establishing a water supply source the focus of the geophysical investigation shifted to the area between the Thabina River and the Maake site where a successful borehole (H08-1793) was drilled in the contact zone between a dyke and the surrounding lithologies. This dyke is believed to have a SE-NW orientation and is located between the Thabina River and a water supply canal running parallel to the river.

7.3.8. Borehole drilling (In-Situ Groundwater Consulting)

Borehole H08-1793 (water supply borehole) was successfully drilled 400-500m west of the Maake site. This borehole was drilled along the western contact zone of the identified dyke, to a depth of 50m, transecting weathered and fractured quartz-mica schist to a depth of 32m until solid, hard rock was encountered.

Two monitoring boreholes were drilled up gradient (H08-1872) and down gradient (H08-1873) of the proposed filling station. The soil profile ranged between 2m and 4m in depth. Both boreholes penetrated highly weathered, weathered quartz-mica schist, encountering fresh bedrock between 37m and 38m below surface, respectively.

Borehole H08-1872 intersected the identified dyke between the proposed filling station and the R36 at a depth between 33m and 36m below surface, confirming the geophysical results. The dolerite was noted as fractured.

Borehole construction and geological logs for the newly drilled monitoring boreholes are attached in Appendix III of the attached geo-hydrological report.

7.3.9. Regional geo-hydrology (In-Situ Groundwater Consulting)

Groundwater is usually associated with the following geological features within hard rock terrain:

- Deeply weathered zones underlain by competent, hard bedrock with water being found on the contact zone,
- Secondary fractures found within the hard rock; aperture widths can be from millimetres to meters in thickness and may or may not contain groundwater,
- Contact zones found between the country rock and intrusions such as the dykes.

The published hydrogeological maps listed below have been studied in order to obtain a better understanding of the expected groundwater and geological conditions of the investigation area:

- The 1:250 000 2330 Tzaneen Geological Sheet (1985),
- The Groundwater Resources of the Republic of South Africa Map. Borehole Prospects, sheet 1 (1995),
- The Groundwater Resources of the Republic of South Africa Map. Saturated Interstices, sheet 2 (1995),
- The Hydrogeological Map Series of the Republic of South Africa, Phalaborwa Map, 1998, scale 1:500 000,

From these sources of groundwater information, the following could be deduced:

- The investigation area is underlain by the schists of the Murchison Greenstone Belt,
- The aquifer type is intergranular and fractured (d3),
- The average borehole yields are 0.5 – 2.0L/s,
- The probability of drilling a borehole with a yield of >2L/s (exploitability) is 30-40%,
- The probability of drilling a successful borehole (> 0.1L/s) (accessibility) is 40-60%,
- The mean annual precipitation for the area is between 700-800mm per annum,

- The average depth to groundwater is 10-20m below surface,
- Rainfall recharge rates to groundwater are between 75-110mm per annum,
- The groundwater component of base flow to streams and dams is negligible.

Borehole data for the investigation area was obtained from GPM Consultants in Polokwane. GPM is the DWA-appointed Groundwater Database Management Consultants for the whole Limpopo Province and all boreholes and groundwater-related data is captured and available on request from GPM. GPM assimilated 27 borehole data points within the investigation area of which only 8 have been tested and is recommended as sustainable water sources in the investigation area.

Borehole depths
From the 27 borehole data points, borehole depth measurements are available for 21 boreholes. Borehole depths range from 10m to 108m, but the average borehole depth drilled in the investigation area is 45m.

Static water levels
Static water levels are available from 12 boreholes and on average the depth to water level over the investigation area is approximately 22m. A few perched water tables were found, scattered throughout the area.

Recommended borehole abstraction rates
Recommended borehole yields range from 0.44 to 28.67m^3/day with most of the production boreholes pumping between 1.0 and 2.5L/s.

Water chemistry classification
Water samples analyzed from tested boreholes in the investigation area are either classified as Class 0 (ideal water quality) or Class 2 (marginal water quality). Water chemistry results were available from 9 boreholes in the investigation area.

7.3.10. Local geo-hydrology (In-Situ Groundwater Consulting)

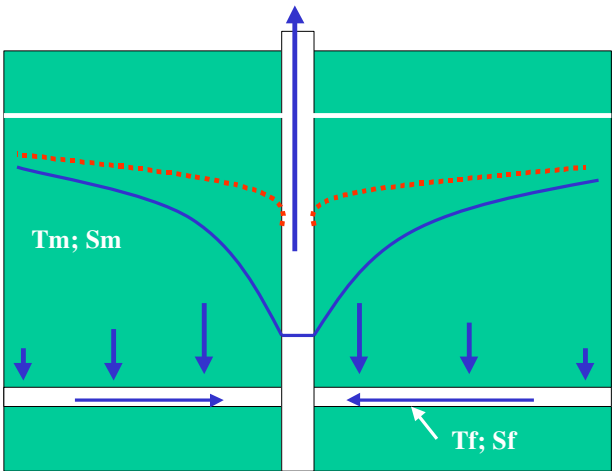
The area of investigation is underlain by lithologies which were subjected to shearing, fracturing and metamorphism under green schist facies conditions and intruded by numerous diabase dykes. Aquifers in the area are predominantly secondary in nature and vary in their lateral extent, thickness and distribution.

- Structural secondary aquifers: Aquifers associated with geological structures such as dykes, faults, fractures, and joints. Generally these aquifers exhibit high transmissivity but low storage capacity.
- Weathered secondary aquifers: Aquifers generally exhibit low transmissivity; storage capacity varies between very low and low and the aquifer is often semi-confined by overlying layers of lesser permeability.
- Contact secondary aquifers: Aquifers associated with geological contacts. Water transmissivity is generally high and storage capacity may be enhanced by seepage from overlying alluvial or weathered deposits.

The secondary aquifers in the investigation area are classified as double porosity systems, conceptually consisting of two major components: matrix rock blocks and fractures, each with its own character and behaviour, in which groundwater flow takes place. The fractures serve as higher conductivity conduits for flow if the apertures are large enough, whereas the matrix blocks may be permeable or impermeable, with most of the storage usually contained within the matrix (Kirchner and van Tonder, 1995). The hydraulic conductivities of fractured systems vary considerably and are dependent on:

- Aperture (distance between fracture walls),
- Frequency or spacing (density),
- Length,
- Orientation (random or preferred),
- Wall roughness,
- Presence of filling material,
- Fracture connectivity, channelling (preferred paths),
- Porosity and permeability of the rock matrix.

Figure 7.1: Conceptual model for the flow regimes in a double porosity system



Close to the tested borehole the pressure in the large fractures decline rapidly relative to its rate of decline in the matrix blocks, resulting in the development of a large localized pressure gradient between the piezometric head of the matrix block and that of the large conduit fracture.

The former therefore releases a relative large amount of water into the conductive fractures. Far from the pumping borehole, the pressure gradient between the fracture and matrix block is relatively small and water released from the matrix into the fracture is slow. During the first stages of pump testing water is abstracted from the fracture and linear flow dominates but as the fracture area dewatered and water is released from matrix storage into the conduit fractures, matrix flow becomes dominant over time.

7.3.11. Hydro-census (In-Situ Groundwater Consulting)

A hydro-census of all borehole locations within the study area supplied by GPM was conducted to verify coordinates, equipment status and current abstraction Of the original 27 data points only 8 were located in the field of which 3 boreholes were destroyed, and only 3 are still equipped. Of the three equipped holes, only 2 are still in working condition. Possibly due to theft and poor maintenance, most of the

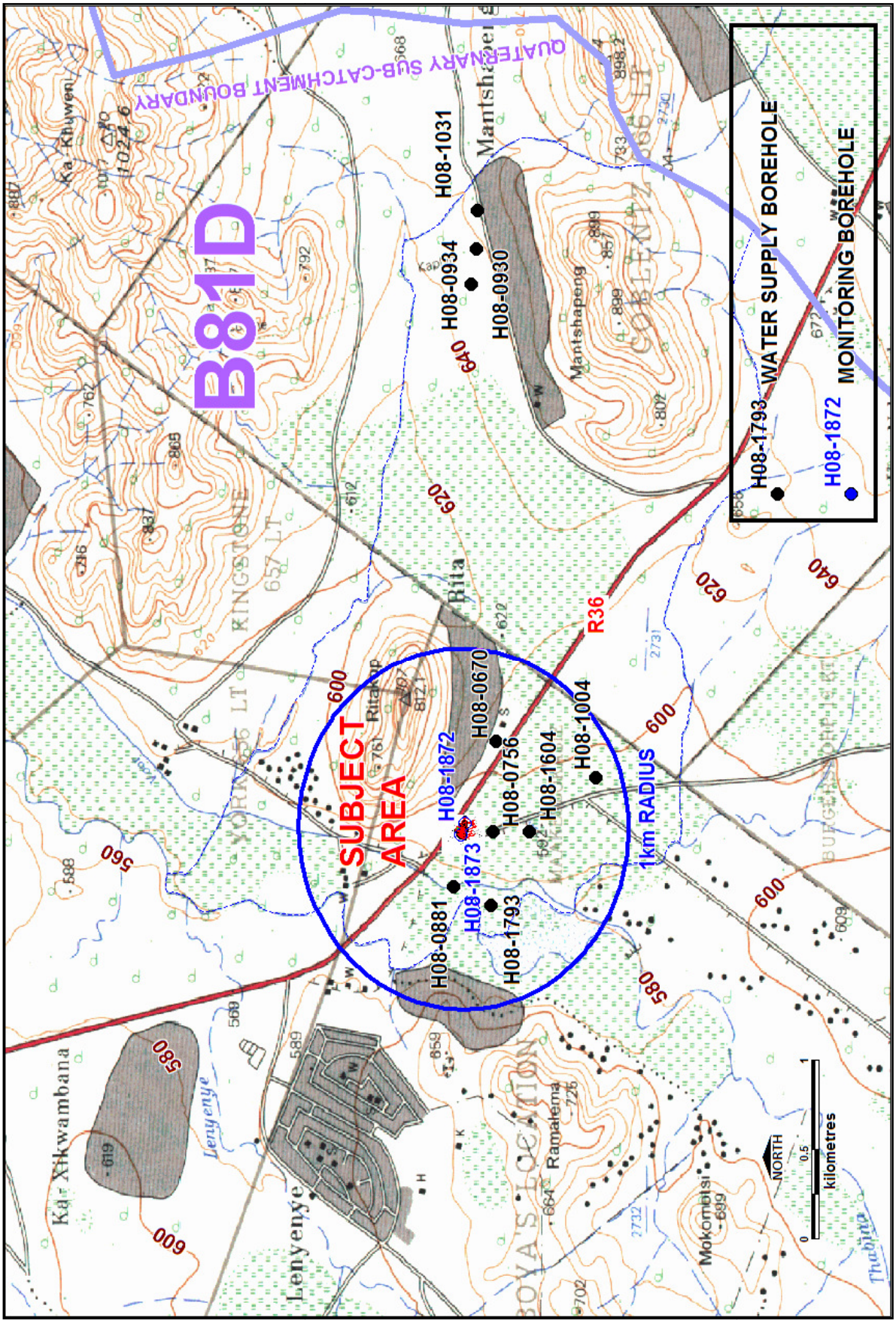
production boreholes (as indicated by GPM data) are currently not abstracting water from the immediate catchment area of borehole H08-1793.

Figure 7.2 overleaf shows the location and position of all the borehole data points pertaining to the hydro census survey. Table 7.3 below is a summary of the details recorded.

Table 7.3: Summary of current or potential rural water supply production boreholes

Borehole	Position	Potential Abstraction (L/day)	Static water level (mbgl)	Status quo
H08-0670	23.97717° S 30.29294° E	10 800	35.67	Not located during census
H08-0756	23.97903° S 30.28797° E	235 872	10.07	Not located during census
H08-0881	23.97486° S 30.28494° E	64 800	9.4	Motorized – not working
H08-0930	23.97583° S 30.31806° E	28 800	38	Not located during census
H08-0934	23.97611° S 30.32000° E	28 800	38.90	Open BH only casing found in field
H08-1004	23.98264° S 30.29089° E	90 000	18.47	Open BH only casing & block found in field
H08-1031	23.97617° S 30.32211° E	5 760	28.56	Motorized – in working condition
H08-1604	23.97902° S 30.28794° E	371 520	15.47	Motorized – in working condition

Figure 7.2: Hydro-census Survey Borehole Localities.



The current groundwater abstraction volume from the investigation area by existing users is approximately 377.28m^3/day. Existing boreholes that has the potential to be utilized as future production boreholes could abstract an additional 459.07m^3/day, bringing the total groundwater abstraction possible from existing sources in the investigation area to 836.35m^3/day.

Borehole H08-1793 that supplies water to the Maake Plaza Shopping Centre could optimally deliver a sustainable yield of 237.6m^3/day, although only 56m3/day is required by the centre.
Incorporating the latter's sustainable yield calculates to a maximum, total groundwater abstraction from existing sources in the investigation area of 1073.95m3/day.

A Groundwater Balance Equation yielded a surplus and it was therefore concluded that there is sufficient groundwater available in the immediate catchment area for the utilization of borehole H08-1973 even at full capacity (19 800L/hr or 237.6m^3/day) without permanently removing water from storage or lowering the local groundwater levels.

7.3.12. Commissioning of monitoring boreholes (In-Situ Groundwater Consulting)

All boreholes were drilled under supervision of In-Situ Consulting according to SANS 10299 and specifications as laid down by the Department of Water Affairs and Forestry in their *"Minimum Standards and Guidelines for Groundwater Resource Development for the community Water Supply and Sanitation Program"*. The air rotary percussion method, ideally suited for hard rock formations, was applied.

The cuttings brought to the surface by air return from the bore were collected and described for each meter drilled. The lithologies described are presented in the borehole log in the Appendix III, together with all other relevant information pertaining to and obtained from the borehole. Water intersections were recorded, and the blow yield measured using a 20L drum and stopwatch.

During the commissioning of a water supply source for the shopping centre, 3 boreholes were drilled on site yielding less than 0.1L/s where after borehole H08-1793 was successfully drilled 400-500m west of the Maake site. This borehole was drilled along the western contact zone of the a dolerite dyke to a depth of 50m, transecting weathered and fractured schist to a depth of 32m until solid, hard rock was encountered. Water strikes were measured from 18 to 32m yielding a cumulative blow yield of 5L/s. Six and a half inch (165mm) diameter casing was installed to 35m depth with a thickness of 4mm. The borehole was gravel packed (according to specifications) and completed with a 3m deep sanitary seal.

For this study two monitoring boreholes were drilled up gradient (H08-1872) and down gradient (H08-1873) of the proposed filling station. They were drilled to respective depths of 45m and 47m below surface. Both boreholes penetrated highly weathered, weathered quartz-mica schist, encountering fresh bedrock between 37m and 38m below surface, respectively. Five inch (125mm OD) diameter pvc casing with a wall thickness of 6mm was installed from top to bottom with slotted section respectively between 33m to 45m and 29.5m to 47m below surface. Both boreholes were gravel packed (according to specifications) and completed with 3m deep sanitary seals and closed with steel plates welded onto the borehole collar. Water strikes were respectively encountered at 36-37m (blow yield of 2.00L/s) and 33-34m (blow yield of 0.05L/s).

Borehole H08-1872 intersected the identified dyke between the proposed filling station and the R36 at a depth between 33m and 36m below surface, confirming the geophysical results. The dolerite was noted as fractured.

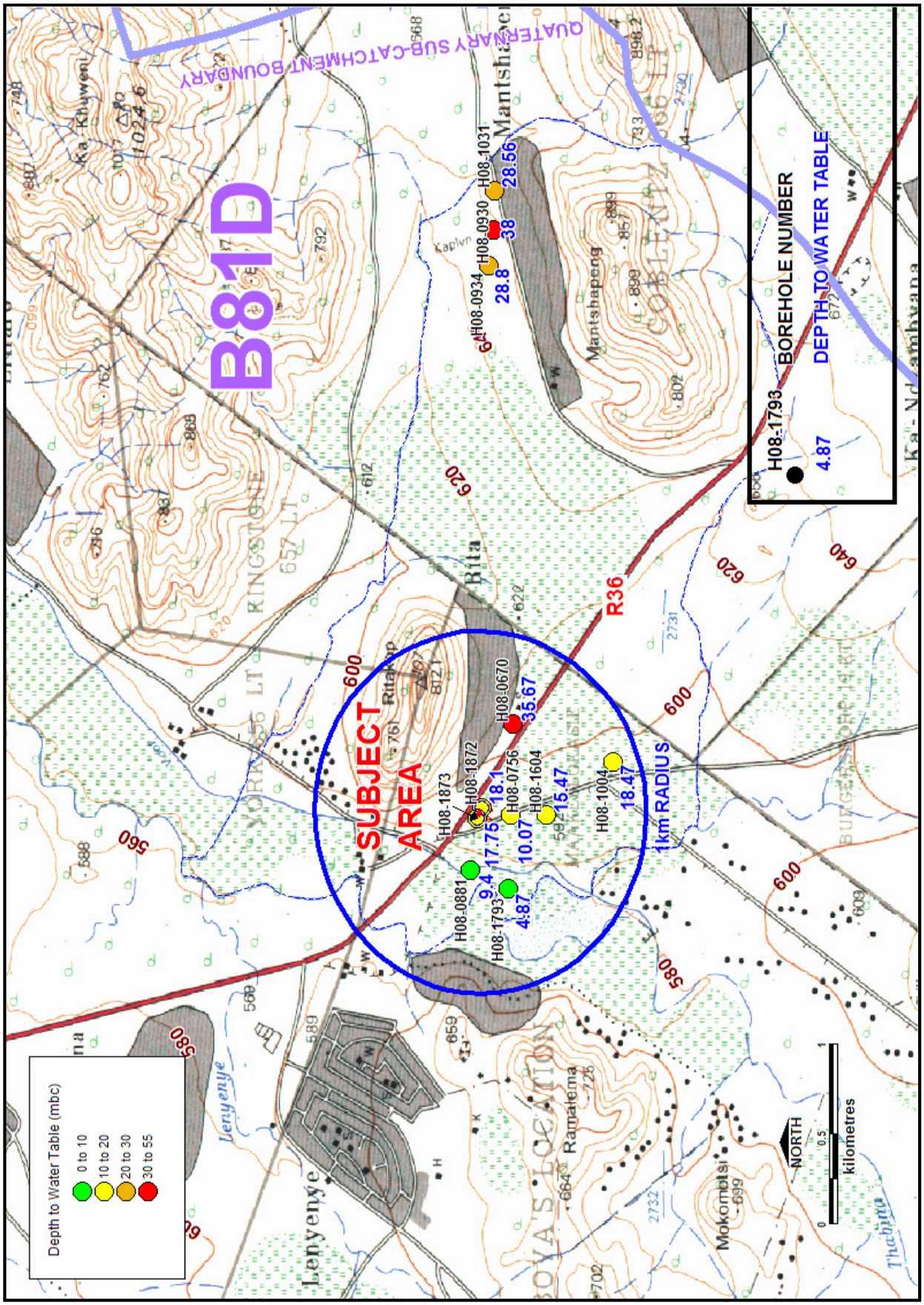
7.3.13. Depth to water table (In-Situ Groundwater Consulting)

No groundwater seepage was encountered in any of the nine pits excavated during the geotechnical investigation pertaining to the shopping centre. Geo3 cc. stated that owing to the unconsolidated nature of the regolith, the development of a perched water table at shallow depth, i.e. with 1.5m of ground level, is unlikely.

The unsaturated and saturated aquifer thickness is a function of the depth of weathering (physical thickness of the flow regime) and the depth to the water table. The average water level depth is some 21.39 mbc, which in conjunction with the average weathering depth of 35.67m, yields an average saturated aquifer thickness of 14.28m.

Please refer to figure 7.3 overleaf for the depth to water table distribution.

Figure 7.3: Depth to Water Table Distribution (mbc).



7.3.14. Groundwater quality (In-Situ Groundwater Consulting)

Groundwater samples were collected from the newly commissioned monitoring boreholes and sent to both UIS Analytical Services in Centurion and to Labserve in Nelspruit for hydro-chemical analysis. The samples were taken according to the DWAF standards, at the end of the constant discharge test (H08-1872) in order to be representative of the water of a wider zone around the borehole, while a gab sample was taken from borehole H08-1873. Copies of the hydro-chemistry results are presented in Appendix IV.

The groundwater quality distribution and compliance, will be discussed using Standards South Africa's, (a division of SABS) specification for Drinking Water, SANS 241: 2006 Edition 6.1, as compliance criteria.

The measured physical requirements, namely pH, EC and TDS are all within the SANS 241 Class I (recommended operational limit) ranges.

As far as the chemical requirements for the macro-determinants are concerned, all of the measured concentrations fall within the SANS 241 Class I (recommended operational limit) ranges, except the NO_3 concentration for borehole H08-1872 which falls within the Class II (max. allowable for limited duration) range. The Class II (health/operational) maximum consumption period for NO_3 is indicated as seven years. It should however be noted that the laboratory detection limit for NH_4 is higher than the SANS 241 Class II (max. allowable for limited duration) range.

Compliance with the SANS 241 Class I (recommended operational limit) ranges were met for all the measured micro-determinants except:

- The Fe concentration for sample H08-1872 falls within the Class II (max. allowable for limited duration) range. The Class II (aesthetic/operational) maximum consumption period for Iron is indicated as seven years.
- The Mn concentrations of both samples fall within the Class II (max. allowable for limited duration) range. The Class II (aesthetic/operational) maximum consumption period for manganese is indicated as seven years.

It should however be noted that the laboratory detection limits for Pb and Se exceed the Class I (recommended operational limit) ranges, while the detection limits for As, Cd and Sb exceed the SANS 241 Class II (max. allowable for limited duration) ranges.

As far as the Total Hardness is concerned, the water of both samples can be categorized as slightly hard. The Ryznar Index class values for both samples fall in the aggressive class indicating heavy corrosion (Carrier 1965). A negative Langelier Index (both samples) indicates that the water is under saturated with calcium carbonate and will tend to be corrosive in a distribution system. Experience has however shown that Langelier Index values in the range of -1 to +1 have a relatively low corrosion impact on metallic components of a distribution system.

No Faecal Colliforms were detected in any of the two samples. However, the Total Coliforms observed in sample H08-1873 exceed the SANS 241 Operational Water Quality Alert Value and can be classified as completely unacceptable with serious health affects in all users in terms of the document *"Quality of Domestic Water Supplies"* (Second edition, 1998)" as set forward by the Department of Water Affairs and Forestry, Department of Health and the Water Research Commission in 1998.

Borehole H08-1793 was classified as a Class 4 - Dangerous water quality *[Quality of Domestic Water Supplies"* (Second edition, 1998)] due to a very high Total Coliform Count during the compilation of a previous geohydrological report to confirm the availability, sustainability and suitability of this water supply source as supportive documentation for the Shopping Centre's water use license application to DWAF. Continuously disinfection through chlorination and routine analysis for faecal contamination is therefore imperative.

7.3.15. Hydro-chemical facies (In-Situ Groundwater Consulting)

Hydro-chemical facies are defined as distinct zones that have cation and anion concentrations describable within defined compositional categories. The definition of a composition category is based on subdivisions of tri-linear diagrams such as Piper diagrams. For visual inspection of hydro-chemical data the result of the analysis was plotted on a semi-logarithmic Schoeller diagram and a tri-linear Piper diagram.

Both these diagrams permit the cation and anion compositions of the sample to be represented on single graphs in which major groupings or trends in the data can be discerned visually. The Schoeller diagram shows the total concentrations of the cations and anions whereas the tri-linear Piper diagram represents the concentrations as percentages.

The water supply borehole to the shopping centre (H08-1793) as well as the newly commissioned monitoring boreholes exhibits strong magnesium bicarbonate ($MgHCO_3$) characteristics, typical of relatively recent recharged or recharging water. The strong bicarbonate character of the boreholes reflects the general freshness of the aquifers in the area. All 3 samples plot as typical unpolluted water on both the Piper and Expanded Durov Diagrams.

In the Schoeller diagram, when compared with the newly commissioned monitoring boreholes the SO_4 concentration for the Maake Plaza Shopping Centre' water supply borehole appears slightly elevated and can probably be attributed to rural agricultural activities.

7.3.16. Groundwater evolution (In-Situ Groundwater Consulting)

Groundwater evolution follows the classic Chebotrev Sequence. As groundwater moves along its flow paths in the saturated zone, an increase of total dissolved solids and most major ions occur due to the increased residence time and travel distance.

Crystalline rocks contain abundant aluminosilicate minerals (feldspar and mica) and quartz. As these minerals formed at temperatures and pressures far above those occurring at or near earth's surface, these minerals are thermodynamically unstable and tend to dissolve when in contact with water. The dissolution process is strongly influenced by the presence of dissolved CO_2 (acquired through infiltration of water through the soil horizon) and causes the groundwater to acquire dissolved constituents. When CO_2-charged waters that are low in dissolved solids encounter silicate minerals high in cations, aluminum and silica, cations and silica are leached, leaving behind clay minerals.

Relatively recent recharged groundwater has a high bicarbonate (HCO_3) concentration due to interaction with CO_2 in the soil horizon. This water reacts with carbonate and silicate minerals and Ca^{2+} and Mg^{2+}

ions are added. Further movement through the subsurface exposes the water to cation exchange processes where Na^+ in clays exchange for Ca^{2+} and Mg^{2+} from the groundwater, thus increasing the Na^+ content of the water. At the end of the Chebotrev Sequence for groundwater evolution is the saline NaCl water that is not seen in the investigation areas.

Figure 7.4: Schoeller diagram

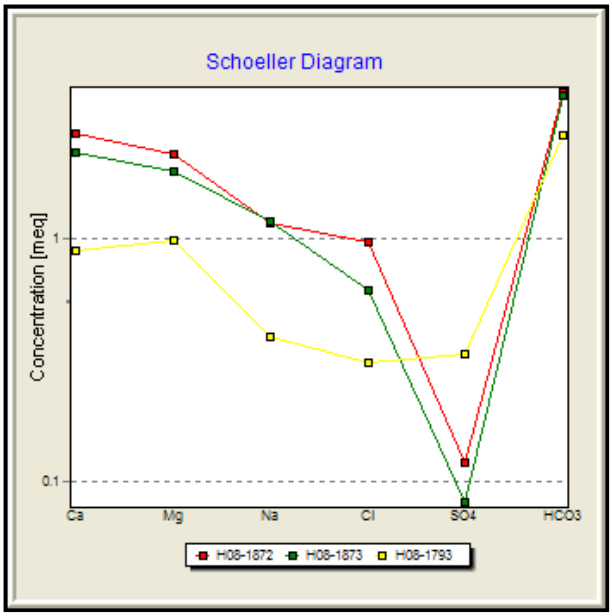


Figure 7.5: Piper diagram

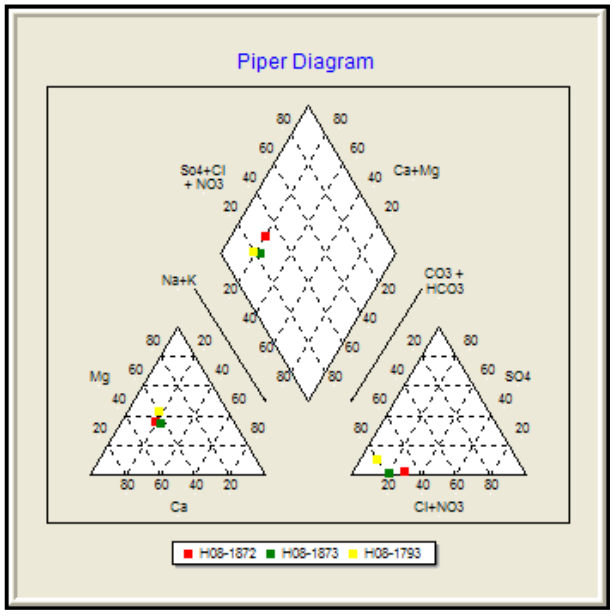
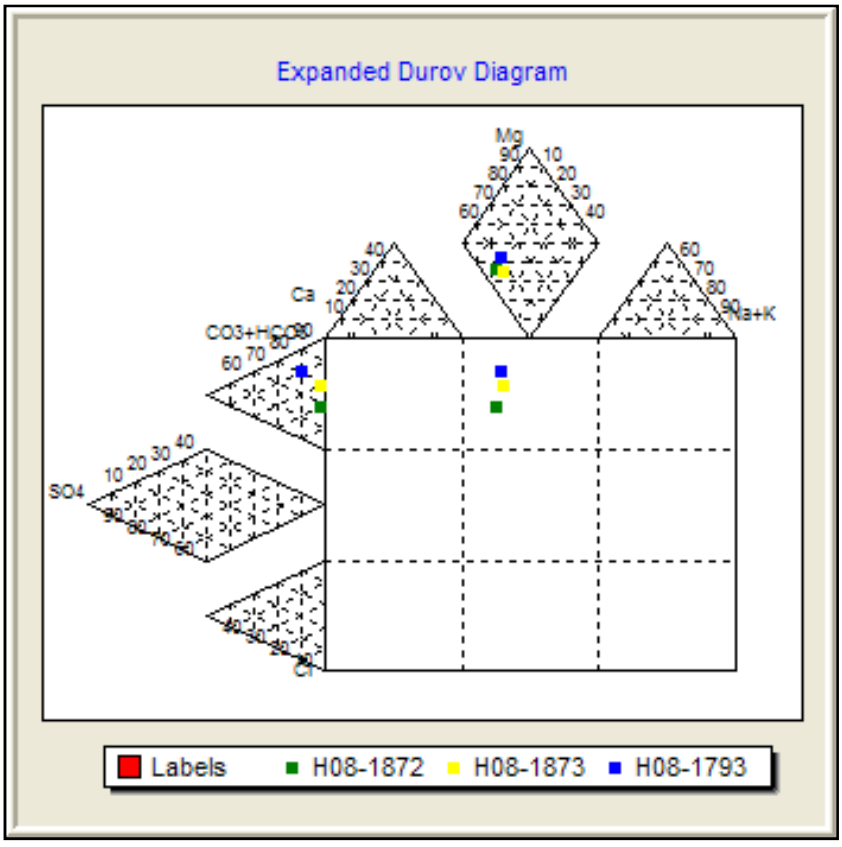


Figure 7.6: Expanded Durov diagram



7.3.17. Lateral extent of the groundwater zone

Two types of aquifer boundaries are anticipated to exist within the study area:

- Hydraulic aquifer boundaries such as surface infiltration sources which usually represent constant head influx boundaries, streams that act as groundwater discharge boundaries and groundwater divides which act as no-flow boundaries.
- Physical aquifer boundaries such as impermeable dolerite dykes and sills, or other geological discontinuities, for example where layers pinch out or outcrop.

The major lateral aquifer boundaries constituting the proposed groundwater zone for the subject area are indicated in Figure 7.7.

The boundaries to the subject area's groundwater zone are constituted by both ground water divides which act as no-flow boundaries as well as a number of streams acting as natural groundwater discharge boundaries.

As can be seen in Figure 7.7, the subject area's groundwater regime is bounded in the north by a no-flow boundary constituted by the surface water divide separating the catchment areas of the two non-perennial tributaries of the Thabina River to the north and south of the proposed filling station.

The rest of the subject area's flow regime is enclosed in the west by the Thabina River and in the south by the non-perennial stream located to the south of the proposed filling station, all constituting natural groundwater discharge boundaries. The Thabina River west of the proposed filling station constitutes the natural discharge boundary to the stations groundwater flow regime and therefore as its natural impact zone.

As previously stated, the Maake Plaza Shopping Centre's water supply borehole (H08-1793) is situated between the Thabina River and a water supply canal running parallel to the river (Figure 4). To the north and south of the borehole, small-scale rural farming is practiced with water being channeled from the canal to the fields along hand-dug trenches. The canal and trenches constitute constant head influx boundaries.

The two dolerite dykes identified during the geophysical surveys performed at and to the west of the Maake Plaza Shopping Centre, although they most likely constitute major preferential flow zones, are not believed to represent physical no-flow boundaries due to the fractured nature of the intersections penetrated in commissioned boreholes as well as the observed depth of weathering recorded in the boreholes.

The Thabina Fault transecting the western boundary of the investigation area roughly outlines the river course of the Thabina River and probably, also constitutes a major preferential flow zone.

Although physical and hydraulic aquifer boundaries may become dynamic under conditions of major aquifer application, a Groundwater Balance Equation yielded a surplus concluding that there is sufficient groundwater available in the immediate catchment area for the utilization of borehole H08-1973 even at full capacity (19 800L/hr or 237.6m^3/day), as well as the other water supply boreholes, without permanently removing water from storage or lowering the local groundwater levels.

Please refer to Figure 8.7 overleaf for a map of the lateral extent of the groundwater zone

7.3.18. Receptor identification

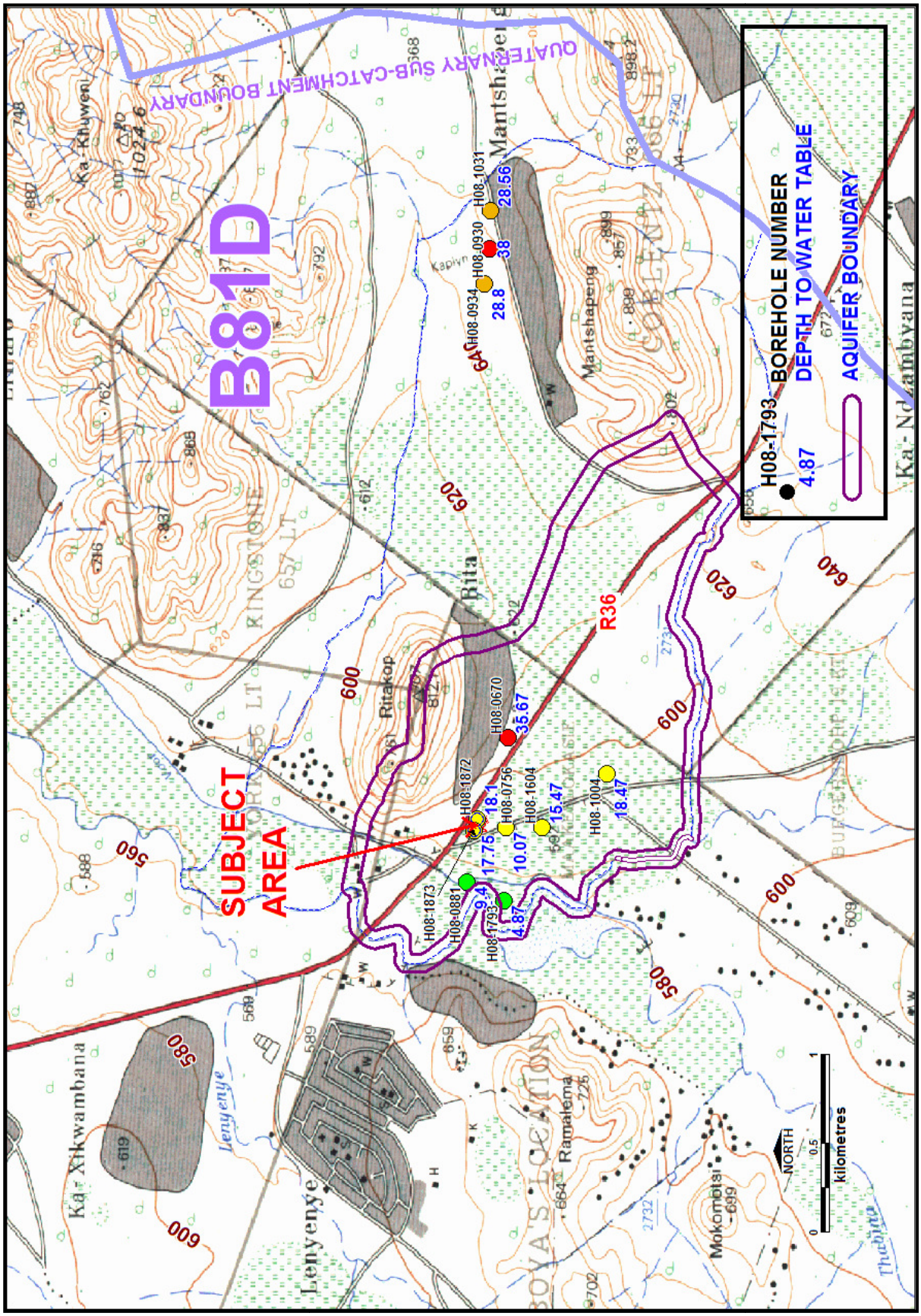
The following receptors were identified:

- The groundwater regime underlying the site.
- The Thabina River forming the western discharge boundary of the subject area's flow regime, the closest point being some 370m to the west of the proposed filling station.
- The preferential flow zones identified within the proposed filling station's flow regime.
- The water supply borehole for the Maake Plaza Shopping Centre.
- The other five rural water supply boreholes that occur within the proposed filling station's flow regime (of which only one is in a working condition and another two that could not be found during the hyro-census).

The potential contaminant migration or pathway at the site can be described as follow:

- Pollution generated at the site will migrate vertically through the ± 3m thick soil profile to the residual weathered schist.
- Small cracks, fissures and openings in the matrix rock will act as preferred pathways for the contamination migration vertically to the groundwater.
- The groundwater will be the transport medium for downstream migration of the contaminant. The migration rate will depend on the natural groundwater flow.

Figure 7.7: Lateral Extent of the Groundwater Zone



7.3.19. Permeability / Transmissivity

The permeability (k – m/day) of an aquifer is a measure of the ease with which ground water will move along the ground water pathway. The transmissivity (T – m^2/day) of an aquifer incorporates the thickness (d - m) of the saturated flow regime:

T = k*d

Transmissivity values were determined by performing pumping tests on boreholes H08-1872 and H08-1793. Respective values of 8.72 m^2/day and 35m^2/day were calculated. These values are high and are believed to be representative of the secondary structural aquifers.

Literature permeability values are indicated to range between 0.002m/day and 0.104m/day.
Assuming an average saturated aquifer thickness of 14.28m and a maximum bulk permeability value of 0.104m/day, a T value of 1.4m^2/day is obtained for the secondary weathered aquifer.

A Pumping Test Report as well as a Water Source Evaluation Report for borehole H08-1872 is attached in Appendix V.

7.3.20. Porosity

Porosity plays a governing role in ground water seepage velocity, which relates not only to the rate at which ground water moves through the aquifer, but indeed also to the rate of dissolved contaminant migration, the latter which occurs through the mechanism of advection.

Based on literature values, a porosity value of 0.04 is proposed for the subject area.

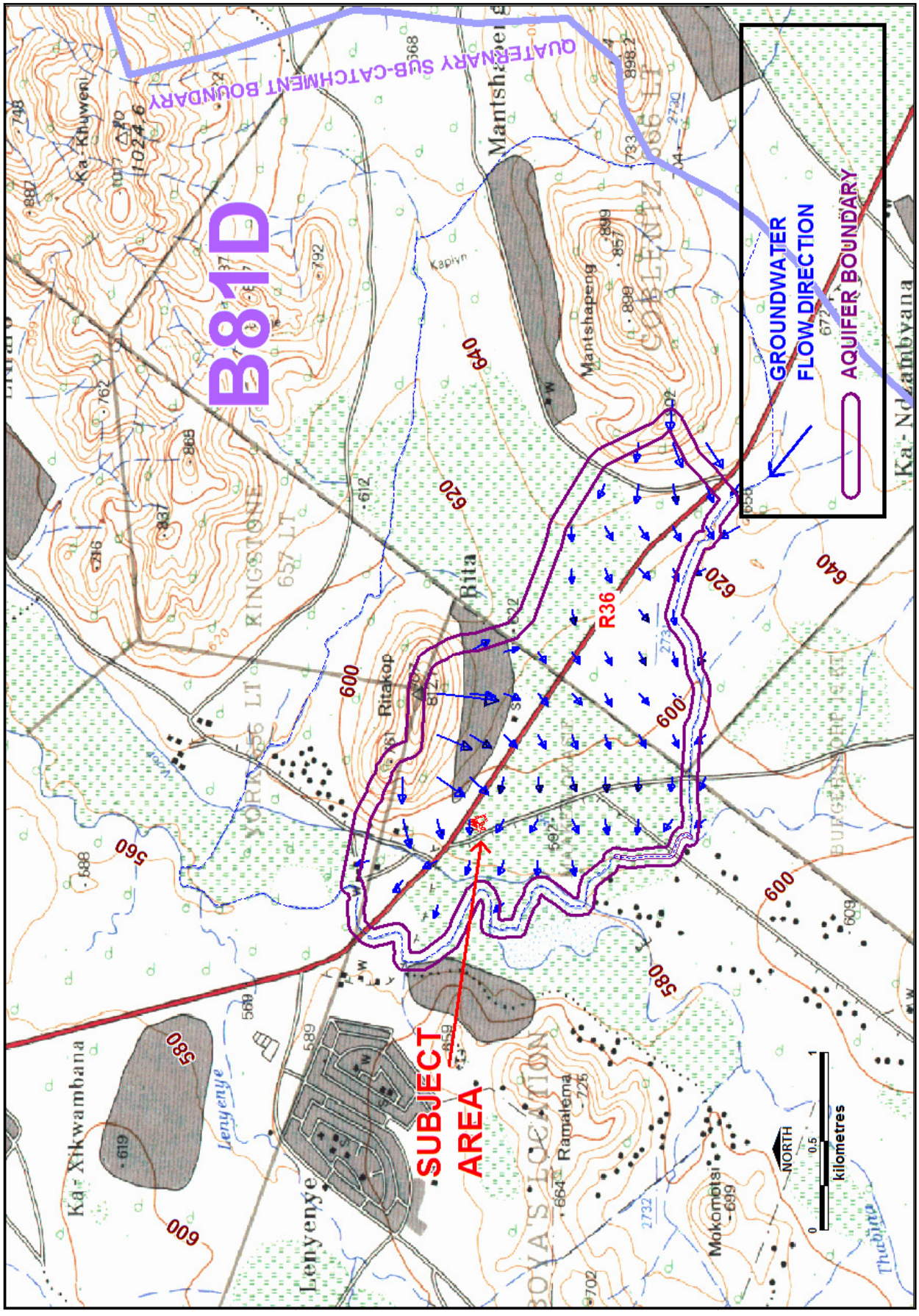
7.3.21. Groundwater flow directions and velocity

The water table, under normal conditions is expected to emulate the surface topography. Groundwater flow although dynamic in the sense that directions might be manipulated by groundwater abstraction in the area, is thus towards the low lying areas i.e. the rivers and streams which represent natural aquifer discharge boundaries.

The available information was used to calculate groundwater flow directions which are presented in Figure 7.8. From this map it is evident that the general flow direction is towards the west, and thus towards production borehole H08-0881 and the Thabina River, which constitutes the western discharge boundary of the subject area's flow regime.

Assuming a groundwater gradient no larger than 2%, subject to the estimated values for hydraulic conductivity and porosity, the groundwater seepage velocity in the secondary weathered zone aquifer is estimated at 0.052 m/day, or 18.98 m/year.

Figure 7.8: Groundwater Flow Directions



7.3.22. Aquifer classification / strategic value

The aquifer(s) underlying the subject area were classified in accordance with ***"A South African Aquifer System Management Classification, December 1995."***

Classification has been done in accordance with the following definitions for Aquifer System Management Classes:

Sole Aquifer System:
An aquifer which is used to supply 50 per cent or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.

Major Aquifer System:
Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 *mS/m* Electrical Conductivity).

Minor Aquifer System:
These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.

Non-Aquifer System:
These are formations with negligible permeability that are regarded as not containing ground water in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, ground water flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Figure 7.9: Ratings for the Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	**Points**	**Maake**
Sole Source Aquifer System:	6	-
Major Aquifer System:	4	-
Minor Aquifer System:	2	2
Non-Aquifer System:	0	-
Special Aquifer System:	0 - 6	-
Second Variable Classification Weathering/Fracturing		
Class	**Points**	**Maake**
High:	3	-
Medium:	2	2
Low:	1	-
Note: Preferential flow zones with high T-values in site's flow regime		

Figure 7.10: Ratings for the Ground Water Quality Management Classification System

Aquifer System Management Classification		
Class	**Points**	**Maake**
Sole Source Aquifer System:	6	-
Major Aquifer System:	4	-
Minor Aquifer System:	2	3
Non-Aquifer System:	0	-
Special Aquifer System:	0 - 6	-
Aquifer Vulnerability Classification		
Class	**Points**	**Maake**
High:	3	-
Medium:	2	-
Low:	1	1

The subject area aquifer(s), in terms of the above definitions, is classified as a **minor aquifer system**.

Figure 7.11: Level of ground water protection based on the Ground Water Quality Management Classification (*GQM Index = Aquifer System Management x Aquifer Vulnerability)*

GQM Index	**Level of Protection**	**Maake**
<1	Limited	-
1 - 3	Low Level	-
3 - 6	Medium Level	3
6 - 10	High Level	-
>10	Strictly Non-Degradation	-

Aquifer Vulnerability: The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as **low**.

Aquifer Susceptibility: Aquifer susceptibility, a qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and which includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification, in terms of the above, is classified as **low**.

Aquifer Protection Classification: The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a Ground Water Quality Management Index of 4 for the subject area, indicating that **medium** level ground water protection may be required.

In terms of DWAF's overarching water quality management objectives which is ***(1)*** protection of human health and ***(2)*** the protection of the environment, the significance of this aquifer classification is that if any potential risk exists, **measures must be put in place to limit the risk to the environment, which in this case is the protection of the Primary Underlying Aquifer, the streams which drains the subject area, and the External Users' of ground water in the area**.

7.3.23. Potential impacts

A Risk Assessment was undertaken by In-Situ Groundwater Consulting. Two different types of activities are associated with the development: Firstly the installation and construction has to take place (construction phase) before the filling station can be put into operation (operational phase). The potential impacts associated with the proposed project proposal are described and, where appropriate, ranked by a significance assessment methodology.

The assessment of overall impact significance provides an indication of the extent to which the impacts either could have "no-go" implications for certain aspects of the project (i.e. that the activity should not be allowed to proceed) or will need to be countered by appropriate mitigation.

The risk that the proposed filling station poses to the rural and natural environments has to be considered in terms of the source, pathway and receptor principle. The proposed filling station is a potential source of petroleum pollution if an accidental release of product takes place. The most hazardous pathway through which the contamination can impact on human receptors is through groundwater ingestion.

Apart from the Maake Plaza Shopping Centre's water supply borehole (H08-1793) situated some 430m to the west of the proposed filling station between the Thabina River and a water supply canal running parallel to the river, five other water supply boreholes are located within 1 km of the proposed filling station area and another three some 3km to the east.

The current groundwater abstraction volume from the investigation area by existing users is approximately 377.28m^3/day. Existing boreholes that have the potential to be utilized as future production boreholes could abstract an additional 459.07m^3/day, bringing the total groundwater abstraction possible from existing sources in the investigation area to 836.35m^3/day.

Incorporating the Maake Plaza Shopping Centre's water supply borehole's sustainable capacity, the maximum total groundwater abstraction from existing sources in the investigation area calculates to a volume of 1073.95m3/day.

The observed and potential groundwater usage increases the risk in terms of the impact on human receptors significantly.

During the rating and ranking procedure of impacts, no impact had the "no-go" implication (i.e. that the project should not be allowed to proceed) for certain aspects of the project, and all impacts can be countered by appropriate mitigation and training of all personnel.

In conclusion, considering the available information, the proposed filling station might have some impact on the environment, but as long as proper management procedures are in place, the effect is anticipated to be minimal.

Table 7.4: Geo-hydrological risk assessment

Aspect	Possible Impacts	Significance of Impacts							
		Probability of impact being experienced in case of aspect coming to pass	Significance rating		Severity Factor	Severity Rating	Significance Rating	Mitigation Plan	Responsible Person
			Intensity	Duration					
1. Construction phase									
1.1. Waste water	Contamination of soil, groundwater	3	1	2	2	2	6 Low	No wastewater is expected to be generated during the construction phase.	Oil company / Contractor
2. Operational phase									
2.1. Accidental Spillages	Contamination of soil and ground water	5	4	4	16	5	25 Very High	On hard surfaces, the product will be covered and adsorbed with biodegradable absorbent materials. Spills on soil would require the determination of the lateral and vertical extent of the contamination and then based on the risk that the contamination pose to the receiving environment, remedial actions will be implemented.	Oil company / Site Manager
2.2 Overfill	Contamination of soil and groundwater	4	4	4	16	5	20 Very High	As part of the SABS 089-3 requirements, secondary containment features will be installed around the filler points and on top of the tanks. These units are sealed and facilitate the recovery of product in the event of an overfill or spill.	Oil company / Site Manager
2.3. Leaking Tank	Contamination of soil and groundwater	4	4	3	8	3	12 Medium	A Leak is detected immediately by means of reconciliation of delivery and use/sales. Monitoring wells (installed as per SABS 089-3 regulations) that are installed with the tanks serve as an early warning system. Tanks will be fitted with on-line leak detection, for purposes of pro-actively detecting any potential product loss. Leaks are also detected by means of visual inspection, smell and record keeping of fuel volumes. Pump sumps and containment manholes will serve as containment tools in the event of a leak.	Oil company / Site Manager

Potential impacts relate mainly to two aspects:

Potential acceleration of soil erosion

Potential acceleration of soil erosion is mainly a short-term impact that is expected to be limited largely to the ***construction phase***, when a portion of bare soil will be exposed to the elements for a short period of time. The topography of the proposed development site is relatively flat; however, soils were found during the geotechnical investigation to be susceptible to erosion. No prominent erosion features were observed on the site, and soil erosion was minimal during construction of the Maake Plaza shopping centre on the rest of the property (with similar soil properties and topography). It is therefore anticipated that similarly insignificant levels of soil erosion will be found during construction of the proposed filling station.

It is *not* expected that increased erosion rates will be experienced during the ***operational phase***, as most of the site will be covered by a concrete slab. Any exposed soil will be covered, either through re-vegetation of exposed soil or covering of exposed areas with gravel or paving. Impacts in this regard are therefore regarded as negligible.

Potential soil and groundwater contamination

During the operational phase of the proposed filling station, there is a risk of groundwater pollution in the event of leakage from fuel storage tanks, fuel spillage or overfilling. Though the risk of leakage, accidental spillage or overfilling is anticipated to be medium to low if proper monitoring, management and mitigation measures are implemented, the risk of soil or groundwater contamination in case of leakage, spillage or overfilling is high. It is therefore imperative that monitoring, management and mitigation measures, which will be detailed in the EMP which will developed during the next phase of this EIA, are implemented in order to keep risks to an absolute minimum.

Table 7.5: Potential impacts in terms of soils and hydrology

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Accelerated soil erosion	Negative	Site-bound	Short term	Very low	Possible	Very low
OPERATIONAL PHASE						
Accelerated soil erosion	Negative	Site-bound	Long term	Negligible	Improbable	Negligible
Increased peak storm water flow	Negative	Site-bound	Long term	Low	Highly probable	Low
Risk of soil and groundwater pollution in case of overfilling of fuel storage tanks	Negative	Local to sub-regional	Long term	Unknown (depends on amount of overfilling)	Possible	Very high
Risk of soil and groundwater pollution in case of accidental spillage	Negative	Regional	Long term	Unknown (depends on scale of spill)	Possible	Very high
Risk of soil and groundwater pollution in case of leakage	Negative	Regional	Long term	Unknown (depends on scale of leakage)	Possible	Medium

7.4. Ecology

The site of the proposed filling station has already been mostly cleared and landscaped during construction of the Maake Plaza shopping centre, as the site was initially to form part of the centre.

An ecological assessment was conducted as part of the Basic Assessment for the (then proposed) Maake Plaza shopping centre in 2007, and relevant information from the said study is included in this

section. Though information on the ecology of the site itself is no longer relevant (as the natural vegetation has been cleared), information on the ecology of the broader, surrounding area is included in this section.

The ecological assessment conducted during the Maake Plaza Basic Assessment was conducted by Dr Buks Henning of Africa Geo-Environmental Services (AGES) during June 2007, and consisted of a literature survey and onsite investigation. The following was documented during the investigation:

- State of vegetation and time of survey
- Plant species of importance:
  - Dominant plant species
  - Red data plant species
  - Protected tree species
  - Exotic species
  - Indicator species of the state of the vegetation
- Average cover and height of floristic components
- General ecological information such as soil type, geology, location of drainage channels etc
- Plant communities were identified on site and a classification of vegetation data was done to identify, describe and map vegetation units, which will include a sensitivity map.

7.4.1. Status quo

The proposed development site itself currently consists mostly of landscaped lawns – the natural vegetation was transformed during the construction of the Maake Plaza shopping centre. The site is situated in an area of which the vegetation type can be broadly classified as Granite Lowveld Grassland in terms of Mucina *et al* (2005), Sour Lowveld Bushveld by Low and Rebelo (1996) or Lowveld Sour Bushveld by Acocks (1988).

Apart from the vegetation onsite having been transformed, vegetation in the immediate area has been transformed to a large extent through development around the site, and vegetation in remaining open spaces in the immediate vicinity has been degraded due to human activities such as collection of firewood and establishment of networks of informal footpaths. The transformation and degradation of vegetation has reduced and degraded available habitat for fauna. Habitat on the nearby Ritakop is relatively intact (as compared to the situation on and directly around the proposed development site) due to the steep slopes which discourage development and are not as readily accessible as is the case with terrain with more even gradients.

Plant species occurring within the general area (though not necessarily on the site itself) include the following:

Table 7.6: Plant species occurring within the broad area in which the site is situated

WOODY SPECIES		
Acacia burkei	*Diospyros mespiliformes*	*Piliostigma thonningii*
Acacia gerrardi	*Ehretia amoena*	*Psidium guajava*
Acacia sieberiana	*Ficus glumosa*	*Schotia affra*
Caesalpinnia decapetala	*Ficus thonningii*	*Sclerocarya birrea*
Combretum apiculatum	*Philonaptera violaceae*	*Trichilia emetica*

Dichrostachys cinerea		
GRASSES		
Aristida spp.	*Eragrostis rigidior*	*Pennisetum clandestinum*
Botriochloa radicans	*Heteropogon contortus*	*Sprobolus fimbriatus*
Cenchrus ciliaris	*Melinis repens*	*Urochloa mosambicensis*
Cynodon dactylon	*Panicum maximum*	
FORBS & SUCCULENTS		
Achyrantes aspera	*Dicerocarium eriocarpum*	*Senna italica*
Agave mexicana	*Diospyros lycioides*	*Solanum panduriforme*
Bidens pilosa	*Pearsonia cajanifolia*	*Tagetes minuta*
Chromolanea odorata	*Senecio gerrardi*	*Vigna vexillata*
Datura stramonium		

7.4.2. Potential impacts and recommendations

With the natural vegetation already having mostly been **cleared** and the site having been landscaped as part of the construction of the Maake Plaza shopping centre, faunal and vegetation impacts of the proposed establishment of the filling station are anticipated to be **negligible**.

None of the protected tree species listed in terms of the Limpopo Environmental Management Act (LEMA) are found on the site. However, it is recommended that any trees still occurring on the site should either be preserved as far as is practicable, transplanted to a different section of the site or replaced through planting of another tree(s) elsewhere on the site, in order to ensure that the habitat currently provided by the trees is not permanently lost.

If existing tree(s) cannot be accommodated in the layout of the proposed filling station and it is determined that the existing tree(s) should be felled and replaced through planting of trees elsewhere on the site, it is important that only locally indigenous tree species be used, as these are suited to the local climate and other conditions (for instance soil types) and are better suited to provide habitat for local fauna than exotic species would be. Trees should be planted sufficiently far away from the fuel tank farm, to prevent damage to the tanks through chemical interactions and structural damage caused by the trees' roots. It is recommended that trees be planted not on the site of the filling station itself, but rather on the section of the site occupied by the Maake Plaza shopping centre, in order to avoid the risk of roots damaging fuel storage facilities.

Table 7.7: Potential ecological impacts

CONSTRUCTION AND OPERATIONAL PHASES						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Temporary loss of habitat currently provided by existing trees onsite, while replacement trees elsewhere onsite reach maturity	Negative	Site-bound	Medium term	Negligible	Probable	Negligible

7.5. Air Quality

7.5.1. Status quo

The site of the proposed filling station is situated in a rural built-up area, surrounded mostly by small-scale formal and informal commercial activity and some residential land use. A large shopping centre (Maake Plaza) is under construction on the same property on which this filling station is proposed; the shopping centre is due to open at the end of October 2008. The site is situated at the junction of the regional road the R36 (the main road connecting Tzaneen with towns such as Gravelotte, Lydenburg and Hoedspruit) and the D4075 (leading into Maake / Rita villages) and as such carries quite heavy traffic, especially (but not exclusively) during the early mornings when residents of the surrounding villages travel to Tzaneen for work, and back to villages in the late afternoons.

An informal taxi rank is currently situated directly outside the perimeter fence of the proposed filling station site. The taxi rank will be formalised to form part of Maake Plaza shopping centre – facilities such as a taxi office, ablutions and covered parking are under construction on the premises of the shopping centre. The future position of the taxi rank is directly adjacent to the proposed filling station site. An existing filling station is also situated across the road from the proposed site.

The main existing sources of air pollution in the area are:

- Smoke from cooking and heating fires from homes in the surrounding villages;
- Exhaust emissions from vehicles travelling on the adjacent roads;
- Exhaust emissions from taxis at the adjacent taxi rank;
- Exhaust emissions from vehicles patronizing the nearby Poo ke Nna filling station (to a lesser extent).

7.5.2. Potential impacts

Petrol and diesel fumes may have potentially negative impacts on human health, particularly on the central nervous system, under conditions of high levels of exposure over a long period of time. However, the proposed facility has been designed to limit the potential for escape of fumes as far as possible. Vents will be placed in a safe place, installations will be done according to SANS 10089-3 and vent pipes are to be at a minimum of 3.6m above ground to minimise fugitive emissions due to the storage of fuel as well as potential health risk associated with possible fugitive emissions. Areas where fuel is to be dispensed or storage tanks refilled, i.e. where there is an elevated risk of fumes escaping, are furthermore not situated in enclosed spaces where concentrations of harmful substances could build up to dangerous levels, but rather are situated in the open where fumes can easily dissipate.

A related potential impact is the potential generation of exhaust fumes from vehicles visiting the filling station and waiting to be assisted. Again, the idling vehicles will be in the open, where fumes can dissipate; however, drivers will, through appropriate signage, be advised to switch off vehicles while waiting to be assisted.

The above-mentioned impacts are anticipated to be almost entirely site-bound.

Table 7.8: Potential impacts in terms of air quality

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Airborne dust during construction activities	Negative	Local	Short term	Very low	Probable	Very low
OPERATIONAL PHASE						
Health risk associated with petrol/diesel fumes and exhaust fumes	Negative	Site-bound	Long term	*Very low* (normal circumstances); *Unknown* (accidents)	Highly probable (very low exposure to fumes under normal circumstances); Possible (dangerous exposure in case of accidents)	Low-Medium

7.6. Civil Services and Waste Management

Please refer to Sections 2.3 and 2.4 for descriptions of civil services and solid waste management to be associated with the proposed facility.

7.6.1. Potential impacts

Water and electricity consumption, as well as generation of sewage, is expected to increase as a result of activities at the proposed facility. This would place added pressure on the nearby borehole which is to supply water to the proposed facility, as well as on the municipal electricity supply infrastructure and the onsite sewerage treatment facility.

Generation of solid waste is anticipated to increase, along with littering. Solid waste generated at the proposed facility is expected to comprise mostly packaging material associated with stock at the convenience shop; office consumables such as waste paper and spent printer cartridges generated by the filling station's office; and containers, food scraps and packaging discarded by customers of the convenience shop.

Recyclable waste (paper / cardboard; glass; aluminium cans; and spent printer cartridges) will be separated from non-recyclable waste at source, and will be collected by a recycling contractor on a regular basis for delivery to relevant recycling facilities.

Table 7.9: Potential impacts in terms of services and waste management

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Littering onsite and in the immediate vicinity of the site	Negative	Site-bound and in the immediate vicinity of the site	Short term	Very low	Highly probable	Very low
OPERATIONAL PHASE						
Increased water use	Negative	Local	Long term	Low	Definite	Low
Increased electricity use	Negative	Local	Long term	Low	Definite	Low
Increased generation of sewage	Negative	Local	Long term	Low	Definite	Low

Increased solid waste generation	Negative	Local	Long term	Low	Definite	Low
Littering	Negative	Site-bound and in immediate vicinity of site	Long term	Low	Highly probable	Low

7.7. Cumulative and Indirect Impacts

As is the case for any activity, impacts are not limited to those directly associated with the proposed activity – potential cumulative impacts need to be considered as well, so that activities can be seen not just as stand-alone entities but as part of the larger picture of development in the area.

Table 7.10: Potential cumulative and indirect bio-physical impacts

OPERATIONAL PHASE						
BIO-PHYSICAL IMPACTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Potential exacerbation of groundwater contamination already experienced	Negative	Local – Regional	Long term	Unknown	Possible	High
Increased pressure on electricity supply	Negative	Local	Long term	Low	Definite	Low
Increased water abstraction from the nearby borehole	Negative	Local	Long term	Low	Definite	Low
Increased pressure on the onsite sewerage treatment system	Negative	Local	Long term	Low	Definite	Low
Increased solid waste generation	Negative	Local	Long term	Low	Definite	Low

8. SOCIO-ECONOMIC INVESTIGATIONS

Socio-economic investigations consisted of the following:

- Heritage Impact Assessment (HIA) by the archaeologist Mr Stephan Gaigher, then of Archaeo-Info Northern Province (AINP) but now with Gaigher and Associates Heritage Practitioners;
- Market feasibility assessment by Mr Hannes Pieterse of Petrorex to assess the feasibility of the proposed filling station as well as to gauge the potential financial impact of the proposed station on existing filling stations within the local trading area;
- Desktop overview of the social conditions within the GTM; and
- Desktop analysis of health and safety aspects related to the proposed filling station.

8.1. Heritage Assessment

An HIA was conducted by Mr Stephan Gaigher of Archaeo-Info Northern Province (AINP) during June 2007 in order to determine the presence or not of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance, and to submit appropriate recommendations with regard to the cultural resources management measures that may

be required at affected sites / features, as the proposed activity might potentially be harmful to heritage resources that might occur in the demarcated area.

The report thus provides an overview of the heritage resources which may occur in the demarcated area where development is intended. The significance of the heritage resources was assessed in terms of criteria defined in the methodology section. The potential impact of the proposed development on these resources is indicated and the report recommends mitigation measures that should be implemented to minimize any potential adverse impacts of the proposed development on these heritage resources.

This HIA was performed in accordance with section 38 of the National Heritage Resources Act (NHRA), Act 25 of 1999.

8.1.1. Methodology

(a) Inventory

Inventory studies involve the in-field survey and recording of archaeological resources within a proposed development area. The nature and scope of this type of study is defined primarily by the results of the overview study. In the case of site-specific developments, direct implementation of an inventory study may preclude the need for an overview. There are a number of different methodological approaches to conducting inventory studies. Therefore, the proponent, in collaboration with the archaeological consultant, must develop an inventory plan for review and approval by the SAHRA prior to implementation (*Dincause, Dena F., H. Martin Wobst, Robert J. Hasenstab and David M. Lacy 1984)*.

Site Surveying

Site surveying is the process by which archaeological sites are located and identified on the ground. Archaeological site surveys often involve both surface inspection and subsurface testing. For the purposes of heritage investigations, *archaeological sites* refer to any site with heritage potential (e.g. historic sites, cultural sites, rock art sites etc.).

A **systematic surface** inspection involves a foot traverse along pre-defined linear transects which are spaced at systematic intervals across the survey area. This approach is designed to achieve representative area coverage. Alternatively, an archaeological site survey may involve a non-systematic or random walk across the survey area. Subsurface testing is an integral part of archaeological site survey.

The purpose of **subsurface testing**, commonly called "shovel testing", is to:

- Assist in the location of archaeological sites which are buried or obscured from the surveyor's view, and
- Help determine the horizontal and vertical dimensions and internal structure of a site.

In this respect, subsurface testing should not be confused with evaluative testing, which is a considerably more intensive method of assessing site significance (*King, Thomas F., 1978)*. Once a site is located, subsurface testing is conducted to record horizontal extent, depth of the cultural matrix, and degree of internal stratification. Because subsurface testing, like any form of site excavation, is

destructive it should be conducted only when necessary and in moderation. Subsurface testing is usually accomplished by shovel, although augers and core samplers are also used where conditions are suitable. Shovel test units averaging 40 square cm are generally appropriate, and are excavated to a sterile stratum (e.g. C Horizon, alluvial till, etc.). Depending on the site survey strategy, subsurface testing is conducted systematically or randomly across the survey area. Other considerations such as test unit location, frequency, depth and interval spacing will also depend on the survey design as well as various biophysical factors. *(Lightfoot, Keng G. 1989)*.

Survey Sampling

Site survey involves the complete or partial inspection of a proposed project area for the purpose of locating archaeological or other heritage sites. Since there are many possible approaches to field survey, it is important to consider the biophysical conditions and archaeological site potential of the survey area in designing the survey strategy. Ideally, the archaeological site inventory should be based on intensive survey of every portion of the impact area, as maximum area coverage will provide the most comprehensive understanding archaeological and other heritage resource density and distribution. However, in many cases the size of the project area may render a complete survey impractical because of time and cost considerations. In some situations it may be practical to intensively survey only a sample of the entire project area. Sample selection is approached **systematically**, based on accepted statistical sampling procedures, or **judgementally**, relying primarily on subjective criteria *(Butler, W., 1984)*.

- *Systematic survey sampling*

A systematic sample survey is designed to locate a representative sample of archaeological or heritage resources within the project area. A statistically valid sample will allow predictions to be made regarding total resource density, distribution and variability. In systematic sample surveys it may be necessary to exempt certain areas from intensive inspection owing to excessive slope, water bodies, landslides, land ownership, land use or other factors. These areas must be explicitly defined. Areas characterized by an absence of road access or dense vegetation should not be exempted. *(Dunnel, R.C., Dancey W.S. 1983)*.

- *Judgemental survey sampling*

Under certain circumstances, it is appropriate to survey a sample of the project area based entirely on professional judgement regarding the location of sites. Only those areas which can reasonably be expected to contain archaeological or heritage sites are surveyed. However, a sufficient understanding of the cultural and biophysical factors which influenced or accounted for the distribution of these sites over the landscape is essential. Careful consideration must be given to ethnographic patterns of settlement, land use and resource exploitation; the kinds and distribution of aboriginal food sources; and restrictions on site location imposed by physical terrain, climatic regimes, soil chemistry or other factors. A judgemental sample survey is not desirable if statistically valid estimates of total heritage resource density and variability are required *(McManamon F.P. 1984)*.

(b) Assessment

Assessment studies are only required where conflicts have been identified between heritage resources and a proposed development. These studies require an evaluation of the heritage resource to be impacted, as well as an assessment of project impacts. The purpose of the assessment is to provide recommendations as to the most appropriate manner in which the resource may be managed

in light of the identified impacts. Management options may include alteration of proposed development plans to avoid resource impact, mitigative studies directed at retrieving resource values prior to impact, or compensation for the unavoidable loss of resource values. It is especially important to utilize specialists at this stage of assessment. The evaluation of any archaeological resource should be performed by professionally qualified individuals.

Site evaluation

Techniques utilized in evaluating the significance of a heritage site include **systematic surface collecting** and **evaluative testing**. Systematic surface collection is employed wherever archaeological remains are evident on the ground surface. However, where these sites contain buried deposits, some degree of evaluative testing is also required.

Systematic surface collection from archaeological sites should be limited, insofar as possible, to a representative sample of materials. Unless a site is exceptionally small and limited to the surface, no attempt should be made at this stage to collect all or even a major portion of the materials. Intensive surface collecting should be reserved for full scale data recovery if mitigative studies are required. Site significance is determined following an analysis of the surface collected and/or excavated materials (*Miller, C.L. II, 1989)*.

Significance criteria

There are several kinds of significance, including scientific, public, ethnic, historic and economic, that need to be taken into account when evaluating heritage resources. For any site, explicit criteria are used to measure these values. Checklists of criteria for evaluating pre-contact and post-contact archaeological sites are provided in Appendix B and Appendix C of the HIA report (Appendix H of this report). These checklists are not intended to be exhaustive or inflexible. Innovative approaches to site evaluation which emphasize quantitative analysis and objectivity are encouraged. The process used to derive a measure of relative site significance must be rigorously documented, particularly the system for ranking or weighting various evaluatory criteria.

Site integrity, or the degree to which a heritage site has been impaired or disturbed as a result of past land alteration, is an important consideration in evaluating site significance. In this regard, it is important to recognize that although an archaeological site has been disturbed, it may still contain important scientific information.

Heritage resources may be of **scientific value** in two respects. The potential to yield information which, if properly recovered, will enhance understanding of Southern African human history is one appropriate measure of scientific significance. In this respect, archaeological sites should be evaluated in terms of their potential to resolve current archaeological research problems. Scientific significance also refers to the potential for relevant contributions to other academic disciplines or to industry.

Public significance refers to the potential a site has for enhancing the public's understanding and appreciation of the past. The interpretive, educational and recreational potential of a site are valid indications of public value. Public significance criteria such as ease of access, land ownership, or scenic setting are often external to the site itself. The relevance of heritage resource data to private industry may also be interpreted as a particular kind of public significance.

Ethnic significance applies to heritage sites which have value to an ethnically distinct community or group of people. Determining the ethnic significance of an archaeological site may require consultation with persons having special knowledge of a particular site. It is essential that ethnic significance be assessed by someone properly trained in obtaining and evaluating such data. Historic archaeological sites may relate to individuals or events that made an important, lasting contribution to the development of a particular locality or the province. Historically important sites also reflect or commemorate the historic socioeconomic character of an area. Sites having high historical value will also usually have high public value.

The **economic or monetary value** of a heritage site, where calculable, is also an important indication of significance. In some cases, it may be possible to project monetary benefits derived from the public's use of a heritage site as an educational or recreational facility. This may be accomplished by employing established economic evaluation methods; most of which have been developed for valuating outdoor recreation. The objective is to determine the willingness of users, including local residents and tourists, to pay for the experiences or services the site provides even though no payment is presently being made. Calculation of user benefits will normally require some study of the visitor population *(Smith, L.D. 1977)*.

Assessing impacts

A heritage resource impact may be broadly defined as the net change between the integrity of a heritage site with and without the proposed development. This change may be either beneficial or adverse.

Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource. For example, development may have a beneficial effect by preventing or lessening natural site erosion. Similarly, an action may serve to preserve a site for future investigation by covering it with a protective layer of fill. In other cases, the public or economic significance of an archaeological site may be enhanced by actions which facilitate non-destructive public use. Although beneficial impacts are unlikely to occur frequently, they should be included in the assessment.

More commonly, the effects of a project on heritage sites are of an adverse nature. Adverse impacts occur under conditions that include:

- Destruction or alteration of all or part of a heritage site;
- Isolation of a site from its natural setting; and
- Introduction of physical, chemical or visual elements that are out-of-character with the heritage resource and its setting.

Adverse effects can be more specifically defined as direct or indirect impacts. **Direct impacts** are the immediately demonstrable effects of a project which can be attributed to particular land modifying actions. They are directly caused by a project or its ancillary facilities and occur at the same time and place. The immediate consequences of a project action, such as slope failure following reservoir inundation, are also considered direct impacts.

Indirect impacts result from activities other than actual project actions. Nevertheless, they are clearly induced by a project and would not occur without it. For example, project development may induce changes in land use or population density, such as increased urban and recreational development,

which may indirectly impact upon heritage sites. Increased vandalism of heritage sites, resulting from improved or newly introduced access, is also considered an indirect impact. Indirect impacts are much more difficult to assess and quantify than impacts of a direct nature.

Once all project related impacts are identified, it is necessary to determine their individual level-of-effect on heritage resources. This assessment is aimed at determining the extent or degree to which future opportunities for scientific research, preservation, or public appreciation are foreclosed or otherwise adversely affected by a proposed action. Therefore, the assessment provides a reasonable indication of the relative significance or importance of a particular impact. Normally, the assessment should follow site evaluation since it is important to know what heritage values may be adversely affected. The assessment should include careful consideration of the following level-of-effect indicators, which are defined in Appendix D of the HIA (Appendix E of this report):

- Magnitude
- Severity
- Duration
- Range
- Frequency
- Diversity
- Cumulative effect
- Rate of change

The level-of-effect assessment should be conducted and reported in a quantitative and objective fashion. The methodological approach, particularly the system of ranking level-of-effect indicators, must be rigorously documented and recommendations should be made with respect to managing uncertainties in the assessment. *(Zubrow, Ezra B.A., 1984).*

Table 8.1: Impact severity table

Impact Effect	Score
Magnitude	0-4
Severity	0-4
Duration	0-4
Range	0-4
Frequency	0-4
Diversity	0-4
Cumulative effect	0-4
Rate of change	0-4
Total score:	0-32

Table 8.2: Impacts will be defined along the following parameters:

Effect	Score
No effect on site	0
Insignificant impact on site	1-5
Significant impact on site	6-16
Major destruction of site and attributes	17-24
Total destruction of sites and attributes	25-32

The study area was surveyed using standard archaeological surveying methods. The area was surveyed using directional parameters supplied by the GPS and surveyed by foot. This technique has proven to result in the maximum coverage of an area. This action is defined as: "*an archaeologist being present in the course of the carrying-out of the development works (which may include conservation works), so as to identify and protect archaeological deposits, features or objects which may be uncovered or otherwise affected by the works" (*DAHGI 1999a, 28). Standard archaeological documentation formats were employed in the description of sites. Using standard site documentation forms as comparable medium, it enabled the surveyors to evaluate the relative importance of sites found (no sites of heritage significant were found on the proposed development site, though).

Indicators such as surface finds, plant growth anomalies, local information and topography were used in identifying sites of possible archaeological importance. Test probes were done at intervals to determine sub-surface occurrence of archaeological material. The importance of sites was assessed by comparisons with published information as well as comparative collections.

Test excavation is that form of archaeological excavation where the purpose is to establish the nature and extent of archaeological deposits and features present in a location which it is proposed to develop (though not normally to fully investigate those deposits or features) and allow an assessment to be made of the archaeological impact of the proposed development. It may also be referred to as archaeological testing' (DAHGI 1999a, 27).

'Test excavation should not be confused with, or referred to as, archaeological assessment which is the overall process of assessing the archaeological impact of development. Test excavation is one of the techniques in carrying out archaeological assessment which may also include, as appropriate, documentary research, field walking, examination of upstanding or visible features or structures, examination of aerial photographs, satellite or other remote sensing imagery, geophysical survey, and topographical assessment' (DAHGI 1999b, 18).

A hierarchical system was used for assessment of the importance of any sites. These categories are as follows:

Table 8.3: Site significance table for pre-contact heritage sites.

Degree of significance	Justification	Score
Exceptional significance	Rare or outstanding, high degree of intactness. Can be interpreted easily.	13 – 16
High significance	High degree of original fabric. Demonstrates a key element of item's significance. Alterations do not detract from significance.	9 – 12
Moderate significance	Altered or modified elements. Element with little heritage value, but which contribute to the overall significance.	5 – 8
Little significance	Alterations detract from significance. One of many. Alterations detract from significance.	1 – 4
Intrusive	Damaging to the item's heritage significance.	0

Table 8.4: Site significance table for post contact sites.

Degree of significance	Justification	Score
Exceptional significance	Rare or outstanding, high degree of intactness. Can be interpreted easily.	29 – 24
High significance	High degree of original fabric. Demonstrates a key element of item's significance. Alterations do not detract from significance.	13 – 18
Moderate significance	Altered or modified elements. Element with little heritage value, but which contribute to the overall significance.	7 – 12
Little significance	Alterations detract from significance. One of many. Alterations detract from significance.	1 – 6
Intrusive	Damaging to the item's heritage significance.	0

The qualitative value of a site's significance is calculated by tabling its significance characteristics (as outlined in appendix B & C of the HIA – Appendix E of this report) on a sliding value scale and determining an accumulative value for the specific site. Two tables will be used:

Table 8.5: Pre-contact site criteria (0- no value, 4- highest value)

Site significance characteristics slide scale (Pre-Contact Criteria)					
Scientific Significance	0	1	2	3	4
Public Significance	0	1	2	3	4
Ethnic Significance	0	1	2	3	4
Economic Significance	0	1	2	3	4
				Total Score	

Table 8.6: Post-contact site criteria (0- no value, 4- highest value)

Site significance characteristics slide scale (Post-Contact Criteria)					
Scientific Significance	0	1	2	3	4
Historic Significance	0	1	2	3	4
Public Significance	0	1	2	3	4
Other Significance	0	1	2	3	4
Ethnic Significance	0	1	2	3	4
Economic Significance	0	1	2	3	4
				Total Score	

The values calculated (as specified in appendix B & C of the HIA – Appendix H of this report) are attributed to a category within the site significance table to provide the site with a quantifiable significance value. This is only done for identified sites; no sites of potential heritage significance were identified on the site. Where areas under investigation do not show any evidence of human activity, this is stated and no further qualifying is done.

8.2.1. Resource Inventory

Although the site under investigation shows numerous signs of human activity, none of these are of heritage importance. No sites warranted classification as sites of heritage potential therefore no resources were documented for evaluation. As no sites of heritage importance were identified within the study area, no negative impacts on heritage resources are anticipated. However, should sub-surface artefacts be unearthed during construction, all activities should be ceased and a heritage specialist / archaeologist as well as a representative of the South African Heritage Resources Association (SAHRA) should be contacted.

It was recommended by the heritage consultant that interviews should be conducted with the present and previous occupants of the proposed development site to determine the likelihood of unmarked graves being present on the property. Representatives of the Bakgaga Tribal Authority, who are the

custodians of the land on which the development is proposed and have been the custodians for quite some time, have indicated to the EAP that there are no graves on the site.

8.2.2. Potential impacts

No sites of heritage importance were identified within the study area; no negative impacts on heritage resources are therefore anticipated. However, should sub-surface artefacts be unearthed during construction, all activities should be ceased and the South African Heritage Resources Association (SAHRA) as well as a heritage specialist should be contacted.

8.2. Social Aspects

8.2.3. Greater Tzaneen Municipality

The Greater Tzaneen Municipality (GTM) is located in the eastern part of the Limpopo Province and forms part of the Mopani District Municipality. The GTM covers a land area of approximately 3240km^2 and encompasses the following proclaimed towns:

- Tzaneen
- Nkowankowa
- Lenyenye
- Letsitele
- Haenertsburg

Apart from the above towns, there are 125 rural villages forming part of the municipal area. These villages are clustered mainly in the south-eastern and north-western areas of the GTM, and nearly 80% of the GTM population live in the rural villages.

Approximately 66% of the total municipal land area is in private ownership, ranging from smallholdings to extensive farms. These are used mainly for commercial farming activities. Approximately 33% of the land area is in State ownership, under the custodianship of six traditional authorities. (The proposed development site, which is under the custodianship of the BCT, falls in the latter category.)

The GTM Integrated Development Plan (IDP) for 2004 – 2007 notes a rapid increase in “squatting” / informal settlement, leading to a reduction in land availability which may in turn result in neutralization of development alternatives currently available to the GTM. Squatting furthermore leads to problems in terms of relocation. These settlements can, however, be used as an indicator of areas with development potential and as such can be employed as an indicator in the design of the desired spatial framework. Land reform in the area is taking place slowly in the form of formalization of villages.

Agricultural activity, whether commercial or subsistence, plays a prominent role in the local economy, with both intensive and extensive farming taking place in the municipal area.

The Greater Tzaneen area has a well-developed network of primary and secondary arterial routes, and indeed the formal urban component (viz. Tzaneen, Nkowankowa and Lenyenye) have developed along a major arterial route. However, the majority of villages in the municipal area have limited

accessibility as a result of inadequate access roads and internal street networks. Provision of infrastructural, social and institutional services is currently experiencing severe backlogs.

8.2.4. Potential impacts

Direct social impacts are expected to have **low** significance. ***Construction phase*** impacts are expected to relate mainly to job creation, whilst ***operational phase*** impacts are expected to relate to job creation, increased access to fuel for local vehicle owners, potential safety risk because of the highly flammable nature of the types of fuel to be stored onsite, and potential health risk related to the chemicals in fuel vapours during filling of fuel tanks and pumping of fuel. Health and safety issues are elaborated upon in the following section.

Workers employed in the construction of the proposed filling station will be sourced from the local area as far as possible; the BCT will assist with the sourcing of locally-based labourers. However, it is not anticipated that large numbers of workers will be employed during construction, and the construction phase will be of short duration. Much of the work involved in establishment of the filling station will furthermore be specialised work for which suitable workers may not be available within the local community. Approximately 20 to 30 workers are anticipated to be employed during the operational phase, consisting of pump attendants, shop assistants and managers.

This proposed filling station, once established, may siphon off customers who currently patronize the existing filling stations in the area. This may lead to job losses at the existing filling stations; however, the nett impact of the proposed project on employment is anticipated to be positive. This is because it is foreseen that with the coming of the new Maake Plaza shopping centre, residents and taxi drivers will be more inclined to fill up at the onsite filling station instead of filling up in Tzaneen. More customers are also anticipated to be drawn from passing traffic on the Tzaneen-Lydenburg road, from non-locals who might feel more comfortable making use of a filling station forming part of a well-known national chain than existing filling stations. These aspects will, however, be investigated further as part of the feasibility study which will be undertaken during the impact assessment phase of this EIA.

Table 8.7: Potential social impacts

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Employment creation	Positive	Local	Short term	Low – Very low	Definite	Low – Very low
Unruliness and/or crime	Negative	Local	Short term	Unknown	Possible	Low
OPERATIONAL PHASE						
Employment creation	Positive	Local	Long term	Low – Very low	Definite	Low – Very low
Job losses at existing filling stations	Negative	Local	Long term	Low	Possible	Low (jobs lost at existing filling stations (if any) are anticipated to be absorbed by new job opportunities at proposed new filling station)
Criminal elements attracted to filling station	Negative	Local	Long term	Medium	Possible	Medium

8.3. Health and Safety Aspects

Potential health and safety impacts are expected to relate mostly to the operational phase and to be associated with the flammable and potentially hazardous nature of the chemicals which make up petrol and diesel.

Fire and/or Explosion

Petrol and diesel are both highly flammable. Furthermore, mixtures of petrol vapour and air may lead to explosion (HPA, 2007). For this reason, extensive measures are proposed to be in place at the proposed filling station in order to minimise the risk of explosion or fire, and an emergency response plan will be in place to specify steps to be taken in case of fire or explosion.

Health risk

Long-term exposure to petrol / diesel vapours, as in the case of persons regularly involved in filling of fuel storage tanks over a long period of time, may be detrimental to human health; however, customers of filling stations and the general public are not at risk. As indicated in Section 2.4 (Design Specifications), measures will be in place to minimise fugitive emissions from storage tanks. Fumes may be generated during filling of the underground storage tanks from fuel tankers; it is recommended that air quality be monitored during filling of storage tanks and workers be provided with any necessary safety gear at these times.

Table 8.8: Potential health and safety impacts

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Potential worker injury during construction	Negative	Site-bound	Short-term	Unknown	Possible	Low
OPERATIONAL PHASE						
Health risk of exposure to fuel or fumes	Negative	Site-bound	Long-term	*Very low* under normal circumstances; *unknown* in case of an accident	*Highly probable* (very low exposure to fumes); *Possible* (for dangerous exposure)	Medium-High
Risk of fire / explosion	Negative	Local	Long-term	Unknown	Possible	High

8.4. Economic Aspects

A feasibility study was conducted by Petrorex in December 2008. As part of this study, the potential impact of the proposed filling station on existing nearby filling stations was gauged.

In considering the possible impact on the environment of the proliferation of a filling station as well as the possible impact on existing filling stations, the following must be taken under consideration:

- Fulfilling the needs of the targeted community / market;
- Economical impact on the sustainability of existing filling stations.

Existing fuel stations within a driving distance of 25km on the same provincial route as the proposed development site were analysed, as required in terms of GDACEL's (now GDACE) *EIA Administrative Guideline for the Construction and Upgrade of Filling Stations and Associated Tank Installations* (2002). These stations also have direct access from the provincial road and not via a secondary route. Filling stations in Tzaneen, though located within a radius of 25km of the proposed development site, were not evaluated in detail, as they are not situated on a provincial route as is the case with the proposed development site, and therefore fall outside the local market within which the new filling station is proposed to be established. The potential economic impact on the filling stations in Tzaneen was looked at cumulatively as a total impact on all the stations on Tzaneen; the stations were not analysed individually.

The anticipated cumulative effect of the proliferation of filling stations, especially the negative economical impact due to overtrading, has recently become a sensitive and debatable subject. This threat, however, is addressed in the feasibility report on the basis of market sharing of the proposed service station with the existing filling stations in the GTM area.

The volume of fuel sales projection based on the commuter and transient trade passing the proposed site on road R36 / P17-3 and road D4075, as well as the volume of fuel sales generated by the Maake Plaza Shopping centre, can be seen as the volume likely to have an influence on the competitor sites in the trading area of the GTM area.

Taking into consideration that there is a 50% chance for those motorist to fill up at a service station near work or a 50% chance to fill up at a service station near home, the volumes generated from routes 1 to 6 will be shared with the competitor sites in the local trading area as well as in Tzaneen. The determined potential volume of fuel sales of the proposed site to be shared with the competition sites in the local trading area was calculated at 65%. This calculated potential share volume was then divided by the percentage share held by each identified filling station in the local trading area combined fuel volume sales. The share holding of each filling station site in local trading area can be considered as an indicator of the overall market supply and demand as well as preference of support by the motorist.

The economic effect on a filling station cannot only be attributed to the anticipated volume fuel sales loss in isolation. Due to the beneficial role of the additional profit centres such as convenience stores (inclusive of the permissible special promotional benefits) as well as car wash facilities, it attracts significant additional customers, other than fuel customers.
The two main expense items are the rent and wages. The operational rental per month is normally based on a fixed rental component based on the floor areas of the filling station as well as a turn-over / gross profit percentage share to be paid to the oil company. The operator therefore has the benefit of paying a lesser amount of rental should the sales of these departments decline. Due to the fact that most of the competition sites in the local trading area can not be considered as a franchise site, none of these high rentals and fees would be applicable. The owners of these non-franchise, non tied – Dealer owned sites, also benefit from the fact that they buy their fuel at a extra discount from other wholesalers.

Taking into consideration the newly announced increase in wages as well as the Dealers' margin, determined by the DME, it has become imperative for all Dealers to revise their wage bill and time-

schedule to their own financial advantage. This action led to an actual increase in newly appointed staff instead of paying expensive overtime. Therefore, the amount of attendants ratio influenced by the fuel sales is not the only factor to be taken into consideration in determining the possible job loss scenario in the event of another service station infiltrating the market area.

In this scenario the influence of the volume loss of each competitor service station's performance was allocated as mentioned earlier. The Ofcolaco BP is anticipated to experience the highest negative influence at an expected volume loss of 61 kilolitres in the first year, followed by the Engen site in Ka-Mohlaba at 38 kilolitres, Total Lenyene at 37 kilolitres, the non-branded site (Poo ke Nna Filling Station) at 35 kilolitres and Tepco Mohlaba Crossing at 24 kilolitres. The identified competitor sites will not suffer a significant fuel sales volume loss and will still be viable and sustainable if the proposed Maake Plaza filling station development becomes operational. The proposed service / filling station carries no significant threat to the economical sustainability of the competitor service station sites in the identified local trading area.

Table 8.9: Potential economic impacts

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Employment creation	Positive	Local	Short term	Low – Very low	Definite	Low – Very low
OPERATIONAL PHASE						
Reduction in turnover of existing filling stations	Negative	Local	Long term	Medium (estimated at ± 12% of current turnover)	Highly probable	Medium
Employment creation	Positive	Local	Long term	Low	Definite	Low
Job losses at existing filling stations	Negative	Local	Long term	Low	Possible	Low (jobs lost at existing filling stations are anticipated to be absorbed by new job opportunities at proposed new filling station)

8.5. Visual Aspects

8.5.1. Status quo

The site is situated in a built-up area and is bound on all sides by commercial and residential development (mostly commercial), as described in Chapter 2. Although the shopping complex of which the filling station is proposed to form part, is surrounded by majestic mountains, the level at which the filling station is to be situated has already been transformed by development, and the proposed filling station would be in line with the type and scale of developments already found in the area.

8.5.2. Potential impacts

Potential visual impacts can be distinguished into construction-phase impacts and operational-phase impacts. Construction-phase impacts are related to construction activities such as earthworks and

actual construction activities. Operational phase impacts relate to the visual impact of the established filling station and any associated signage and lighting.

Construction phase visual impacts are anticipated to have a **low** significance, as these activities will be very **short term** in duration and would extend over a **small area** only.

The ***operational phase*** visual impact of the proposed development is anticipated to have **low** significance, as the proposed development is visually compatible with the type of activities on surrounding properties. The affected area will also be relatively **small** in size (the filling station is to cover approximately 1 700m^2). Furthermore, as the filling station is to form part of a commercial development (Maake Plaza), it is **not** expected to visually intrude on the landscape but rather is expected to visually form a part of the rest of the development on the site. Night-time visual impacts are expected to be of **low-medium** significance: the proposed filling station is anticipated to have 24-hour lighting for security purposes as well as lit signage, but the lighting is anticipated to be compatible with that of the Maake Plaza shopping centre of which the filling station is proposed to form part, as the centre also has 24-hour lighting in the parking area, shopfronts and back of house. It is therefore anticipated that the filling station would visually form a whole with the shopping centre.

Table 8.10: Potential visual impacts

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Visual impact of construction activities	Negative	Local	Short-term	Low	Highly probable	Low
OPERATIONAL PHASE						
Visual impact of the filling station structures and signage – daytime	Negative	Local	Long-term	Low	Definite	Low
Visual impact of the filling station and signage – night-time	Negative	Local	Long-term	Medium	Definite	Medium

8.6. Noise

8.6.1. Status quo

The proposed development site is situated in a thriving commercial hub, which is host to a variety of formal and informal commercial activities. The chatter of large volumes of pedestrians blends with the constant buzz of traffic on the busy adjacent road. Current sources of noise in the immediate vicinity of the site include the following:

- Traffic on the busy R36 and D4075 roads;
- Taxi rank, situated on the premises of the Maake Plaza shopping centre;
- Vehicular and pedestrian traffic at the Maake Plaza shopping centre;
- Music from certain shops in Maake Plaza shopping centre;
- Formal and informal commercial activities around the site, which draw a large number of customers;
- Heavy pedestrian traffic.

8.6.2. Potential impacts

Construction-phase impacts are anticipated to be mainly associated with construction activities themselves, including earthworks, off-loading of material from trucks, etc. A small amount of noise can be expected to be generated by the engines of heavy trucks delivering materials to the site. Noise impacts during the construction phase will be short-term in duration, occurring only whilst construction is underway. Construction activities will, as far as possible, be limited to the daytime, when ambient noise levels are higher than at night and the impact of noise associated with the construction / establishment activities is therefore lower. Construction-related noise is anticipated to have a low significance in the context of the ambient noise levels.

Noise impacts expected to be introduced into the receiving environment by the proposed new filling station during the ***operational phase*** are anticipated to be similar to the types and levels of noise currently experienced. Current noise levels are associated mostly with vehicular traffic (engines) and pedestrian traffic (voices), and operational-phase noise impacts associated with the proposed filling station are similarly anticipated to relate to vehicles visiting the filling station and the chatter of drivers, pedestrians and pump attendants. Noise impacts are anticipated to be felt mostly during the daytime, when the filling station would be most active, and during this time the ambient noise levels are also elevated. Very little noise is expected to be generated during the relatively quiet night time, and impacts are therefore anticipated to be negligible.

Due to the compatibility of the anticipated new noise impacts with the existing ambient noise sources and levels, potential noise impacts are anticipated to be of low significance.

Table 8.11: Potential impacts in terms of noise

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Noise associated with construction activities	Negative	Local	Short-term	Medium-low	Highly probable	Low
OPERATIONAL PHASE						
Noise associated with vehicular and pedestrian traffic	Negative	Local	Long-term	Medium-low	Definite	Low

8.7. Traffic

According to Mr Awie van Zyl, traffic engineer with Avzcons, filling stations are not trip generators, i.e. no additional vehicle trips are loaded onto the surrounding road system and intersections. Rather, filling stations **intercept** trips on the road system. It was therefore not necessary to conduct an additional traffic impact assessment over and above the one which was conducted as part of the Basic Assessment for the Maake Plaza shopping centre.

Impacts with regards to traffic load and congestion associated with the proposed filling station are anticipated to be insignificant, due to the fact that no new trips are anticipated to be generated, and the fact that the entrance to the filling station is proposed to be via the existing access to Maake Plaza shopping centre, off the secondary road D4075 (and not the busier R36), which carries a lighter traffic load – little disruption to traffic flow is therefore expected.

Table 8.12: Potential traffic-related impacts

CONSTRUCTION PHASE						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disruption of traffic by slow-moving construction vehicles	Negative	Local	Short-term	Very low	Highly probable	Low
OPERATIONAL PHASE						
Disruption of traffic flow by vehicles turning into, and exiting from, the filling station	Negative	Local	Long-term	Very low	Possible	Very low
Disruption of traffic flow by fuel tankers turning into the filling station when delivering fuel	Negative	Local	Long-term	Very low	Highly probable	Low

8.8. Cumulative and indirect impacts

As is the case for any activity, impacts are not limited to those directly associated with the proposed activity – potential cumulative impacts need to be considered as well, so that activities can be seen not just as stand-alone entities but as part of the larger picture of development in the area.

Table 8.13: Potential cumulative and indirect socio-economic impacts

OPERATIONAL PHASE						
SOCIO-ECONOMIC IMPACTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Alteration of the visual landscape	Negative	Local	Long term	Low	Definite	Low
Contribution to light pollution	Negative	Local	Long term	Medium-low	Definite	Medium
Noise impacts	Negative	Local	Long term	Medium-low	Definite	Low
Littering	Negative	Local	Long term	Low	Probable	Low
Reduction in turnover at existing filling stations	Negative	Local	Long term	Medium	Highly probable	Medium
Triggering of further development in the area	Negative	Local	Long term	Unknown	Possible	Unknown

9. PUBLIC PARTICIPATION PROCESS

The purpose of the public participation process was to inform Interested and/or Affected Parties (I&APs) of the proposed project and to obtain their input into the process.

9.1. Background Information Document and Comment and Registration Form

A Background Information Document (BID) was compiled in English (also containing the SePedi version of the process advertisement in lieu of a summary of the BID) in order to provide a background and description of the proposed project and the EIA process being followed. The BID was distributed to stakeholders and adjacent landowners along with the locality map and comment and registration

form. The comment and registration form provided I&APs and stakeholders with a convenient method of submitting their contact details to the consultants in order to register on the project database, as well as to raise any issues, comments or concerns that they had in terms of the proposed project.

9.2. Advertisement of First Public Meeting and Commencement of EIA Process

The commencement of the EIA process was advertised for a period of 30 days (29 August – 28 September 2008) in the following ways (please refer to Appendix K for copies of newspaper advertisements, photographs of site notices and proof of direct notification of stakeholders):

- Placement of notices in the local newspaper the Bulletin in both English and SePedi;
- Display of 2 site notices (each containing both the English and the SePedi adverts) at the proposed development site;
- Direct notification of identified stakeholders via fax and/or e-mail;
- Extensive communication with the BCT;
- Notification, including background information documents, comment and registration forms and locality maps, was provided to the BCT, who in turn distributed it to the indunas (headmen) of all the villages forming part of Bakgaga Tribal Authority, as well as to other relevant stakeholders within the community.

Please refer to Appendix Q for the list of Interested and/or Affected Parties (I&APs) and stakeholders.

9.3. Stakeholder Meetings

9.3.1. Scoping-phase Public Meeting

A Public Meeting was held on 13 September 2008 at the Bakgaga Tribal Office in Maake. The purpose of the Public Meeting was to afford stakeholders and members of the public the opportunity to interface with the project team to obtain information about the proposed project and to have their comments, queries and/or concerns noted. Comments mostly centred on the concern of owners of existing nearby filling stations that the proposed new filling station would siphon off customers from the existing stations, eroding the income of the owners of these stations. Please refer to Appendix P for the minutes of the public meeting. Comments raised at the meeting have also been captured in the Issues Trail, which is attached in Appendix R of this report.

The Public Meeting was advertised together with the advertisement of the commencement of the EIA process, as set out above.

9.3.2. EIA-phase Public Meetings

The **first** of two EIA-phase public meetings was held on Saturday, 12 September 2009 at Maake Plaza shopping centre. The purpose was to update I&APs on the results of specialist studies undertaken since the first public meeting, and to discuss the way forward for the remainder of the EIA process. Comments centred mostly around the specialist feasibility assessment which had been undertaken by Petrorex, and the potential financial impact of the proposed filling station on the existing filling stations within the local trading area. Also under discussion was the appeal which had been submitted by EBB Consulting on behalf of PRAF against LDEDET's acceptance of the ESR.

The Public Meeting was advertised in English and SePedi by means of an advertisement in the Letaba Herald, three site notices (two at Maake Plaza and one at the Bakgaga ba Maake Tribal Office) and distribution of invitations to registered I&APs via fax, e-mail, post or personal delivery

The **second** EIA-phase public meeting has been arranged for Saturday, 24 July 2010 (during the public review period of this report) in order to discuss the content of this EIR and the associated EMP, particularly for the benefit of illiterate or semi-literate community members.

Comments raised during the meeting will be incorporated into the final EIR and EMP, which will then be submitted to LDEDET for their decision-making on the proposed project.

9.3.3. Focus Group Meeting

A Focus Group Meeting (FGM) was held on Friday, 30 October 2009 at Maake Plaza shopping centre with representatives of existing filling stations in the local trading area. Also in attendance were representatives of LDEDET, the developer and the specialist who undertook the feasibility study.

The purpose of the FGM was to discuss issues of concern with the nearby filling station owners who have raised concerns with regards to the need of the proposed filling station, and to come to an amicable agreement with these parties. However, the most vociferous objectors did not attend the meeting, and the parties who were present (certain filling station owners or their representatives) did not raise serious objections. Please refer to the attached minutes (Appendix P).

9.4. Issues Raised

Comments and issues raised during the Public Participation Process thus far have been incorporated into the Issues Trails (Appendix R), which provide a summary in English of all issues raised, the forum through which these issues were raised and the response provided during the Scoping phase and the EIA phase respectively. Please note that comments / queries received during the scoping phase and those received during the EIA phase have been combined in one issues trail, but EIA-phase comments have been italicized to distinguish it from scoping-phase comments. Copies of correspondence with I&APs are also included in Appendix R.

The main issue raised during public participation was the concern that there may not be sufficient **demand** for another filling station in the area, and the fear of the owners of two nearby filling stations that their **income** might be reduced if customers prefer the new filling station to their existing facilities.

9.5. Availability of Draft ESR for Public Review

9.5.1. Original draft ESR

The draft ESR was **originally** available for public review and comment for a period of 30 days, from 3 October to 3 November 2008, at the Bakgaga ba Maake tribal office in Maake as well as at the offices of Polygon Environmental Planning in Tzaneen. The availability of the report was advertised by means of the following:

- Placement on 3 October 2008 of English and SePedi notices in the local newspaper the Bulletin;
- Display of 2 site notices (each containing both the English and the SePedi adverts) at the proposed development site;
- Direct notification of identified stakeholders via fax and/or e-mail;
- Notification was distributed by the BCT to the indunas (headmen) of all the villages resorting under the Bakgaga Tribal Authority, as well as to other community structures and stakeholders in the community.

Copies of the draft ESR were also submitted directly to the following stakeholders for their review and comment:

- SAHRA, Polokwane
- Department of Water Affairs (DWA), Polokwane
- GTM
- The Petroleum Retailers Alignment Forum (PRAF)
- Mr ME Bopape (co-owner: Poo ke Nna filling station)

Please refer to Appendix L for proof of advertisement of the availability of the original draft ESR for public review and comment.

9.5.1. Revised draft ESR

Following input from I&APs with regards to the original draft ESR, the report was subsequently amended, and a significant amount of information added. The **revised draft ESR** was made available for public review and comment for a period of 30 days, from 14 May to 13 June 2009. The report was available at the following locations:

- Bakgaga ba Maake tribal office in Maake;
- Maake Plaza shopping centre's centre management office;
- Offices of Polygon Environmental Planning at 21C Peace Street, Tzaneen.

Copies of the amended draft ESR, whether in hard copy or electronically on CD, were provided directly to the following stakeholders:

- SAHRA, Polokwane
- DWA, Polokwane
- GTM – Environmental Management division
- GTM – Town Planning division
- EBB Consulting (acting on behalf of PRAF)
- Mr ME Bopape (Poo ke Nna filling station, Maake)
- Mr Cassie Nel (Engen filling station, Ka-Mohlaba).

The availability of the revised draft ESR for public review and comment was advertised as follows:

- Placement on 14 May 2009 of English and Sepedi notices in the local newspaper the Letaba Herald;

- Display of 3 site notices (each containing both the English and the SePedi adverts): two at the proposed development site and 1 at the Bakgaga ba Maake tribal office;
- Direct notification of identified stakeholders via fax, e-mail, post and/or personal delivery of notices;
- Notification was distributed to the tenants of Maake Plaza shopping centre by the centre manager, Mr Judas Rakgwale;
- Notification was distributed by the BCT to the indunas (headmen) of all the villages resorting under the Bakgaga Tribal Authority, as well as to other community structures and stakeholders in the community.

Please refer to Appendix M for proof of advertisement of the availability of the revised ESR.

9.6. Availability of Draft EIR and EMP for Public Review

The draft EIR and EMP are currently available for public review and comment for a period of 62 days (from 2 June to 5 August 2010) at the following locations:

- Maake Plaza shopping centre (cnr. R36 and D4075, Maake) – centre management office;
- Bakgaga Tribal Office (Maake);
- Offices of Polygon Environmental Planning (Tzaneen);
- Electronic copies are available from Polygon upon request.

The usual 30-day comment period has had to be extended due to the June school holidays partially overlapping with the comment period. The extended comment period provides for 30 days outside of school holidays.

Copies are also being submitted to the following stakeholders for their perusal:

- LIHRA, Polokwane
- DWA, Polokwane
- GTM – Environmental Management division
- SAHRA, Cape Town
- EBB Consulting (acting on behalf of PRAF)
- Mr ME Bopape (Poo ke Nna filling station)
- Mr KKK Sekgobela (Lenyenye Total)
- Mr Cassie Nel (Engen filling station – Ka-Mohlaba)

9.7. Authorization

Following review of the final EIR and EMP, LDEDET will either authorise, reject or conditionally authorise the proposed filling station development. All registered I&APs and stakeholders will be directly notified via fax, e-mail and/or post of the outcome of L DEDET's decision within 10 days of issuing of the authorization; they will also be informed regarding the appeal process which can be followed if any parties wish to appeal LDEDET's decision. A period of 10 days will be offered within which notice will need to be submitted to L DEDET of the appellant's intent to appeal, and a further 30 days will be available for submittal of appeal documentation for decision making by the Member of the

Executive Council (MEC) for Economic Development, Environment and Tourism in Limpopo. Should appeal documentation be submitted, the appeal review procedure will follow.

10. CONCLUSIONS AND RECOMMENDATIONS

The EIA process has identified no fatal flaw issues associated with the proposed development and has found that the proposed development can be supported on the proposed site, provided that the recommended management and mitigation measures are implemented in order to limit potentially negative impacts and reinforce potential positive impacts that may be associated with the proposed project. These measures are stipulated in the accompanying EMP.

A summary of the potential impacts is included in Table 10.1 (construction-phase impacts) and Table 10.2 (operational phase impacts). Measures for the management and/or mitigation of potential impacts are contained in the EMP.

Table 10.1: Potential direct impacts that may be associated with the proposed filling station – construction phase

BIO-PHYSICAL ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increase in the risk of soil erosion during construction activities	Negative	Site-bound	Short term	Very low	Possible	Very low
Risk of soil or groundwater pollution by wastewater during construction	Negative	Local	Short term	Negligible	Improbable	Negligible
Temporary loss of habitat currently provided by existing trees onsite, while replacement trees elsewhere onsite reach maturity	Negative	Site-bound	Medium term	Negligible	Highly probable	Negligible
Airborne dust during construction	Negative	Local	Short term	Very low	Probable	Very low
Littering by workers involved in construction	Negative	Site-bound and in the immediate vicinity of the site	Short term	Very low	Highly probable	Very low
SOCIO-ECONOMIC ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Airborne dust during construction	Negative	Local	Short term	Very low	Probable	Very low
Construction-phase employment creation	Positive	Local	Short term	Low – Very low	Definite	Low – Very low
Unruliness and/or crime during construction phase	Negative	Local	Short term	Unknown	Possible	Low
Visual impact of construction activities	Negative	Local	Short-term	Low	Highly probable	Low
Noise associated with construction activities	Negative	Local	Short-term	Medium-low	Highly probable	Low
Disruption of traffic by construction vehicles	Negative	Local	Short-term	Very low	Highly probable	Very low

Table 10.2: Potential direct impacts that may be associated with the proposed filling station – operational phase

BIO-PHYSICAL ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Long-term increase in soil erosion rates	Negative	Site-bound	Long term	Negligible	Improbable	Very low
Increased peak storm water flow	Negative	Site-bound	Long term	Low	Highly probable	Low
Risk of soil and groundwater pollution in case of overfilling, leakage or spillage	Negative	Regional	Long term	Unknown (depends on scale)	Possible	Medium - Very high
Increased littering	Negative	Site-bound and in the immediate vicinity of the site	Long term	Low	Highly probable	Low
Increased water use	Negative	Local	Long term	Low	Definite	Low
Increased electricity use	Negative	Local	Long term	Low	Definite	Low
Increased generation of sewage	Negative	Local	Long term	Low	Definite	Low
Increased solid waste generation	Negative	Local	Long term	Low	Definite	Low
SOCIO-ECONOMIC ASPECTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Health risks associated with exposure to fuel and fumes	Negative	Site-bound	Long term	*Very low* under normal circumstances; *unknown* in case of an accident	*Highly probable* (very low exposure to fumes); *Possible* (for dangerous exposure)	Medium-High
Risk of increase in criminal elements attracted to new filling station	Negative	Local	Long term	Unknown	Possible	Medium
Long-term employment creation	Positive	Local	Long term	Low – Very low	Definite	Low – Very low
Job losses at nearby existing filling stations	Negative	Local	Long term	Low	Possible	Low (jobs lost at existing filling stations are anticipated to be absorbed by new job opportunities at proposed new filling station)
Reduction in turnover of existing filling stations	Negative	Local	Long term	Medium (estimated at ± 12% of current turnover)	Highly probable	Medium
Increased risk of fire / explosion	Negative	Local	Long-term	Unknown	Possible	High
Day-time visual impact of filling station	Negative	Local	Long-term	Low	Definite	Low
Night-time visual impact of	Negative	Local	Long-	Medium	Definite	Medium

filling station (light pollution)			term			
Noise associated with vehicular and pedestrian traffic to filling station	Negative	Local	Long-term	Medium-low	Definite	Low
Disruption of traffic flow by vehicles turning into, and exiting from, the filling station	Negative	Local	Long-term	Very low	Possible	Very low
Disruption of traffic flow by fuel tankers turning into the filling station when delivering fuel	Negative	Local	Long-term	Very low	Highly probable	Low

In addition to the potential direct impacts listed above, a number of cumulative and/or indirect impacts may also be experienced in relation to the proposed filling station.

Table 10.3: Cumulative and indirect impacts potentially associated with the proposed filling station

OPERATIONAL PHASE						
BIO-PHYSICAL IMPACTS						
Potential impact	**Status**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Potential soil and/or groundwater contamination	Negative	Local – Regional	Long term	Unknown	Possible	Medium to Very high
Increased pressure on electricity supply	Negative	Local – Sub-regional	Long term	Low	Definite	Low
Increased water abstraction from the nearby borehole	Negative	Local	Long term	Low	Definite	Low
Increased pressure on sewerage treatment system	Negative	Local	Long term	Low	Definite	Low
Increased solid waste generation	Negative	Local	Long term	Low	Definite	Low
SOCIO-ECONOMIC IMPACTS						
Alteration of the visual landscape	Negative	Local	Long term	Low	Definite	Low
Contribution to light pollution	Negative	Local	Long term	Medium-low	Definite	Medium
Noise impacts	Negative	Local	Long term	Medium-low	Definite	Low
Littering	Negative	Local	Long term	Low	Probable	Low
Reduction in turnover at existing filling stations	Negative	Local	Long term	Medium	Highly probable	Medium
Triggering of further development in the area	Negative	Local	Long term	Unknown	Possible	Unknown

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